Four-year Undergraduate Programme
Subject: Botany
Semester: First
Course Name: *Plant and Microbial Diversity*
Existing Base Syllabus: UG CBCS Syllabus
Course Level: 100-199, and subsequent level as per NEP structure

THEORY [Total marks: 60] Credit: 03; Total No. of classes: 45			
Unit no.	**Unit content**	**No. of classes**	**Marks**
Unit 1	**Origin of life:** Theories of the Origin of Life, Concept of Kingdoms, and Tree of Life	3	4
Unit 2	**Bacteria and Viruses:** Bacteria: General features, cell structure, reproduction, conjugation, transformation, and transduction; introduction to Archaebacteria Viruses: General features, replication, reproduction (Lytic and Lysogenic life cycles), RNA virus (TMV), DNA virus (Cauliflower Mosaic Virus).	8	10
Unit 3	**Algae:** General features, cell structure, range of thallus structure, reproduction, and classification; a brief account on *Nostoc*, *Oedogonium*, and *Chara*	6	10
Unit 4	**Fungi & Lichens:** General features, distribution of fungi and its current status in the living world, reproduction, and classification (Anisworth, 1973); a brief account of *Mucor*, *Ascobolus*, and *Agaricus*; a brief account on lichens: structure, types, and economic importance	7	12
Unit 5	**Bryophytes and Pteridophytes:** Bryophytes: General features, adaptation to land habits, classification, and evolutionary trends; a brief account on *Marchantia* and *Polytrichum* Pteridophytes: General features, classification, reproduction, evolutionary trends (stellar evolution), and affinities; a brief account on *Lycopodium*, *Selaginella*, and *Pteris*	10	12
Unit 6	**Gymnosperms and Angiosperms:** Gymnosperms: General features, classification, reproduction, evolutionary trends, and affinities; a brief account on *Cycas*, and *Gnetum*	11	12

	Angiosperms: General features, Concept of an artificial, natural, and phylogenetic system of classification. Floral parts and inflorescence; Brief accounts on Lamiaceae and Orchidaceae		
PRACTICAL [Credit: 01]			
	1. Study of structure of TMV and Bacteriophage (electron micrographs/models). 2. Study of morphology of *Nostoc*, *Oedogonium*, *Chara* (Temporary preparation of slides). 3. Study of *Mucor*, *Ascobolus, Agaricus* (Temporary preparation of slides) 4. Study of vegetative and reproductive parts of *Marchantia* and *Polytrichum*(preparation of slides). 5. Study of *Lycopodium/ Selaginella* (morphology, strobilus, and spores), *Adiantum/ Pteris* (morphology). 6. Study of *Cycas*/ *Pinus* and *Gnetum* (morphology, leaf/ needle, megasporophyll and microsporophyll) 7. Study of leaf venations in dicots and monocots (at least two specimens each) 8. Study of different types of inflorescences and fruits.	30	40

Reading list:

1. Bhatnagar SP, Moitra A (1996) Gymnosperms. New Delhi, Delhi: New Age International (P) Ltd Publishers.
2. Campbell NA, Reece JB (2008) Biology, 8th edition, Pearson Benjamin Cummings, San Francisco.
3. Evert RF, Eichhorn SE (2012) Raven Biology of Plants, 8th edition, New York, NY: W.H. Freeman and Company.
4. Ingrouille M, Eddie B (2006) Plants: Evolution and Diversity. Cambridge University Press.
5. Kumar HD (1999) Introductory Phycology, 2nd edition. Delhi, Delhi: Affiliated East-West. Press Pvt. Ltd.
6. Parihar NS (1991) An Introduction to Embryophyta. Vol. II. Pteridophytes. Prayagraj: U.P.: Central Book Depot.
7. Pelczar MJ (2001) Microbiology, 5th edition. New Delhi, Delhi: Tata McGraw-Hill Co.
8. Puri P (1985) Bryophytes. New Delhi, Delhi, Atma Ram and Sons.
9. Sethi IK, Walia SK (2018) Text book of Fungi and Their Allies. 2nd Edition, Med tech Publishers, Delhi.
10. Singh G (2019) Plant Systematics: An Integrated Approach. 4th edition. CRC Press, Taylor and Francis Group.

11. Singh V, Pandey PC, Jain DK (2001) A Text Book of Botany. Meerut, UP: Rastogi and Co.
12. Tortora GJ, Funke BR, Case CL (2007) Microbiology. San Francisco, U.S.A: Pearson Benjamin Cummings.
13. Vashishta PC, Sinha AK, Kumar A (2010) Pteridophyta. New Delhi, Delhi: S. Chand & Co Ltd.
14. Webster J, Weber R (2007) Introduction to Fungi. Cambridge, Cambridge University Press.

Graduate Attributes

Course Objective:

This paper will explain the origin of life, the diversity of Bacteria, Viruses, Algae, Fungi & Lichen, Bryophytes, Pteridophytes, Gymnosperms, and Angiosperms on the planet, and how they may be related to each other. The emphasis will also be on the hands-on approach and laboratory techniques for identification of the plant and microbial groups using various morphological features.

Learning outcome:

On successful completion of the course, students will have:

1. Knowledge with the concept of different kingdoms and the theories behind how life began.
2. Basic understanding of the characteristics, distribution, classification, reproduction, and current status of various microbial and plant communities.
3. Good understanding of virus, algae, fungus, bryophyte, and pteridophyte cell structures, dicotyledonous and monocotyledonous leaf venation patterns, and inflorescence and fruit features.
4. Knowledge to identify various groups of organisms in the laboratory through morphological analysis.

Theory Credit: 03

Practical Credit: 01

No. of Required Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)

No. of Non-Contact Classes: Nil

Particulars of Course Designer (Name, Institution, email id):

Prof. Bhaben Tanti
Head, Department of Botany,
Gauhati University
Email id: btanti@gauhati.ac.in

Four-year Undergraduate Programme
Subject: Botany
Semester: Second
Course Name: *Cell Biology and Biomolecules*
Existing Base Syllabus: UG CBCS Syllabus
Course Level: 100-199, and subsequent level as per NEP structure

THEORY [Total marks: 60] Credit: 03; Total No. of classes: 45			
Unit no.	**Unit content**	**No. of classes**	**Marks**
Unit 1	**Introduction to cell:** Cell as a unit of structure and function; Characteristics of prokaryotic and eukaryotic cells; Origin of eukaryotic cell (Endosymbiotic theory); Cytoskeleton, Cell division: Phases of eukaryotic cell cycle, mitosis and meiosis; Regulation of cell cycle.	8	12
Unit 2	**Cell wall and plasma membrane:** Chemistry, structure and function of Plant cell wall. Overview of membrane function; fluid mosaic model; Chemical composition of membranes; Membrane transport – Passive, active and facilitated transport.	6	12
Unit 3	**Cell organelles:** Nucleus: Structure-nuclear envelope, Organization of chromatin, Nucleolus, Ribosome, Chloroplast, Mitochondria, Peroxisomes, Endoplasmic Reticulum, Golgi Apparatus, and Lysosomes.	9	8
Unit 4	**Carbohydrates and Lipids:** Carbohydrates: Nomenclature and classification. Lipids: Definition and major classes of storage and structural lipids; Structure, properties and functions of Essential fatty acids.	9	8
Unit 5	**Aminoacids and Proteins:** Structure and classification of amino acids; Levels of protein structure (primary, secondary, tertiary, and quarternary); Protein denaturation and biological roles of proteins.	8	10
Unit 6	**Nucleic acids:** Structure of nitrogenous bases; Structure and function of nucleotides; Types of nucleic acids; Structure of A, B, Z types of DNA;	5	10

	Types of RNA.		
PRACTICAL [Credit: 01]			
1. Qualitative tests for carbohydrates, reducing sugars, non-reducing sugars, lipids and proteins. 2. Study of plant cell structure with the help of epidermal peel mount of Onion/ *Rhoeo*/ *Crinum*. 3. Demonstration of the phenomenon of protoplasmic streaming in *Hydrilla* and *Vallisnaria*leaf. 4. Counting the cells per unit volume with the help of haemocytometer. (Yeast/ pollen grains). 5. Cytochemical staining of: DNA- Feulgen and cell wall in the epidermal peel of onion using Periodic Schiff's (PAS) staining technique. 6. Study different stages of mitosis and meiosis.		30	40

Reading list:

1. Berg JM, Tymoczko JL and Stryer L (2011) Biochemistry, W.H. Freeman and Company.
2. Campbell MK (2012) Biochemistry, 7th Edition. Published by Cengage Learning
3. Campbell PN, Smith AD (2011) Biochemistry Illustrated, 4th Edition, Published by Churchill Livingstone.
4. Cooper GM, Hausman RE (2009) The Cell: A Molecular Approach. 5th edition. ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA.
5. Hardin J, Becker G, Skliensmith LJ (2012) Becker's World of the Cell, Pearson EducationInc. U.S.A. 8th Edition.
6. Karp G (2010) Cell Biology, John Wiley & Sons, U.S.A. 6th Edition.
7. Nelson DL, Cox MM (2008) Lehninger Principles of Biochemistry, 5th Edition, W.H. Freeman and Company.
8. Tymoczko JL, Berg JM and Stryer L (2012) Biochemistry: A short course, 2nd Edition, W.H. Freeman.

Graduate Attributes

Course Objective:

This paper will explain biomolecules, the basic building blocks of living organisms, with a focus on their structural organization, molecule properties, biological roles, and functions. The emphasis will be on the relationship between the structure and function of various biomolecules at the chemical level with a biological perspective, as well as a hands-on approach and laboratory techniques.

Learning outcome:

On successful completion of the course, students will be:

1. Able to obtain knowledge of structure, classification, and physicochemical properties of biomolecules and enzymes.
2. Detailed knowledge of the structure, properties, and functions of a cell and its components.
3. Acquainted with practical knowledge of properties of cell and cell membranes, DNA staining techniques, and microscopy of the plant cell.
4. Able to identify various biomolecules in the laboratory by qualitative tests of biomolecules.

Theory Credit: 03

Practical Credit: 01

No. of Required Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)

No. of Non-Contact Classes: Nil

Particulars of Course Designer (Name, Institution, email id):

Prof. Bhaben Tanti
Head, Department of Botany,
Gauhati University
Email id: btanti@gauhati.ac.in

Four-year Undergraduate Programme
Subject: Botany
Semester: Third
Course Name: *Laboratory and Field Techniques in Plant Science*
Existing Base Syllabus: UG CBCS Syllabus
Course Level: 200-299, and subsequent level as per NEP structure

THEORY [Total marks: 60] Credit: 03; Total No. of classes: 45			
Unit no.	**Unit content**	**No. of classes**	**Marks**
Unit 1	**Laboratorysafetyandgoodpractices:** General laboratory safety: dos and don'ts, lab safety measures, code of conduct in laboratory, safe handling of chemicals, glass apparatus, instruments, electrical appliances; First aid practices (acid spills, burns and other injuries), safety symbols, classes/ grades of chemicals, Laboratorywastemanagement: radioactive, hazardouschemicalsandbiologicalwastes.	8	8
Unit 2	**Handling and maintenanceofinstruments:** Weighingbalance,pipettesandmicropipettes,magnetic stirrer,autoclave,laminarairflow,pH and conductivity meter(calibrationanduse),Incubator (static and shaker),Luxmeter, hemocytometer, micrometer, spectrophotometer, Agarose gel electrophoresis unit, SDS PAGEunit,centrifuge,distillationunit.	8	12
Unit 3	**Measurementsandcalculations:** Units of measurements, conversion from one unit to another, Weighing,calculations:scientificnotations,powers,logarithmandfractions ; measurement of volumes ofliquids.	4	8
Unit 4	**Solutions and Buffers:** Preparation of solutions: stock solution, standard solution. Types of solutions: Normal, Molar, Molal, Percentage, ppm, ppb. Dilution and dilution factors, Acids, Bases, adjustment of pH, Buffers - phosphate, Tris- HCl and Citratebuffer.	6	8
Unit 5	**Microscopy and Culture Techniques:** Microscopes: working principles and types (Light and Electron microscopes), sampleandslidepreparation: fixation, staining, mounting, preservation(for light and electron microscopy). Basicculturemedia(NA, NB, PDA, MS), selective and differential media, Culturetechniques:plating(streak,spread&pour),serial dilution.	8	12

Unit 6	**Biostatistics, computingand field skills:** Datatypes-primaryandsecondary,methodsofdatacollection,sample and samplingmethods-meritsanddemerits;technicalandbiologicalreplicates; Tabulation and presentation of data, Descriptive statistics - Mean,Median,Mode, Variance,StandardDeviation,Standarderror,CoefficientofVariation, MS-Word,PowerPoint,Excel, concept on biologicaldatabases. Collection, Identification, Preparation and Preservation of Herbarium andMuseum specimens.	11	12
PRACTICAL [Credit: 01]			
1. Preparation of solutions- molar, molal, normal, percentage, stock solution and dilution 2. Measurement of pH of solutions using pH meter/ pH strip and preparation of buffers (Phosphate /citrate buffer) 3. Working with instruments - Centrifuge, autoclave, laminar air flow, hot air oven, incubator, light microscope, spectrophotometer/colorimeter, 4. Slide preparation and staining of plant materials. 5. Determination of cell/spore size using micrometer. 6. Preparation of PDA/NA medium for growth and maintenance of fungal/bacterial cultures. 7. Calculation of mean, mode, median, standard deviation using data set. 8. Drawing of tables, graphs and to carry out statistical calculation using MicrosoftExcel. 9. Preparation of herbarium specimen: Collection, processing, mounting, and labelling of plant specimen.	30	40

Reading list:

1. Bisen PS (2014) Laboratory Protocols in Applied Life Sciences, 1st Edition. CRC Press.
2. Danniel WW (1987) Biostatistics. New York, NY: John Wiley Sons.
3. Evert RF, Eichhorn SE, Perry JB (2012) Laboratory Topics in Botany. W.H. Freeman and Company.
4. Jones AM, Reed R, Weyers J (2016) Practical Skills in Biology, 6th Edition, Pearson
5. Mann SP (2016) Introductory Statistics, 9th edition. Hoboken NJ, John Wiley and Sons Inc.
6. Mesh MS, Kebede-Westhead E (2012) Essential Laboratory Skills for Biosciences. John Wiley & Sons, Ltd.

7. Mu P, Plummer DT (2001) Introduction to practical biochemistry. Tata McGraw- Hill Education.
8. Zar ZH (2010) Biostatistical Analysis, 5th Edition, Pearson Prentice Hall, New Jersey, USA.

Graduate Attributes

Course Objective:

This paper will provide basic knowledge and understanding of good laboratory practices, laboratory waste management, understanding hazards and risks to ensure a safe laboratory environment, measurements, units, and common mathematical calculations, sampling and data collection, and instrument operation and maintenance.

Learning outcome:

On successful completion of the course, students will be:

1. Able tolearnfundamentalskillsimportantforperforminglaboratoryandfieldexperiments.
2. Able to prepare,analysisofdataandinterpretationofresults.

Theory Credit: 03

Practical Credit: 01

No. of Required Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)

No. of Non-Contact Classes: Nil

Particulars of Course Designer (Name, Institution, email id):

Prof. Bhaben Tanti
Head, Department of Botany,
Gauhati University
Email id: btanti@gauhati.ac.in

Four-year Undergraduate Programme
Subject: Botany
Semester: Fourth
Course Name: *Mycology and Phytopathology*
Existing Base Syllabus: UG CBCS Syllabus
Course Level: 200-299, and subsequent level as per NEP structure

THEORY [Total marks: 60] Credit: 03; Total No. of classes: 45			
Unit no.	**Unit content**	**No. of classes**	**Marks**
Unit 1	**Introduction to Fungi:** General characteristics of fungi; hyphal forms; Cell and Cell wall composition; Nutrition; Origin of fungi; Classification of Fungi (Alexopoulos, 1962 & Ainsworth, 1973); General characteristics of Myxomycota and Eumycota; Symbiotic fungi (Lichen & Mycorrhiza): Structural organization and types.	10	10
Unit 2	**Lower Fungi: Mastigomycotina&Zygomycotina:** Characteristic features; Reproduction; Heterothallism; Life cycle with reference to *Synchytrium, Phytophthora* and *Mucor*	6	8
Unit 3	**Higher fungi: Ascomycotina&Basidiomycotina:** Characteristic features; Reproduction; Different fruiting bodies; Life cycle with reference to *Aspergillus, Peziza, Puccinia* and *Agaricus*	6	12
Unit 4	**Fungi Imperfecti: Deuteromycotina:** General characteristics; Thallus organization; Reproduction; Heterokaryosis & Parasexuality; Classification with special reference to *Alternaria* and *Colletotrichum*	5	8
Unit 5	**Phytopathology:** Concept of plant disease; Symptoms of plant diseases; Etiology and disease cycle; Host-pathogens interaction; Control of plant diseases and quarantine; Bacterial diseases - Citrus canker and angular leaf spot of cotton. Viral diseases - Tobacco Mosaic viruses, vein clearing. Fungal diseases - Early blight of potato, Black stem rust of wheat, White rust of crucifers	10	12
Unit 6	**Applied Mycology:** Role of fungi in biotechnology; food industry (Flavour & texture,	8	10

	Fermentation, Organic acids & Enzymes); Pharmaceutical (Secondary metabolites); Agriculture (Biofertilizers & Biological control); Mushroom cultivation; Medical mycology.		
PRACTICAL [Credit: 01]			
	1. Study of vegetative and reproductive structures of Mastigomycotina (*Phytophthora*) and Zygomycotina (*Mucor/Rhizopus*) by temporary mounts and through permanent slides. 2. Study of vegetative and reproductive structures of Ascomycotina (*Aspergillus* and *Penicillium*/*Peziza*) and Basidiomyctina (*Agaricus* and *Puccinia*) by temporary mounts and through permanent slides. 3. Study of vegetative and reproductive structures of Deuteromycotina (*Alternaria* and *Colletotrichum/ Fusarium*) by temporary mounts and through permanent slides; Study of thallus and reproductive structures of lichen and mycorrhiza through permanent slides/ photographs. 4. Study of symptoms of locally available plant diseases caused by fungi, bacteria, and virus by preparation of disease album and bottle specimens. 5. Applied mycology: Photographs/report onfungi used in medicine, fungi used as biological control agents, fungi used in industry, fungi causing human infections	30	40

Reading list:

1. Agrios GN (1997) Plant Pathology, 4thedition, Academic Press, U.K.
2. Alexopoulos CJ, Mims CW, Blackwell M (1996) Introductory Mycology, John Wiley & Sons (Asia) Singapore. 4th edition.
3. GanguleeHC, KarAK. College Botany, Vol. II., New Central Book Agency, Kolkata.
4. Hait G (2022) A Textbook of Plant Pathology: Principles and Diseases. Global Net Publication, India.
5. HaitG, BhattacharyaK, GhoshAK (2011) Text Book of Botany, Vol. I & II., New Central Book Agency, Kolkata.
6. MitraJN, MitraD, ChowdhuryS. Studies in Botany. Vol. I., Moulik Library, Kolkata.
7. Pandey BP (2020) Plant Pathology - Pathogen and plant disease. S. Chand and Company Limited, New Delhi, India.
8. Sethi IK, Walia SK (2011) Text book of Fungi and Their Allies, Macmillan Publishers India Ltd.
9. Sharma PD (2011) Plant Pathology, Rastogi Publication, Meerut, India.
10. Webster J, Weber R (2007) Introduction to Fungi, Cambridge University Press, Cambridge. 3rd edition.

Graduate Attributes

Course Objective:

This paper will explain the general characteristics and reproductive procedures of fungi from different groups such as Mastigomycotina, Zygomycotina, Ascomycotina, Basidiomycotina, and Deuteromycotina. The paper will also focus on the basic idea of host-pathogen interaction during disease development, along with symptomology and the disease cycle of common fungal, bacterial, and viral diseases. Furthermore, the role of fungi in various biotechnological aspects, pharmaceutics, and agriculture will be highlighted.

Learning outcome:

On successful completion of the course, students will have:

1. Knowledge on general features of fungi and their classification
2. Knowledge on different classes of fungi, symbiotic fungi, and their characteristics
3. Knowledge on the application of fungi in different fields
4. Knowledge of plant pathogens and some important plant diseases
5. Practical knowledge on different classes of fungi based on their morphological and reproductive features
6. Practical knowledge on morphology, anatomical features of symbiotic fungi and locally available important plant pathogens.
7. Understanding biotechnological applications of fungi in industry, agriculture, and medicine.

Theory Credit: 03

Practical Credit: 01

No. of Required Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)

No. of Non-Contact Classes: Nil

Particulars of Course Designer (Name, Institution, email id):

Prof. Bhaben Tanti
Head, Department of Botany,
Gauhati University
Email id: btanti@gauhati.ac.in

Four-year Undergraduate Programme
Subject: Botany
Semester: Fourth
Course Name: *Morphology and Anatomy of Angiosperms*
Existing Base Syllabus: UG CBCS Syllabus
Course Level: 200-299, and subsequent level as per NEP structure

THEORY [Total marks: 60] Credit: 03; Total No. of classes: 45			
Unit no.	**Unit content**	**No. of classes**	**Marks**
Unit 1	**Introduction to Plant Morphology and Anatomy:** Morphology of inflorescence, stamens and carpel, fruit; Telome theory, phyllode theory; Role of morphology in plant classification. Plant anatomy: Application in systematics, forensics and pharmacognosy.	6	10
Unit 2	**Tissue and Tissue Systems:** Classification of tissues; Simple and complex tissue, Tissue systems, Pits and plasmodesmata; Wall ingrowths and transfer cells, Types of vascular bundles; Endodermis, exodermis and origin of lateral root. Hydathodes, cavities, lithocysts and laticifers; Ergastic substances.	7	8
Unit 3	**Structure and Development of Plant Body:** Internal organization of plant body: Development of plant body: Polarity, Cytodifferentiation and organogenesis during embryogenic development. Origin and development of leaves; Structure of dicot and monocot stem, root and leaf; Kranz anatomy.	5	8
Unit 4	**Apical meristems:** Concept of organization of shoot apex (Apical cell theory, Histogen theory, Tunica Corpus theory); Organization of root apex (Apical cell theory, Histogen theory, Korper-Kappe theory); Quiescent centre; Root cap.	11	14
Unit 5	**Vascular Cambium and Wood:** Structure, function and seasonal activity of cambium; Secondary growth in stem and root. Sapwood and heartwood; Ring and diffuse porous wood; Early and late wood, tyloses; Dendrochronology. Development and composition of periderm,	11	12

	rhytidome and lenticels.		
Unit 6	**Adaptive and Protective Systems:** Epidermis, cuticle, epicuticular waxes, trichomes (uni-and multicellular, glandular and nonglandular, two examples of each), stomata (classification); Adcrustation and incrustation; Anatomical adaptations of xerophytes and hydrophytes.	5	8
PRACTICAL [Credit: 01]			
1. Study of special types of inflorescences – Cyathium, Hypanthodium, Verticillaster, Hypanthium. 2. Study of special types of fruits- Spurious fruits (*Dillenia*); Aggregate fruits (Custard apple, *Michelia*, Periwinkles, *Polyalthia*); Multiple fruits (Pineapple, Jack fruits). 3. Study of anatomical details through permanent slides/temporary stain mounts / macerations / museum specimens with the help of suitable examples. 4. Apical meristem of root, shoot and vascular cambium (permanent slides/ photographs) 5. Epidermal system: cell types, stomata types; trichomes: non-glandular and glandular. 6. Root anatomy: monocot and dicot 7. Stem: monocot, dicot - primary and secondary growth; periderm; lenticels. 8. Leaf: isobilateral, dorsiventral, C4 leaves (Kranz anatomy). 9. Adaptive Anatomy: xerophytes, hydrophytes. 10. Secretory tissues: cavities, lithocysts and laticifers.		30	40

Reading list:

1. Dickison WC (2000) Integrative Plant Anatomy. Harcourt Academic Press, USA.
2. Evert RF (2006) Esau's Plant Anatomy: Meristems, Cells, and Tissues of the Plant Body: Their Structure, Function and Development. John Wiley and Sons, Inc.
3. Fahn A (1974) Plant Anatomy. Pergmon Press, USA.
4. Mauseth JD (1988). Plant Anatomy. The Benjammin/Cummings Publisher, USA.

Graduate Attributes

Course Objective:

This paper will explain the detailed account on the morphological and anatomical features of Angiosperms.

Learning outcome:

1. Knowledge on morphology of angiosperms and developmental biology of plant body.
2. Knowledge on structural and anatomical organization of tissue system in plants and their classification.
3. Practical knowledge on inflorescences and fruits of angiosperms.
4. Practical knowledge on anatomical features of plant body parts.

Theory Credit: 03

Practical Credit: 01

No. of Required Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)

No. of Non-Contact Classes: Nil

Particulars of Course Designer (Name, Institution, email id):

Prof. Bhaben Tanti
Head, Department of Botany,
Gauhati University
Email id: btanti@gauhati.ac.in

Four-year Undergraduate Programme
Subject: Botany
Semester: Fourth
Course Name: *Microbiology*
Existing Base Syllabus: UG CBCS Syllabus
Course Level: 200-299, and subsequent level as per NEP structure

THEORY [Total marks: 60] Credit: 03; Total No. of classes: 45			
Unit no.	**Unit content**	**No. of classes**	**Marks**
Unit 1	**Introduction to microbial world:** History of development of Microbiology as a subject, Germ theory of diseases, Koch postulates, Major groups of microorganisms, Mode of nutrition and metabolic diversity in microbes, Growth and growth curves, Ecological importance of microorganisms.	6	6
Unit 2	**Viruses:** Characteristics of viruses, viroids and prions; Biomolecules and genetic materials of viruses; Baltimore system of classification; Morphological structure of TMV and Corona viruses; Life cycle and reproduction of bacteriophage; Replication of viral RNA and DNA; Viral diseases of common plants and animals	8	10
Unit 3	**Bacteria:** General characteristics of bacteria, shapes and sizes, ultra-cellular structure, major groups of bacteria with their general characteristics; Actinomycetes, Mycoplasma and Rickettsiae; growth and nutrition, reproduction – binary fission and endospore formation, horizontal gene transfer and genetic recombination in bacteria (conjugation, transformation and transduction). Examples of agriculturally and industrially important bacteria.	8	12
Unit 4	**Environmental Microbiology:** Microorganisms in different habitats: Air, soil and water; Soil microorganisms and their role in soil health; Role of microorganisms in biogeochemical cycles (C, N, P and S); Microorganisms in extreme environments (cold desert, hot water spring, marine water, hydrothermal vent, aquifers)	8	8
Unit 5	**Pathogenic microorganisms and Host Immunity:**	8	12

	Bacterial pathogens causing diseases in plants, animals and humans; fungal pathogens causing diseases in agriculturally important crops; host-pathogen interactions; pathogenesis; disease symptoms; host defence mechanisms; Host immunity - immune responses against pathogens; types of immunity; humoral and cell mediated immunity; hypersensitivity and autoimmunity; concept of Rh antigens.		
Unit 6	**Applied Microbiology:** Application of microorganisms in food industries for food fermentation and SCP production; in agriculture for biofertilizer, biopesticides, biocompost production; in pharmaceuticals for insulin and antibiotics production; in industries for alcohol and organic acid productions; citric acid and acetic acid; in genetic engineering for GMO development and other research purposes; in space and oil exploration and in pollution and waste management.	7	12
PRACTICAL [Credit: 01]			
1. Slide preparation and Gram staining of bacteria (urd bacteria, nodule bacteria) 2. Slide preparation and study of *Nostoc*, *Anabaena*, *Mucor*, *Rhizopus*, *Aspergillus*, *Penicillium*, *Colletotrichum*, *Cladosporium* 3. Pure culture isolation of soil bacteria/fungi through serial dilution plating and subsequent sub-culturing methods, population estimation by CFU and haemocytometer. 4. Measurement of microbial cells/spores with the help of micrometers or inbuilt software in microscopic camera. 5. Study on symptoms of plant viral diseases 6. Endospore staining of soil bacteria with malachite green 7. 7. Collection and study of diseases caused by virus, bacteria and fungi in crop plants		30	40

Reading list:

1. Aneja KR, Jain P, Aneza R (2021) A Textbook of Basic and Applied Microbiology. New Age International Publisher.

2. Aneja KR (2022) Experiments in Microbiology, Plant Pathology, Tissue Culture and Microbial Biotechnology. New Age International Publisher
3. Bhattacharya IK, Bhattacharya RN (2017) Fundamentals of Microbiology.
4. Pelczar MJ (2001) Microbiology, 5th edition, Tata McGraw-Hill Co, New Delhi.
5. Sharma PD (2009) Microbiology. latest edition, Rastogi Publication, Meerut.
6. Singh RS (2017) Plant Diseases.
7. Wiley JM, Sherwood LM and Woolverton CJ (2013) Prescott's Microbiology. McGraw Hill International.

Graduate Attributes

Course Objective:

1. To give concise knowledge on basic microbiology
2. To give practical knowledge on handling of microorganisms
3. To inculcate knowledge on usefulness of microorganisms for sustainable development

Learning outcome:

1. Knowledge on microbial diversity and distribution in different habitats
2. Knowledge on ecological and economic importance of microorganisms in our day-to-day life
3. Knowledge on growth, reproduction and life cycles of viruses and microorganisms
4. Knowledge on genetic recombination of bacteria
5. Practical knowledge on microscopy, slide preparation, staining and morphological study of microorganisms
6. Knowledge on pathogenic microorganisms, host-pathogen interaction, and immunity
7. Practical knowledge on isolation and pure culture of bacteria/fungi from soil samples

Theory Credit: 03

Practical Credit: 01

No. of Required Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)

No. of Non-Contact Classes: Nil

Particulars of Course Designer (Name, Institution, email id):

Prof. Bhaben Tanti
Head, Department of Botany,
Gauhati University
Email id: btanti@gauhati.ac.in

Four-year Undergraduate Programme
Subject: Botany
Semester: Fourth
Course Name: *Plant Resources and Economic Botany*
Existing Base Syllabus: UG CBCS Syllabus
Course Level: 200-299, and subsequent level as per NEP structure

THEORY [Total marks: 60] Credit: 03; Total No. of classes: 45			
Unit no.	**Unit content**	**No. of classes**	**Marks**
Unit 1	**Origin of Cultivated Plants:** Centres of Origin, their importance with reference to Vavilov's work. Introductions, domestication, and loss of crop genetic diversity; evolution of new crops/varieties, importance of germplasm diversity and conservation. Classification of plant resources on the basis of their uses.	6	8
Unit 2	**Food and Food Adjuncts:** Cereals and millets: Rice and wheat (origin, morphology, processing, post-harvest management & uses); Brief account of millets and their climatic and nutritional importance. Legumes: Origin, morphology, cultivation, uses and commercial importance of Chick pea, Pigeon pea and fodder legumes. Importance of legumes to man and ecosystem. Spices: Listing of important spices, their family and part used. Economic importance with special reference to Assam. Study of fennel, saffron, clove and black pepper. Beverages: Tea, Coffee (morphology, processing, cultivation, Types & uses).	12	14
Unit 3	**Plants and Plant Products of Industrial Value:** Oils and Fats: General description, classification, extraction, their uses and health implications groundnut, coconut, soybean, and mustard. Essential Oils: General account, extraction methods, comparison with fatty oils & their uses. Non edible oil yielding trees and importance as biofuel. Sugar and starches: Morphology, new varieties and processing of sugarcane, products and by-products	12	14

	of sugarcane industry. Potato: morphology, propagation, post-harvest management, uses of potato and starches. Natural Rubber**:** Para-rubber: tapping, processing and uses. Fibres: Classification based on the origin of fibres; Cotton, Coir and Jute (morphology, extraction and uses).		
Unit 4	**Drug-yielding plants:** Therapeutic and habit-forming drugs with special reference to C*inchona, Digitalis, Aloe vera* and *Cannabis*; Tobacco (Morphology, processing, uses and health hazards).	5	8
Unit 5	**Forest Products:** Forest and forest products. Timber and Non-Timber Forest Products (NTFP), Forest types of Assam and their conservation strategies; Community forestry.	5	8
Unit 6	**Ethnobotany Hours:**Definition, concept and scope; relevance of ethnobotany in the present context; Traditional knowledge and IPR.	5	8
PRACTICAL [Credit: 01]			
1. Cereals: Study of useful parts: Rice/Bean (habit sketch, study of paddy and grain, starch grain, micro-chemical test). 2. Legumes: Bean, (habit, fruit, seed structure, micro-chemical tests). 3. Beverages: Tea (plant specimen, tea leaves). 4. Oils and fats: Coconut and Mustard, Groundnut, 5. Rubber:Specimen, photograph/model of tapping, samples of rubber products. 6. Test for alkaloids: Neem, *Vinca rosea*. 7. Fibre-yielding plants: Cotton (specimen, whole mount of seed to show lint and fuzz; whole mount of fibre and test for cellulose), Jute (specimen, transverse section of stem, test for lignin).	30	40

Reading list:

1. Chrispeels MJ, Sadava DE (1994) Plants, Genes and Agriculture. Jones & Bartlett Publishers.
2. Gonsalves J (2010) Economic Botany and Ethnobotany. Mittal Publications, New Delhi, India.
3. Hill AF (1972) Economic Botany: A Textbook of Useful Plants and Plant Products. Tata McGraw-Hill, New Delhi, India.
4. Jain SK, Mudgal V (1999) A Hand Book of Ethnobotany. Bishen Singh Mahendra Pal Singh, Dehra Dun, India.
5. Kochhar SL (2012) Economic Botany in Tropics, MacMillan & Co. New Delhi, India.
6. Samba Murty AVSS, Subramanyam NS (1989) A Textbook of Economic Botany. Wiley Eastern Limited, New Delhi.
7. Wickens GE (2001) Economic Botany: Principles & Practices. Kluwer Academic Publishers, The Netherlands.
8. Wickens GE (2006) Economic Botany Principles and Practices, Springer India, New Delhi.

Graduate Attributes

Course Objective:

This paper will provide an understanding of major introduced plant species, concept of centre of origin and their importance, domestication of crops and loss of genetic diversity, evolution of new crops /varieties. This paper will also provide knowledge on germ plasm diversity, importance of ethnobotany and economic importance of various plants.

Learning outcome:

On successful completion of the course, students will:

1. Know the centre of origin, domestication, and loss of genetic diversity
2. Understand the evolution of new crops /varieties
3. Know about the germplasm diversity
4. Understand the economic values of various plant species.
5. Understand the importance of ethnobotany in the present context.

Theory Credit: 03

Practical Credit: 01

No. of Required Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)

No. of Non-Contact Classes: Nil

Particulars of Course Designer (Name, Institution, email id):

Prof. Bhaben Tanti
Head, Department of Botany,
Gauhati University
Email id: btanti@gauhati.ac.in

Four-year Undergraduate Programme
Subject: Botany
Semester: Fifth
Course Name: *Genetics*
Existing Base Syllabus: UG CBCS Syllabus
Course Level: 300-399, and subsequent level as per NEP structure

THEORY [Total marks: 60] Credit: 03; Total No. of classes: 45			
Unit no.	**Unit content**	**No. of classes**	**Marks**
Unit 1	**Mendelian genetics and its extension:** Mendelism: History; Principles of inheritance; Chromosome theory of inheritance; Autosomes and sex chromosomes; Probability and pedigree analysis; Incomplete dominance and codominance; Multiple alleles, Lethal alleles, Epistasis, Pleiotropy, Recessive and Dominant traits, Penetrance and Expressivity, Numericals; Polygenic inheritance.	13	14
Unit 2	**Extrachromosomal Inheritance:** Chloroplast mutation: Variegation in Four o'clock plant; Mitochondrial inheritance in yeast; Maternal effects-shell coiling in snail; Infective heredity-Kappa particles in *Paramecium*	4	6
Unit 3	**Linkage, crossing over and chromosome mapping:** Linkage and crossing over-Cytological basis of crossing over; Recombination frequency, two factor and three factor crosses; Interference and coincidence; Numerical based on gene mapping; Sex Linkage.	8	10
Unit 4	**Variation in chromosome number and structure:** Deletion, Duplication, Inversion, Translocation, Position effect, Euploidy and Aneuploidy.	6	8
Unit 5	**Fine structure of gene and Gene mutations:** Classical vs molecular concepts of gene; Ciston, Racon, Muton, rII locus; Types of mutations; Molecular basis of Mutations; Mutagens – physical and chemical (Base analogs, deaminating, alkylating and intercalating agents); Detection of mutations: ClB method. Role of Transposons in mutation. DNA repair mechanisms	10	12

Unit 6	**Unit 6. Population and Evolutionary Genetics:** Allele frequencies, Genotype frequencies, Hardy-Weinberg Law, role of natural selection, mutation, genetic drift. Genetic variation and Speciation.	4	10
PRACTICAL [Credit: 01]			
1. Mendel's laws through seed ratios. 2. Chromosome mapping using point test cross data. 3. Incomplete dominance and gene interaction through seed ratios (9:7, 9:6:1, 13:3, 15:1,12:3:1, 9:3:4). 4. Permanent Slides showing Translocation Ring, Photograph showing Laggards and Inversion Bridge.		30	40

Reading list:

1. Gardner EJ, Simmons MJ, Snustad DP (2015) Principles of Genetics, John Wiley & sons, India. 8th edition.
2. Griffiths AJF, Wessler SR, Carroll SB, Doebley J (2010) Introduction to Genetic Analysis. W. H. Freeman and Co., U.S.A. 10th edition.
3. Klug WS, Cummings MR, Spencer CA (2012) Concepts of Genetics. Benjamin Cummings, U.S.A. 10th edition.
4. Snustad DP, Simmons MJ (2010) Principles of Genetics, John Wiley & Sons Inc., India. 5thedition.

Graduate Attributes

Course Objective:

To gain knowledgeonclassical and modern concepts of genetics.

Learning outcome:

1. Knowledge of Mendelian and non- Mendelian inheritance in organisms.
2. Knowledge of gene and chromosomal mutations
3. Knowledge of basic concepts of population and evolutionary genetics
4. Ability to work out problems related to Mendel's experiments, Chromosome mapping and gene interaction

Theory Credit: 03

Practical Credit: 01

No. of Required Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)

No. of Non-Contact Classes: Nil

Particulars of Course Designer (Name, Institution, email id):

Prof. Bhaben Tanti
Head, Department of Botany,

Gauhati University
Email id: btanti@gauhati.ac.in

Four-year Undergraduate Programme
Subject: Botany
Semester: Fifth
Course Name: *Molecular Biology*
Existing Base Syllabus: UG CBCS Syllabus
Course Level: 300-399, and subsequent level as per NEP structure

THEORY [Total marks: 60] Credit: 03; Total No. of classes: 45			
Unit no.	**Unit content**	**No. of classes**	**Marks**
Unit 1	**Nucleic acids: Carriers of genetic information:** Historical perspective; DNA as the carrier of genetic information (Griffith's, Hershey & Chase, Avery, McLeod & McCarty, Fraenkel-Conrat's experiment.	3	4
Unit 2	**The Structures of DNA and RNA / Genetic Material:** DNA Structure: Miescher to Watson and Crick- historic perspective, DNA structure, Salient features of double helix, denaturation and renaturation, cot curves; Organization of DNA- Prokaryotes, Viruses, Eukaryotes. Organelle DNA - mitochondria and chloroplast DNA. The Nucleosome Chromatin structure- Euchromatin, Heterochromatin- Constitutive and Facultative heterochromatin.	8	12
Unit 3	**The replication of DNA, Central dogma and genetic code:** Chemistry of DNA synthesis (Kornberg's discovery); General principles – bidirectional, semi- conservative and semi discontinuous replication, RNA priming; Various models of DNA replication, including rolling circle, θ (theta) mode of replication, replication of linear ds-DNA; Enzymes involved in DNA replication. Key experiments establishing-The Central Dogma (Adaptor hypothesis and discovery of mRNA template), Genetic code (deciphering & salient features)	10	12
Unit 4	**Transcription:** Transcription in prokaryotes and eukaryotes. Principles of transcriptional regulation; Prokaryotes: Regulation of lactose metabolism and tryptophan synthesis in *E.coli*. Eukaryotes: transcription factors, heat shock proteins, steroids	10	12

	and peptide hormones; Gene silencing.		
Unit 5	**Processing and modification of RNA:** Split genes-concept of introns and exons, removal of introns, spliceosome machinery, splicing pathways, group I and group II intron splicing, alternative splicing eukaryotic mRNA processing (5' cap, 3' poly A tail); Ribozymes; RNA editing and mRNA transport.	7	10
Unit 6	**Translation:** Ribosome structure and assembly, mRNA; Charging of tRNA, aminoacyl tRNA synthetases; Various steps in protein synthesis, proteins involved in initiation, elongation and termination of polypeptides; Fidelity of translation; Inhibitors of protein synthesis; Post-translational modifications of proteins.	7	10
PRACTICAL [Credit: 01]			
1. DNA isolation from any plant material. 2. DNA estimation by diphenylamine reagent/UV Spectrophotometry (Demonstration). 3. Study of DNA replication mechanisms through photographs (Rolling circle, Theta replication and semi-discontinuous replication). 4. Study of structures of prokaryotic RNA polymerase and eukaryotic RNA polymerase II through photographs. 5. Study of the following through photographs: Assembly of Spliceosome machinery; Splicing mechanism in group I & group II introns; Ribozyme and Alternative splicing.		30	40

Reading list:

1. Griffiths AJF, Wessler SR, Carroll SB, Doebley J (2010) Introduction to Genetic Analysis. W. H. Freeman and Co., U.S.A. 10th edition.
2. Klug WS, Cummings MR, Spencer CA (2009) Concepts of Genetics. Benjamin Cummings. U.S.A. 9th edition.
3. Russell PJ (2010) iGenetics - A Molecular Approach. Benjamin Cummings, U.S.A. 3rd edition.
4. Snustad DP, Simmons MJ (2010) Principles of Genetics. John Wiley and Sons Inc., U.S.A. 5th edition.
5. Watson JD, Baker TA, Bell SP, Gann A, Levine M, Losick R (2007) Molecular Biology of the Gene, Pearson Benjamin Cummings, CSHL Press, New York, U.S.A. 6th edition.

Graduate Attributes

Course Objective:

To have detailed knowledge of DNA, RNA and central dogma of molecular biology

Learning outcome:

1. Knowledge of structure, organization, and replication mechanism of DNA
2. Detailed knowledge of central dogma, mechanism of transcription and processing of different types of RNA
3. Knowledge of genetic code, molecular mechanisms associated with various steps in protein synthesis and post translational modifications
4. Ability to isolate genomic DNA from plant samples

Theory Credit: 03

Practical Credit: 01

No. of Required Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)

No. of Non-Contact Classes: Nil

Particulars of Course Designer (Name, Institution, email id):

Prof. Bhaben Tanti
Head, Department of Botany,
Gauhati University
Email id: btanti@gauhati.ac.in

Four-year Undergraduate Programme
Subject: Botany
Semester: Fifth
Course Name: *Plant Ecology, Phytogeography and Climate Change*
Existing Base Syllabus: UG CBCS Syllabus
Course Level: 300-399, and subsequent level as per NEP structure

THEORY [Total marks: 60] Credit: 03; Total No. of classes: 45			
Unit no.	**Unit content**	**No. of classes**	**Marks**
Unit 1	**Ecology and Ecosystem:** Ecology: Basic concepts, Levels of organization, Inter-relationships between the living world and the environment. Ecosystem: Structure, functions, and types, trophic organisation, food chains and food webs, ecological pyramids, homeostasis.	8	8
Unit 2	**Ecological Factors:** Climatic, Edaphic and Biotic Factors, Factorial interactions, Plant adaptation to environmental factors (light, temperature, wind, and fire); autotrophy, heterotrophy; symbiosis, commensalism, ammensalism, parasitism, parasitoidism. Aquatic ecology- concept.	8	8
Unit 3	**Population ecology:** Population characteristics, Growth curve, Lotka-Volterra model, population regulation, *r* and *k*-selection. Types of ecological speciation, Ecological equivalents.	7	12
Unit 4	**Plant communities:** Plant Community: Basic concept, types, characters (analytical and synthetic), Dynamics: succession – processes, types, models; climax concepts, Habitat and Niche: concept &types.	7	12
Unit 5	**Functional Ecology:** Principles and models of energy flow; Production and productivity; Ecological efficiencies; Ecological energetics; Biogeochemical cycles (C, N and P) and water cycle.	7	10
Unit 6	**Phytogeography and Climate Change:** Principles; Continental drift; Theory of tolerance; Endemism; Brief description of major terrestrial biomes (one each from tropical, temperate & tundra);	8	10

	Phytogeographical division of India;Vegetation types of NE India with special reference to Assam. Climate change: Basic concepts; global warming, causes and consequences (Rise in Sea levels, Glacier melting, Biodiversity Loss), Adaptation, Mitigation, Global and National Efforts, Concept on Sustainable Development, Sustainable Development Goals (SDGs).		
PRACTICAL [Credit: 01]			
1. Determination of minimal quadrat size and number for the study of herbaceous vegetation in the college campus by species area curve method (species to be listed). 2. Quantitative analysis of herbaceous vegetation for density and abundance in the college campus. 3. Quantitative analysis of herbaceous vegetation in the college campus for frequency and comparison with Raunkiaer's frequency distribution law. 4. Study of instruments used to measure microclimatic variables: Soil thermometer, maximum and minimum thermometer, anemometer, psychrometer/hygrometer, rain gauge and lux meter. 5. Analysis for carbonates, chlorides, nitrates, sulphates, organic matter and base deficiency from two soil samples by rapid field tests. 6. Determination of dissolved oxygen of water samples from polluted and unpolluted sources. a) Study of morphological adaptations of hydrophytes and xerophytes (four each). b) Study of biotic interactions of the following: Stem parasite, Root parasite, Epiphytes, Predation (Insectivorous plants). 7. Local field visit to nearby areas to familiarise students with various plant communities. 8. Soil respiration study in two agricultural systems to determine the CO_2 evolution.		30	40

Reading list:

1. Ambasht and Ambasht (2002) A text book of Plant Ecology. CBS publisher and Distributors.
2. Bhattacharya K, Ghosh AK, HaitG (2017) A Text Book of Botany. New Central Book Agency (P), Kolkata, India.
3. Bowmen WD, Hacker SD, Cain ML (2018) Ecology, Oxford University Press.
4. Deka U, Dutta T (2022) Plant Ecology and Phytogeography. Asian Humanitities Press, Guwahati, Assam.
5. KapurP, GovilSR (2000, 2007). Experimental Plant Ecology. CBS Publishers and Distributors, New Delhi (India).
6. Kormondy EJ (1996) Concepts of ecology. PHI Learning Pvt. Ltd., Delhi, India. 4th edition.
7. Misra R (1968, Reprinted in 2019). Ecology Workbook. Scientific Publishers (India), Jodhpur
8. OdumEP (2005) Fundamentals of ecology. Cengage Learning India Pvt. Ltd., New Delhi. 5th edition.
9. Raj M, Deka H (2022) Plant Ecology and Phytogeography. Ashok Book Stall, Guwahati, Assam.
10. Sharma PD (2010) Ecology and Environment. Rastogi Publications, Meerut, India. 8th edition.
11. Smith TM, Smith RL (2015) Elements of ecology. Pearson publishers., London. 9th Edition
12. StilingPD (1996) Ecology: theories and applications (Vol. 4). Upper Saddle River: Prentice Hall.
13. Verma PS, Agarwal VK (2003) Environmental Biology-Principles of Ecology. S Chand & Company Ltd. Ramnagar, New delhi-110055.
14. Wilkinson DM (2007) Fundamental Processes in Ecology: An Earth Systems Approach. Oxford University Press. U.S.A.

Graduate Attributes

Course Objective:

This course will provide an understanding on ecology and ecosystems, biotic and abiotic interactions, ecosystem processes, terrestrial and aquatic environment, population and community interactions, plant distribution and effect of climate change on natural environment. Emphasis will be given on the hands-on approach, field, and laboratory techniques.

Learning outcome:

On successful completion of the course, students will:

1. Understand the concept of ecology, ecosystems, and importance of factors.
2. Understand the population, community, biodiversity, and conservation strategies.
3. Understand the concept of phytogeography, endemism, and floristic distributions.
4. Understand the science of climate change and sustainable developmentstrategies
5. Know the adaptation and mitigation against climate change-induced phenomena.

Theory Credit: 03

Practical Credit: 01

No. of Required Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)

No. of Non-Contact Classes: Nil

Particulars of Course Designer (Name, Institution, email id):

Prof. Bhaben Tanti
Head, Department of Botany,
Gauhati University
Email id: btanti@gauhati.ac.in

Four-year Undergraduate Programme
Subject: Botany
Semester: Fifth
Course Name: *Plant Systematics*
Existing Base Syllabus: UG CBCS Syllabus
Course Level: 300-399, and subsequent level as per NEP structure

THEORY [Total marks: 60] Credit: 03; Total No. of classes: 45			
Unit no.	**Unit content**	**No. of classes**	**Marks**
Unit 1	**Significance of Plant systematics:** Introduction to systematics; Plant identification, Classification, Nomenclature. Evidences from palynology, cytology, phytochemistry and molecular data. Functions and importance of Herbarium and botanical garden; Important herbaria and botanical gardens of the world and India; Virtual herbarium; Categories and taxonomic hierarchy; Concept of taxa (family, genus, species).	8	8
Unit 2	**Botanical nomenclature:** History, Principles and Rules (ICN); Ranks and names; Typification, Author citation, Effective and Valid publication, Rejection of names, Principle of priority and its limitations.	5	8
Unit 3	**Systems of classification:** Major contributions of Theophrastus, Bauhin, Tournefort, Linnaeus, Adanson, de Candolle, Bessey, Hutchinson, Takhtajan and Cronquist; Classification systems of Bentham and Hooker, Engler and Prantl, Takhtajan; Brief account of Angiosperm Phylogeny Group (APG) classification.	9	12
Unit 4	**Numerical taxonomy and cladistics:** OTUs, characters, character weighting and coding; Cluster analysis; Phenograms & Cladograms (definitions and differences).	6	8
Unit 5	**Phylogeny of Angiosperms:** Terms and concepts (primitive and advanced, homology and analogy, parallelism and convergence, monophyly, Paraphyly, polyphyly and clades). Origin and evolution of angiosperms; Co-evolution of angiosperms and animals; Methods of illustrating	6	10

	evolutionary relationship (phylogenetic tree, cladogram).		
Unit 6	**Angiospermic Families:** Detail study of the following families: Magnoliaceae, Fabaceae, Asteraceae, Solanaceae, Acanthaceae, Lamiaceae, Euphorbiaceae, Orchidaceae, Musaceae, Zingiberaceae, Poaceae.	11	14
PRACTICAL [Credit: 01]			
1. Study of vegetative and floral characters of locally available angiospermic plants belonging to the following families (Description, V.S. flower, section of ovary, floral diagram/s, floral formula/e and systematic position according to Bentham & Hooker's system of classification): Fabaceae, Solanaceae, Acanthaceae, Lamiaceae, Euphorbiaceae, Musaceae, Orchidaceae. 2. Field visits to familiarise students with vegetation of an area and identification of plant species / Visit to Academic or Research Institutions. 3. Mounting of properly dried and pressed specimens of at least 10 (ten) wild plant species with herbarium labels (to be submitted with the record book).	30	40

Reading list:

1. Jeffrey C (1982) An Introduction to Plant Taxonomy. Cambridge University Press, Cambridge.
2. Judd WS, Campbell CS, Kellogg EA, Stevens PF (2002) Plant Systematics-A Phylogenetic Approach. Sinauer Associates Inc., U.S.A. 2nd edition.
3. Mitra JN (1988) An Introduction to Systematic Botany and Ecology. The World Press Private Ltd. Calcutta.
4. Mondal AK (2009) Advanced Plant Taxonomy. New Central Book Agency (P) Ltd.
5. Naik VN (1984) Taxonomy of Angiosperms. Tata Mc Graw-Hill.
6. Pandey BP (2018) A Textbook of Botany: Angiosperm. S. Chand Publishing, 7361, Ram Nagar, Qutab Road, New Delhi-110055.
7. Simpson MG (2006) Plant Systematics. Elsevier Academic Press.
8. Singh G (2012) Plant Systematics: Theory and Practice. Oxford & IBH Pvt. Ltd., New Delhi. 3rd edition.

Graduate Attributes

Course Objective:

This paper will provide an understanding of knowledge on plant systematics, basic understanding of plant identification, classification systems and plant nomenclature, significance of systematics in different fields/branches of botany, phylogenetic and evolutionary relationships of angiosperms. The paper will also focus on knowledge about

herbaria and botanical gardens in India and abroad and their significant role in plant identification.

Learning outcome:

On successful completion of the course, students will be:

1. Able to obtain knowledge on plant identification and classification systems, plant nomenclature.
2. Detailed knowledge of the phylogenetic and evolutionary relationships of angiosperms.
3. Able to obtain knowledge on various herbaria and botanical gardens in India and abroad, their role in plant systematics.
4. Acquainted with practical knowledge on vegetative and reproductive structures of angiosperms.
5. Acquainted students with practical knowledge on vegetation of an area.

Theory Credit: 03

Practical Credit: 01

No. of Required Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)

No. of Non-Contact Classes: Nil

Particulars of Course Designer (Name, Institution, email id):

Prof. Bhaben Tanti
Head, Department of Botany,
Gauhati University
Email id: btanti@gauhati.ac.in

Four-year Undergraduate Programme
Subject: Botany
Semester: Sixth
Course Name: *Reproductive Biology of Angiosperm*
Existing Base Syllabus: UG CBCS Syllabus
Course Level: 300-399, and subsequent level as per NEP structure

THEORY [Total marks: 60] Credit: 03; Total No. of classes: 45			
Unit no.	**Unit content**	**No. of classes**	**Marks**
Unit 1	**Introduction to reproductive biology of Angiosperms:** History (contributions of G.B. Amici, W. Hofmeister, E. Strasburger, S.G. Nawaschin, P. Maheshwari, B.M. Johri, W.A. Jensen, J. Heslop-Harrison) and scope.	4	4
Unit 2	**Reproductive development:** Induction of flowering; flower as a modified determinate shoot. Flower development: genetic and molecular aspects.	4	6
Unit 3	**Anther and pollen biology:** Anther wall: Structure and functions, microsporogenesis, callose deposition and its significance. Micro-gametogenesis; Pollen wall structure, MGU (male germ unit) structure; Palynology and scope (a brief account); NPC system; Pollen wall proteins; Pollen viability, storage and germination; Abnormal features: Pseudomonads, polyads, massulae, pollinia.	10	14
Unit 4	**Ovule:** Structure; Types; Special structures– endothelium, obturator, aril, caruncle and hypostase; Female gametophyte- megasporogenesis (monosporic, bisporic and tetrasporic) and megagametogenesis (details of *Polygonum* type); Organization and ultrastructure of mature embryo sac.	6	10
Unit 5	**Pollination and fertilization:** Pollination types and significance; adaptations; structure of stigma and style; path of pollen tube in pistil; double fertilization. Basic concept of Self incompatibility (interspecific, intraspecific, homomorphic, heteromorphic, GSI and SSI); Methods to overcome self- incompatibility: mixed pollination, bud	12	12

	pollination, stub pollination; Intra-ovarian and *in vitro* pollination; Modification of stigma surface, parasexual hybridization; Cybrids, *in vitro* fertilization.		
Unit 6	**Embryo, Endosperm and Seed:** Structure and types; General pattern of development of dicot and monocot embryo and endosperm; Suspensor: structure and functions; Embryo-endosperm relationship; Nutrition of embryo; Unusual features; Embryo development in *Paeonia*. Seed structure, importance, and dispersal mechanisms. Polyembryony and apomixis: Introduction; Classification; Causes and applications.	9	14
PRACTICAL [Credit: 01]			
1. **Anther:** Wall and its ontogeny; Tapetum (amoeboid and glandular); MMC, spore tetrads, uninucleate, bi-celled and dehisced anther stages through slides/micrographs, male germ unit (MGU) through photographs and schematic representation. 2. **Pollen grains:** Fresh and acetolyzed showing ornamentation and aperture, psuedomonads, polyads, pollinia (slides/photographs, fresh material), ultrastructure of pollen wall(micrograph); Pollen viability: Tetrazolium test for germination: Calculation of percentage germination in different media using hanging drop method. 3. **Ovule:** Types-anatropous, orthotropous, amphitropous/ campylotropous, circinotropous, unitegmic, bitegmic; Tenuinucellate and crassinucellate; Special structures: Endothelium, obturator, hypostase, caruncle and aril (permanent slides/specimens/photographs). 4. **Female gametophyte through permanent slides/ photographs:** Types, ultrastructure of mature egg apparatus. 5. Intra-ovarian pollination; Test tube pollination through photographs. 6. **Endosperm:** Dissections of developing seeds for endosperm with free-nuclear haustoria. 7. **Embryogenesis:** Study of development of dicot embryo through permanent slides; dissection of developing seeds for embryos at various developmental stages.	30	40

Reading list:

1. Bhattacharya M, Bhattacharya. (2012). A Textbook of Palynology: Basic and Applied. New Central Book Agency (P) Ltd. Guwahati.
2. Bhojwani SS, Bhatnagar SP (2011) The Embryology of Angiosperms, Vikas Publishing House. Delhi. 5th edition.
3. Johri BM (1984) Embryology of Angiosperms, Springer-Verlag, Netherlands.
4. Raghavan V (2000) Developmental Biology of Flowering plants, Springer, Netherlands.
5. Shivanna KR (2003) Pollen Biology and Biotechnology. Oxford and IBH Publishing Co. Pvt. Ltd. Delhi.

Graduate Attributes

Course Objective:

This paper will explain the detailed accounts on reproductive and developmental characteristics of Angiosperm.

Learning outcome:

1. Knowledge on detailed morphological andreproductive structures of angiosperm.
2. Knowledge on embryology and embryological abnormalities in angiosperms.
3. Practical knowledge on developmental biology of embryo and endosperms.

Theory Credit: 03

Practical Credit: 01

No. of Required Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)

No. of Non-Contact Classes: Nil

Particulars of Course Designer (Name, Institution, email id):

Prof. Bhaben Tanti
Head, Department of Botany,
Gauhati University
Email id: btanti@gauhati.ac.in

Four-year Undergraduate Programme
Subject: Botany
Semester: Sixth
Course Name: *Plant Physiology*
Existing Base Syllabus: UG CBCS Syllabus
Course Level: 300-399, and subsequent level as per NEP structure

THEORY [Total marks: 60] Credit: 03; Total No. of classes: 45			
Unit no.	**Unit content**	**No. of classes**	**Marks**
Unit 1	**Plant-water relations:** Water Potential and its components; Water absorption by roots: aquaporins; Pathway of water movement: symplast, apoplast, transmembrane pathways; Ascent of sap: Mechanisms, cohesion-tension theory, root pressure, guttation; Transpiration: Factors affecting transpiration, anti-transpirants, mechanism of stomatal movement.	5	8
Unit 2	**Mineral nutrition and nutrient uptake:** Criteria for essentiality of mineral elements, macro and micronutrients, nutrient solutions for plant growth experiments, roles of essential elements, mineral deficiency symptoms, chelating agents, Ion antagonism and toxicity. Soil as a nutrient reservoir; Transport of ions across cell membrane: Passive and active absorption, electrochemical gradient, facilitated diffusion, carrier systems, proton ATPase pump and ion flux, uniport, symport, antiport, co-transport.	10	10
Unit 3	**Translocation of organic solutes:** Phloem as the path of organic solute translocation: Experimental evidences, Mechanisms of solute transport, Pressure-Flow Model and Munch's hypothesis, Phloem loading and unloading, Source - sink relationship.	4	8
Unit 4	**Plant growth regulators (PGRs):** Discovery, chemical nature (basic structure), bioassay and physiological roles of Auxins, Gibberellins, Cytokinins, Abscisic acid, Ethylene, Brassinosteroids and Jasmonic acid; Synthetic PGRs; Application of PGRs in agriculture and horticulture.	10	14

Unit 5	**Physiology of flowering and seed dormancy:** Photoperiodism: SDPs and LDPs, flowering stimulus, florigen concept; Vernalization; Photoreceptors: Phytochrome, crytochrome and phototropin; Discovery, chemical nature, mechanism of action, role in photomorphogenesis, low energy responses (LER) and high irradiance responses (HIR); Seed dormancy: Significances, causes of dormancy, mechanisms to break dormancy.	8	12
Unit 6	**Plant stress physiology:** Abiotic and biotic stress: Plants' responses to drought, water logging, salinity, heavy metals, freezing, heat stress and pathogen attack. Oxidative stress: Generation of reactive oxygen species (ROS); Effect of ROS on metabolism; ROS detoxification mechanisms in plants; Stress mitigation strategies (Enzymatic and non-enzymatic).	8	8
PRACTICAL [Credit: 01]			
1. Determination of osmotic potential of plant cell sap by the method of plasmolysis. 2. Determination of water potential of given tissue (e.g., potato tuber) by weight method. 3. Study of the effect of sunlight on the rate of transpiration in excised twig/leaf. 4. Calculation of stomatal index and stomatal frequency from the two surfaces of leaves of mesophyte/ xerophyte. 5. Effect of carbon dioxide concentration on the rate of photosynthesis. 6. To study the effect of different concentrations of IAA on Gram/Pea/Moong root (IAA Bioassay). 7. Determination of seed germination percentage in different physical conditions (Demonstration) 8. To demonstrate water stress by application of PEG/ water withdrawal in germinating seeds /growing plants (Demonstration) 9. Fruit ripening/Rooting from cuttings (Demonstration).		30	40

Reading list:

1. Bajracharya D (1999) Experiments in Plant Physiology-A Laboratory Manual. Narosa Publishing House, New Delhi.
2. Bhatla SC, Lal MA (2018) Plant Physiology, Development and Metabolism. Springer Nature Singapore Pte Ltd.

3. Devlin RM (2017) Outline of Plant Physiology. Medtech: Scientific International Pvt. Ltd.
4. Devlin RM, Witham FH, Blaydes DF (2017) Devlin's Exercises in Plant Physiology. Medtech: Scientific international Pvt. Ltd.
5. Hopkins WG, Huner A (2008) Introduction to Plant Physiology (4th edition). John Wiley and Sons. U.S.A.
6. Kochhar SL, Gujral SK (2021) Plant Physiology: Theory and Applications (2nd edition). Cambridge University Press.
7. Malik CP, Srivastava (2015) Text Book of Plant Physiology. Kalyani Publishers, New Delhi.
8. Salisbury FB, Ross CW (2004) Plant Physiology (4th edition). Cengage Learning India Pvt. Ltd., New Delhi, India.
9. Taiz L, Zeiger E, MØller IM, Murphy A (2015) Plant Physiology and Development (6th edition). Sinauer Associates Inc. USA.

Graduate Attributes

Course Objective:

Students will be able to learn the plant and water relation and thus will be able to elucidate the crucial role of water in diverse physiological functions of plants, by studying this paper. The paper will also highlight the importance of mineral elements in plant physiology and various mechanisms applied to uptake mineral elements by plants. It will provide the basic idea of pathways and mechanisms of translocation of organic solutes synthesised in plant. Furthermore, this paper will explain the role and mechanisms of action of various plant growth regulators as well as physiology of flowering and dormancy of seeds. Additionally, the paper will also focus on the different abiotic and biotic stresses encountered by the plants in their environment as well as various stress mitigation strategies employed by plants to overcome the effects of stress.

Learning outcome:

1. Knowledge on mechanisms of water, minerals, and nutrient absorption of plants
2. Knowledge on roles of plant hormones and mechanism of flowering in plants
3. Practical knowledge on effects of growth regulators on plant parts
4. Practical knowledge on determination of osmotic and water potential

Theory Credit: 03

Practical Credit: 01

No. of Required Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)

No. of Non-Contact Classes: Nil

Particulars of Course Designer (Name, Institution, email id):

Prof. Bhaben Tanti
Head, Department of Botany,
Gauhati University
Email id: btanti@gauhati.ac.in

Four-year Undergraduate Programme
Subject: Botany
Semester: Sixth
Course Name: *Plant Metabolism and Biochemistry*
Existing Base Syllabus: UG CBCS Syllabus
Course Level: 300-399, and subsequent level as per NEP structure

THEORY [Total marks: 60] Credit: 03; Total No. of classes: 45			
Unit no.	**Unit content**	**No. of classes**	**Marks**
Unit 1	**Concepts of metabolism:** Introduction, anabolic and catabolic pathways, regulation of metabolism, role of regulatory enzymes; classification, nomenclature, and importance of enzyme; Concept of coenzyme, apoenzyme and prosthetic group; Enzyme inhibition (allosteric, covalent modulation); Isozymes.	6	8
Unit 2	**Carbon assimilation:** Role of photosynthetic pigments (chlorophylls and accessory pigments), antenna molecules and reaction centers, photochemical reactions, photosynthetic electron transport, PSI, PSII, Q-cycle, CO_2 reduction: C3, C4-pathways, Crassulacean acid metabolism; Photorespiration.	8	12
Unit 3	**Carbon oxidation and ATP Synthesis:** Glycolysis and its regulation, oxidative decarboxylation of pyruvate, TCA cycle and regulation, amphibolic role, anaplerotic reactions, mitochondrial electron transport, oxidative phosphorylation, cyanide-resistant respiration, pentose phosphate pathway; Factors affecting respiration; ATP synthesis: substrate level phosphorylation, chemiosmotic mechanism, ATP synthase, Boyer's conformational model, Racker's experiment, Jagendorf'sexperiment, role of uncouplers.	10	12
Unit 4	**Carbohydrate, Lipid and Nitrogen metabolism:** Synthesis and catabolism of sucrose, starch and cellulose, Synthesis and breakdown of triglycerides, β-oxidation, glyoxylate cycle, gluconeogenesis and its role in mobilisation of lipids during seed germination, α-oxidation. Nitrogen assimilation: biological nitrogen fixation (examples of legumes and non-legumes), biochemistry of nitrogen	12	14

	fixation, ammonia assimilation and transamination.		
Unit 5	**Mechanisms of Signal Transduction:** Receptor-ligand interactions, Second messenger concept, Calcium-calmodulin, MAP kinase cascade, two-component system.	5	8
Unit 6	**Secondary Metabolites:** Shikimate Pathway: Role in biosynthesis of secondary metabolites; Biosynthesis and physiological roles of terpenes, phenols and nitrogenous compounds.	4	6
PRACTICAL [Credit: 01]			
1. Chemical separation of photosynthetic pigments by solvent method/paper chromatography 2. Estimation of sugar content by DNSA method 3. Determination of titratable acid number (TAN) in plant materials 4. Quantification of chlorophyll a, b and total chlorophyll and determination of chlorophyll a/b ratio 5. Estimation of phenol/tannin/flavonoid by colorimetric method 6. Estimation of protein in plant sample by Lowry's method/Biuret method 7. Separation of amino acids by paper chromatography 8. Demonstration of Thin layer chromatography (TLC)/Column chromatography 9. To compare the rate of respiration by Ganong's respirometer in different parts of plant (Demonstration)		30	40

Reading list:

1. Cox MM, Nelson DL (2017) Principles of Biochemistry (7th Edition). WH Freeman & Co., Newyork.
2. Goodwin TW, Mercer EI (2005) Introduction to Plant Biochemistry. CBS Publishers and Distributors Pvt. Ltd., New Delhi.
3. Jain J L, Jain S, Jain N (2016) Fundamentals of Biochemistry (7th edition). S Chand & Co. PVT. Ltd., New Delhi, India;
4. Palmer T, Bonner P (2008) Enzymes: Biochemistry, Biotechnology, Clinical Chemistry. East West Press Pvt. Ltd., New Delhi;
5. Plummer D (2017) An Introduction to Practical Biochemistry (3rd edition). McGraw Hill Education, New Delhi, India
6. Sadasivam A, Manickam S (2022) Biochemical Methods (4th edition). New Age International Pvt. Ltd.
7. Satyanarayana U, Chakrapani U (2021) Biochemistry (6th edition). Elsevier;
8. Voet D, Voet JG, Pratt CW (2018) Principles of Biochemistry (5th edition). J Wiley & Sons, Singapore Pte. Ltd.

Graduate Attributes

Course Objective:

Students will be acquainted with the elaborate concept of plant metabolism and biochemical pathways, by studying this paper. The paper will highlight the carbon assimilation pathways as well as carbon oxidation and ATP synthesis mechanisms in plant body. It will provide the detailed idea of pathways and mechanisms of carbohydrate, lipid, and nitrogen metabolism in plants. Furthermore, this paper will explain the various aspects and cascades of signal transduction mechanism. Additionally, the paper will also focus on the biosynthesis and physiological roles of secondary metabolites in plants.

Learning outcome:

1. Knowledge in basic understanding of plant metabolism and their regulation
2. Knowledge in concepts of carbon assimilation, oxidation, ATP synthesis
3. Knowledge in basic concepts of carbohydrate, Lipid and Nitrogen metabolism
4. Knowledge in basic concepts of signal transduction
5. Practical knowledge in separation of pigments, estimation of sugars, rate of respiration.
6. Ability to perform experiments on chromatographic techniques, spectrophotometric analysis.

Theory Credit: 03

Practical Credit: 01

No. of Required Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)

No. of Non-Contact Classes: Nil

Particulars of Course Designer (Name, Institution, email id):

Prof. Bhaben Tanti
Head, Department of Botany,
Gauhati University
Email id: btanti@gauhati.ac.in

Four-year Undergraduate Programme
Subject: Botany
Semester: Sixth
Course Name: *Applied Plant Biology*
Existing Base Syllabus: UG CBCS Syllabus
Course Level: 300-399, and subsequent level as per NEP structure

THEORY [Total marks: 60] Credit: 03; Total No. of classes: 45			
Unit no.	**Unit content**	**No. of classes**	**Marks**
Unit 1	**Plant Tissue Culture:** Historical perspective; Composition of media; Nutrient and hormone requirements (role of vitamins and hormones); Totipotency; Organogenesis; Embryogenesis (somatic and zygotic); Protoplast isolation, culture and fusion.	8	10
Unit 2	**Application of tissue culture:** Micropropagation, androgenesis, virus elimination, secondary metabolite production, haploids, triploids and hybrids; Cryopreservation; Germplasm conservation.	4	6
Unit 3	**Recombinant DNA technology:** Restriction Endonucleases (History, Types I-IV, biological role and application); Restriction Mapping (Linear and Circular); Cloning Vectors: Prokaryotic (pUC 18 and pUC19, pBR322, Ti plasmid, BAC); Lambda phage, M13 phagemid, Cosmid, Shuttle vector; Eukaryotic Vectors (YAC).	8	10
Unit 4	**Gene Cloning:** Recombinant DNA, Bacterial Transformation and selection of recombinant clones, PCR- mediated gene cloning; Gene Construct; construction of genomic and cDNA libraries, screening DNA libraries to obtain gene of interest by genetic selection; complementation, colony hybridization; PCR	9	12
Unit 5	**Methods of gene transfer:** *Agrobacterium*-mediated, Direct gene transfer by Electroporation, Microinjection, Microprojectile bombardment; Selection of transgenics - selectable marker and reporter genes (Luciferase, GUS, GFP).	6	10

Unit 6	**Applications of genetic engineering:** Pest resistant (Bt-cotton); herbicide resistant plants (Round Up Ready soybean); Transgenic crops with improved quality traits (FlavrSavr tomato, Golden rice); Improved horticultural varieties (Moondust carnations); Role of transgenics in bioremediation (Superbug).	10	12
PRACTICAL [Credit: 01]			
1. (a) Preparation of MS medium. (b) Demonstration of *in vitro* sterilization and inoculation methods using leaf and nodal explants of any plant species. 2. Study of anther, embryo and endosperm culture, micropropagation, somatic embryogenesis & artificial seeds through photographs. 3. Isolation of protoplasts. 4. Construction of restriction map of circular and linear DNA from the data provided. 5. Study of methods of gene transfer through photographs: Agrobacterium-mediated, direct gene transfer by electroporation, microinjection, microprojectile bombardment. 6. Study of steps of genetic engineering for production of Bt cotton, Golden rice, FlavrSavr tomato through photographs. 7. Isolation of plasmid DNA. 8. Restriction digestion and gel electrophoresis of plasmid DNA.		30	40

Reading list:

1. Bhojwani SS, Bhatnagar SP (2011) The Embryology of Angiosperms. Vikas Publication House Pvt. Ltd., New Delhi. 5th edition.
2. Bhojwani SS, Razdan MK (1996) Plant Tissue Culture: Theory and Practice. Elsevier Science Amsterdam. The Netherlands.
3. Ganguli P (2001) Intellectual Property Rights: Unleashing the Knowledge Economy. New Delhi: Tata McGraw-Hill Pub.
4. Glick BR, Pasternak JJ (2003) Molecular Biotechnology- Principles and Applications of recombinant DNA. ASM Press, Washington.
5. Kuhse H (2010) Bioethics: An Anthology. Malden, MA: Blackwell.
6. Snustad DP, Simmons MJ (2010) Principles of Genetics. John Wiley and Sons, U.K.
7. Stewart CNJr (2008) Plant Biotechnology & Genetics: Principles, Techniques and Applications. John Wiley & Sons Inc. U.S.A.

Graduate Attributes

Course Objective:

To gain knowledge on plant tissue culture, recombinant DNA technology and applications of genetic engineering techniques.

Learning outcome:

1. Knowledge of various methods of Plant tissue culture and their application
2. Knowledge of gene cloning, recombinant DNA technology and various methods of gene transfer in plants
3. Knowledge of the application of genetic engineering techniques for agriculture.
4. Ability to demonstrate tissue culture technique; isolate plasmid DNA and to carry out DNA manipulation using restriction enzymes

Theory Credit: 03

Practical Credit: 01

No. of Required Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)

No. of Non-Contact Classes: Nil

Particulars of Course Designer (Name, Institution, email id):

Prof. Bhaben Tanti
Head, Department of Botany,
Gauhati University
Email id: btanti@gauhati.ac.in

Semester –I: Chemistry I (45 h)

Unit	Content	Contact Hours
Unit I: Atomic structure	Historical development on structure of atom; Bohr's model, H-atom Spectrum; Black Body Radiation; Photoelectric effect (qualitative treatment only); The dual behaviour and uncertainty Quantum mechanical approach to atomic structure: Concept of Wave function, well behaved function, operator, Normalised and Orthogonal wave function, Schrodinger Wave equation, eigenfunction, Significance of Ψ and Ψ^2, Particle in a ID box; Schrodinger equation of hydrogen atom (no derivation), radial and angular wave functions for hydrogen atom, probability distribution, Quantum numbers, Pauli's Exclusion Principle, Hund's rule of maximum multiplicity, Aufbau's principle and its limitations.	8
Unit II: Periodicity and Chemical behaviour	Effective Nuclear Charge; Slater's Rule; Covalent and ionic Radii, Ionization energies, Electronegativity (Various scales), Electron affinities	3
Unit III: Chemical Bonding I (Ionic interaction)	General characteristics of Ionic compounds; Lattice and Solvation energy; Born Lande equation; Kapustinski equation, Madelung constant, Born Haber Cycle for lattice energy calculation	4
Unit IV: Structure of organic molecules	Nature of Bonding: Hybridisation of atomic orbitals (qualitative VB and MO approach); Effect of hybridization on bond properties.	4
Unit V: Stereochemistry of organic molecules	Representation of organic molecules in 2D and 3D (Fischer, Newman and Sawhorse Projection formulae and their interconversions); Geometrical isomerism (cis-trans, syn-anti, E/Z notations); Concept of chirality (enantiomers and diastereomers); Configuration and Conformation, Barriers to rotation, Conformational Analysis (ethane, butane, cyclohexane)	8
Unit VI: Electronic effects in organic molecules	Concept of Electrophiles and Nucleophiles; Inductive effects; Resonance, Conjugation and Delocalisation.	3

Unit VII: Gaseous state	Causes of deviation from ideal gas behaviour, compressibility factor, Z, and its variation with pressure and temperature for different gases. State variables and equation of states for real gases; van der Waals equation of state, its derivation and application in explaining real gas behaviour. Reasons and examples of failure of van der Waal equation of state and interpretation of van der Waals pressure-volume isotherm. Critical state and phenomena, mathematical definition and interpretation of critical point, relation between critical constants and van der Waals constants: along with their thermodynamic interpretation. Introduction to virial equation and virial coefficients, derivation of Boyle temperature.	8
Unit VIII: Liquid state	Qualitative treatment of the structure of the liquid state. Physical properties of liquids, vapour pressure, surface tension coefficient of viscosity, and their determination. Temperature variation of viscosity of liquids and comparison with that of gases. Effect of addition of various solutes on surface tension and viscosity. Explanation of cleansing action of detergents (micelle formation and critical micelle concentration).	7

Lab Course I	1. Introduction to laboratory apparatus and safety measures in laboratory, 2. Calibration of apparatus (volumetric flask, thermometer, melting point apparatus etc.) **Group A** • Preparation of normal and molar solution, for example KCl, $Na_2C_2O_4$, HCl, H_2SO_4 etc. (Verification by conductometric measurement). • Determination of solubility of a given salt at different temperature and plot solubility curve. • Determination of water of crystallisation of hydrated salt by ignition and weighing. **Group B** • Determination of the melting points of above compounds and unknown organic Compounds (Here, the student is required to learn about thermometer calibration before performing the experiment). • Effect of impurities on the melting point – mixed melting point of two unknown organic compounds. • Purification of organic compounds by crystallization using the following solvents: (a) Water, (b) Alcohol, (c) Alcohol-Water. **Group C** • Evaluating the compressibility factor using standard package such as Excel/Origin/Python/Fortran. • Simulating an ideal gas using programming. • Simulation of a real gas using programming. • To determine the partial molar volume of ethanol-water mixture at a given composition. • Determine the surface tension of a given liquid at room temp using stalagmometer by drop number method. • Determine the surface tension of a given liquid by means of stalagmometer using drop weight method. • Determine the composition of a given mixture by surface tension method. • Study the variation of surface tension of detergent solutions with concentration. (Students are required to perform Expt. 1, 2 and a minimum of two experiments from each group)	30

Text Book /Reference Book	1. University Chemistry, P. Siska, O. K. Medhi, 2nd edition, Pearson Education 2. General and Inorganic Chemistry, R.P. Sarkar (part 1) 3rd edition, NCBA 3. Concise Inorganic Chemistry, J. D. Lee, 5th Edition, Pearson Education 4. Inorganic Chemistry (Principles of Structure and Reactivity), J. E. Huheey, E. A. Keiter, R. L. Keiter, O. K. Medhi, 5th edition, Pearson Education 5. Principles of Physical Chemistry, Puri, Sharma, Pathania, 48th Edition, Vishal Publishing Com. 6. Atkins Physical Chemistry, Atkins, de Paula and Keeler, 11th Edition, Oxford University Press. 7. March's Advanced Organic Chemistry: Reactions, Mechanisms, and Structure, Michael B. Smith 7th Edition (Wiley) 8. Organic Chemistry, Jonathan Clayden, Nick Greeves, Stuart Warren, 2nd Edition (Oxford) 9. Reaction Mechanism in Organic Chemistry, S. M. Mukherji, S. P. Singh 3rd Edition (Macmillan) 10. Organic Reactions and their Mechanisms, P. S. Kalsi 11. Organic Chemistry, Maitland Jones, Jr., Steven A. Fleming 5th Edition (Norton)

Semester –II, Chemistry-II (45 h)

Unit I: Chemical Bonding II (Covalent Bond and Chemical forces)	Valence Bond theory (Heitler-London approach), Energetics of hybridization, equivalent and non-equivalent hybrid orbitals. Bent's rule, Resonance and resonance energy, Molecular orbital theory. Molecular orbital diagrams of homonuclear (N_2, O_2) and heteronuclear diatomic (CO, NO, CN^-) , Bonding in BeF_2 and HCl (idea of s-p mixing and orbital interaction). Valence shell electron pair repulsion theory (VSEPR). Covalent character in ionic compounds, polarising power and polarizability. Fajan's rules and consequences of polarisation. Ionic character in covalent compounds: Bond moment and dipole moment. Percentage ionic character from dipole moment and electronegativity difference. Weak Chemical Forces (van der Waals forces, ion-dipole forces, dipole-dipole interactions, induced dipole interactions, Instantaneous dipole-induced dipole interactions and hydrogen bonding) and their effects on melting and boiling points, solubility and hydration energy.	10

Unit II: Coordination Chemistry-I (structure and Isomerism)	Introduction to coordination complexes (Werner theory, types of ligands) IUPAC nomenclature, Isomerism in coordination complexes, Stereochemistry of complexes with coordination numbers 4, 5, and 6. Berry pseudorotation.	5
Unit III: Reactive Intermediates in Organic Reactions	Formation, structure and stability of reactive intermediates: Carbocations, Carbanions, Radicals, Carbenes, Nitrenes, Benzyne (Brief mechanistic perspective using concepts of Substitution, Addition, Elimination and Rearrangements reactions).	12
Unit IV: Acidity, basicity, and pK_a	The definition of pK_a; Lewis acids and bases; Organic acids and bases (Factors affecting relative strength); Substituents affect the pK_a (carbon acids).	3
Unit V: Thermodynamics	Mathematical treatment: Exact and inexact differentials, partial derivatives, Euler's reciprocity, cyclic rules. Intensive and extensive variables, isolated, closed and open systems. Cyclic, reversible and irreversible processes. Zeroth law of thermodynamics. First law of thermodynamics, concept of heat (q) and work (w), internal energy (U) and enthalpy (H) in differential forms: their molecular interpretation. Calculation of w, q, ΔU and ΔH for expansion of ideal gas under isothermal and adiabatic conditions for reversible and irreversible processes. Derivation of Joule-Thomson Coefficient and inversion temperature. Application of First law of thermodynamics: standard state, standard enthalpy changes of physical and chemical transformations: fusion, sublimation, vaporization, solution, dilution, neutralization, ionization. Bond-dissociation energy Kirchhoff's equation, relation between ΔH and ΔU of a reaction. Difference between enthalpy and standard enthalpy. Second law of thermodynamics, entropy (S) as a state function, molecular interpretation of entropy. Residual Entropy. Free energy: Gibbs function (G) and Helmholtz function (A) and their molecular interpretation. Difference between free energy and standard free energy. Gibbs-Helmholtz equation, criteria for thermodynamic equilibrium and spontaneity of a process. Maxwell's Relations and their physical significance.	15

Lab Course II	a) Determination of total hardness of water by titration against standardised EDTA solution. b) Synthesis of coordination compounds i) Potassium tris(oxalato)chromate(III), ii) $[Ni(DMG)_2]$ c) Qualitative organic analysis for N, S, halogen and functional group test d) Preparation of Buffer solution and measurement of pH using pH-meter (acetic acid-sodium acetate buffer) e) Determination of heat capacity of the calorimeter and enthalpy of neutralisation of hydrochloric acid with sodium hydroxide. f) Detect the presence of nitrogen, sulphur and halogens in a given organic compounds. g) Detection of presence of unsaturation and aromaticity in an organic sample. h) Identify acidic functional groups of a given organic sample (Acetic acid, Lactic acid, Tartaric acid and Phthalic acid) and determine the pKa by titrametric methods. i) Determine the enthalpy of solution of oxalic acid from solubility measurements. j) Determination of heat capacity of the calorimeter and enthalpy of neutralization of hydrochloric acid with sodium hydroxide. k) Determination of heat capacity of a calorimeter for different volumes using change of enthalpy data of a known system (method of back calculation of heat capacity of calorimeter from known enthalpy of solution or enthalpy of neutralization). l) Calculation of the enthalpy of ionization of ethanoic acid. Determination of heat capacity of the calorimeter and integral enthalpy (endothermic and exothermic) solution of salts. m) Determination of enthalpy of hydration of copper sulphate.	30
Text Book /Reference Book	1. General and Inorganic Chemistry, R.P. Sarkar (part 1) 3rd edition, NCBA 2. Concise Coordination Chemistry, R. Gopalan, V. Ramalingam, 1st Edition, Vikash Publishing House 3. Inorganic Chemistry (Principles of Structure and Reactivity), J. E. Huheey, E. A. Keiter, R. L. Keiter, O. K. Medhi, 5^{th} edition, Pearson Education 4. Principles of Physical Chemistry, Puri, Sharma, Pathania, 48^{th} Edition, Vishal Publishing Com. 5. Atkins Physical Chemistry, Atkins, de Paula and Keeler, 11^{th} Edition, Oxford University Press.	

Semester III, Chemistry –III (3 L-0 T-1 P)

Unit	**Content**	**Contact Hrs**
Unit I: Acid and Bases	Acid-base concepts, Measure of acid and base strength, proton affinity, acidity and basicity of binary hydrogen compounds, inductive effect and strength of oxyacids, acidity of aqua ions, steric effect, proton sponge, solvation and acid base strength, non-aqueous solvents and acid base strength, levelling effect, superacids and superbases. Hard and Soft Acids and Bases (HSAB), Application of HSAB principle and symbiosis	7
Unit II: Oxidation and reduction -I	Reduction potentials: Redox half-reactions, standard potentials and spontaneity, trends in standard potentials, the electrochemical series, Nernst equation (Influence of pH and concentration on electrode potential). Principles of redox titration and choice of redox indicators.	4
Unit III: Coordination Chemistry-II	Valence bond theory, inner and outer orbital complexes, electroneutrality principle and back bonding, effects of hybridization in metal ligand bond strength and stability of complexes, choice of metal d-orbital(s) in hybridization in different coordination geometries, magnetic properties of complexes, Drawback of VBT	4
Unit IV: Aromaticity	Concepts of aromatic, anti-aromatic and non-aromatic compounds (including examples of cyclic carbocations, carbanions and heterocyclic compounds); Hückel's rule.	3
Unit V: Hydrocarbons and halogenated compounds	Methods of preparation, properties and relative reactivity of alkyl and aryl halides; Selectivity in electrophilic and nucleophilic substitution reactions (S_NAr), Preparation and reactions of diazonium salts; Benzyne mechanism.	4
Unit VI: Alcohols, Phenols, Thiols and related compounds:	Preparation, properties and relative reactivity of 1°,2°, and 3°-alcohols, Ethers, Epoxides (Preparation and reactions with alcohols, ammonia derivatives and $LiAlH_4$). Thiols and Sulfides; Phenols (Preparation, properties and reactivity; Reimer–Tiemann and Kolbe's–Schmidt Reactions)	4
Unit VII: Carbonyl Compounds	Structure, reactivity and preparation; Oxidations and Reductions (Jones reagent, PCC and PDC, Oppenauer, Clemmensen, Wolff-Kishner, $NaBH_4$, $LiAlH_4$, MPV), Baeyer Villiger oxidation.	4

Unit VIII: Solution	Vapour pressure of solution. Ideal solutions, ideally diluted solutions and colligative properties. Raoult's law & Henry's Law. Thermodynamic derivation of colligative properties of solution (using chemical potentials) and their inter-relationships. Abnormal colligative properties.	7
Unit IX: Partial Molar quantities	Fugacity, activity coefficients and Concept of chemical potential: Gibbs Duhem Equation and Duhem-Margules Equation: their use and application, Enthalpy, free energy and entropy of mixing, excess thermodynamic functions.	8
Lab course III (at least three experiments from each group)	**Group A** • Acid-base titration: Estimation of carbonate, bicarbonate and hydroxide. • Redox titration: Estimation of Fe(II) using standardised $KMnO_4$ solution. • Determination of water of crystallisation of Mohr Salt using standardised $KMnO_4$ solution. • Estimation of Fe(II) with $K_2Cr_2O_7$ using internal indicators (diphenylamine). **Group B** • Determine the surface tension of a given solution at room temp using a stalagmometer. • Prepare derivatives of a given organic sample containing a single functional group (i.e. alcohols, phenols, carbonyl and carboxylic acid group). • Identification of functional groups in a given organic sample: Simple functional groups such as alcohols, phenols, amines, carbonyl and carboxylic acid groups. • Prepare derivatives of a given organic sample containing single functional group (i.e. alcohols, phenols, amines, nitro, carbonyl and carboxylic acid group). **Group C** • Determine the viscosity of a liquid at a given concentration at laboratory temperature, by viscometer. • Determine the composition of a given liquid mixture by viscosity method. • Study the variation of viscosity of sucrose solution with the concentration of the solute. • Compare the strengths of HCl and H_2SO_4 by studying kinetics of hydrolysis of methyl acetate.	30

Books:

1. General and Inorganic Chemistry, R.P. Sarkar (part 1), 3rd edition, NCBA
2. Concise Coordination Chemistry, R. Gopalan, V. Ramalingam, 1st Edition, Vikash Publishing House
3. Inorganic Chemistry (Principles of Structure and Reactivity), J. E. Huheey, E. A. Keiter, R. L. Keiter, O. K. Medhi, 5th edition, Pearson Education
4. Principles of Physical Chemistry, Puri, Sharma, Pathania, 48th Edition, Vishal Publishing Com.
5. Atkins Physical Chemistry, Atkins, de Paula and Keeler, 11th Edition, Oxford University Press.
6. March's Advanced Organic Chemistry: Reactions, Mechanisms, and Structure, Michael B. Smith 7th Edition (Wiley).
7. Organic Chemistry, Jonathan Clayden, Nick Greeves, Stuart Warren, 2nd Edition (Oxford)
8. Reaction Mechanism in Organic Chemistry, S. M. Mukherji, S. P. Singh 3rd Edition (Macmillan).
9. Organic Reactions and their Mechanisms, P. S. Kalsi.
10. Organic Chemistry, Maitland Jones, Jr., Steven A. Fleming 5th Edition (Norton).

Semester –IV, Inorganic Chemistry-I (45 h)

Unit	**Content**	**Contact Hrs**
Unit I Introduction to molecular symmetry	Symmetry elements and operations, molecular point groups, symmetry elements present in C_{2v}, C_{3v}, T_d and O_h point group (pictorial representation), Introductory idea of character tables, Mulliken symbols.	6
Unit II: D-block Chemistry	Chemistry of first row transition elements (Ti-Cu) in various oxidation states as halides and oxides, Comparison of the first, second and third transition series elements.	8

Unit III Coordination chemistry III	Crystal Field Theory (qualitative treatment): d-Orbital splitting in tetrahedral, square planar, trigonal bipyramidal, square pyramidal and octahedral geometries, Calculation of CFSE, Thermodynamic and structural aspect of orbital splitting, pairing energies (contribution of exchange and coulomb energy), factors affecting the magnitude of 10 Dq (Δ_o, Δ_t), Spectrochemical series, tetragonal distortions from octahedral geometry and Jahn-Teller theorem. Limitations of CFT (nephelauxetic effect and EPR evidences), Elementary idea on Ligand field theory, MOT with special reference to sigma bonded octahedral and tetrahedral complexes (qualitative treatment only), Pi bonding in octahedral complexes. Metal-metal quadruple bond in $[Re_2Cl_8]^{2-}$	10
Unit IV: Metallurgy	Chief modes of occurrence of metals based on standard electrode potentials. Ellingham diagrams for reduction of metal oxides using carbon and carbon monoxide as reducing agents. Electrolytic Reduction, Methods of purification of metals: Electrolytic Kroll process, Parting process, van Arkel-de Boer process and Mond's process, Zone refining.	5
Unit V: Oxidation and reduction - II	Redox stability: Reaction with water, oxidation by atmospheric oxygen, disproportionation and comproportionation, the influence of complexation, relation between solubility and standard potential Diagrammatic representation of potential data (Latimer diagram, Frost diagram, Pourbaix diagram)	6
Unit VI Lanthanoids and Actinoids:	Lanthanoids: Electronic configuration, oxidation states, colour, spectral and magnetic properties, lanthanide contraction, separation of lanthanides (ion-exchange method only). Coordination chemistry of lanthanides Actinoids: electronic configuration, oxidation states, magnetic properties, Comparison with lanthanides	6
Unit VII Nuclear Chemistry	Stability of nucleus and radioactive decay processes, Fermi theory, half-lives, auger effect, Mass defect, Nuclear reactions – notations, comparison with chemical reaction: Types of nuclear reactions. Applications of radioisotopes in age determination.	4

Lab: Inorganic Qualitative analysis	Qualitative semimicro analysis of mixtures containing 3 anions and 3 cations. Emphasis should be given to the understanding of reactions. The following radicals are suggested: CO_3^{2-} , NO_2^-, S^{2-}, SO_3^{2-}, $S_2O_3^{2-}$, CH_3COO^-, F^-, Cl^-, Br^-, I^-, NO_3^-, BO_3^{3-}, $C_2O_4^{2-}$, PO_4^{3-}, NH_4^+, K^+, Pb^{2+}, Cu^{2+}, Cd^{2+}, Bi^{3+}, Sn^{2+}, Sb^{3+}, Fe^{3+}, Al^{3+}, Cr^{3+}, Zn^{2+}, Mn^{2+}, Co^{2+}, Ni^{2+}, Ba^{2+}, Sr^{2+}, Ca^{2+}, Mg^{2+} Mixtures should preferably contain one interfering anion, or insoluble component ($BaSO_4$, $SrSO_4$, $PbSO_4$, CaF_2 or Al_2O_3) or combination of anions such as CO_3^{2-} and SO_3^{2-}, NO_2^- and NO_3^-, Cl^- and Br^-, Cl^- and I^-, Br^- and I^-, NO_3^- and Br^-, NO_3^- and I^-. Spot tests should be done whenever possible.	30
Text Book/ Ref. Book	1. Inorganic Chemistry, G.L. Meissler and D. A. Tarr, 5th Edition, Pearson 2. Inorganic Chemistry, P. Atkins, Overtone Rourke, Weller and Armstrong 5th Edition, Oxford	

Semester IV - (Organic Chemistry-I) – 45 h

Unit	Content	Contact Hrs
Unit I: Carboxylic Acids and their Derivatives:	Preparation, physical properties and reactions of monocarboxylic acids: Typical reactions of dicarboxylic acids, hydroxy acids and unsaturated acids: succinic/phthalic, lactic, malic, tartaric, citric, maleic and fumaric acids. Preparation and reactions of acid chlorides, anhydrides, esters and amides; Comparison of nucleophilic substitution at acyl group: Mechanism of acidic and alkaline hydrolysis of esters; Claisen condensation, Dieckmann and Reformatsky reactions.	**10**
Unit II: Nitrogen Containing Functional Groups	Amines: Effect of substituent and solvent on basicity; Preparation and properties: Gabriel phthalimide synthesis, Carbylamine reaction, Mannich reaction, Hofmann-elimination reaction; Distinction between 1°, 2°and 3° amines with Hinsberg reagent and nitrous acid. Diazonium Salts: Preparation and their synthetic applications. General methods for preparation of nitro compounds, nitriles and isonitriles and important reactions.	**10**
Unit III: Heterocyclic Compounds	Classification and nomenclature (5-numbered and 6-membered rings containing one heteroatom); Synthesis and reactions of Furan, Pyrrole, Thiophene, Pyridine, Pyrimidine, and Indoles: Selected name reactions (Paal-Knorr synthesis, Knorr synthesis, Hantzsch synthesis, Fischer indole synthesis, Skraup synthesis, Knorr quinolone synthesis, Doebner-Miller synthesis, Bischler-Napieralski reaction)	**9**
Unit IV: Alkaloids	Natural occurrence, General structural features, Isolation and their physiological action; Hoffmann's exhaustive methylation,	**6**

	Emde's modification, Structure elucidation of Nicotine; Medicinal importance of Nicotine, Hygrine, Quinine, Morphine and Cocaine.	
Unit V: Organic Spectroscopy	Introduction to UV-visible and infrared spectroscopy in structure elucidation of organic compounds; Relation between absorption spectroscopy and molecules containing conjugated C=C and C=O groups Analysis of compounds containing alkenes, alkynes and carbonyl compounds using infrared spectroscopy (conceptual aspects).	**10**
Laboratory experiments	1. Organic preparations (any two from each): Benzoylation of organic compounds: amines (aniline, toluidines, anisidine) and phenols (phenol, β-naphthol, salicylic acid) by the following methods: (i). Using conventional method. (ii). Using green chemical approach. 2. Organic preparations (any three): (i). Bromination of acetanilide by conventional methods. (ii). Nitration of salicylic acid using ceric ammonium (green chemistry approach). (iii). Selective reduction of meta dinitrobenzene to m-nitroaniline (iv). Oxidation of ethanol/ isopropanol (Iodoform reaction). (v). Aldol condensation using either conventional or green method. (vi). Benzil-Benzilic acid rearrangement. 3. Chromatography : (a) Separation of a mixture of two amino acids by ascending and horizontal paper chromatography; (b) Separation of a mixture of o-and p-nitrophenol or o-and p-nitro-aniline by thin layer chromatography (TLC)	**30**

Semester IV - (Theoretical Chemistry) – 45 h

Learning objectives: Students will be exposed to the fundamental aspects of atomic structure through mathematical point of view. The students may be demonstrated the following lab activities using open-source programs such as GAMESS, MacMolPlt, Avogadro, etc or commercial software such as Gaussian, GaussView, etcBuilding and manipulating a small molecular model using a molecular builder such as MacMolPlt, Avogadro, GaussView etc.

Unit	**Content**	**Contact Hrs**
Unit I: **Quantum Theory**	Plancks' Quantization of energy and Hydrogen Line spectrum. Postulates of quantum mechanics and their physical interpretation, wavefunctions and quantum mechanical operators. Born interpretation. Well behaved wavefunctions	**37**

	and commutation relations. Orthonormality and physical meaning of expanding a wavefunction in orthonormal basis. Hermitian Operators and Real Eigenvalues, Eigenvectors: their physical significance. Particle in a 1-D box (complete solution with orthonormalization) and relation to conjugated polyenes. Heisenberg Uncertainty Principle from expectation values of 1 D box, extension to two and three-dimensional boxes. Rotational Motion and Energy: Schrödinger equation of a rigid rotator and brief discussion of its results (solution not required). Quantization of rotational energy levels. Vibrational Motion: Schrödinger equation of a linear harmonic oscillator and brief discussion of its results (solution not required). Quantization of vibrational energy levels. Interpretation of zero-point energy. Hamiltonian for 1 electron H-atom, its wavefunctions (only explanation, no derivation) and its relation to atomic orbitals. Constructing Radial and Angular Distribution Curves from H-like wave functions. Quantum mechanical idea of chemical bond formation: Heitler-London's Valence bond theory. Atomic Units. Good quantum numbers for multi-electron systems and Atomic Term Symbols. LS and j-j coupling schemes. Qualitative idea of tunneling.	
Unit II: Molecular Properties	Intermolecular forces and potentials, Polarizability of atoms and molecules, dielectric constant and polarisation, molar polarisation for polar and non-polar molecules. Clausius- Mosotti equation (with derivation) and Debye equation and their application.	**8**
Laboratory experiments	4. Writing and plotting basic expressions and graphs (eg. Maxwell-Boltzmann distribution law, radial and angular distribution functions for H-atom etc.) using any spreadsheet software such as MSExcel/LibreOffice etc or simple programming language (GWBasic, FORTRAN, python etc). 5. Putting atoms and fragments, choosing an element, selecting hybridization, changing bond angle/bond length, editing individual atoms, centering, rotation of structure, etc 6. Geometry optimization (energy minimization): Making input file through selection of calculation method (e.g., using Hartree Fock or Density Functional Theory), basis set, specifying charge and multiplicity, etc 7. Frequency calculation: Locating results in output file, displaying calculated properties through molecular viewing software such as Avogadro, MacMolPlt, VMD, GaussView, etc. 8. Calculate the energy of the H-like atoms (H, He+, C+5) using the Hartree-Fock method and the cc-pVnZ basis set series (n=D,T).Tabulate the energy (in Hartree) and	

	number of basis functions for each calculation. Compare your energy results with the exact value and discuss the effect of the number of basis functions. Discuss the effect of increasing nuclear charge on the energy. 9. Perform optimization of malonaldehyde and obtain energy, dipole moment, charge on various atoms and important geometrical parameters such as bond length, bond angle, etc. 10. Perform geometry optimizations (energy minimizations) to calculate the energy of various conformations of molecules (e. g. butane, and predict the most stable conformation. 11. Compare the optimized C-C bond lengths in ethane, ethene, ethyne and benzene. Visualize the molecular orbitals of the ethane σ bonds and ethene, ethyne, benzene and pyridine π bonds.	

Textbooks:

1. Molecular Quantum Mechanics, Atkins and Friedman, 5th Edition, Oxford University Press
2. Quantum Chemistry, McQuarrie, Viva Student Edition, Viva Press

Reference Books:

1. Quantum Chemistry, AK Chandra
2. Introduction to Quantum Chemistry, Eyring, Walter and Kimball
3. Modern Quantum Chemistry, Szabo

Semester IV – Magnetic Resonance Spectroscopy and Analytical Techniques – 45 h

Unit	**Content**	**Contact Hrs**
Unit I: NMR spectroscopy	Nuclear Spin quantum number, effect of magnetic field on the nuclear spin, Zeeman effect and nuclear agneton, and Larmor Precision. Radiowaves and principles of NMR spectroscopy. Chemical shift and factors affecting it. Factors affecting intensity and spectral width. NMR peak area integration relative peak positions of organic functional groups eg. alkyl halides, olefins, alkynes, aldehyde H, substituted benzenes (toluene, anisole, 15 nitrobenzene, halobenzene, dinitrobenzenes, chloronitrobenzene), first order coupling (splitting of the signals: ordinary ethanol, bromoehane, dibromoehanes), Spin-spin coupling and high resolution spectra, interpretation of PMR spectra of simple organic molecules like methanol, ethanol, acetaldehyde, acetic acid and aromatic protons.	**12**
Unit II:	Electron Spin Resonance and hyperfine splitting. G value and	**5**

ESR spectroscopy	hyperfine constant, Bohr magneton Electron Zeeman splitting, electron nuclear hyperfine splitting, llustration using simple examples like H atom, methyl radical etc.	
Unit III: Mass Spectrometry	Ionization techniques (electron impact, chemical ionization), Making liquids and solids into ions (electrospray, electrical discharge, laser desorption, fast atom bombardment), Separation of ions on basis of mass to charge ratio, Interpretation of the mass spectrum, base peak and molecular ion peak. Fragmentation patterns of Common organic molecules along with McLafferty rearrangement. Determination of empirical chemical formula from molecular ion peak and isotopic distribution.	**8**
Unit IV: Separation techniques	Introduction to Chromatography and its techniques, TLC, Column Chromatography, GC and HPLC.	**5**
Unit V: Electroanalytical Techniques	Conductance measurements and EMF and Cell Reactions. Conductivity, equivalent and molar conductivity and their variation with dilution for weak and strong electrolytes. Conductometric titrations (only acid-base and acid base mixtures). Types of electrodes, standard electrode potential, cell reactions and salt bridges Glass electrodes and others, concentration cells with transference and without transference, liquid junction potential and salt bridge, pH determination using hydrogen electrode and quinhydrone electrode, Potentiometric titrations-qualitative treatment (acid- base, acid mixture and base and oxidation-reduction only). Zeta potential.	**10**
Unit VI: Diffraction	Packing of solids and how solids diffract (reflection view and scattering view) Bragg's Law, Miller indices and Reciprocal lattices. Laws of Crystallography. Basics of X-ray diffraction (powder and single crystal).	**5**
Laboratory experiments	1. Determination of cell constant of a conductivity cell. 2. Determine the equivalent conductance of a strong electrolyte (e.g. NaCl) at various concentrations and verify the Onsager equation. 3. Determination of equivalent conductance, degree of dissociation and dissociation constant of a weak acid. 4. Perform the following conductometric titrations: a. Strong acid vs. strong base b. Weak acid vs. strong base c. Mixture of strong acid and weak acid vs. strong base	

	d. Strong acid vs. weak base 2. Perform the following potentiometric titrations: i) Strong acid vs. strong base ii) Weak acid vs. strong base iii) Dibasic acid vs. strong base iv) Potassium dichromate vs. Mohr's salt 3. Determination of basicity/proticity of a polyprotic acid by the thermochemical method in terms of the changes of temperatures observed in the graph of temperature versus time for different additions of a base. Also calculate the enthalpy of neutralization of the first step 4. Structure elucidation from simple proton NMR spectrum, MS. **5.** Separation of organic compounds using TLC, CC.	

Books
1. NMR Spectroscopy by Kemp
2. NMR Spectroscopy by Gunther
3. Physical Methods in Inorganic Chemistry, Drago
4. Electroanalytical methods, Bard and Faulkner

Inorganic Chemistry-Semester –V (45 h)

Unit	**Content**	**Contact Hrs**
Unit I: Coordination Chemistry IV	**Electronic spectra and magnetism of coordination compounds**: Microstates, Free Ion term symbols and their splitting in tetrahedral and octahedral field, Racah parameters, Selection rules and relaxation mechanism (vibronic coupling and spin orbit coupling), Orgel Diagrams and prediction of spectral transitions, Jahn-Teller effect on electronic spectra, Charge-Transfer spectra, Calculation of spin only and orbital contribution to magnetic moments. Spin crossover.	12

Unit II: Main Group elements	Relative stability of different oxidation states, Inert pair effect, diagonal relationship, and anomalous behaviour of main group elements. a) Preparation and properties of Ortho and Para hydrogen b) Preparation, structure and properties of borane (bonding in diborane, brief idea of styx number, wade's rule), boric acid, borax, borazine, phosphazine, S_4N_4, c) Preparation and properties of oxides, superoxides, peroxides, hydrides, hydroxides, halides and carbonates of alkali and alkaline earth metals. Reactions of alkali and alkaline earth metals with liquid ammonia. d) Allotropes of carbon, phosphorus, and sulphur. e) Oxides and oxoacids of nitrogen, phosphorus, sulphur, and chlorine. g) Interhalogen compounds, polyhalides, pseudo halogen i) Hydrates, clathrates and inclusion compounds j) Preparation, structure and properties of silicates, aluminosilicates.	15
Unit III: Noble Gases	Occurrence and uses, rationalisation of inertness of noble gases, Clathrates; preparation and properties of XeF_2, XeF_4 and XeF_6; Nature of bonding in noble gas compounds (Valence bond treatment and MO treatment for XeF_2). Molecular shapes of noble gas compounds (VSEPR theory).	6
Unit IV: Organometallics I	Definition and classification of organometallic compounds on the basis of bond type. Concept of hapticity of organic ligands, 18 electron rule. Metal carbonyls: Electron count of mononuclear, polynuclear and substituted metal carbonyls of 3d series. General methods of preparation (direct combination, reductive carbonylation, thermal and photochemical decomposition) of mono and binuclear carbonyls of 3d series. Structures of mononuclear and binuclear carbonyls of Cr, Mn, Fe, Co and Ni -acceptor behaviour of CO (MO diagram of CO to be discussed), synergic bonding effect and use of IR data to explain the extent of back bonding. Zeise's salt: Preparation and structure, evidence of synergic effect and comparison of synergic effect with that in carbonyls.	12

Lab Inorganic quantitative analysis	Estimation by volumetric method of any one of the following : a. Fe(III)- By standard $KMnO_4$ solution b. Fe(III) – By standard $K_2Cr_2O_7$ solution c. Cu(II) – By Iodometric method. d. Ni(II) by gravimetric method This should be followed by separation and estimation of individual ions in two-component systems of a.Cu and Fe b. Fe and Ca c. Ca and Mg d. Cu and Ni and e. Cl^- and SO_4^{2-}.	

Semester V - (Organic Chemistry) – 45 h

Unit	Content	Contact Hrs
Unit I: Formation of carbon-carbon and carbon-heteroatom bonds:	Wurtz Reaction, Wurtz-Fittig Reactions, Free radical substitutions; Saytzeff and Hofmann eliminations; Reagents of phosphorus, sulfur and boranes; Stereospecific and stereoselective reactions; Stereoselective reactions of alkenes: Epoxidation reaction using mCPBA.	10
Unit II: Reactions of active methylene compounds	Active methylene compounds (Keto-enol tautomerism): Preparation and synthetic applications of diethyl malonate and ethyl acetoacetate.	**10**
Unit III: Reactions of Enolates and Enamines	Formation and stability of enolates and enamines; Alkylation of enolates and enamines; The Aldol reaction; Aldol and Benzoin condensation, Claisen reaction, Claisen-Schmidt reaction, Knoevenagel condensation, Perkin reaction; Cannizzaro and Wittig reaction, Beckmann and Benzil-Benzilic acid rearrangements; Addition reactions of unsaturated carbonyl compounds; Michael addition.	**10**
Unit IV: Nucleophilic reactions on the C=O groups	Nucleophilic attack at the carbonyl group (geometrical aspects); Concept of Prochirality; Stereoselective additions to carbonyl groups: Crams rule, Felkin–Anh model.	**6**

Unit V: Carbohydrate chemistry	Classification of monosaccharides; Absolute configuration of glucose and fructose, Epimers and Anomers; Mutarotation; Determination of ring size of glucose and fructose; Conformations of glucose (Fischer, Haworth and Stereoscopic projections); Interconversions of aldoses and ketoses; Killiani Fischer synthesis and Ruff degradation; Disaccharides: Structure elucidation of maltose, lactose and sucrose. Polysaccharides – Structures of starch, cellulose and glycogen.	**9**
Laboratory experiments:	1. Qualitative Analysis of Carbohydrates: Aldoses and ketoses, reducing and non-reducing sugars. 2. (a) Qualitative analysis of unknown organic compounds containing simple functional groups (alcohols, phenols, amines, carboxylic acids and carbonyl compounds). (b) Interpretation of infrared (IR) spectra of simple organic compounds: The student is required to learn about Identification of functional groups of simple organic compounds by interpreting the IR spectra. The spectra may be recorded and/or provided to the students from literature.	**30**

Semester V – Reaction Dynamics – 45 h

Unit	**Content**	**Contact Hrs**
Unit I: Kinetics I	Order and molecularity of reactions. Rate laws and rate equations for zero, first and second order reactions (2A→P, A+B→ P): their derivations, graphical representations and examples. Expressing the rate laws in terms of volume and pressure of reactants. Experimental determination of order of reactions (half-life method and initial rate method). Temperature dependence of reaction rate, energy of activation (its connection to Gibbs free energy). Arrhenius equation, energy of activation. Pre-exponential Factor and failure of Arrhenius Equation.	9

Unit II: Kinetics II	Difference between equilibrium and steady state. Limiting reagents, rate-determining step and steady-state approximation – explanation with suitable examples (eg. dissociation of HBr and acetaldehyde). Opposing reactions, consecutive reactions and parallel reactions (with examples and explanation of kinetic and thermodynamic control of products; all steps first order). Idea on explosive reactions. Enzyme catalysis: Derivation of Michaelis-Menten equation and interpretation of Lineweaver-Burk Plots. Eadie- Hofstee plot. Turn-over number. Oscillating reactions.	14
Unit III: Reaction Dynamics	Collision theory (detailed treatment). Modeling the Preexponential factor. Sphere of influence and collision cross section, Equivalence between Arrhenius and Collision theory. Failure of Collision theory. Physical interpretation of reaction co-ordinates and potential energy surfaces. Activated complex theory (detailed treatment). Thermodyamic formulation and derivation of Eyring equation. Evaluation of Arrhenius pre-exponential factor from transition state theory. Common examples where transition states have been experimentally identified or predicted. Chemically and Diffusion controlled reactions with examples. Primary and secondary salt effects with examples. Derivation of Bronsted-Bjerrum Equation and its graphical representation. Lindemann and Hinshelwood theory of unimolecular reaction and graphical representation.	22

Lab	1. Determine the rate constant of the acid catalysed hydrolysis of methyl acetate. 2. Determine the rate constant of saponification of ethyl acetate. 3. Determine the activation energy of the hydrolysis of methyl acetate catalyzed by hydrochloric acid. 4. Verify the Freundlich isotherm for the adsorption of oxalic acid on activated charcoal. 5. Verify the Langmuir isotherm for the adsorption of acetic acid on activated charcoal. Determine the critical micelle concentration of a surface-active agent by surface tension measurements. 6. Study the kinetics of the Iodide-persulphate reaction by Initial rate method. 7. Theory and computer aided linear curve-fitting techniques (eg. first order kinetics using least squares) and evaluation of errors and standard deviations.	

Text Books:

1. Atkins' Physical Chemistry, Atkins, de Paula and Keeler
2. Chemical Kinetics and Reaction Dynamics, Paul L. Houston

Reference books:

1. K. L. Kapoor, Volume V
2. Puri, Sharma, Pathania
3. Physical Chemistry: P C Rakshit
4. Physical Chemistry: A Molecular Approach by McQuarrie and Simon
5. Reference Book: Chemical Kinetics by Laidler.

Semester V – Light-Matter Interaction– 45 h

Unit	Content	Contact Hrs
Unit I: Photochemistry:	Laws of photochemistry: Grotthus-Draper law, Stark-Einstein law of photochemical equivalence. Beer-Lambert law (for solids and liquids) and limitations; quantum yield and its measurement for a photochemical process, actinometry. Photostationary state. Photosensitized reactions (with examples). Jablonski Diagram, Internal Conversion, Intersystem Crossing, Fluorescence and Phosphorescence. Primary and secondary processes in photochemical reactions. Frank Condon Principle.	10
Unit II: Spectroscopy	Spectroscopy and its importance in chemistry. Wave-particle duality. Link between spectroscopy and quantum chemistry. Electromagnetic radiation and its interaction with matter. Types of spectroscopy. Absorption Cross section and Einstein's Coefficients. Difference between atomic and molecular spectra. Born- Oppenheimer approximation: Separation of molecular energies into translational, rotational, vibrational and electronic components. Factors affecting intensities and width of spectral lines. Microwave (pure rotational) spectra of diatomic molecules. Selection rules and transition dipole moment. Structural information derived from rotational spectroscopy. IR Spectroscopy: Selection rules, IR spectra of diatomic molecules and organic compounds having functional group. Structural information derived from vibrational spectra. Vibrations of polyatomic molecules. Group frequencies. Effect of hydrogen bonding (inter- and intramolecular) and substitution on vibrational frequencies. Electronic Spectroscopy: Electronic excited states. Free electron model and its application to electronic spectra of polyenes. Colour and constitution, chromophores, auxochromes, bathochromic and hypsochromic shifts. Woodward-Fieser Rules, Qualitative treatment of Rotational Raman effect; Vibrational Raman spectra, Stokes and anti-Stokes lines; their intensity difference, rule of mutual exclusion. (35)	35

1. Calculate the rotational constant, B, for N_2, F_2, O_2 via quantum chemistry calculations.
2. Calculate the optimum bond length by hand from the rotational constant via the rigid rotor approximation for a diatomic molecule.
3. Perform a series of single point calculations above and below re to generate a potential energy surface (PES). Perform a frequency calculation on the optimized geometry. Use the resulting fundamental frequency, ν_0, to calculate the force constant of the bond, k.
4. Study the 200-500 nm absorbance spectra of $KMnO_4$ and $K_2Cr_2O_7$ (in 0.1 M H_2SO_4) and determine the λ_{max} values. Calculate the energies of the two transitions in different units (J molecule^{-1}, kJ mol^{-1}, cm^{-1}, eV).
5. Study the pH-dependence of the UV-Vis spectrum (200-500 nm) of $K_2Cr_2O_7$.
6. Record the 200-350 nm UV spectra of the given compounds (acetone, acetaldehyde, 2-propanol, acetic acid) in water. Comment on the effect of structure on the UV spectra of organic compounds.
7. Analysis of the given vibration-rotation spectrum of HCl(g).
8. Verify Lambert-Beer's law and determine the concentration of $CuSO_4$/$KMnO_4$/$K_2Cr_2O_7$ in a solution of unknown concentration
9. Determine the concentrations of $KMnO_4$ and $K_2Cr_2O_7$ in a mixture.
10. Study the kinetics of iodination of propanone in acidic medium.
11. Determine the amount of iron present in a sample using 1,10-phenathroline.
12. Determine the dissociation constant of an indicator (phenolphthalein).
13. Study the kinetics of interaction of crystal violet/ phenolphthalein with sodium hydroxide.

Books:

1. Spectroscopy, Banwell
2. Introduction to Molecular Spectroscopy: Barrow
3. Quantum Chemistry and Spectroscopy, Engel and Reid
4. Atomic and Molecular Spectroscopy; Rita Kakkar
5. Molecular Spectroscopy, Hollas

Unit	Content	Contact Hrs
Unit I Coordination Chemistry -V	Introduction to inorganic reaction mechanisms. Stepwise and overall formation constants, the chelate effect, Thermodynamic and kinetic stability of complexes, chelate effect and its applications in analytical chemistry and biology. Substitution reactions in octahedral complexes, effect of acid and bases on substitution reaction of octahedral complexes, factor affecting the substitution reaction. Substitution reaction of square planar complexes, Trans-effect, theories of trans effect, Trans effect in synthesis of square planar complexes, Electron transfer reactions (elementary ideas only)	12
Unit II Organometallics II	Metal Alkyls: Important structural features of methyl lithium (tetramer) and trialkyl aluminium (dimer), concept of multicenter bonding in these compounds.Role of triethylaluminium in polymerisation of ethene (Ziegler – Natta Catalyst). Species present in ether solution of Grignard reagent and their structures, Schlenk equilibrium. Metal alkenes, alkynes and allyls: Synthesis, Structure and Bonding Metal carbene: Synthesis, Structure and Bonding Ferrocene: Preparation and reactions (acetylation, alkylation, metallation, Mannich condensation). Structure and aromaticity. Comparison of aromaticity and reactivity with that of benzene Fundamentals of organometallic reactions: oxidative addition, reductive elimination, insertion and elimination reaction Transition Metals in Catalysis Study of the following industrial processes and their mechanism: Alkene hydrogenation (Wilkinson's Catalyst), Hydroformylation (Co catalysts), Wacker Process, Synthetic gasoline (Fischer Tropsch reaction)	18
Unit III Bioinorganic Chemistry	Essential and trace metals in biology, Effect of deficiency of some metal ions (). Toxic effect of metal ions (Fe, Cu, Hg, Pb, Cd and As), Chelate therapy, Cisplatin as anticancer drug. Storage and transport of iron, active transport of ions (Sodium - potassium pump) Active site structure and function of Haemoglobin (cooperativity and Bohr effect), Myoglobin, Hemocyanin, Hemerythrin, Rubredoxin, Ferredoxin (Fe_2S_2, Fe_4S_4), Cytochrome P450, Superoxide dismutase, carbonic anhydrase and carboxypeptidase, Nitrogenase enzyme, V-B12	15

Inorganic lab III Inorganic Preparation	Following compounds should be prepared and test the presence of ions qualitatively. IR and UV-Visible spectra of these complexes should be recorded, interpreted and discussed. i) Preparation of Mohr's Salt, chrome alum and potash alum ii) Cis and trans $K[Cr(C_2O_4)2.(H_2O)_2]$ Potassium dioxalatodiaquachromate (III) iii) Potassium tris(oxalato)ferrate(III) iv) Vanadyl bis(acetylacetonate) v) Cu(thiourea) complex vi) Acetylation of ferrocene and purification of mono and bis derivatives by column chromatography.	30

Semester VI - (Organic Chemistry) – 45 L

Unit	Content	Contact Hrs
Unit I: Photochemistry	Electron excitation in organic molecules (alkenes and carbonyl compounds); Fate of electronically excited molecules; Singlet and Triplet states; Photoreduction of carbonyl compounds; Photoaddition of alkenes to carbonyl compounds (Patemo-Biichi reaction); Photoaddition of alkeñes to aromatic compounds; Photorearrangement (Cis-trans isomerization, Intramolecular cyclization of dienes); Photochemical fragmentation (Photolysis of carbonyl compounds: Norrish Type I and Type II reactions).	**10**
Unit II: Terpenes	Occurrence of terpenes; Structure and Classification, Isoprene rule; Elucidation of structure; Synthesis of Citral, Neral and α-terpineol; Biosynthesis of limonene, pinene, carvone (via Isopentenyl pyrophosphate).	**5**
Unit III: Pericyclic reactions	Cycloadditions: General description of the Diels–Alder reaction; Frontier orbital description of (4+2) cycloadditions; Regioselectivity in Diels–Alder reactions; Woodward–Hoffmann description of the Diels–Alder reaction; Photochemical [2 + 2] cycloadditions; Thermal [2 + 2] cycloadditions. Sigmatropic reactions: Conditions for sigmatropic reactions Orbital descriptions of [3,3]-sigmatropic rearrangements; Cope rearrangement Electrocyclic reactions: Conditions for (4n+2) and (4n) electrocyclic reactions; Conrotatory and disrotatory reactions	**15**
Unit IV:	Overview of structure and reactivity of Organolithium,	**15**

Organometallic Chemistry	Organomagnesium, Organocopper, Organozinc, and Organoboron reagents; General methods of preparation: Deprotonation, Metal-halogen exchange, Transmetallation; Directed metallation.	
Laboratory experiments:	1. Extraction of D-limonene from orange peel by the conventional method/ using liquid CO_2 prepared form dry ice. 2. Extraction of caffeine from tea leaves. 3. Photoreduction of benzophenone to benzopinacol in the presence of sunlight/UV irradiation. 4. Organic estimations: (any three): (i). Estimation of glycine by Sorenson's formalin method. (ii). Study of the titration curve of glycine (by pH metric methods). (iii). Determination of Iodine number of an oil/ fat. (iv). Saponification value of an oil or a fat.	**30**
Recommended textbooks: 1. March's Advanced Organic Chemistry: Reactions, Mechanisms, and Structure, Michael B. Smith 7th Edition (Wiley) 2. Organic Chemistry, Jonathan Clayden, Nick Greeves, Stuart Warren, 2nd Edition (Oxford) 3. Reaction Mechanism in Organic Chemistry, S. M. Mukherji, S. P. Singh 3rd Edition (Macmillan) 4. Organic Reactions and their Mechanisms, P. S. Kalsi 5. Organic Chemistry, Maitland Jones, Jr., Steven A. Fleming 5th Edition (Norton)		

Semester VI - Physical Chemistry – 45 h

Unit	Content	Contact Hrs
Unit I: **Chemical Equilibria**	Equilibrium of homogeneous and heterogeneous systems. Law of mass action, derivation of expression of equilibrium constants; temperature, pressure and concentration dependence of equilibrium constants (K_P, K_C, K_X), their applications. Le Chatelier's principle of dynamic equilibrium and its applications.	**5**
Unit II: Ionic equilibria	Introduction to Ionic equilibrium. Ionic Product. Common ion effect: its application. Acid Base Equilibria. Dissociation constants of mono and dibasic acids. pH scale, pH of very dilute and very concentrated solutions. Concept of strengths of	**10**

	solutions (molarity, normality and molality, difference between mass of a substance and amount of a substance). Calculation of strengths of acid and basic mixtures. pH titration curves of acid mixtures, salt hydrolysis-calculation of hydrolysis constant, degree of hydrolysis and pH for different salts. Buffer solutions and derivation of Henderson-Hasselbalch equation (for mono and dibasic acids). Solubility and solubility product of sparingly soluble salts – applications of solubility product principle with special reference to inorganic group separation. Explanation of Inorganic Group Separation Table using Le Chatelier's principle, solubility product and common ion effect.	
Unit III: **Phase Equilibria**	Definitions of phase, component and degrees of freedom. Gibb's phase rule and its derivations. Clausius-Clapeyron equation and its applications to solid-liquid, liquid-vapour and solid-vapour equilibria, phase diagram for one component systems, with applications. Phase diagrams for systems of solid-liquid equilibria involving eutectic, congruent and incongruent melting points, solid solutions. Fractional distillation of binary miscible liquids (ideal and nonideal), azeotropes, lever rule, partial miscibility of liquids, CST, miscible pairs, steam distillation. Nernst distribution law. Solvent extraction.	**15**
Unit IV: Electrochemistry	Conductivity, equivalent and molar conductivity and their properties; Kohlrausch law; Debye-Huckel Theory, Debye-Huckel Limiting Law , Debye Hückel Onsager equation (no derivation required); Ionic velocities, mobilities, transference numbers and its experimental determination using Hittorf and moving boundary methods; Applications of conductance measurement; Quantitative aspects of Faraday's laws of electrolysis, applications of electrolysis in metallurgy and industry; Electrolytic and galvanic cells, Electromotive force of a cell, Nernst equation; Standard electrode potential, Electrochemical series; Concentration cells with and without transference; Applications of EMF measurements including potentiometric titrations. Electrochemistry behind standard Pb Batteries and Li-ion batteries.	15
Laboratory experiments:	1. pH metric titration of (i) strong acid vs. strong base, (ii) weak acid vs. strong base. 2. Determination of dissociation constant of a weak acid. 1. Determination of critical solution temperature	**30**

	and composition of the phenol-water system and to study the effect of impurities on it. 2. Determine the transition temperature of a salt hydrate. 3. Construction of phase diagram (freezing point curve) using ignition tube method for two- component simple eutectic system. 4. Construction of phase diagram (freezing point curve) using ignition tube method for two- component congruently melting compound forming system. 5. Study the distribution of iodine between water and kerosene/carbon tetrachloride. 6. Determine the association factor of benzoic acid in benzene by distribution of benzoic acid between water and benzene. 7. Determine the vapour pressure of water at different temperatures and hence evaluate the enthalpy of vaporization of water. 8. Determine the equilibrium constant of the $I_2(aq) + KI \rightarrow KI_3(aq)$ system by the distribution method. Hence determine the concentration of the KI solution. 9. Determine the partition coefficient of ammonia between water and chloroform and also determine the formula of copper-ammonia complex. 10. Study of the solubility of benzoic acid in water and determination of ΔH.	
Books 1. Physical Chemistry: Atkins 2. Puri, Sharma, Pathania 3. Physical Chemistry: Berry Rice and Ross 4. Physical Chemistry: PC Rakshit 5. Reference Book: Bockris and Reddy Volume I (Ionics)		

Semester VI: Industrial Chemistry (45 h)

Units	**Content**	**Contact Hrs**
Unit I: Industrial Gases and Common Inorganic Chemicals	Industrial Gases: Large scale production, uses, storage and hazards in handling of the following gases: oxygen, nitrogen, argon, helium, hydrogen, acetylene, chlorine, phosgene. Inorganic Chemicals: Manufacture, application, analysis and hazards in handling the following chemicals: hydrochloric acid, nitric acid, sulphuric acid, caustic soda, bleaching powder, hydrogen peroxide, potash alum, and potassium permanganate.	9

Unit II: Silicate Industries	**Glass**: Glassy state and its properties, classification (silicate and non-silicate glasses). Manufacture and processing of glass. Composition and properties of the following types of glasses: Soda lime glass, lead glass, armoured glass, safety glass, borosilicate glass, coloured glass, photosensitive glass. **Ceramics:** Important clays and feldspar, ceramic, their types and manufacture. High technology ceramics and their applications, semiconducting Oxides. **Cements:** Classification of cement, ingredients and their role, Manufacture of cement and the setting process, quick setting cements.	8
Unit III: Fertilizers	Different types of fertilizers. Manufacture of the following fertilizers: Urea, ammonium nitrate, calcium ammonium nitrate, ammonium phosphates; polyphosphate, superphosphate, compound and mixed fertilizers, potassium chloride, potassium sulphate.	6
Unit IV: Surface Coatings	Objectives of coatings surfaces, preliminary treatment of surface, classification of surface coatings. Paints and pigments-formulation, composition and related properties. Oil paint, Vehicle, modified oils, Pigments, toners and lakes pigments, Fillers, Thinners, Enamels, emulsifying agents. Special paints (Heat retardant, Fire retardant, Eco-friendly paint, Plastic paint), Dyes, Wax polishing, Water and Oil paints, additives, Metallic coatings (electrolytic and electroless), metal spraying and anodizing.	8
Unit V: Alloys	Classification of alloys, ferrous and non-ferrous alloys, Specific properties of elements in alloys. Manufacture composition and properties of different types of steels (stainless steel, Ni-steel, Cr-steel) Brass, Bronze and Cu-Ni alloy.	6
Unit VI: Catalysis	Catalysts and their industrial applications, Deactivation or regeneration of catalysts. Phase transfer catalysts, application of zeolites as catalysts.	4
Unit VII: Pyrotechnics and Propellants	Firecrackers- composition and effect, Fire Extinguishers-types and use, Car Airbag chemistry, Introduction to rocket propellants.	4

Lab	1. Determination of free acidity in ammonium sulphate fertilizer. 2. Estimation of Calcium in Calcium ammonium nitrate fertilizer. 3. Estimation of phosphoric acid in superphosphate fertilizer. 4. Electroless metallic coatings on ceramic and plastic material. 5. Determination of composition of dolomite (by complexometric titration). 6. Analysis of (Cu, Ni); (Cu, Zn) in alloy or synthetic samples. 7. Analysis of Cement. 8. Preparation of pigment (zinc oxide).	**30**
Text Books and Reference Books	1. E. Stocchi: Industrial Chemistry, Vol-I, Ellis Horwood Ltd. UK. 2. R. M. Felder, R. W. Rousseau: Elementary Principles of Chemical Processes, Wiley Publishers, New Delhi. 3. W. D. Kingery, H. K. Bowen, D. R. Uhlmann: Introduction to Ceramics, Wiley Publishers, New Delhi. 4. J. A. Kent: Riegel's Handbook of Industrial Chemistry, CBS Publishers, New Delhi. 5. P. C. Jain, M. Jain: Engineering Chemistry, Dhanpat Rai & Sons, Delhi. 6. R. Gopalan, D. Venkappayya, S. Nagarajan: Engineering Chemistry, Vikas Publications, New Delhi B. K. Sharma: Engineering Chemistry, Goel Publishing House, Meerut	

GAUHATI UNIVERSITY

FOUR YEAR UNDERGRADUATE PROGRAMME (FYUGP)

SUBJECT: MATHEMATICS
Syllabus: Version-I

Programme Code: MAT027

Programme name & Programme Code: MAT027	Eligibility Criteria of the programme, if any	Semester	Course name	Course code	credits	Credit distribution of the course			Pre-requisite of the course (if any)	Internal marks	External Marks
						Lecture	Tutorial	Practical			
FYUGP in Mathematics (Major/ Minor)	Nill	1	**Classical Algebra**	MAT010104	4	4	0	0	Mathematics in 10+2 or equivalent standard	40	60
		2	**Calculus**	MAT020104	4	4	0	0	Do	40	60
		3	**Ordinary Differential Equations**	MAT030104	4	4	0	0	MAT020104	40	60
		4	**Real analysis**	MAT040104	4	4	0	0	Mathematics in 10+2 or equivalent standard	40	60
			Complex Analysis-I (with practical)	MAT040204	4	3	0	1	Mathematics in 10+2 or equivalent standard	Practical 25+Internal 30	45
			Analytical Geometry	MAT040304	4	4	0	0	Do	40	60

			Number Theory-I	MAT040404	4	4	0	0	Do	40	60
		5	**Abstract Algebra**	MAT050104	4	4	0	0	Do	40	60
			Multivariate Calculus	MAT050204	4	4	0	0	MAT020104	40	60
			Theory of Real Functions	MAT050304	4	4	0	0	MAT040104	40	60
			Numerical Analysis (with practical)	MAT050404	4	3	0	1	Mathematics in 10+2 or equivalent standard	Practical 25+Internal 30	45
		6	**Linear Algebra**	MAT060104	4	4	0	0	MAT050104	40	60
			Partial Differential Equations (with practical)	MAT060204	4	3	0	1	MAT030104	Practical 25+Internal 30	45
			Metric Spaces	MAT060304	4	4	0	0	MAT040104	40	60
			Mechanics	MAT060404	4	4	0	0	Mathematics in 10+2 or equivalent standard	40	60
Honours/ Honours with Research		7	**Algebra**	MAT070104	4	4	0	0	MAT050104	40	60
			Real Analysis and Lebesgue Measure	MAT070204	4	4	0	0	MAT040104 & MAT050304	40	60
			Complex Analysis-II	MAT070304	4	4	0	0	MAT040204	40	60

			Differential Equations	MAT070404	4	4	0	0	MAT030104 & MAT060204	40	60
			Research Methodology	MAT070504	4	4	0	0	Nil	40	60
Honours		8	**Topology**	MAT080104	4	4	0	0	MAT040104	40	60
			Number Theory-II	MAT080204	4	4	0	0	MAT040404	40	60
			Mechanics and Tensor Calculus	MAT080304	4	4	0	0	MAT060404	40	60
			Mathematical Methods	MAT080404	4	4	0	0	MAT050404	40	60
			Seminar/ Project	MAT080504	4	4	0	0		40	60
Honours with Research		8	**Dissertation**	MAT080116	16					160	240
			Seminar/ Project	MAT080204	4					40	60

Programme Specific Outcomes:

PSO1: Demonstrate mathematical ability effectively by oral, written, computational and graphical means.

PSO2: Measure the hypothesis, theories, techniques and proofs provisionally through analytic ability.

PSO3: Utilize mathematics to solve theoretical and applied/ real world problems by critical understanding, analysis and synthesis.
PS04: Develop a spirit of lifelong learning through continued education and research.

SEMESTER-I

MAT010104: Classical Algebra

Total Marks: 100 (External 60, Internal Assessment 40)
No. of Credits: 4
No. of Contact classes: 60

No. of Non-Contact classes: 0

Prerequisites: Mathematics in 10+2 or equivalent standard

Course Outcomes:

The students who take this course will be able to:

CO1 Identify symmetric functions of the roots for cubic and biquadratic equations, solve cubic and biquadratic equations.

CO2 Recognize consistent and inconsistent systems of linear equations by the row echelon form of the augmented matrix and calculate the inverse and rank of a matrix.

CO3 Classify and compute Learn how to find the nature of the roots of a given polynomial equation by Descartes' rule

CO4 Express the basic concepts of exponential, logarithmic and hyperbolic functions of complex numbers.

CO5 Apply De Moivre's theorem in a number of applications to solve numerical problems.

UNIT 1: Polar representation of complex number, De Moivre's theorem (both integral and rational index), Roots of complex numbers, n^{th} roots of unity, Application of De Moivre's Theorem, Exponential and logarithmic functions of complex numbers, Hyperbolic functions.

[1] Chapter 2 (Sections 2.7-2.13, 2.16)

(No. of classes: 20, Marks: 20)

UNIT 2: Algebraic equations: Deduction from Fundamental Theorem of Classical Algebra, Descartes' rule of signs, relation between roots and coefficients of a polynomial equation of degree n, symmetric functions of roots, Transformation of equations, Cardon's method of solution of a cubic equation, Euler's method of solution of a biquadratic equation.

[1] Chapter 5; Theorem 5.1.1, Theorem 5.2.1, Section 5.3 - 5.6, 5.11,5.12.

(No. of classes: 20, Marks: 20)

UNIT 3: Matrix Algebra, Addition, Transposition, Symmetry, Multiplication of matrices and their properties, Matrix inversion and properties, Row Echelon form and Rank of a matrix, Reduced row Echelon form, Consistency of linear systems, Solutions of system of homogeneous linear equations with number of equations and unknowns up to four.

[2] Chapter 3 (Sections 3.2, 3.5, and 3.7) Chapter 2 (Sections 2.1 to 2.4)

(No. of classes: 20, Marks: 20)
Text Books:

1. Mappa, S.K., Higher Algebra (Classical), Revised 8^{th} Edition, 2011, Levant Books.

2. Meyer, Carl D. (2000). Matrix Analysis and Applied Linear Algebra. Society for Industrial and Applied Mathematics (Siam).

Reference Books:

1. Dickson, Leonard Eugene (2009). First Course in The Theory of Equations. The Project Gutenberg eBook (http://www.gutenberg.org/ebooks/29785)

2. Gilbert, William J., & Vanstone, Scott A. (1993). Classical Algebra (3rd ed.). Waterloo Mathematics Foundation, Canada.

3. Titu Andreescu and Dorin Andrica, Complex Numbers from A to Z, Birkhauser,2006.

SEMESTER-II

MAT020104: Calculus

Total Marks: 100 (External: 60, Internal Assessment 40)

No. of Credits: 4

No. of Contact classes: 60

No. of Non-Contact classes: 0

Prerequisites: Mathematics in 10+2 or equivalent standard

Course Outcomes: The students who take this course will be able to:

CO1 Describe asymptotic behavior in terms of limits involving infinity.

CO2 Recognize function of two variables and operate the partial derivatives.

CO3 Express continuity and differentiability in terms of limits.

CO4 Calculate integrations which can be solved by reduction formula

CO5 Use the mean value theorems.

UNIT 1: Limits and continuity of a function including different approaches, Properties of continuous functions including Intermediate value theorem.

[1] Chapter 1

(No. of classes: 15, Marks: 15)

UNIT 2: (a) Differentiability, Successive differentiation, Leibnitz theorem, Recursion formulae for higher derivatives.

(b) Reduction formulae, derivations and illustrations of reduction formulae of the type $\int \sin^n x\,dx$, $\int \cos^n x\,dx$, $\int \tan^n x\,dx$, $\int \sec^n x\,dx$, $\int (\log x)^n\,dx$, $\int \sin^n x \cos^m x\,dx$.

[2] Chapter 5(for part (a))

[3] Chapter 4 (4.1-4.6) (only for part (b))

(No. of classes: 15, Marks: 15)

UNIT 3: Rolle's theorem, Lagrange's mean value theorem with geometrical interpretations and simple applications, Maclaurin and Taylor polynomials and their sigma notations. Taylor's formula with remainder, Introduction to Maclaurin and Taylor series.

[1] Chapter 9 (Sections 9.8 and 9.9 (without 'convergence' part))

[2] Chapter 6

(No. of classes: 15, Marks: 15)

UNIT 4: Functions of two or more variables, Partial differentiation up to second order, Euler's theorem on homogeneous functions

[1] Chapter 13 (Sections 13.1 and 13.3)

[2] Chapter 10(10.81)

(No. of classes: 15, Marks: 15)

Text books:

[1] Anton, Howard, Bivens, Irl, & Davis, Stephen (2013). Calculus (10th ed.). John Wiley & Sons Singapore Pte. Ltd. Reprint (2016) by Wiley India Pvt. Ltd. Delhi

[2] Shanti Narayan and P.K. Mittal, Differential Calculus, S. Chand, 2005

[3] Shanti Narayan and P.K. Mittal, Integral Calculus, S. Chand, 2007.

Reference book:

[1] Thomas, Jr. George B., Weir, Maurice D., & Hass, Joel (2014). Thomas' Calculus (13^{th} ed). Pearson Education, Delhi. Indian Reprint 2017.

SEMESTER-III

MAT030104: Ordinary Differential Equations

Total Marks: 100 (External 60, Internal Assessment 40)

No. of Credits: 4

No. of Contact classes: 60

No. of Non-Contact classes: 0

Prerequisites: MAT040104: Classical Algebra

Course Outcomes:

CO1 Identify 1st order ordinary differential equations like exact first order differential equations, Bernoulli equations and rules of finding integrating factors of exact equations.

CO2 Recognize the second order differential equations like homogenous equations with constant coefficients equations, non-homogenous equations and Cauchy-Euler equations

CO3 Solve first order and second order differential equations

CO4 Calculate Wronskian and show its properties.

CO5 Use the method of undetermined coefficients, variation of parameters.

UNIT 1: **First Order Ordinary Differential Equations**

Classification of differential equations; their origin and application. Solutions. First order exact differential equation. Integrating factors, Rules to find an integrating factor.

[1] Chapter 1(Sections 1.1and 1.2) Chapter 2 (Sections 2.1, 2.2 and 2.4)

Linear equations and Bernoulli equations. Basic theory of higher order linear differential equations. Solving differential equation by reducing its order. Wronskian and its properties.

[1] Chapter 2 (Section 2.3), Chapter 4 (Sections 4.1 and 4.6)

(No. of classes: 30, Marks: 30)

UNIT 2: Second Order Linear Differential Equations

Linear homogenous equations with constant coefficients. Linear non- homogenous equations; the method of undetermined coefficients, the method of Variation of Parameters. The Cauchy-Euler equations.

[1] Chapter 4 (Sections 4.2, 4.3, 4.4 and 4.5)

(No. of classes: 30, Marks: 30)

Text Book:

[1] Ross, Shepley L. (1984). Differential Equations (3rd Ed.), John Wiley & Sons,Inc.

Reference Book:

1.Kreyszig, Erwin (2011). Advanced Engineering Mathematics(10th ed.).John Wiley & Sons, Inc. Wiley India Edition 2015.

SEMESTER-IV

MAT040104: Real analysis

Total Marks: 100 (External60, Internal Assessment 40)

No. of Credits: 4

No. of Contact classes: 60

No. of Non-Contact classes: 0

Prerequisites: Mathematics in 10+2 or equivalent standard

Course Outcomes:

CO1 Identify the properties of the real line *R*, including completeness and Archimedean properties.

CO2 Define sequences in terms of functions from *N* to a subset of *R*.

CO3 Recognize bounded, convergent, divergent, Cauchy and monotonic sequences and to calculate their limit superior, limit inferior, and the limit of a bounded sequence.

CO4 Distinguish alternating series and infer absolute convergence of an infinite series of real numbers.

CO5 Apply limit comparison tests for convergence, the ratio, root, Raabe's, integral tests for convergence of an infinite series of real numbers.

UNIT 1: Algebraic and order properties of R, absolute value and real line, bounded sets, supremum and infimum, completeness property of R, the Archimedean property, the density theorem, intervals, Nested interval theorem, uncountability of R.

[1] Chapter 2 **(No of classes: 15, Marks: 15)**

UNIT 2: Real sequences, limit of a sequence, convergent sequence, bounded sequence, limit theorems, monotone sequences, monotone convergence theorem, subsequences, monotone subsequence theorem, Bolzano Weierstrass theorem for sequences, Cauchy sequences, Cauchy's convergence criterion, properties of divergence sequences.

[1] Chapter 3 **(No of classes: 20, Marks: 20)**

UNIT 3: Infinite series, convergence and divergence of infinite series, Cauchy criterion, Tests for convergence: comparison test, limit comparison test, ratio test, root test, integral test, Raabes's test, Absolute convergence, rearrangement theorem, alternating series, Leibniz test, conditional (non-absolute) convergence.

[1] Chapter 3: Section: 3.7, Chapter 9: Sections: 9.1-9.3.

(No of classes: 25, Marks: 25)

Text Book:

1. R.G. Bartle and D.R. Sherbert, *Introduction to Real Analysis*, 3rd Ed., John Wiley and Sons, 2002.

Reference Books:

1. Gerald G. Bilodeau, Paul R. Thie, G.E. Keough, *An Introduction to Analysis,* Jones &Bartlett, Second Edition, 2010.
2. A. Kumar and S. Kumaresan, *Basic Course in Real Analysis*, CRC Press, 2014.
3. K.A. Ross, *Elementary Analysis*: *The Theory of Calculus*, Undergraduate Texts in Mathematics, Springer (SIE), Indian reprint, 2004.

SEMESTER-IV

MAT040204: Complex Analysis-I (with practical)

Total Marks: 100

(External:45, Practical 25, InternalAssessment:30)

No. of Credits: 4 (Theory 3, Practical 1)

No. of Contact classes: 75 (45+30×1)

No. of Non-Contact classes: 0

Prerequisites: Knowledge on

- complex number system as the extension of real number system
- Algebra of complex numbers.
- Properties of complex number.
- Modulus, argument and geometrical representation of complex numbers

Course Outcomes:

CO1 List some elementary functions and evaluate the contour integrals.

CO2 State Cauchy−Goursat theorem and the Cauchy integral formula

CO3 Discuss the differentiability of complex functions

CO4 Explain the concept of Cauchy-Riemann equations.

CO5 Apply Cauchy-Riemann equations, Cauchy−Goursat theorem and the Cauchy integral formula.

UNIT1: Functions of complex variable, mappings, limits, theorems on limits, limits involving point at infinity, continuity. Derivatives, rules for differentiation, Cauchy-Riemann equations, sufficient conditions for differentiability, polar co-ordinates.

[1]: Chapter 2(Section 13, 14, 15,16,17, 18,19,20, 21,22,23,24)

(No. of classes: 10, Marks: 15)

UNIT 2: Analytic functions, examples of analytic functions, harmonic function. The exponential function, Logarithmic function, examples, branches and derivatives of logarithms, some identities involving logarithms, the power function. Trigonometric function, zeros and singularities of trigonometric functions derivatives of functions, definite integrals of functions.

[1]:Chapter2(Sections25, 26,27),Chapter3(Sections30, 31,32,33,34, 35,36,37,38),Chapter4(Section41,42)

(No. of classes: 15, Marks: 10)

UNIT 3: Contours, Contour integrals and its examples, upper bounds for moduli of contour integrals, antiderivatives, proof of antiderivative theorem.

[1]: Chapter 4 (Section43, 44, 45,47, 48, 49)

(No. of classes: 10, Marks: 10)

UNIT4: Cauchy-Goursattheorem, simply connected domains, multiply connected domains, Cauchyintegralformula, extension of Cauchy integral formula, Liouville's theorem and the fundamental theorem of algebra.

[1]:Chapter4(Sections50, 52,53,54, 55, 58)

(No. of classes: 10, Marks: 10)

LAB WORK TOBEPERFORMEDONACOMPUTER

(MODELINGOFTHEFOLLOWINGPROBLEMSUSINGMATLAB/MATHEMATICA/MAPLEetc.)

1. Declaring a complex number and graphical representation. e.g. $Z_1=3+4i, Z_2= 4-7i$

2. Program to discuss the algebra of complex numbers,e.g.,

$Z_1=3+4i, Z_2=4- 7i$,thenfind$Z_1+Z_2, Z_1-Z_2, Z_1*Z_2andZ_1/ Z_2$

3. To find conjugate, modulus and phase angle of an array of complex numbers.

e.g.Z= [2+ 3i,4-2i, 6+11i,2-5i]

4. To compute the integral over a straight line path between the two specified end points.

e. g., $\oint \mathrm{Sin} z d$, along the contour C which is a straight line pathfrom-1+ ito2 -i.

5. To perform contour integration.,e.g.,

(i) $\oint (z^2-2z+1)dz$ along the Contour C given by $x=y^2+1; -2\leq y\leq 2$.

(ii) $\oint (z^3+2z^2+1)dz$ along the contour C given by $x^2+y^2=1$,which can be parameterized by

$x = \cos(t)$, $y= \sin(t)$for $0\leq y\leq 2\pi$.

6. To plot the complex functions and analyze the graph.e.g.,

$f(z)=z, iz, z^2, z^3, e^z$ and $(z^4-1)^{1/4}$,etc

(No. of practical classes: 30, Marks: 25)

Text Book:

1. James Ward Brown and Ruel V. Churchill ,Complex Variables and Applications (NinthEdition),McGraw-Hill Indian Edition, 2021.

ReferenceBook:

1. Joseph Bak and Donald J. Newman,*Complex analysis* (2ndEdition),Undergraduate Texts in Mathematics, Springer-Verlag New York, Inc., NewYork, 1997.

2. M.R. Spiegel, *Complex Variables*. Schaum's Outlines series, McGraw Hill Education, 2017

SEMESTER-IV

MAT040304: Analytical Geometry

Total Marks: 100 (External 60, Internal Assessment 40)

No. of Credits: 4

No. of Contact classes: 60

No. of Non-Contact classes: 0

Prerequisites: Mathematics in 10+2 or equivalent standard

Course Outcomes:

CO1 Define Vector Algebra and represent the use of geometric view of vectors in Coordinate Geometry.

CO2 Recognize three dimensional surfaces represented by equations of the second degree

CO3 Change the coordinate systems

CO4 Explain pair of straight lines, conic sections and related properties

CO5 Express systems of coordinates which are very useful to define the position of a point in space

UNIT 1: Transformation of coordinates, invariants under orthogonal transformations, pair of straight lines.

[1] Chapter 1 (Section 1.3), Chapter 2, Chapter 3

(No. of classes: 15, Marks: 15)

UNIT 2: Parabola, parametric coordinates, tangent and normal, ellipse and its conjugate diameters with properties, hyperbola and its asymptotes, General conics: tangent, condition of tangency, pole and polar, centre of a conic, equation of pair of tangents, reduction to standard forms, central conics, equation of the axes, and length of the axes, polar equation of a conic, tangent and normal, and properties.

[1] Chapters 4, 5, 6, 7, 9 (upto Section 9.43)

(No. of classes: 15, Marks: 15)

UNIT 3: Quadric surfaces:Sphere, Cylinder and Cone. Cylindrical and spherical polar coordinates.

[1] Chapter 6 (Section 6.1 – 6.3), Chapter 12

(No. of classes: 15, Marks: 15)

UNIT 4: Rectangular coordinates in 3-space, Vector viewed geometrically, Vectors in coordinates system, Vectors determined by length and angle, Dot product, Cross product and their geometrical properties, Triple product, Parametric equations of lines in 2-space and 3-space.

[2] Chapter 11 (Section 11.1 - 11.5)

(No. of classes: 15, Marks: 15)

Text Books:

1. R.M. Khan, Analytical Geometry of two and three dimensions and Vector Analysis. New Central Book Agency, 2012.

2. Anton, Howard, Bivens, Irl, & Davis, Stephen (2013), Calculus (10^{th} ed.). John Wiley & Sons, Singapore Reprint (2016) by Wiley India Pvt. Ltd., Delhi.

Reference Book:

1. R.J.T. Bell, Coordinate Solid Geometry, Macmillan, 1983.

2. E.H. Askwith, The Analytical Geometry of the Conic Sections, Nabu Press (27 February 2012)

3. B. Das, Analytical Geometry and Vector Analysis, Orient Book Company, Kolkata -700007

SEMESTER-IV

MAT040404: Number Theory-I

Total Marks: 100 (External 60, Internal Assessment 40)

No. of Credits: 4

No. of Contact classes: 60

No. of Non-Contact classes: 0

Prerequisites: Mathematics in 10+2 or equivalent standard

Course Outcomes:

CO1	State Fermat's theorem and Wilson's theorem and use them to solve problems
CO2	Explain division algorithm, Euclid's algorithms , greatest common divisor, the concepts of congruences, linear congruences
CO3	Explore the Chinese Remainder theorem to solve simultaneous linear congruences.
CO4	Apply mathematical ideas and concepts within the context of number theory.
CO5	Summarize number theoretic techniques to a mathematical audience.

UNIT 1: Well-Ordering Principle of integers, Archimedian property, First principle of finite induction, Second principle of finite induction, The division algorithm of integers, The greatest common divisor, The Euclidean algorithm, The Diophantine equation $ax + by = c$, Fundamental Theorem of Arithmetic, The sieve of Eratosthenes, The Goldbach Conjecture.

[1] Chapter 1 (Sections 1.1), Chapter2 (sections 2.2 -- 2.5), Chapter3.

(No of classes:20, Marks:20)

UNIT 2: Congruence modulo of a fixed positive integer, Basic properties of congruences, Binary and decimal representation of integers, Linear congruences, Chinese Remainder Theorem, Fermat's Little Theorem, pseudoprimes, Wilson's Theorem.

[1] Chapter 4 (Sections 4.2-4.4) Chapter5 (Sections: 5.2, 5.3). **(No of classes: 20, Marks: 20)**

UNIT 3: Number Theoretic Functions: The sum and number of divisors of a positive integer, Multiplicative functions, Mobius function, The Mobius inversion Formula, The greatest integer function, Euler's Phi-Function, Euler's Theorem, Properties of Euler's Phi function.

[1] Chapter 6 (Sections 6.1-6.3), Chapter 7 (Sections 7..2 to 7.4) .

(No of classes:20, Marks: 20)

Text Books:

1. David M. Burton, *Elementary Number Theory*, 7th Edition, McGraw Hill Education (India) private limited. 2012.

Reference Books:

1. G.A. Jones and J. Mary Jones, *Elementary Number Theory*. Undergraduate Mathematics Series (SUMS) , 2005.

2. Neville Robinns, *Beginning Number Theory*. 2nd Ed., Narosa Publishing House Pvt. Ltd. Delhi-2007

3. K.C. Chowdhury, *A First Course in Number Theory*, Asian Books Publications- 2012.

SEMESTER-V

MAT050104: Abstract Algebra

Total Marks: 100 (External 60, Internal Assessment 40)

No. of Credits: 4

No. of Contact classes: 60

No. of Non-Contact classes: 0

Prerequisites: Mathematics in 10+2 or equivalent standard

Course Outcomes:

CO1	Recognize the mathematical objects called group, ring and fields.
CO2	Associate the fundamental concepts of groups and symmetries of geometrical objects.
CO3	Explain the significance of the notion of Permutation groups, cosets, cyclic groups, normal subgroups, factor groups.
CO4	Analyse consequences of Lagrange's theorem and Fermat's Little theorem.
CO5	Describe structure preserving mappings between groups and their consequences.
CO6	Describe the fundamental concepts in ring theory such as of the subrings, integral domains, ideals, factor rings and fields.

Unit 1: Definition and examples of groups, Elementary properties of groups, Symmetries of a square, Dihedral groups, order of a group, Order of an element in a group, Subgroups, Subgroup Tests, Subgroup generated by an element of a group, Centre of a group, Centralizer of an element in a group, Cyclic groups, Properties of cyclic groups, Fundamental theorem of cyclic groups.

[1] Chapter 1 to Chapter 4.

(No. of classes: 15, Marks: 15)

Unit 2: Permutations, Permutation group, Properties of permutations, Even and odd permutations, Alternating groups, Cosets, Properties of cosets, Lagrange's Theorem, Fermat's Little Theorem, Normal subgroups, Factor groups.

[1] Chapter 5 (up to theorem 5.7), Chapter 7 (up to theorem 7.2), Chapter 9 (up to theorem 9.2)

(No. of classes: 15, Marks: 15)

Unit 3: Isomorphism of groups, Cayley's Theorem, Properties of isomorphism, Group homomorphism, Kernal of a group homomorphism, Properties of group homomorphism, First isomorphism Theorem of groups.

[1] Chapter 6 (up to theorem 6.3), Chapter 10 (up to theorem 10.4).

(No. of classes: 15, Marks: 15)

Unit 4: Rings, Examples of rings, Properties of rings, Subrings, Zero-Divisors in a ring, Integral domains, Fields, Characteristic of a ring, Ideals, Ideal Test, Factor rings, Prime ideals and maximal ideals of a ring.

[1] Chapter 12 to Chapter 14.

(No. of classes: 15, Marks: 15)

Text Books:

1. Gallian Joseph A., *Contemporary Abstract Algebra* (8th Edition) , Cengage Learning India Private limited, Delhi, Fourth impression, 2015.

Online link: https://ict.iitk.ac.in/wp-content/uploads/CS203-Mathematics-for-Computer-Science-III-Gallian.pdf

Reference Books:

1. David S. Dummit and Richard M. Foote*, Abstract Algebra* (2nd Edition) , John Wiley and Sons (Asia) Pvt. Ltd. , Singapore, 2003.

2. John B. Fraleigh, *A First course in Abstract Algebra*, 7th Edition, Pearson, 2002.

3. G. Santhanam. *Algebra,* Narosa Publishing House, 2017.

SEMESTER-V

MAT050204: Multivariate Calculus

Total Marks: 100 (External 60, Internal Assessment 40)

No. of Credits: 4

(Use of Scientific calculator is allowed)

No. of Contact classes: 60

No. of Non-Contact classes: 0

Prerequisites: Knowledge on the following topics:

- Functions of single variable, limit, continuity, differentiability and extrema of single variable functions.
- Knowledge of Integration
- Vector valued functions, dot and cross product of vectors.

Course Outcomes:

CO1 Identify the conceptual variations when advancing in calculus from one variable to multivariable discussion.

CO2 Describe themaximizationandminimizationofmultivariablefunctionssubjecttothegivenconstraintsonvariables.

CO3 Explain about the inter-relationship amongst the line integral, double and triple integral formulations.

CO4 Assess Green's, Stokes' and Gauss divergence theorems

UNIT1: Functions of several variables, Level curves and surfaces, Limits and continuity, Partial differentiation, Higher order partial derivative, Chain rule, Directional derivatives, The gradient, Maximal property of the gradient.

[1]Chapter11 [(Sections11.1, 11.2, 11.3,11.5, Section 11.6 (upto page 592)]

(No. of classes: 15, Marks: 15)

UNIT 2: Extrema of functions of two variables, Method of Lagrange multipliers, Constrained optimization problems; Definition of vector field,

Divergence and curl.

[1]Chapter 11[Section11.7(uptopage605),Section11.8(pages610-614)],Chapter13(Section13.1)

(No. of classes: 15, Marks: 15)

UNIT 3: Double integration over rectangular and nonrectangular regions, Double integrals in polar coordinates, Triple integral over a parallelepiped and solid regions, Volume by triple integrals.

[1]Chapter 12(Sections12.1-12.4)

(No. of classes: 15, Marks: 15)

UNIT4: Line integrals, Applications of line integrals**:** Mass and Work, Fundamental theorem for line integrals, Conservative vector fields, Green's theorem, Area as a line integral; Surface integrals, Stokes' theorem, The Gauss divergence theorem.

[1] Chapter 13 [(Sections 13.2, 13.3), Section 13.4 (pages 712 to 716), Section 13.5 (pages 723to 726) Section 13.6 (pages 733 to 737), Section 13.7 (pages 742 to 745)]

(No. of classes: 15, Marks: 15)

Textbook:

[1] Strauss, Monty J., Bradley, Gerald L.,& Smith, Karl J.(2007). *Calculus* (3rded.). Dorling Kindersley (India)Pvt. Ltd. (Pearson Education). Delhi. IndianReprint2011

Reference Books:

1. Marsden, J.E., Tromba, A., & Weinstein,A.(2004).*Basic Multivariable Calculus*. Springer (SIE). First Indian Reprint.
2. G.B.Thomas and R.L.Finney,Calculus,9thEd.,Pearson Education,Delhi,2005.
3. James Stewart, Multivariable Calculus, Concepts and Contexts, 2nd Ed., Brooks /Cole, Thomson Learning, USA,2001.

SEMESTER-V

MAT050304: Theory of Real Functions

Total Marks: 100 (External 60, Internal Assessment 40)

No. of Credits: 4

No. of Contact classes: 60

No. of Non-Contact classes: 0

Prerequisites: MAT040104: Real analysis

Course Outcomes:

CO1 Describe the concept of limit of a function.

CO2 Define differentiability using limits, leading to a better understanding for applications.

CO3 Explain the continuity and uniform continuity of functions defined on intervals.

CO4 Analyze geometrical properties of continuous functions on closed and bounded intervals.

CO5 Apply mean value theorems and Taylor's theorem

UNIT 1: Cluster point or limit point of a set, limits of a function (ε-δ approach), sequential criterion for limits, divergence criteria, limit theorems, one sided limits, infinite limits and limits at infinity.

[1] Chapter 4

(No. of classes: 15, Marks: 15)

UNIT 2: Continuous functions, sequential criterion for continuity and discontinuity, algebra of continuous functions, continuous functions on intervals, maximum-minimum theorem, intermediate value theorem, location of roots theorem, preservation of intervals theorem, uniform continuity, uniform continuity theorem, monotone and inverse functions.

[1] Chapter 5 (5.1 to 5.6)

(No. of classes: 20, Marks: 20)

UNIT 3: Differentiability of a function at a point and in an interval, Caratheodory's theorem, chain rule, derivative of inverse function, Rolle's theorem, mean value theorem, Darboux's theorem, Cauchy mean value theorem, Taylor's theorem and applications to inequalities, Taylor's series expansions of exponential and trigonometric functions, ln(1+x), 1/(ax+b) and $(1+x)^n$.

[1] Chapter 6, and Taylor series as in Section 6.4.

(No. of classes: 25, Marks: 25)

Text Book:

1. R.G. Bartle and D.R. Sherbert, *Introduction to Real Analysis*, 3rd Ed., John Wiley and Sons, 2002.

Reference Books:

1. Ajit Kumar and S. Kumaresan, *A Basic Course in Real Analysis*, CRC Press, Indian Ed. 2014.
2. K.A. Ross, *Elementary Analysis: The Theory of Calculus*, Springer, 2004.
3. Mattuck, *Introduction to Analysis*, Prentice Hall, 1999.
4. S.R.Ghorpade and B.V.Limaye, *A Course in Calculus and Real Analysis*, Springer, 2006.

SEMESTER-V

MAT050404: Numerical Analysis (with practical)

Total Marks: 100

(External 45, Practical 25, Internal Assessment:30)

No. of Credits: 4 (Theory 3, Practical 1)

(Use of Scientific calculator is allowed)

No. of Contact classes: 75 (45+30×1)

No. of Non-Contact classes: 0

Prerequisites: Mathematics in 10+2 or equivalent standard, Knowledge on computer software and programming

Course Outcomes:

CO1 Apply numerical methods to find the zeroes of nonlinear functions of a single variable and solution of a system of linear equations, upto a certain given level of precision.

CO2 Compute the values for a tabulated function at points not in the table using interpolation techniques.

CO3 Measure a definite integral that cannot be done analytically

CO4 Estimate numerical differentiation of functional values

CO5 Solve differential equations that cannot be solved by analytical methods

UNIT1: Gaussian elimination method (withrowpivoting),Gauss-Jordan method; Iterative methods**:** Jacobi method, Gauss-Seidel method; Interpolation**:** Lagrange form, Newton form, Finite difference operators, Gregory-Newton forward and backward difference interpolations, Piecewise polynomial interpolation (Linear and Quadratic).

[1] Chapter3(Sections3.1, and3.2),Chapter6(Sections6.1and6.2)Chapter8(Section8.1, Section8.3 (8.3.1,and8.3.2)

[2] Chapter3(Sections3.2, and3.4)Chapter4(Section4.2)Chapter4(Sections4.3,and4.4)[1]Chapter18(Sections18.1to18.3)

[3] **(No. of classes: 20, Marks: 25)**

UNIT 2: Numerical differentiation**:** First and second order derivatives; Numerical integration**:** Trapezoid rule, Simpson's rule; Extrapolation methods**:** Richardson extrapolation, Romberg integration; Ordinary differential equation**:** Euler's method, Modified Euler's methods **(**Heun and Mid-point).

[2] Chapter 11 [Sections 11.1(11.1.1,11.1.2,11.1.4), and11.2(11.2.1,11.2.2,11.2.4)]

[1] Chapter22 (Sections22.1, and 22.2,22.3)

(No. of classes: 25, Marks: 20)

***Practical /Lab work to be performed on a compute*r:**

Use of computeraided software (CAS),for example *Matlab/Mathematica/Maple*etc., for developing the following numerical programs:

(i) Lagrange's interpolation method

(ii) Newton's interpolation method

(iii) To calculate forward and backward differences

(iv) Trapezoidal rule

(v) Simpson's rule

Note: For any of the CAS *Matlab/Mathematic a/Maple* etc., Data types-simple data types, floating data types,characterdatatypes,arithmeticoperatorsandoperatorprecedence,variablesandconstantdeclarations,expressions,input/output, relational operators, logical operators and logical expressions, control statements and loop statements, arrays should be introduced to the students.

(No. of practical classes: 30, Marks: 25)

Text Books:

[1] Chapra, Steven C.(2018).*Applied Numerical Methods with* MATLAB *for Engineers and* Scientists(4th ed.) Mc Graw-Hill Education.

[2] Fausett ,LaureneV. (2009). *Applied Numerical Analysis Using* MATLAB.Pearson.India

[3] Jain,M.K.,Iyengar,S.R.K.,&JainR.K.(2012). *NumericalMethods for Scientific and Engineering Computation*(6th ed.).New Age International Publishers. Delhi.

SEMESTER-VI

MAT060104: Linear Algebra

Total Marks: 100 (External 60, Internal Assessment 40)

No. of Credits: 4

No. of Contact classes: 60

No. of Non-Contact classes: 0

Prerequisites: MAT050104: Abstract Algebra

Course Outcomes:

CO1 Define linear spaces and discuss their general properties, linear dependence and linear independence of vectors, bases and dimensions of vector spaces

CO2 Explain the basic concepts of linear transformations, dimension theorem, matrix representations of linear transformations, and the change of coordinate matrix.

CO3 Compute the characteristic polynomial, eigenvalues, eigenvectors and eigenspaces, as well as the geometric and the algebraic multiplicities of an eigenvalue and apply the basic diagonalization result.

CO4 Determine inner products and orthogonality on vector spaces.

CO5 Use Gram-Schmidt orthogonalization to obtain orthonormal basis.

UNIT 1: Definition and examples of vector spaces, general properties of vector spaces, Definition and examples of subspaces, subspace criterions and algebra of subspaces, null space and column space of a matrix, Linear transformations, Kernel and range of a linear transformation.

[1]: Chapter 4 (Sections 4.1-4.2), [2] : Chapter 4

(No. of classes: 15, Marks: 15)

UNIT 2: Linear combinations of vectors, linearly dependent and independent sets, bases of vector spaces, coordinate systems, dimension of a vector space, ranks, change of basis.

[1]: Chapter 4 (Sections 4.3-4.7), [2] : Chapter 5

(No. of classes: 15, Marks: 15)

UNIT 3: Eigenvectors and eigenvalues of a matrix, The Characteristic equation, Diagonalization, eigenvector of a linear transformation, Complex eigenvalues. Invariant subspaces and Cayley- Hamilton Theorem.

[1]: Chapter 5 (Sections 5.1-5.5), [2]: Chapter 9, [3]: Chapter 5 (Sections 5.4)

(No. of classes: 15, Marks: 15)

UNIT 4: Inner products, Length and orthogonality, orthogonal sets, orthogonal projections, The Gram-Schmidt process, Inner product spaces.

[1]: Chapter 6 (Sections 6.1-6.4, 6.7), [2]: Chapter 12

(No. of classes: 15, Marks: 15)

Text Books:

1. David C. Lay, *Linear Algebra and its Applications*, 3rd Edition, Pearson Education, Asia, Indian Reprint, 2007
2. Seymour Lipschutz, *Theory and Problems of Linear Algebra*, Schaum's Outline Series, McGraw-Hill Book Company, Singapore
3. Stephen H. Friedberg, Arnold J. Insel, Lawrence E. Spence, *Linear Algebra*, 4th Edition, Prentice Hall of India Pvt. Ltd., New Delhi, 2004.

Reference Books:

1. S. Kumaresan, *Linear Algebra- A Geometric Approach*, Prentice Hall of India, 2017
2. Gilbert Strang, Linear Algebra and its Applications, Thomson, 2007
3. G. Schay, Introduction to Linear Algebra, Narosa, 1997

SEMESTER-VI

MAT060204: Partial Differential Equations (with practical)

Total Marks: 100

(External:45, Practical 25, Internal Assessment: 30)

No. of Credits: 4 (Theory 3, Practical 1)

No. of Contact classes: 75 (15×3+30×1)

No. of Non-Contact classes: 0

Prerequisites: Mathematics in 10+2 or equivalent standard, Knowledge on computer software

Course Outcomes:

CO1	Formulate, classify and transform first order PDEs into canonical form.
CO2	Explain method of characteristics, separation of variables and solve first order PDE's.
CO3	Classify and solve second order linear PDEs.
CO4	Discuss Cauchy problem for second order PDE and homogeneous and non-homogeneous wave equations.
CO5	Apply the method of separation of variables for solving many well-known second-order PDEs.

UNIT 1: Introduction, Classification, Construction of first order partial differential equations (PDE). Cauchy's problem for first order equations, linear equations of the first order, Integral surfaces passing through a given curve, Nonlinear partial differential equations of the first order, Cauchy's method of characteristics, Charpit's method. Solutions satisfying given conditions, Jacobi's method.

[1] Chapter 2 (Sections 2.1 to 2.3), [2] Chapter 2 (Section 3, 4,5, 7,8,10,12, 13)

(No. of classes: 15, Marks: 15)

UNIT 2: Canonical form of first order PDE, Method of separation of variables for first order PDE.

[1] Chapter 2 (Sections 2.6 and 2.7)

(No. of classes: 15, Marks: 15)

UNIT 3: Reduction to canonical forms, Equations with constant coefficients, General solution.

[1] Chapter 4 (Sections 4.1 to 4.5), [2] Chapter 3 (Sections 4, 5)

(No. of classes: 15, Marks: 15)

Practical /Lab work to be performed in a Computer Lab:

Modelling of the following similar problems using Mathematica /MATLAB/ Maple/ Maxima/Scilab etc.

1. Solution of Cauchy problem for first order PDE.
2. Plotting the characteristics for the first order PDE.
3. Plot the integral surfaces of a given first order PDE with initial data.
4. Solution of wave equation $\frac{\partial^2 u}{\partial t^2} = c^2 \frac{\partial^2 u}{\partial x^2}$ for any two of the following associated conditions:

(a) $u(x,0) = \phi(x);\ u(x,0) = \psi(x), x \in R; t > 0$

(b) $u(x,0) = \phi(x); u_t(x,0) = \psi(x);\ \ u(0,t) = 0, x > 0; t > 0$

(c) $u(x,0) = \phi(x); u_t(x,0) = \psi(x);\ \ u_x(0,t) = 0, x > 0; t > 0$

(d) $u(x,0) = \phi(x); u_t(x,0) = \psi(x);\ \ u(0,t) = 0, u(l,t) = 0; x > 0; t > 0$

5. Solving systems of ordinary differential equations.
6. Solution of one-Dimensional heat equation $u_t = k\, u_{xx}$, for a homogeneous rod of length l.

That is - solve the IBVP:

$$u_t = k\, u_{xx}, \qquad 0 < x < l, \qquad t > 0$$
$$u(0,t) = 0, \qquad u(l,t) = 0, \qquad t \geq 0$$
$$u(0,t) = f(x), \ \ 0 \leq x \leq l$$

(No. of practical classes: 30, Marks: 25)

Text Book:

1. Tyn Myint-U and Lokenath Debnath**,** *Linear Partial Differential Equation for Scientists and Engineers*, Springer, Indian reprint, 2006.
2. Sneddon, I. N. (2006). *Elements of Partial Differential Equations*, Dover Publications. Indian Reprint.

Reference Book:

1. Stavroulakis, Ioannis P & Tersian, Stepan A. (2004). *Partial Differential Equations*: *An Introduction with Mathematica and* MAPLE (2nd ed.). World Scientific.
2. M. D. Raisinghania, Advanced Differenti al Equations, S. Chand & Company LTD.

SEMESTER-VI

MAT060304: Metric Spaces

Total Marks: 100 (External 60, Internal Assessment 40)

No. of Credits: 4

No. of Contact classes: 60

No. of Non-Contact classes: 0

Prerequisites: MAT040104: Real Anaylsis

Course Outcomes:

CO1 Define various natural and abstract formulations of distance on the sets of usual or unusual entities. Become aware one such formulations leading to metric spaces.

CO2 Analyse how a theory advances from a particular frame to a general frame.

CO3 Construct the mathematical understanding of various geometrical concepts, viz. Balls or connected sets etc. in an abstract setting.

CO4 Develop the two important topological properties of metric spaces, namely connectedness and compactness.

UNIT 1: Definition and examples of Metric spaces, sequences in metric spaces, Cauchy sequences, complete metric spaces. Open and closed balls, neighbourhood, open set, interior of a set. Limit point of a set, closed set, diameter of a set, Cantor's theorem. Subspaces, dense sets, separable spaces.

[1] Chapter 1, Sections: 1.1-1.4, Chapter 2, Sections: 2.1, 2.2, 2.3.12 - 2.3.16

(No. of classes: 15, Marks: 15)

UNIT 2: Continuity: Continuous mappings, sequential criterion and other characterizations of continuity. Uniform continuity. Homeomorphism, Equivalent metrics, Isometry. Contraction mappings.

[1] Chapter 3, Sections 3.1, 3.4, 3.5, 3.7 (upto 3.7.2)

(No. of classes: 15, Marks: 15)

UNIT 3: Connected metric spaces: Connectedness, connected subsets of real numbers, connectedness and continuous mappings, components. Compact metric spaces: bounded sets and compactness, other characterisations of compactness, continuous functions on compact spaces.

[1] Chapter 4, Sections 4.1, Chapter 5, Sections 5.1, 5.2, 5.3

(No. of classes: 30, Marks: 30)

Text Book:

1. Satish Shirali & Harikishan L. Vasudeva, Metric Spaces, Springer Verlag London (2006) (First Indian Reprint2009)

Reference Books:

1. S. Kumaresan, Topology of Metric Spaces, 2nd Ed., Narosa Publishing House, 2011.
2. G.F. Simmons, Introduction to Topology and Modern Analysis, McGraw-Hill, 2004.
3. Micheal O. Searcoid, Metric Spaces, Springer Publication, 2007

SEMESTER-VI

MAT060404: Mechanics

Total Marks: 100 (External 60, Internal Assessment:40)

No. of Credits: 4

No. of Contact classes: 60

No. of Non-Contact classes: 0

Prerequisites: Mathematics in 10+2 or equivalent standard

Course Outcomes:

CO1 Define the concepts in statics such as moments, couples, equilibrium in both two and three dimensions.

CO2 Explain the theory behind friction and center of gravity.

CO3 Formulate conservation of mechanical energy and work-energy equations.

CO4 Illustrate translational and rotational motion of rigid bodies.

UNIT1: Composition and resolution of forces, Parallelogram of forces, Triangle of forces, Converse of triangle of forces, Lami's Theorem, Parallel forces, Moment of a force about a point and an axis. Couple, Resultant of a system of forces. Equilibrium of coplanar forces. Friction, C.G of an arc, plane area, surface of revolution, solid of revolution.

[3] Chapter I-X

(No. of classes: 30, Marks: 30)

UNIT 2: Velocities and acceleration along radial and transverse directions and along tangential and normal directions, motion in a straight line under variable acceleration, simple harmonic motion and elastic string. Newton's law of motion. Work, Energy and momentum, Conservative forces-Potential energy, Impulsive forces, Motion in resisting medium.

[1] Chapter I Sections 1.1, 1.2,1.3, Chapter –2 Sections 2.1,2.2, Chapter 3 Sections 3.1.3.2, Chapter 4 Sections 4.1, Chapter 5Sections5.1,5.3,Chapter 6Sections6.1,6.3.

[2] Chapter 3(Sections:3.1,3.2,3.3,3.4).

(No. of classes: 30, Marks: 30)

Text Books:

1. S.L. Loney, An elementary treatise on the dynamics of a particle and of rigid bodies, Surjeet publications
2. F.Chorlton,TextbookofDynamics,CBS,Publications2nd Edition,1985
3. B.C. Das & B. N. Mukherjee, Statics, U. N. Dhur & Sons Pvt. Ltd.

Reference books:

1. M.R.Spiegel, Theoretical Mechanics, Schaum Series 2010.

SEMESTER-VII (Honours/Honours with Research)

MAT070104: Algebra

Total Marks: 100 (External 60, Internal Assessment 40)

No. of Credits: 4

No. of Contact Classes: 60

No. of Non-Contact Classes: 0

Pre-requisite for the paper: MAT050104: Abstract Algebra and MAT060104: Linear Algebra

Course Outcomes: On successful completion of the course students will be able to:

CO1: Describe direct product of groups and different kinds of subnormal series of groups.

CO2: Explain polynomial rings over commutative rings, PID, Euclidean Domain and UFD.

CO3: Discuss field extension and its application to geometry.

CO4: Identify about similarity of linear transforms and classify Jordan canonical forms and quadratic forms.

Unit 1: Direct product and Direct sums of Groups, Internal direct product and Decomposable Groups, Normal and Subnormal series of Groups, Solvable Groups, Composition series of Groups, Jordan-Holder theorem.

[1] Chapter 4 (Section 1), Chapter 5.

(No. of classes: 15, Marks: 15)

Unit 2: Polynomial rings over commutative rings, Divisibility in commutative rings, Principal Ideal Domain (PID), Euclidean Domain, Unique Factorization Domains (UFD) and their properties. Eisenstein's irreducibility criterion.

[1] Chapter 9, Chapter 10.

(No. of classes: 15, Marks: 15)

Unit 3: Subfields and Prime fields, Extensions of fields, Algebraic and Transcendental elements, Algebraic extensions, Splitting fields, Perfect fields, Finite fields, Moore's theorem, Construction by ruler and compass.

[1] Chapter 13, Chapter 14 (Section 4).

(No. of classes: 15, Marks: 15)

Unit 4: Canonical forms, Similarity of linear transforms, Invariant subspaces, Reduction to triangular forms, Nilpotent transformations, Primary decomposition theorem, Jordan blocks and Jordan canonical form, Quadratic forms, Reduction and classification of quadratic forms.

[2] Chapter 6 .

(No. of classes: 15, Marks: 15)

Text Books:

1. S. Singh and Q. Zameeruddin, Modern Algebra, Vikas Publishing House, 9th Revised Edition, 2006.
2. I. N. Herstein, Topics in Algebra, John Wiley & Sons, 2nd Edition, 1975.

Reference Books:

1. D. S. Malik, J. M. Mordeson and M. K. Sen, Fundamentals of Abstract Algebra, McGraw Hill Company, 1997.
2. C. Musili, Introduction to Rings and Modules, Narosa Publishing House, 1994.
3. K. Hoffman and R. Kunz, Linear Algebra, Prentice Hall, 1965.
4. K. B. Datta, Matrix and Linear Algebra, Prentice Hall of India, 2004.
5. S. Lipschutz, Schaum's Outline Series of Linear Algebra, McGraw Hill, 2013.

SEMESTER-VII

MAT-070204: Real Analysis and Lebesgue Measure

Total Marks: 100 (External 60, Internal Assessment 40)

No. of Credits: 4

No. of Contact Classes: 60

No. of Non-Contact Classes: 0

Course outcome:

After completing this course, the student will be able to:

CO1 Identify the region of convergence of power series.

CO2 Illustrate Lebesgue measure on R, and construct integrals using Lebesgue measure.

CO3 Explain basic convergence theorems for the Lebesgue integral.

CO4 Explain sequences of functions and their uniform convergence

CO5 Develop the core skills of the subject and research skills in this areas.

Unit 1: Pointwise and uniform convergence, Cauchy Criterion for Uniform Convergence, Interchange of Limits, Series of Functions, Tests for Uniform Convergence, Power series. **(No. of classes: 15, Marks: 15)**

Unit 2: Definition of the Riemann Integral, examples, Some Properties of the Integral, Riemann Integrable Functions, The Fundamental Theorem, The Darboux Integral, Definition of Riemann Steiltjes integral, examples and properties, Integration and Differentiation, Fundamental theorem of calculus.

(No. of classes: 15, Marks: 15)

Unit 3: Set functions, Construction of Lebesgue measure, Measure spaces, Measurable functions, simple functions. **(No. of classes: 15, Marks: 15)**

Unit 4: Lebesgue integration, Lebesgue's monotone convergence theorem, Fatou's theorem, Lebesgue's dominated convergence theorem, Comparison with Riemann integral, Integration of complex functions. **(No. of classes: 15, Marks: 15)**

Text Books:

1. W. Rudin, Principles of Mathematical Analysis, McGraw-Hill Education, 1976
2. Bartle R.G. and Sherbert R.D., Introduction to Real Analysis, John Wiley & Sons, Inc

Reference Books:

1. S.C. Malik and Savita Arora, Mathematical Analysis, New Age International Private Limited,2017
2. R.R. Goldberg, Methods of Real Analysis, Oxford and IBH Publishing, 2012.

SEMESTER VII

MAT-070304: Complex Analysis-II

Total Marks: 100 (External: 60, Internal: 40)

No of credit: 4

No of contact classes; 60

No of non contact classes: 0

Prerequisites: MAT040204: Complex Analysis-I

Course learning outcomes: This course will enable the students to:

CO1: Define Conformal mappings and illustrate with examples.
CO2: Discuss analytic continuation and Gamma function.
CO3: Compute integrals of complex functions using Residue theorem.
CO4: Understand the concept of Riemann surface.
CO5: Formulate Power series expansions of complex valued functions.

Unit1: Power Series: Taylor's and Laurent's Theorem, Zero and Singularity of an analytic function, The Argument Principle, Rouche's theorem.

(No. of classes: 15, Marks: 15)

Unit 2: Theory of Residues: Residue, Calculation of Residues, Cauchy's residue theorem, Evaluation of definite integrals, Special theorems used in evaluating integrals, Mittag-Leffer's theorem. **(No. of classes: 15, Marks: 15)**

Unit 3: Analytic functions as mappings: Isogonal and Conformal Transformation, Necessary and sufficient condition of conformal transformation, Bilinear transformations, Geometrical inversion, Invariance of cross ratio, Fixed points of a bilinear transformation, some special bilinear transformation e.g. real axis on itself, unit circle on itself, real axis on unit circle etc. Branch point and Branch line, Concept of the Riemann surface.

(No. of classes: 15, Marks: 15)

Unit 4: Analytic Continuation: Analytical continuation, Schwarz's reflection principle, Infinite products, Gamma Function and its properties

(No. of classes: 15, Marks: 15)

Text Books:

1. M.R. Spiegel, Complex Variables. Schaum's Outlines series, McGraw Hill Education, 2017
2. E.G. Philips, Functions of acomplex variables with applications, Oliver and Boyd,1957.

Reference Books:

1. Walter Rudin, Real and Complex Analysis, McGraw Hill Education, 2017
2. L.V. Ahlfors, Complex Analysis, McGraw Hill, 2000
3. H.A. Priestly, Introduction to Complex Analysis, Clarendon Press Oxford, 1990
4. Mark J. Ablowitz and A.S. Fokas, Complex Variables, Introduction and Application, CUP, 1998.
5. John B Conway, Functions of Complex Variable, Springer, 1872.

SEMESTER VII

MAT-070404: Differential Equations

Total Marks: 100 (External: 60, Internal: 40)

No of credit: 4

No of contact classes: 60

No of non contact classes: 0

Prerequisites: MAT030104: Ordinary Differential Equations, MAT060204: Partial Differential Equations.

Course Learning Outcomes:

Students will be able to:

CO1: Identify critical point of an autonomous system and analyse their stability.

CO2: Discuss Frobenius method of series solution for differential equations.

CO3: Explain the existence and uniqueness of solution of first order differential equations

CO4: Construct Green's function, and illustrate Sturm Liouville systems

CO5: Explain the characteristics second order linear PDE.

Unit 1: Well posed problems, Existence, uniqueness and continuity of solution of ODEs of first order, Picard's method, Existence and uniqueness of solution of differential equations of first order, Sturm separation and comparison theorems, Homogeneous linear systems, Non-homogeneous linear systems. **(No. of classes: 10, Marks: 10)**

Unit 2: Linear homogeneous differential equation-Ordinary and singular points, Series solution, Method of Frobenius, Solutions of Bessel's and Legendre equations. **(No. of classes: 10, Marks: 10)**

Unit 3: Two point boundary value problems, Green's function, Construction of Green's function, Sturm Liouville systems, Eigen values and eigen functions, Stability of autonomous system of differential equations, Critical point of an autonomous system and their classification as stable, Asymptotically stable, Strictly stable and unstable, Stability of linear systems with constant coefficients, Linear plane autonomous systems, Perturbed systems, Method of Lyapunov for nonlinear systems. **(No. of classes: 20, Marks: 20)**

Unit 4: Second order linear PDE-Classification, General solution of higher order PDE with constant coefficients, Method of Characteristics.

(No. of classes: 20, Marks: 20)

Text Books:

1. S.L. Ross, Differential Equations, Second Edition, John Wiley & Sons, India, 2007.
2. I.N. Sneddon, Elements of Partial Differential Equations, Mcgraw Hill 2006
3. K.S. Rao, Introduction to partial differential equations, Prentice Hall, New Delhi, 1997.

Reference Books:

1. Lawrence C. Evans, Partial Differential Equations, Second Edition, American Mathematical Society, 2014.
2. Erich Zauderer, Partial Differential Equations of Applied Mathematics, A Wiley-Interscience Publication, John Wiley and Sons, 1983.
3. H.F. Weinberger, A first course in partial differential equations, Blaisdell, 1965.
4. C.R. Chester, Techniques in partial differential equations, McGraw Hill, New York, 1971.
5. R. Courant and D. Hilbert: Methods of Mathematical Physics: Partial differential equations, Vol –II, Wiley-VCH, 1989
6. W.E. Williams, Partial Differential Equations, Oxford University Press,1980
7. F.H. Miller, Partial Differential Equations, J. Wiley & Sons; London, Chapman & Hall, 1941.
8. A. Sommerfeld, Partial differential equations in physics, Academic Press, New York, 1967.
9. I. Stakgold, Green's functions and boundary value problems, Wiley, New York, 1979.

SEMESTER-VII

MAT070504: RESEARCH METHODOLOGY

Total Marks: 100 (External 60, Internal Assessment 40)

No. of Credits: 4

No. of Contact classes: 60

No. of Non-Contact classes: 0

Prerequisites: Nil

Course Learning Outcomes:

CO1: Identify iimportance of hypothesis in different types of research.
CO2: Classify the different types of research methods.
CO3: Discuss the criteria of a good problem.
CO4: Analyze and distinguish the interpretation of data
CO5: Develop the idea of formulation of scientific articles, report writing and synopsis
CO6: Explain the subject classification number and the preparation of bibliography.

Unit-1: (a) Research-Introduction: Knowledge and Research, Research and Scientific Thinking, Distinguishing characteristics of scientific thinking. Steps in the progress of scientific thinking. Characteristics of research. Classifications of research. Comparison of fundamental research and action research.

(b) Research Problem: The source of problem. Criteria of a good problem. A guide to judge a research problem. Formulating and starting the problem. Definition of problem. Determination of the problem. Justification of the problem. **(Marks: 10, No of class 10)**

Unit-2: (a) Hypothesis: The meaning of hypothesis. Importance of hypothesis, Source of hypothesis, Characteristics of hypothesis. The use of hypothesis in different types of research. Different forms of hypothesis. Difficulties in the formulation of hypothesis. Testing of hypothesis.

(b) Survey of related studies: Purpose of survey of related studies, Research reading. The search of sources. Use of library, Note-taking. The bibliography.

(Marks: 10, No of class 10)

Unit-3: Classification of Research Methods: Historical methods, normative survey method, Survey testing. The questionnaire, Documentary frequency studies, Interview, Observation. Appraisal procedure, Experimental methods (Bases of experiential method, Variable control, Control of the experiment, purpose of control, methods of control, types of experiments, characteristics of an experiment, major steps in the experimental methods, experimental designs, limitations of experimental method). **(Marks: 10, No of class 10)**

Unit-4 (a) Some tools and Techniques of Research: Inquiry forms, Schedule, Opinionnaire, Sociometry, Social distance scale, Guess-who technique, Q-sort technique, Situational test, follow-up study, Quantitative studies, qualitative studies.

(b) Sampling: The sampling theory, Bases of sampling, Importance of sampling. Advantage of sampling, Disadvantages of sampling, Characteristics of a good sampling. Steps in sampling procedure. Methods of sampling, Size of sampling. Errors in sampling. **(Marks: 10, No of class 10)**

Unit-5: Analysis and Interpretation of Data: Analysis from the very beginning, Various steps in analysis and interpretation, Common statistical methods of analysis, Interpretation, Necessary precautions in interpretation, Comparison in interpretation, Conclusions and generalizations. **(Marks: 10, No of class 10)**

Unit-6: The Research Report: Preliminary Section, Main body of the report, Reference section, Style of writing, Tables, Figures, Quotations, Footnotes, Bibliography, Headings, Preparations of the report, Typing the report. Writing style of Synopsis. Strategy and steps for writing scientific articles.

(Marks: 10, No of class 10)

Text Books:

1. C.R. Kothari: Research Methodology, Methods and Techniques, 3rd Ed, New Age Publ. 2004
2. Antony Edward Kelly, Richard A. Lesh: Handbook of Research Design in Mathematics and Science Education, Lawrence Erlbaum Associates, Inc 2000
3. Michael P. Marder: Research Methods for Science, Cambridge University Press 2011

Reference Books

1. Steven J. Taylor, Robert Bogdan, Marjorie DeVault: Introduction to Qualitative Research Methods: A Guide Book and Resource, Wiley Publ. 2016
2. Nicolas J. Higham: Handbook of *Writing* for the Mathematical Sciences, Siam Pub. 1998
3. Margaret Cargill, Patrick O'Connor: Writing scientific articles: strategy and steps, Wiley-Blackwell 2013.

SEMESTER-VIII (HONOURS)

MAT080104: Topology

Total Marks: 100 (External 60, Internal Assessment 40)

No. of Credits: 4

No. of Contact classes: 60

No. of Non-Contact classes: 0

Prerequisites: MAT060304: Metric Spaces

Course Outcomes: The course will enable the students to:

CO1: identify topological spaces and construct examples of such spaces.

CO2: classify different spaces like first countable, second countable, separable spaces and give the characterization of these spaces using some important results like Urysohn's lemma, Tietze extension theorem.

CO3: use the idea of compactness and connectedness and give their different characterizations.

CO4: explain the product topology and its relationship with compactness, connectedness, and countability.

CO5: provide examples of metrizable spaces and explain the relationship between embedding and metrization.

Unit 1: Definition and examples of topological spaces, Closed sets and closure, Dense subsets, Neighbourhood, Interior, Exterior and Boundary, Accumulation Points and Derived sets, Bases and subbases. Subbase and Relative Topology, Continuous Functions and Homeomorphism.

(No. of classes: 11, Marks: 10)

Unit 2: Countable and uncountable sets, First and second Countable spaces, Lindelof's theorem, Separable spaces, Second Countability and Separability. **(No. of classes: 5, Marks: 10)**

Unit 3: Separation Axioms: T_0, T_1, T_2, $T_{3\frac{1}{2}}$, T_4 ; their characterizations and basic properties, Urysohn's lemma, Tietze Extension Theorem.

(No. of classes: 10, Marks: 10)

Unit 4: Compactness, continuous functions and compact sets. Basic properties of compactness and related theorems, Sequentially and Countably compact sets, Local Compactness and one point compactification, Stone-Cech Compactification. **(No. of classes: 11, Marks: 10)**

Unit 5: Connected spaces, connectedness on the real line, components, totally disconnected spaces, Locally connected spaces.

(No. of classes: 11, Marks: 10)

Unit 6: Tychonoff product topology in terms of standard subbase and its characterizations, Projection Maps, Separation Axioms and Product Spaces, Connectedness and Product spaces, Compactness and Product Spaces (Tychonoff's Theorem), Countability and Product Spaces, Embedding and Metrization, Urysohn's Metrization theorem. **(No. of classes: 12, Marks: 10)**

Text Books:

1. J. R. Munkres, Topology: A first course, Prentice Hall of India, 1974.
2. S. Willard, General Topology, Dover Publications, 2004.
3. J. Dugundji, Topology, Allyn and Bacon, 1966 (Reprinted in India By PHI)

Reference Books:

1. K.D. Joshi, Introduction to General Topology, New Age International Private Limited, 2017
2. S. Lipschutz, Theory and Problems of General Topology, Schaum's Outline Series, McGraw-Hill Book Company, 1965.
3. M. G. Murdeshwar, General Topology, New Age International, 1990

SEMESTER-VIII

MAT080204: Number Theory-II

Total Marks: 100 (External 60, Internal Assessment 40)

No. of Credits: 4

No. of Contact Classes: 60

No. of Non-Contact Classes: 0

Pre-requisite for the paper: MAT040404: Number Theory and MAT050104: Abstract Algebra

Course Learning Outcomes: On successful completion of the course students will be able to:

1. Describe primitive roots and indices for solvability of congruence of higher order.
2. Explain the quadratic reciprocity law using Legendre's and Jacobi's symbol.
3. Generate Fibonacci numbers and discuss related identities.
4. Explain partition functions and develop graphical representations.

Unit 1: Primitive roots: order of an integer modulo n, primitive roots for primes, composite numbers having primitive roots, theory of indices.

[1] Chapter 8 (Sections 8.1 to 8.4). **(No. of classes: 15, Marks: 15)**

Unit 2: Quadratic residues: Euler's criterion, Legendre's symbol and its properties, Quadratic Reciprocity Law, Quadratic congruences with composite moduli.

[1] Cha pter 9 (Sections 9.1 to 9.4). **(No. of classes: 15, Marks: 15)**

Unit 3: Fibonacci numbers: certain identities involving Fibonacci numbers, Continued fractions, Pell's equation.

[1] Chapter 14 (Sections 14.1 to 14.3), Chapter 15 (Sections 15.2, 15.3 and 15.5). **(No. of classes: 15, Marks: 15)**

Unit 4: Partitions, Graphical representation of partitions. Euler's partition theorem, Searching for partition identities, Partition generating functions.

[2] Chapter 12 (Sections 12-1 to 12-4) Chapter 13(Section 13-1). **(No. of classes: 15, Marks: 15)**

Text Books:

1. David M. Burton, Elementary Number Theory, McGraw Hill Education, Seventh Edition, 2011.
2. G. E. Andrews, Number Theory, Dover Publications, 2012.

Reference Books:

1. I. Niven, H. S. Zuckerman and H. L. Montgomery, Introduction to Theory of Numbers, Wiley, 2008.

SEMESTER-VIII

MAT 080304- Mechanics and Tensor Calculus

Total Marks: 100 (External Assessment 60, Internal Assessment 40)

No. of Credits: 4

No. of Contact classes: 60

No. of Non-Contact classes: 0

Prerequisites: MAT050204: Multivariate Calculus, MAT060404: Mechanics

Course outcome: Students will be able to:

CO1 Explain various physical laws of motion, Hamiltonian's principle etc. with mathematical tools.

CO2 Distinguish Tensors and perform algebraic operations on tensors, to obtain covariant derivatives of various tensors and to express Laplacian in tensor form.

CO3 Apply various tools of vector algebra as well as vector calculus, calculus of variations to discuss the motion of rigid bodies under certain constraints.

CO4 Differentiate the properties of motion in various coordinate systems viz. cylindrical, spherical, conical surfaces.

CO5 Construct mathematical models viz. rigid body to describe motions under certain constraints or no constraints which are able to analyse the physical scenario.

Group-A: Mechanics

Total marks: 30 **Credit: 2**

Unit1: Central forces, Central orbit, Laws of inverse square, Kepler's laws of planetary motion; Velocity and acceleration in cylindrical and spherical polar coordinates.

Motion of a rigid body about a fixed point: Euler's equations, Motion under no external forces. **(No. of classes 15, Marks 15)**

Unit 2: Generalized coordinates: Lagrange's equations of motion for finite forces in holonomic systems, Case of conservative forces and theory of small oscillations. Hamilton's equations of motion, Variational methods, Hamilton's principle and Principle of least action. **(No of classes 15, Marks 15)**

Group-B: Tensor Calculus

Total Marks: 30 **Credit: 2**

Unit 3: Transformation laws of covariant and contravariant tensors, Mixed tensor, Rank of tensors. Kronecker delta. Algebraic operations on tensors: addition, subtraction, contraction, inner and outer product of tensors, Quotient law, Group property of tensors, symmetric and anti-symmetric tensors. Related theorems.

Riemannian metric and Fundamental tensors. Christoffel symbols of the first and second kinds and their properties. Transformation laws of Christoffel symbols. **(No of classes 15, Marks 15)**

Unit 4: Covariant derivatives of tensors A_i, A^i, A_{ij}, A^{ij} and A^i_j , Generalizations. Covariant derivatives of fundamental tensors and scalar invariant function. Gradient of an invariant function. Divergence and curl of vectors. Laplacian in tensor form. Application in problems. **(No of classes 15, Marks 15)**

Text Books:

1. S L Loney, An Elementary Treatise on the Dynamics of a Particle and Rigid Bodies, Cambridge University Press, 2017
2. Murray Spiegel, Theory & Problems of Theoretical Mechanics (Schaum's Outline Series), McGraw Hill Education, 2017

3. C. E. Weatherburn, An Introduction to Riemannian Geometry and the Tensor Calculus, Cambridge University Press, Paperback, 2008

Reference Books:

1. F. Chorlton, Text Books of Dynamics, John Wiley & Sons, 1983
2. B. C. Kalita, Tensor Calculus and Applications: Simplified Tools and Techniques, CRC Press, Taylor &Francis Group, 2019
3. David C. Kay, Tensor Calculus (Schaum's Outline Series), McGraw Hill Education, 2011
4. L. P. Eisenhart, Riemannian Geometry, Princeton University Press, 1997.

SEMESTER-VIII

MAT080404: Mathematical Methods

Total Marks: 100 (External 60, Internal Assessment 40)

No. of Credits: 4

No. of Contact classes: 60

No. of Non-Contact classes: 0

Course Learning Outcomes: Students will be able to:

CO1: identify Fredholm integral equations and Volterra integral equations.

CO2: apply Fourier transform to solve ordinary and partial differential equations of initial and boundary value problems.

CO3: apply Laplace transform to solve ordinary, partial differential equations of initial and boundary value problems, and to evaluate definite integrals.

CO4: use calculus of variations to extremize a functional with fixed boundaries.

CO5: formulate and solve isoperimetric problems.

Unit 1: Integral Equations:

Definition of Integral Equation, Reduction of ordinary differential equations into integral equations. Fredholm integral equations with separable kernels, Eigen values and Eigen functions, Method of successive approximation, Iterative scheme for Fredholm Integral equations of second kind. Volterra Integral Equations of second kind, Resolvent kernal of Volterra equation and its results, Application of iterative scheme to Volterra equation of the second kind, Convolution type kernals. **(No of classes 15, Marks 15)**

Unit 2: Fourier Transform:

Fourier Integral Transform. Properties of Fourier Transform, Fourier sine and cosine transforms, Application of Fourier transform to ordinary and partial differential equations of initial and boundary value problems. Evaluation of definite integrals. **(No of classes 15, Marks 15)**

Unit 3: Laplace Transform:

Basic properties of Laplace Transform, Convolution theorem and properties of convolution, Inverse Laplace Transform. Application of Laplace Transform to solution of ordinary and partial differential equations of initial and boundary value problems. The inversion theorem, Evaluation of inverse transforms by residue method. **(No of classes 15, Marks 15)**

Unit 4: Calculus of variations:

Calculus of variation with one independent variable: Basic ideas of calculus of variations, Euler's equation with fixed boundary of the functional Containing only the first order derivative of the only dependent variable with respect to one independent variable, Variational problems with functional having higher order derivatives of the only dependent variable, general case of Euler's equation, applications.

Calculus of Variation with several independent variables: Variational problems with functional dependent on functions of several independent variables having first order derivatives. Variational problems in parametric form, Variational problems with subsidiary condition: Isoperimetric problems.

(No of classes 15, Marks 15)

Text Books:

1. M. D. Raisinghania, Integral Equation & Boundary Value Problem, S. Chand, 2010.
2. Murray Spiegel, Schaum's Outline of Fourier Analysis with Applications to Boundary Value Problems , McGraw-Hill Education, 1974
3. M. R. Spiegel, Schaum's Outline Series: Theory and Problems of Laplace Transforms, McGraw- Hill Book Company, 1965.
4. I.M Gelfand and S.V. Fomin: Calculus of Variations, Prentice Hall, INC, 1963, Edited by R.A. Silvarman

SEMSTER-VIII

MAT080504: SEMINAR/ PROJECT

Total Marks: 100

No. of Credits: 4

SEMESTER-VIII (HONOURS AND RESEARCH)

MAT080116: Dissertation

Total Marks: 400

No. of Credits: 16

MAT080204: SEMINAR

Total Marks: 100

No. of Credits: 4

Four-year Undergraduate Programme

Subject: Physics
Semester: First
Course Name: Mathematical Physics and Mechanics
Existing Base Syllabus: HS Maths and Physics
Course Level: PHY101
Syllabus showing each unit against class number and marks

Unit no.	Unit content	No. of classes	Marks/Credit
Theory			
Part A: Mathematical Physics			
Unit I- Vector Calculus	Scalar and vector fields. Derivatives of vector functions (physical examples-velocity, centripetal acceleration of a point in circular motion). Directional derivative. Gradient of a scalar field (example of Newton's gravitational force as gradient of a scalar potential). Gradient as normal vector to a surface. Divergence and curl of a vector field- solenoidal and irrotational vector fields. Laplacian operator (physical problems –Laplacian of gravitational potential, divergence of central force). Vector identities. Vector integration- Line integral (physical example- work done by a force, path dependence/independence and concept of conservative force). Surface and volume integrals. Concept of vector flux. Gauss's divergence theorem and Stokes's theorem (statement only).	8	Credit - 1
Unit– II: Curvilinear coordinates	Introduction to curvilinear coordinates. Orthogonal curvilinear coordinates. Examples of spherical, cylindrical and plane polar coordinates. Line element- transformation from Cartesian to curvilinear coordinates (spherical and cylindrical). Gradient, divergence and curl in spherical and cylindrical coordinates.	5	
Unit-III: Dirac delta function	Definition and properties of Dirac delta function. Representation of delta function by Gaussian function, rectangular function and Laplacian of 1/r . 3-Dimensional delta function.	2	
Part B – Mechanics			

Unit 1- Reference frames	Inertial frames. Non-inertial frames and fictitious forces. Uniformly rotating frame. Laws of physics in rotating coordinate systems. Centrifugal force. Coriolis force and its applications.	4	Credit - 2
Unit –II: Gravitation and central force motion	Motion under central force. Two-body problem and its reduction to one body problem. Kepler's laws, Gravitational potential and fields due to spherical body. Gauss's law and Poisson's equation for gravitational field.	7	
Unit –III: Conservation laws	Dynamics of a system of particles. Centre of mass. Principle of conservation of momentum. Torque. Impulse. Elastic and inelastic collisions between particles. Centre of mass and laboratory frames.	4	
Unit–IV: Dynamics of rigid bodies	Rigid body motion. Rotational motion. Moment of inertia of rectangular lamina, disc, cylindrical and spherical bodies. Kinetic energy of rotation. Motion involving both translation and rotation.	6	
Unit–V: Work and energy	Work and kinetic energy theorem. Conservative and non-conservative forces. Potential energy. Force as gradient of potential energy. Work and potential energy. Work done by non-conservative forces.	3	
Unit –VI: Oscillations	Oscillation - differential equation of simple harmonic motion and its solution. Total energy of oscillation.	2	
Unit –VII: Properties of matter	Relation between elastic constants. Twisting torque on a cylinder or wire. Cantilever. Kinematics of moving fluids: Poiseuille's equation for flow of a liquid through a capillary tube.	4	
Laboratory			
	<u>At least four from the following:</u> 1. To study the motion of spring and calculate (a) spring constant and (b) rigidity modulus. 2. To determine the moment of inertia of a cylinder about two different axes of symmetry by torsional oscillation method.		Credit-1

	3. To determine coefficient of viscosity of water by capillary flow method (Poiseuille's method). 4. To determine the Young's modulus of the material of a wire by Searle's apparatus. 5. To determine the modulus of rigidity of a wire (static method). 6. To determine the value of g using bar pendulum. 7. To determine the value of g using Kater's pendulum. 8. To determine the height of a building using a sextant. 9. To determine g and velocity for a freely falling body using digital timing technique.		

Reading list

1. Essential Mathematical Methods for the Physical Sciences; K.F. Riley and M.P. Hobson, Cambridge University Press.
2. Advanced Engineering Mathematics; E. Kreyszic, John Wiley & Sons (New York).
3. Mathematical Methods for Physicists; G. B. Arfken, H. J. Weber and F.E. Harris, Elsevier.
4. Mathematical Physics-I, K. K Pathak and S. Parasher, Vishal Publication, Jalandhar (Delhi).
5. Theoretical Mechanics, M. R. Spiegel, Tata McGraw Hill.
6. Mechanics; D. S. Mathur, S. Chand & Company Limited.
7. An Introduction to Mechanics, D. Kleppner and R. J. Kolenkow, Tata McGraw-Hill.
8. Mechanics, Berkeley Physics, vol.1, C. Kittel, W. Knight, et.al., Tata McGraw-Hill.
9. Physics, R. Resnick, D. Halliday and J. Walker, John Wiley & Sons.
10. Analytical Mechanics, G. R. Fowles and G. L. Cassiday, Cengage Learning.

Graduate Attributes

i. Course Objective

This course introduces mathematical physics and mechanics. The basic objectives of the course are

- *to introduce essential primary concepts in mathematical physics such as calculus of vectors, curvilinear coordinates and Dirac delta function which are required for developing insight of the theories of physics,*
- *to introduce the concepts of dynamics of particles, energy, oscillation and basic properties of matter which will equip students with the tools required for applying the concepts of physics in practical problems and*
- *to train the students with concept visualisation through some laboratory practices.*

ii. Learning outcome

On successful completion of the course, students will be able to understand the calculus of vectors and concept of curved spaces which play central roles in developing insight of the theories of physics. They will learn the powerful method of computation through Dirac delta function which often appears in complex problems of physics. Students will be able to understand and apply the concepts of dynamics of particles, energy, oscillation and basic properties of matter in various problems of physics, technology and engineering. They will be trained in concept realisation through laboratory practices.

Theory Credit: 03 (Three)

Practical Credit: 01 (One)

No. of Required Classes: 45

No. of Contact Classes: 45

No. of Non-Contact Classes:

Particulars of Course Designer (Name, Institution, email id):

1) **Dr. Sanjeev Kalita**, Gauhati University (AssamJobz.Com), sanjeev@gauhati.ac.in
2) **Dr. Krishna Kingkar Pathak**, Arya Vidyapeeth College,

Subject: Physics
Semester: Two
Course Name: Mathematical Physics & Electricity and Magnetism
Existing Base Syllabus: HS Maths and Physics
Course Level: PHY151
Syllabus showing each unit against class number and marks

Unit no.	Unit content	No. of classes	Marks/Credit
Theory			
Part A: Mathematical Physics (Theory)			
Unit 1- Differential equations	First and second order ordinary differential equations (ODE). Homogeneous and inhomogeneous differential equations. Solutions of first order ODE – integrating factors (physical examples – radioactive decay, Newton's law of cooling, particle falling under gravity through a resistive medium). Concept of initial/boundary conditions. Solutions of second order ODE with constant coefficients - complementary function and particular integral (physical examples- simple harmonic oscillation, forced vibration). Wronskian- definition and its use to check linear independence of 2nd order homogeneous linear differential equation. Partial differential equations (PDE) (physical examples – wave equation, diffusion equation, Laplace and Poisson equation – introduction only). Exact and inexact differentials. Concept of variable separation in a PDE.	10	Credit - 1
Unit– II: Matrices	Properties of matrices. Determinant and rank. Transpose and complex conjugate of matrices. Hermitian and anti-Hermitian matrices. Unitary and orthogonal matrices. Representation of linear homogeneous and inhomogeneous equations through matrix equation. Inverse of a matrix. Eigen values and eigen-vectors. Cayley-Hamilton Theorem (statement only), Diagonalization of simple matrices.	5	
Part B – Electricity and Magnetism (Theory)			
Unit I: Electric field	Electrostatic field, electric flux. Gauss's law. Application of Gauss's law to charge distributions with planar, spherical and	13	Credit - 2

and electric potential	cylindrical symmetries. Conservative nature of electrostatic field. Electrostatic potential. Electrostatic energy of a system of charges. Electrostatic boundary conditions. Laplace's and Poisson's equations. Uniqueness theorem. Application of Laplace's equation involving planar, spherical and cylindrical symmetries. Potential and electric field of a dipole. Force and torque on a dipole. Capacitance of a system of charged conductors. Parallel plate capacitor. Capacitance on an isolated conductor.		
Unit –II: Dielectric properties of matter	Electric field in matter. Polarisation, polarisation charges. Electrical susceptibility and dielectric constant. Capacitor (parallel plate, spherical and cylindrical) filled with dielectric. Displacement vector, $\vec{D}$. Relation between $\vec{E}$, $\vec{P}$ and $\vec{D}$. Gauss's law in dielectrics.	4	
Unit –III: Magnetic field	Magnetic force on a point charge, definition and properties of magnetic field $\vec{B}$. Curl and divergence. Vector potential, $\vec{A}$. Magnetic scaler potential. Magnetic force on (i) a current carrying wire and (ii) between two elements. Torque on a current loop in a uniform magnetic field. Biot-Savart's law and its simple application: straight wire and circular loop. Current loop as a magnetic dipole and its dipole moment (analogy with electric dipole). Ampere's circuital law and its application to (i) solenoid and (ii) torus.	6	
Unit–IV: Magnetic properties of matter	Magnetization vector, $\vec{M}$. Magnetic intensity, $\vec{H}$. Magnetic susceptibility and permeability. Relation between $\vec{B}$, $\vec{H}$ and $\vec{M}$. Ferromagnetism. B-H curve and hysteresis.	2	
Unit–V: Electrical circuits	AC circuits: Kirchhoff's laws for AC circuits. Complex reactance and inductance. Series LCR circuits and parallel LCR circuits: (i) phasor diagram, (ii) resonance, (iii) power dissipation, (iv) quality factor, and (v) band width. Ideal constant-voltage and constant-current sources. Thevenin theorem and Norton theorem (only statements and solving of related problems).	5	
Laboratory			
	<u>At least four from the following:</u>		Credit-1

	1. Use a Multimeter for measuring (a) Resistances, (b) AC and DC Voltages, (c) DC Current, (d) Capacitances, and (e) Checking electrical fuses. 2. To study the characteristics of a series RC circuit. 3. To determine an unknown Low Resistance using Potentiometer. 4. To determine an unknown Low Resistance using Carey Foster's Bridge. 5. To compare capacitances using De' Sauty's bridge. 6. Measurement of field strength $\vec{B}$ and its variation in a solenoid (determine $\frac{dB}{dx}$). 7. To verify the Thevenin and Norton Theorems. 8. To verify the superposition and maximum power transfer theorems. 9. To determine the self-inductance of a coil by Anderson's bridge. 10. To study the response curve of a Series LCR circuit and determine its (a) Resonant frequency, (b) Impedance at resonance, (c) Quality factor Q, and (d) Band width. 11. To study the response curve of a parallel LCR circuit and determine its (a) Anti-resonant frequency and (b) Quality factor Q. 12. Measurement of charge and current sensitivity and CDR of Ballistic Galvanometer. 13. Determine a high resistance by leakage method using Ballistic Galvanometer. 14. To determine the self-inductance of a coil by Rayleigh's method.		

	15. To determine the mutual inductance of two coils by the Absolute method.		

Reading list

[1] Essential Mathematical Methods for the Physical Sciences; K. F. Riley and M. P. Hobson, Cambridge University Press.
[2] Advanced Engineering Mathematics; E. Kreyszic, John Wiley & Sons (New York)
[3] Mathematical Methods for Physicists; G. B. Arfken, H. J. Weber and F.E. Harris, Elsevier
[4] Mathematical Physics, H. K. Dass and Dr. Rama Verma, S. Chand Publication.
[5] Mathematical Physics-I; Krishna K. Pathak and Sangeeta Prasher, Vishal Publishing Co, Jalalandhar (Delhi).
[6] Introduction to Electrodynamics, D. J. Griffiths.
[7] Electricity and Magnetism [With electromagnetic theory and special theory of relativity], D. Chattopadhyay and P. C. Rakshit, 2013, New Central Book Agency (P) Limited.
[8] Electricity, Magnetism and Electromagnetic Theory, S. Mahajan and S. R. Choudhury, 2012, Tata Mcgraw.
[9] Schaum's outline of Theory and Problems of Electromagnetics, J. A. Edminister.
[10] Electromagnetics, B. B. Laud, New Age International Publishers.
[11] Feynman Lectures Vol. 2, R. P. Feynman, R. B. Leighton, M. Sands, 2008, Pearson Education.
[12] Electricity and Magnetism, Edward M. Purcell, 1986, McGraw-Hill Education.
[13] Elements of Electromagnetics, M. N. O. Sadiku, 2008. Pearson Education.
[14] Electricity and Magnetism, J. W. Fewkes and J. Yarwood, Vol. I, 1991, Oxford Univ. Press.

Graduate Attributes

i. Course Objective

- *To introduce the methods of solving differential equations.*
- *To introduce various concepts of matrix algebra.*
- *Electric field from vector calculus point of view and use of potential formulation to solve electrostatic problems.*
- *Magnetic fields of current carrying conductors, torus, solenoids etc. Study magnetic properties of matter.*
- *Study and analysis of AC circuits like LCR, and use of network theorems in electrical circuits.*

ii. Learning outcome

After the successful completion of the course, students will be able to understand methods of solving various differential equations appearing in physics. It will give an idea of how to study evolution of a physical system. Through matrix algebra students will be able to compute various matrix operations which are required for solving physical problems. They will be able to understand electric field and magnetic fields in matter, dielectric properties of matter, magnetic properties of matter, application of Kirchhoff's law in different circuits, and application of network theorem in different circuits. The students will also get accustomed to using multimeters and potentiometers, and they will be able to determine some of the important physical quantities related to electricity and magnetism for a better understanding of the topic.

Theory Credit: 03 (Three)

Practical Credit: 01 (One)

No. of Required Classes: 45

No. of Contact Classes: 45

No. of Non-Contact Classes:

Particulars of Course Designer (Name, Institution, email id):

1. **Dr. Manos P. C. Kalita**, Gauhati University (AssamJobz.Com), mpckalita@gauhati.ac.in
2. **Dr. Chabin Thakuria**, Tihu College, chabinthakuria@gmail.com
3. **Dr. Bhaskar J. Hazarika**, Pandu College, bh53033@gmail.com

Subject: Physics
Semester: Three
Course Name: Waves and Optics
Existing Base Syllabus: HS Maths and Physics
Course Level: PHY201
Syllabus showing each unit against class number and marks

Unit no.	Unit content	No. of classes	Marks/Credit
Wave and Optics (Theory)			
Unit I: Superposition of harmonic oscillations	Superposition of waves: Linearity and Superposition principle, Superposition of two collinear oscillations having (1) equal frequencies and (2) different frequencies (Beats), Lissajous figures and their use.	4	Credit - 3
Unit– II: Wave motion	Waves: Progressive (Travelling) Waves, wave equation, plane wave and spherical wave, Longitudinal and Transverse Waves, dispersion, group velocity, phase velocity, Pressure of a Longitudinal Wave. Energy Transport. Intensity of Wave.	4	
Unit –III: Velocity of waves	Velocity of Waves: Velocity of Transverse Vibrations of Stretched Strings. Velocity of Longitudinal Waves in a Fluid in a Pipe. Newton's Formula for Velocity of Sound. Laplace's Correction.	4	
Unit–IV: Superposition of two harmonic waves	Superposition of Two Harmonic Waves: Standing (Stationary) Waves in a String: Fixed and Free Ends. Analytical Treatment. Phase and Group Velocities. Changes with respect to Position and Time. Energy of Vibrating String. Transfer of Energy. Normal Modes of Stretched Strings. Plucked and Struck Strings. Melde's Experiment. Longitudinal Standing Waves and Normal Modes. Open and Closed Pipes.	9	
Unit–V: Wave optics	Wave optics: Electromagnetic nature of light, definition and properties of wave front. Huygens principle. Temporal and Spatial coherence.	4	
Unit–VI: Interference	Division of wave front and amplitude, intensity distribution in an interference pattern, Young's	8	

	double slit experiment, Fresnel's Biprism. Phase change on reflection: Stokes' treatment, Interference in Thin Films: parallel and wedge-shaped films, Newton's Rings: Measurement of wavelength and refractive index, Michelson interferometer.		
Unit–VII: Diffraction	Fresnel and Fraunhofer diffraction. Fresnel's Half-Period Zones for Plane Wave. Fresnel diffraction pattern of a straight edge and at a circular aperture. Fraunhofer diffraction: Single slit. Double slit. Diffraction grating. Resolving power of grating.	7	
Unit–VIII: Polarization	Polarized light and its mathematical representation, Production of polarized light by reflection, refraction and scattering. Polarization by double refraction and Huygen's theory, Nicol prism, Production and analysis of circularly and elliptically polarized light.		
Laboratory			
	<u>At least four from the following:</u> 1. To determine the frequency of an electric tuning fork by Melde's experiment and verify λ^2-T law. 2. Study of Lissajous Figure of two different waves using CRO and find out the unknown frequency of an electrical signal. 3. Familiarization with: Schuster's focusing, determination of angle of prism. 4. To determine refractive index of the Material of a prism using sodium source. 5. To determine the dispersive power and Cauchy constants of the material of a prism using mercury source. 6. To determine wavelength of sodium light using Fresnel Biprism. 7. To determine wavelength of sodium light using Newton's Rings.		Credit-1

	8. To determine the thickness of a thin paper by measuring the width of the interference fringes produced by a wedge-shaped Film. 9. To determine wavelength of (1) Na source and (2) spectral lines of Hg source using plane diffraction grating. 10. To determine dispersive power and resolving power of a plane diffraction grating.		

Reading list

[1] Waves: Berkeley Physics Course, vol. 3, Francis Crawford, 2007, Tata McGraw-Hill.

[2] The Physics of Vibrations and Waves, H. J. Pain, 2013, John Wiley and Sons.

[3] Vibrations and Waves in Physics, 2nd edition, I. G. Main, 1984, Cambridge University Press.

[4] A Textbook of Sound, 3rd Edition, A. B. Wood, 1955, Bell & Sons.

[5] The Physics of Waves and Oscillations, N.K. Bajaj, 1998, Tata McGraw Hill.

[6] Fundamentals of Optics, F. A. Jenkins and H.E. White, 1981, McGraw-Hill

[7] Principles of Optics, Max Born and Emil Wolf, 7th Edn., 1999, Pergamon Press.

[8] Optics, Ajoy Ghatak, 2008, Tata McGraw Hill

[9] Principles of Optics, B. K. Mathur and T. P. Pandya, 1981, Tata McGraw-Hill International.

[10] Fundamental of Optics, A. Kumar, H. R. Gulati and D. R. Khanna, 2011, R. Chand Publications.

Graduate Attributes

i. Course Objective

- *To learn the superposition of harmonic waves and oscillations, different types of wave motions, formation of standing waves and velocity of waves in media.*
- *To learn optical phenomena such as interference, diffraction and polarization in terms of the wave model*
- *To learn the principles and applications of optical instruments like biprism, interferometer and diffraction grating etc.*
- *To learn hand on experiments with prism, biprism, spectrometer, Newton's ring apparatus, grating, CRO, sodium and mercury light sources etc.*

ii. Learning outcome

On successful completion of the course students will:

1. understand Simple Harmonic Oscillation and superposition principle.

2. understand the classical wave equation in transvers and longitudinal waves and solutions of few physical systems on its basis.

3. understand the concept of normal modes in transvers and longitudinal waves

4. understand the interference as superposition of waves from coherent sources and also understand the basic principle of Young's double slit experiment, Fresnel's Biprism, Newton's Rings, Michelson interferometer etc.

5. understand the basic concept of diffraction, Fresnel and Fraunhofer diffraction from a slit.

6. understand the concept of polarisation of light, the production and detection of polarized light.

7. understand working principle of prism, biprism, spectrometer, Newton's ring apparatus, grating, CRO, sodium and mercury light sources etc.

Theory Credit: 03 (Three)

Practical Credit: 01 (One)

No. of Required Classes: 45

No. of Contact Classes: 45

No. of Non-Contact Classes:

Particulars of Course Designer (Name, Institution, email id):

1) **Dr. Simanta Hazarika**, Gauhati University (AssamJobz.Com), simanta@gauhati.ac.in
2) **Dr. Hemen Kakati**, Nalbari College, hementeacłarupjchoudhury@gmail.com

Subject: Physics
Semester: Four
Course Name: Classical Mechanics
Existing Base Syllabus: Mechanics of semester I
Course Level: PHY251
Syllabus showing each unit against class number and marks

Unit no.	Unit content	No. of classes	Marks/Credit
Unit I: Mechanics of point particles- the Lagrangian approach	Review of Newtonian mechanics; system of particles; constrained motion – types of constraints; concept of degrees of freedom; generalised coordinates and velocities; principle of virtual work and D'Alembert's principle and associated problems; Lagrange's (Euler-Lagrange, EL) equation; physical problems (construction of EL equations only) – simple and compound pendulums, two vibrating particles of equal mass attached to springs, Lagrange's equations for a particle in spherical and cylindrical coordinate systems, falling body in uniform gravitational field.	14	Credit - 4
Unit– II: Mechanics of point particles – the Hamiltonian approach	Generalised momenta; Legendre transformation; Hamilton's canonical equations; Hamiltonian from the Lagrangian; conservation of energy and momentum; physical problems – Hamiltonian for simple pendulum, particle moving in central force field (gravitational potential).	6	
Unit –III: Small oscillation	Minimum of potential energy and concept of stable equilibrium; expansion of potential energy around a minimum; kinetic and potential energy matrices; equation of motion of small oscillation.	5	
Unit–IV: Special theory of relativity	Inadequacy of Galilean transformation; postulates of special relativity; Lorentz transformation; simultaneity and order of events; length contraction and time dilation; relativistic addition of velocities; variation of mass with velocity and mass-energy equivalence. Lorentz transformation as a rotation in spacetime; relation between proper time and coordinate time; relativistic kinematics: energy-momentum relation.	15	

Unit–V: Fluid dynamics	Definition of a fluid; idea fluids; density and pressure of a fluid; velocity of a fluid element and its time derivative; mass conservation and equation of continuity; incompressible fluid; Euler's equation of fluid dynamics; Navier-Stokes equation (introduction only).	5	

Reading list

(1) Classical Mechanics, H. Goldstein, C.P. Poole and J.L. Safko (Pearson Education)
(2) Theoretical Mechanics, M. R. Spiegel (McGraw Hill Book Company)
(3) Classical Mechanics, P.S. Joag and N.C Rana (McGraw Hill Book Company)
(4) Mathematical Physics, B. S. Rajput (Pragati Prakashan)
(5) Classical Mechanics, T.W.B. Kibble and F.H. Berkshire (Imperial College Press)
(6) Mechanics: Courses in Theoretical Physics (Vol. 1), L.D. Landau and E.M. Lifshitz (Butterworth-Heinemann) (3rd Edn.)
(7) Classical Mechanics: With introduction to non-linear oscillations and chaos, V.B. Bhatia (Narosa Publishing House)

Graduate Attributes

i. Course Objective

The basic objectives of the course are

- *to introduce the laws of classical dynamics*
- *to train students in solving problems of motion of particles, systems of particles and fluids and*
- *to introduce relativity and hence the idea of how space and time play role in dynamics of matter.*

ii. Learning outcome

On successful completion of the course students will be able to apply the laws of classical dynamics to physical problems of motion of particles, systems of particles and fluids in various fields of physics and natural science as a whole. They will also get the exposure of the idea of how space and time play role in dynamics of matter.

Theory Credit: 04 (Four)

Practical Credit: 0 (Zero)

No. of Required Classes: 60 (45 Theory; 15 Tutorials)

No. of Contact Classes: 60

No. of Non-Contact Classes:

Particulars of Course Designer (Name, Institution, email id):

1) **Dr. Sanjeev Kalita,** Gauhati University (AssamJobz.Com), sanjeev@gauhati.ac.in

2) **Dr. Samrat Dey,** Pragjyotish College, samratdgr8@gmail.com
moubhuyan83@gmail.com

Subject: Physics
Semester: Four
Course Name: Quantum Mechanics I
Existing Base Syllabus: HS Maths and Physics
Course Level: PHY252
Syllabus showing each unit against class number and marks

Unit no.	Unit content	No. of classes	Marks/Credit
Theory			
Unit I: Origin of Quantum Theory	Failure of classical theories, Explanation of Black body radiation, Photoelectric effect, Compton effect, different evidences in support of quantum theory, particle nature of radiation, Bohr's correspondence principle.	3	Credit - 3
Unit– II: Dynamical Variables as Operators and Uncertainty Principle	Dynamical variables as operators, definition of an operator, different types of operators and their properties, position, energy and momentum operator; commutation relations; introduction to Hilbert space, Dirac notation, eigenvalue and eigenfunctions; expectation value of an operator e.g. position, momentum operator etc, orthonormality condition, Ehrenfest's theorem. Simultaneous measurement and uncertainty principle; general statement of Heisenberg's uncertainty principle(for any two non commutating operators), different uncertainty relations involving canonical pair of variables; particle trajectory and fuzziness, applications of the position momentum uncertainty principle, application of energy time uncertainty principle to virtual particles and range of an interaction.	10	
Unit –III: Matter Wave and Wave-Particle Duality	Wave particle duality and de Broglie wavelength, particle as a wave or matter wave, wave description of particles by wave packets; phase and group velocity, wave function, wave amplitude, probability; Experimental verification of matter wave, Davisson and Germer experiment; linearity and superposition principle, two slit experiments with electrons and photons; Uncertainty	8	

	principle from wave packet description, Gaussian wave packet and its wave function.		
Unit–IV: Schrödinger Equation and it's applications	Time dependent Schrödinger Equation, Time independent Schrödinger Equation; Physical interpretation and properties of wave function, continuity of a wave function, boundary conditions and emergence of discrete and continuous energy levels; probabilities and normalisation in three and one dimension; equation of continuity, current density in both three and one dimension. Hamiltonian, stationary states and energy eigenvalues; expansion of an arbitrary wave function as a linear combination of energy eigenfunctions; General solution of the time dependent Schrödinger equation in terms of linear combinations of stationary states, discrete and continuous spectrum, wave function of a free particle, spread of Gaussian wave function in one dimension, Fourier transforms and momentum space wave function. Applications of Time independent Schrödinger Equation in different problems like : (i) particle in a one dimensional infinite potential well (quantum dot as an example) (ii) particle in a one dimensional finite square potential well (iii) barrier penetration problems – potential step and rectangular potential barrier (tunnel effect) (iv) linear harmonic oscillator (v) spherically symmetric potential for hydrogen atom- radial solution, spherical harmonics, angular momentum operator and different quantum numbers, radial distribution function and shapes of the probability densities for ground & first excited states; degeneracy of states : s, p, d states.	24	
Laboratory			
	<u>At least four from the following:</u> 1. Measurement of Planck's constant using black body radiation and photo-detector.		Credit-1

	2. Photo-electric effect: Photo current versus intensity and wavelength of light; maximum energy of photo-electrons versus frequency of light. 3. To determine work function of material of filament of directly heated vacuum diode. 4. To determine the Planck's constant using LEDs of at least 4 different colours. 5. To determine the wavelength of H_α emission line of hydrogen atom. 6. To determine the ionisation potential of mercury. 7. To determine the absorption lines in the rotational spectrum of iodine vapour. 8. To determine the value of e/m by (a) magnetic focusing or (b) bar magnet. 9. To setup the Millikan's oil drop apparatus and determine the charge of an electron. 10. To show the tunnelling effect in tunnel diode using I-V characteristics. 11. To determine the wavelength of laser source using diffraction from single slit. 12. To determine the wavelength of laser source using diffraction from double slits. 13. To determine (1) wavelength and (2) angular spread of He-Ne laser using plane diffraction grating.		

Reading list

1. N. Zettili, Quantum Mechanics, John Wiley & Sons (2001).
2. J. J. Sakurai and J. Napolitano, Modern Quantum Mechanics, Cambridge Univ. Press, 2020.
3. Y. R.Waghmare, Fundamentals of Quantum Mechanics, Wheeler publishing (2014).

4. P. A. M. Dirac, Principles of Quantum Mechanics, Oxford University Press (1981).
5. B. H. Bransden and C. J. Joachain, Quantum Mechanics, Pearson Education 2nd Ed. (2004).
6. K. Gottfried and T-M Yan, Quantum Mechanics: Fundamentals,2nd Ed., Springer (2003).
7. R. Shankar, Principles of Quantum Mechanics, Springer (India) (2008).
8. D. J. Griffiths, Introduction to Quantum Mechanics, Pearson Education (2005).
9. L. Schiff, Quantum Mechanics, Mcgraw-Hill (1968).
10. A. K. Ghatak and S. Lokanathan, Quantum Mechanics: Theory and Applications, Springer (2002).
11. A. Bieser, Concepts of Modern Physics, McGraw Hill (2002).
12. Arno Bohm, Quantum Mechanics: Foundations and Applications, 3rd Edition, Springer (1993).
13. H. C. Verma, Quantum Mechanics, TBS publications (2019).
14. P M Mathews and K. Venkatesan, A Text book of Quantum Mechanics, 2nd Edition, McGraw Hill (2010).

Graduate Attributes

i. Course Objective

- *To learn about the inadequacies of classical mechanics, the origin and need of quantum mechanics, historical developments in quantum mechanics.*
- *Dual nature of radiation & matter, description of matter wave through wave packet.*
- *Probabilistic nature and wave function, Schrödinger equation, the uncertainty principle, stationary and non-stationary states.*
- *Applications of Schrödinger equation in different cases like infinite and finite potential well, tunneling effect, linear harmonic oscillator and H-atom.*
- *Formulation of quantum mechanics in terms of operators.*

ii. Learning outcome

On successful completion of the course students will be able to learn physical and mathematical fundamentals of Quantum physics, and various topics in it. These concepts are used in various branches of physics, like condensed matter physics, lasers, quantum statistics, atomic and molecular physics, particle physics, astrophysics and optics etc.

Theory Credit: 03 (Three)

Practical Credit: 01 (One)

No. of Required Classes: 45

No. of Contact Classes: 45

No. of Non-Contact Classes:

Particulars of Course Designer (Name, Institution, email id):

1) **Prof Kalpana Bora,** Gauhati University (AssamJobz.Com)**,** kalpana@gauhati.ac.in

2) **Dr. Bhaskar Jyoti Hazarika,** Pandu College, bh53033@gmail.com

Subject: Physics
Semester: Four
Course Name: Analog Electronics
Existing Base Syllabus: HS Physics
Course Level: PHY253
Syllabus showing each unit against class number and marks

Unit no.	Unit content	No. of classes	Marks/Credit
Theory			
Unit I: Semiconductor Diodes	P and N type semiconductors. Energy Level Diagram. Conductivity and Mobility, Concept of Drift velocity. PN Junction Fabrication (Simple Idea). Barrier Formation in PN Junction Diode. Static and Dynamic Resistance. Current Flow Mechanism in Forward and Reverse Biased Diode. Drift Velocity. Derivation for Barrier Potential, Barrier Width, and Current for Step Junction.	7	Credit - 3
Unit II: Two-terminal Devices and their Applications	Rectifier Diode: Half- wave Rectifiers. Centre-tapped and Bridge type Full-wave Rectifiers. Calculation of Ripple Factor and Rectification Efficiency. C-filter. Zener Diode and Voltage Regulation. Power supply without filter circuit and with C-filter circuit. Principle LEDs, Photodiode, and Solar Cell (Basic concept).	5	
Unit III: Bipolar Junction Transistors	n-p-n and p-n-p Transistors. Characteristics of CB, CE, and CC Configurations. Current gains α and β. Relations between α and β. Load line analysis of Transistors. DC Load line and Q-point. Physical Mechanism of Current Flow. Active, Cut-off, and Saturation Regions.	5	
Unit IV: Amplifiers	Transistor Biasing and Stabilization Circuits. Fixed Bias and Voltage Divider Bias. Transistor as a 2-port Network. h-parameter. Equivalent Circuit. Analysis of a single-stage CE amplifier using Hybrid Model. Input and Output Impedance. Current, Voltage, and Power Gains. Classification of Class A, B & C Amplifiers. Differential amplifiers.	7	
Unit V: Coupled Amplifier	Two-stage RC-coupled amplifier and its frequency response.	2	

Unit VI: Feedback in Amplifiers	Effects of Positive and Negative Feedback on Input Impedance. Output Impedance. Gain. Stability. Distortion and Noise	4	
Unit VII: Sinusoidal Oscillators	Barkhausen's Criterion for self-sustained oscillations. RC Phase shift oscillator. Determination of Frequency. Colpitt's oscillator.	5	
Unit VIII: Operational Amplifiers (Black Box approach)	Characteristics of an Ideal and Practical Op-Amp (IC 741). Open-loop and Closed-loop Gain. Frequency Response. CMRR. Slew Rate and Concept of Virtual Ground.	3	
Unit IX: Applications of Op-Amps	Inverting and non-inverting amplifiers. Adder. Subtractor. Differentiator. Integrator. Log and Anti Log amplifier. Zero crossing detector. Wein bridge oscillator. Comparator.	4	
Unit X: Introduction to CRO (Lectures 03)	Block Diagram of CRO. Electron Gun, Deflection System, and Time Base. Deflection Sensitivity. Applications of CRO: (1) Study of Waveform, (2) Measurement of Voltage, Current, Frequency, and Phase Difference.	3	
Laboratory			
	<u>At least four from the following:</u> 1. To study V-I characteristics of PN junction diode, and light emitting diode. 2. To study the V-I characteristics of a Zener diode and its use as a voltage regulator. 3. Study of V-I and power curves of solar cells, and find maximum power point and efficiency. 4. To study the characteristics of a Bipolar Junction Transistor in CE configuration. 5. To study the various biasing configurations of BJT for normal Class A operation. 6. To design a CE transistor amplifier of a given gain (mid-gain) using voltage divider bias.		Credit-1

	7. To study the frequency response of voltage gain of an RC-coupled transistor amplifier. 8. Using an Op-amp, design a Wien bridge oscillator for a given frequency. 9. To design a phase shift oscillator of given specifications using BJT. 10. To design and study Colpitt's oscillator. 11. To design an inverting amplifier using Op-amp for the DC voltage of a given gain. 12. To design inverting amplifier using Op-amp and study its frequency response. 13. To design a non-inverting amplifier using Op-amp and study its frequency response. 14. To study the zero-crossing detector and comparator. 15. To add two DC voltages using Op-amp in inverting and non-inverting modes. 16. To design a precision Differential amplifier of given I/O specification using Op-amp. 17. To investigate the use of an Op-amp as an Integrator. 18. To investigate the use of an Op-amp as a Differentiator. 19. To measure (a) Voltage, and (b) Time period of a periodic waveform using CRO. Construct a series LR circuit. Display the two waveforms on the CRO and measure the phase differences between the voltages across R and L. 20. To test a Diode and Transistor using a Multimeter. Draw the forward bias characteristic of the diode. Using only the base-emitter junction of the transistor draw a characteristic curve and show that it behaves as a forward-biased diode.		

	Note: All students will have to do an electronic project on the circuits, for example, the power supply, the AM detector, etc. to get acquainted.		

Reading list

1. Integrated Electronics, J. Millman and C. C. Halkias, 1991, Tata Mc-Graw Hill.
2. Electronics: Fundamentals and Applications, J. D. Ryder, 2004, Prentice Hall.
3. Solid State Electronic Devices, B. G. Streetman & S. K. Banerjee, 6th Edn.,2009, PHI Learning
4. Electronic Devices & circuits, S. Salivahanan & N. S. Kumar, 3rd Ed., 2012, Tata Mc-Graw Hill
5. OP-Amps and Linear Integrated Circuit, R. A. Gayakwad, 4th edition, 2000, Prentice Hall
6. Microelectronic circuits, A. S. Sedra, K.C. Smith, A. N. Chandorkar, 2014, 6th Edn., Oxford University Press.
7. Electronic circuits: Handbook of design & applications, U. Tietze, C. Schenk,2008, Springer
8. Semiconductor Devices: Physics and Technology, S. M. Sze, 2nd Ed., 2002, Wiley India
9. Microelectronic Circuits, M. H. Rashid, 2nd Edition, Cengage Learning
10. Electronic Devices, 7/e Thomas L. Floyd, 2008, Pearson India
11. Electronics Fundamentals and Applications, D. Chattopadhyay and P. C. Rakshit, 17th Ed, 2023, New Age International Publishers

Graduate Attributes

i. Course Objective

- To introduce students to analog electronics with hands-on practice on implementing some of these in hardware.
- To make the students understand the physics of semiconductor p-n junction and application in devices like diodes, rectifiers, etc.
- To understand the working of bipolar junction transistors, biasing, stabilization circuits, and various applications like amplifiers, oscillators, etc. together with feedback.
- To know the basics of Operational Amplifiers and applications.

- To understand the basics of the use of CRO in measurements with hands-on experience with some applications

ii. Learning outcome

On successful completion of the course, students will be able to understand the physics of semiconductor p-n junction and devices such as rectifier diodes, Zener diode, photodiode, etc.; they will understand the basics of bipolar junction transistors, transistor biasing, and stabilization circuits; the concept of feedback in amplifiers and the oscillator circuits. Students will also have an understanding of operational amplifiers and their applications.

Theory Credit: 03 (Three)

Practical Credit: 01 (One)

No. of Required Classes: 45

No. of Contact Classes: 45

No. of Non-Contact Classes:

Particulars of Course Designer (Name, Institution, email id):

1) **Prof. Banty Tiru, Gauhati University (AssamJobz.Com),**
btiru@gauhati.ac.in
2) **Dr. Shakeel Zaman, Handique Girls College,** bortmontu1@gmail.com

Subject: Physics
Semester: Four
Course Name: Mathematical Physics
Existing Base Syllabus: HS Mathematics
Course Level: PHY254
Syllabus showing each unit against class number and marks

Unit no.	Unit content	No. of classes	Marks/Credit
Theory			
Unit I: Partial Differential Equations	Solutions to partial differential equations, using separation of variables: Laplace's Equation in problems of rectangular, cylindrical and spherical symmetry. Wave equation and its solution for vibrational modes of a stretched string, rectangular and circular membranes.	10	Credit - 3
Unit II: Fourier Series	Periodic functions. Orthogonality of sine and cosine functions, Dirichlet Conditions (Statement only). Expansion of periodic functions in a series of sine and cosine functions and determination of Fourier coefficients. Complex representation of Fourier series. Application to square and triangular waves.	7	
Unit III: Complex Analysis	Functions of Complex Variables. Analyticity and Cauchy-Riemann Conditions. Examples of analytic functions. Singular functions: poles and branch points, order of singularity. Integration of functions with complex variable. Cauchy's Integral theorem and Cauchy's Integral formula. Simply and multiply connected regions. Laurent and Taylor's series expansions. Residue Theorem with application.	17	
Unit IV: Tensor Algebra	Introduction to tensor, Transformation of co-ordinates, Einstein's summation convention. Contravariant, covariant and mixed tensors. Symmetric and antisymmetric tensors, Kronecker delta, LeviCivita tensor. Quotient law of tensors. Rules of combination of tensors: addition, subtraction, outer multiplication, contraction and inner multiplication.	6	
Unit V: Introduction to Probability	Independent random variables: Probability distribution functions; binomial, Gaussian and Poisson, with examples. Mean and variance.	5	
Laboratory			

	<u>At least four from the following:</u> 1. Solve the differential equations $\frac{dy}{dx} = e^x$ with $y = 0$ for $x = 0$ $\frac{dy}{dx} + e^{-x}y = x^2$ $\frac{d^2y}{dx^2} + 2\frac{dy}{dx} = -y$ $\frac{d^2y}{dx^2} + e^{-x}\frac{dy}{dx} = -y$ 2. Perform the multiplication of two 3×3 matrices. 3. Compute the eigenvalues and eigenvectors of the following matrices. $\begin{bmatrix} 4 & 3 & 7 \\ 1 & 2 & 7 \\ 2 & 0 & 4 \end{bmatrix}, \begin{bmatrix} 1 & -i & 3+4i \\ i & 2 & 4 \\ 3-4i & 4 & 3 \end{bmatrix}, \begin{bmatrix} 2 & -i & 2i \\ i & 4 & 3 \\ -2i & 3 & 5 \end{bmatrix}$ 4. Using random number compute the areas of circle, square, volume of sphere and value of pi (π). 5. Evaluate trigonometric functions e.g. *sinθ; cosθ; tanθ* etc. using Interpolation by Newton Gregory Forward and Backward difference formula. 6. Find the solution of Partial Differential Equations: (a) Wave equation (b) Heat equation. 7. Evaluate the integral *I*,where, $I = \frac{1}{\sqrt{2\pi\sigma^2}} \int exp\left[\frac{(x-2)^2}{2\sigma^2}\right](x+3)dx$ for $\sigma = 1.0, 0.1, 0.01$ and show that $I \to 5$ 8. Compute the *n*th roots of unity for *n* = 2, 3, and 4. 9. Find the two square roots of 5 + 12*i*.		Credit-1

Reading list

1. Mathematical Physics; H K Dass and R Verma, S Chand and Company limited.
2. Mathematical methods for Physics and Engineering; K. F Riley, M. P Hobson, S.J Bence, Cambridge University Press.
3. Graduate Mathematical Physics (With Mathematica Supplement); J J Kelly, Willey-VCH VerlagGmbH and Co. KGaA.
4. Mathematical Methods for Physicists; G. B. Arfken, H. J. Weber and F.E. Harris, Elsevier.
5. Ordinary and Partial Differential equations; M. D Raisinghania, S. Chand and Company Ltd.
6. Complex Variables; M R Spiegel,S Lipschutz, J J Schiller and D Spellman, Schaum's Outline Series, McGraw Hill Education.
7. Complex variables Demystified (A self-teaching guide); D McMahan, McGraw Hill Education.
8. A Student's Guide to vectors and Tensors; D A Fleisch, Cambridge University Press.
9. Vector analysis and an introduction to Tensor analysis; S Lipschutz, D Spellman, M R Spiegel, Schaum's Outline Series, McGraw Hill Education.
10. Tensors and applications with Scilab Programs; N D Soni, I.K International Publishing House Pvt. Limited.
11. Probability and Statistics; M R Spiegel, J J Schiller and R A Srinivasan, Schaum's Outline Series, McGraw Hill Education.

Graduate Attributes

i. Course Objective

- To solve partial differential equations using separation of variables, including Laplace's equation and the wave equation.
- To apply Fourier series expansion to represent periodic functions using sine and cosine functions.
- To understand complex analysis principles, including analytic functions, integration and residue theorem.
- To develop proficiency in tensor algebra, covering transformations, contravariant and covariant tensors and tensor algebra.
- To gain a preliminary knowledge to probability theory, focusing on independent random variables, probability distributions, and mean and variance calculations.

ii. Learning outcome

On successful completion of the course, the students will be equipped with the techniques related to solving partial differential equations using separation of variables method, application of Fourier series analysis, solving complex integrations, dealing with tensors and probability distributions which are relevant while dealing with wave mechanics, electrodynamics, quantum mechanics, theory of relativity and experimental physics.

Theory Credit: 03 (Three)

Practical Credit: 01 (One)

No. of Required Classes: 45

No. of Contact Classes: 45

No. of Non-Contact Classes:

Particulars of Course Designer (Name, Institution, email id):

1) **Dr. Subhankar Roy**, Gauhati University (AssamJobz.Com), subhankar@gauhati.ac.in
2) **Dr. Abhijit Das**, Gauhati University (AssamJobz.Com),

Subject: Physics
Semester: Five
Course Name: Atomic and Molecular Physics
Existing Base Syllabus: HS Physics and/ or Chemistry
Course Level: PHY-301
Syllabus showing each unit against class number and marks

Unit no.	Unit content	No. of classes	Marks/Credit
Theory			
Unit I: Atom Model:	The Bohr model of the hydrogen-like atom, Sommerfeld Relativistic Atom Model: Elliptical orbits, explanation of fine structure of H alpha line in Balmer series of hydrogen atom. Limitation of Sommerfeld atom model. Orbital magnetic dipole moment: Bohr Magneton, Gyromagnetic Ratio, Larmor precession, Space Quantization, Electron Spin, quantum numbers associated with vector atom model, spin-orbit interaction, Coupling Schemes: L-S Coupling and j-j Coupling, Spectroscopic term and their notation, Stern-Gerlach experiment and its conclusion. Normal and Anomalous Zeeman Effect. Paschen Back and Stark Effect (Qualitative Discussion only).	20	Credit - 4
Unit II: X-rays:	Ionizing Power, X-ray Diffraction, Bragg's Law, X-ray Spectra: Continuous and characteristic X-rays Mosley's law, Compton effect.	8	
Unit III: Multi electron atoms:	Hund's rule, Periodic table: Pauli's exclusion principle, explanation of the periodic classification of the elements, Building up or Aufbau Principle, Broad features of Alkali atom (Na etc.) spectra and its explanation	10	
Unit IV: Molecular Spectra	Rotational Energy levels, Selection Rules and Pure Rotational Spectra of a diatomic Molecule. Vibrational Energy Levels, Selection Rules and Vibration Spectra of a diatomic Molecule. Rotation-Vibration Energy Levels, Selection Rules and Rotation-Vibration Spectra. Determination of Internuclear Distance.	15	
Unit V: Raman Effect	Quantum Theory of Raman Effect. Characteristics of Raman Lines. Stoke's and Anti-Stoke's Lines. Complimentary Character of Raman and infrared Spectra.	7	

Reading list

1. Introduction to Atomic spectra, H. E. White, Tata McGraw Hill (1934)
2. Atomic and Molecular Spectra, Raj Kumar
3. Concepts of Modern Physics, Arthur Beiser (McGraw-Hill Book Company, 1987)
4. Atomic physics, J. B. Rajam & foreword by Louis De Broglie (S. Chand & Co., 2007)
5. Physics of Atoms and Molecules, B. H. Bransden and C. J. Joachein.
   Fundamentals of Molecular Spectroscopy, C. N. Banwell and E. M. McCash

Graduate Attributes

i. Course Objective

- To learn the development of atom models.
- To learn the origin of atomic spectra and their modifications under different physical conditions.
- To learn the basics of molecular spectra for diatomic molecule and a few applications.

ii. Learning outcome

Students will be ability to describe the atomic spectra of one and two valance electron atoms and will also understand the change in behavior of atoms and corresponding modification of their spectra in external applied electric and magnetic field. They will understand the basic principle of pure rotational, vibrational, Rotation-Vibration and Raman spectra of molecules and their few applications.

Theory Credit: 04 (Four)

Practical Credit: 0 (Zero)

No. of Required Classes: 60

No. of Contact Classes: 60

No. of Non-Contact Classes:

Particulars of Course Designer (Name, Institution, email id):

1) **Dr. Simanta Hazarika**, Gauhati University (AssamJobz.Com), simanta@gauhati.ac.in
2) **Dr. Hemen Kakati**, Nalbari College, hementeaclarupjchoudhury@gmail.com

Subject: Physics
Semester: Five
Course Name: Condensed Matter Physics
Existing Base Syllabus: HS Physics, Chemistry and Mathematics
Course Level: PHY302
Syllabus showing each unit against class number and marks

Unit no.	Unit content	No. of classes	Marks/Credit
Theory			
Unit I: Crystal Structure and Bonding in solids	Amorphous, crystalline and polycrystalline materials, lattice translation vectors, unit cell, types of crystal lattice, Bravais Lattice, Miller Indices, inter planer spacing. Ionic, covalent, metallic, van-der-Waal and hydrogen bondings, cohesive energy of ionic crystal, Madelung constant.	9	Credit - 3
Unit II: Elementary Lattice Dynamics	Basic idea of lattice vibration and phonon. Dulong and Petit's Law. Einstein and Debye theories of specific heat of solids, T^3 law.	4	
Unit III: Dielectric and Ferroelectric Properties of Materials	Polarization. local electric field at an Atom, depolarization field, electric susceptibility, polarizability. Clausius Mosotti equation, classical theory of electric polarizability, normal and anomalous dispersion, Cauchy and Sellmeir relations, Langevin-Debye equation. Piezoelectric effect, pyroelectric effect, ferroelectric effect, electrostrictive effect, Curie-Weiss Law.	10	
Unit IV: Transport properties of materials	Free electron theory of metals, electrical and thermal conductivity of metals, Wiedemann-Franz law, drawback of classical theory and modification with quantum theory, preliminary idea of band theory, band gap, conductor, semiconductor (*p* and *n* type) and insulator,	9	

	conductivity of semiconductor, mobility, measurement of conductivity (2-probe & 4-probe resistivity measurement method), Hall Effect (Qualitative idea).		
Unit V: Nanophysics and soft matter	Basic idea about nanomaterials, thin film physics and soft matter.	3	
Unit VI: Magnetic Properties of Matter	Dia, para, ferri, ferro and anti ferromagnetic materials, classical Langevin Theory of dia and paramagnetism, Curie's law, Weiss' theory of ferromagnetic domains, discussion of B − H Curve, hysteresis and energy Loss.	7	
Unit VII: Superconductivity	Basic idea of superconductivity, critical temperature, critical magnetic field, Meissner effect. Type I and type II Super-conductors, isotope effect.	3	
Laboratory			
	<u>At least four from the following:</u> 1. Indexing of powder X-Ray diffraction data of cubic crystalline materials and determination of lattice parameters including inter planner spacing (XRD data needs to arrange by the department). 2. Measurement of susceptibility of a paramagnetic solution (Quinck's Tube Method). 3. To measure the magnetic susceptibility of solids. 4. To determine the Coupling Coefficient of a piezoelectric crystal. 5. To measure the Dielectric Constant of a dielectric materials with frequency. 6. To study the *P-E* Hysteresis loop of a Ferroelectric Crystal. 7. To draw the B − H curve of Fe		Credit-1

	using Solenoid & determine energy loss from Hysteresis. 8. To measure the variation of resistivity of a semiconductor with temperature by four-probe method and to determine its band gap. 9. To determine the Hall coefficient of a semiconductor sample.		

Reading list

1. Introduction to Solid State Physics, C Kittel
2. Lattice Dynamics, A K Ghatak and L S Kothari
3. Solid State Physics, A J Dekker.
4. Introductory Solid State Physics, H P Myers.
5. Solid State Physics, N W Ashcroft and N D Mermin
6. Magnetism in solids, D H Martin
7. Physics of Magnetism, S Chikazumi.
8. Solid State Physics, S O Pillai
9. Introduction to Nanotechnology, C. P. Poole, J. F. J. Owens

Graduate Attributes

i. Course Objective

- To provide the elementary idea about crystal structure, bonding and lattice dynamics in solids.
- To make the students understand the concepts of transport properties, dielectric properties, ferroelectric properties and magnetic properties in solids.
- To familiarise the students with nanomaterials, thin film, soft matter and superconductivity.

ii. Learning outcome

On successful completion of the course students will be able to acquire the basic knowledge of crystal structure, bonding in solids and elementary idea lattice dynamics of materials, dielectric, ferroelectric and magnetic properties of solids, the physics of

electrons in solids, basic idea about nanomaterials, thin film and soft matter and understand the basic concept in superconductivity.

Theory Credit: 03 (Three)

Practical Credit: 01 (One)

No. of Required Classes: 45

No. of Contact Classes: 45

No. of Non-Contact Classes:

Particulars of Course Designer (Name, Institution, email id):

1) **Dr. Sulochana Deb**, Gauhati University (AssamJobz.Com), debsulochana@gauhati.ac.in
2) **Dr. Lavita Sharma** Jagiroad CollegShyamoli_ma@yahoo.co.inn

Subject: Physics
Semester: Five
Course Name: Heat and Thermodynamics
Existing Base Syllabus: HS Physics, Chemistry.
Course Level: PHY303
Syllabus showing each unit against class number and marks

Unit no.	Unit content	No. of classes	Marks/Credit
Theory			
Unit I: Distribution of Velocities and Molecular Collisions	Maxwell-Boltzmann Law of Distribution of Velocities in an Ideal Gas and its Experimental Verification. Mean, RMS and Most Probable Speeds. Degrees of Freedom. Law of Equipartition of Energy (No proof required). Mean Free Path. Collision Probability. Transport Phenomenon in Ideal Gases: (1) Viscosity, and (2) Thermal Conductivity. Brownian Motion (qualitative idea only).	9	Credit - 3
Unit II: Real Gases	Behavior of Real Gases: Deviations from the Ideal Gas Equation. The Virial Equation. Andrew's Experiments on CO_2 Gas. Critical Constants. Continuity of Liquid and Gaseous State. Vapor and Gas. Boyle Temperature. Van der Waal's Equation of State for Real Gases. Values of Critical Constants. Law of Corresponding States. Comparison with Experimental Curves. Joule- Thomson Porous Plug Experiment. Joule- Thomson Effect, Joule-Kelvin coefficient for Ideal and Van der Waal Gases. Temperature of Inversion.	8	
Unit III: Principles of Thermodynamics	Thermodynamic preliminaries: Extensive and intensive properties, Thermodynamic Variables, Thermodynamic Equilibrium, P-V indicator diagram. Work done in terms of P and V, Zeroth Law of Thermodynamics & Concept of Temperature, Internal energy and First Law of Thermodynamics, Applications	16	

	of First Law: General Relation between C_P and C_V. Reversible and Irreversible process with examples. Heat & work, state function, Conversion of heat into work and vice versa, Work Done during Isothermal and Adiabatic Processes, Heat Engines, 2nd Law of Thermodynamics: Kelvin-Planck and Clausius Statements and their Equivalence, Carnot's Cycle, Carnot engine & efficiency. Refrigerator & coefficient of performance, Carnot's Theorem. Applications of Second Law of Thermodynamics: Thermodynamic Scale of Temperature and its Equivalence to Perfect Gas Scale.		
Unit IV: Entropy	Concept of Entropy, Clausius Theorem. Clausius Inequality, Second Law of Thermodynamics in terms of Entropy. Entropy of a perfect gas. Entropy Changes in Reversible and Irreversible processes with examples. Entropy of the Universe. Entropy Changes in Reversible and Irreversible Processes. Principle of Increase of Entropy. Temperature–Entropy diagrams for Carnot's Cycle. Third Law of Thermodynamics.	6	
Unit V: Thermodynamic Potentials and Thermodynamic Relations (Lectures 06)	Thermodynamic Potentials: Internal Energy, Enthalpy, Helmholtz Free Energy, Gibb's Free Energy, Surface Films and Variation of Surface Tension with Temperature, Derivations and applications of Maxwell's Relations, Maxwell's Relations:(1) Clausius Clapeyron equation, (2) Values of *Cp*-*Cv*, (3) TdS Equations, (4) Energy equations, (5) Change of Temperature during Adiabatic Process.	6	
Laboratory			
	<u>At least four from the following:</u> 1. To determine mechanical equivalent of heat, J, by Callender and Barne's constant flow method 2. To determine the mechanical equivalent		Credit-1

	of heat, J using calorimeter 3. To determine specific heat of a liquid using calorimeter 4. To determine the coefficient of thermal conductivity of Cu by Searle's Apparatus. 5. To determine the coefficient of thermal conductivity of an insulator by Lee and Charlton's disc method. 6. To determine the temperature coefficient of resistance by Platinum Resistance Thermometer (PRT). 7. To study the variation of thermo-emf of a thermocouple with difference of temperature of its two junctions. 8. To determine the change of entropy of universe for an AC circuit consists of a thermally insulated resistor. 9. To calibrate a thermocouple to measure temperature in a specified range using (1) Null method, (2) Direct measurement using OPAMP and to determine neutral temperature.		

Reading list

1. Heat and Thermodynamics, M. Zemansky, R. Dittman, McGraw-Hill Education, 2017.
2. A Treatise on Heat, Meghnad Saha and B. N. Srivastava, Indian Press, 1973.
3. Thermal Physics: Kinetic Theory, Thermodynamics and Statistical Mechanics, S. C. Garg, R. M. Bansal and C. K. Ghosh, Tata McGraw Hill Education Pvt Ltd, 2013.
4. Thermodynamics, Kinetic Theory and Statistical Thermodynamics, F. W. Sears & G. L. Salinger, Narosa Publishing House, 1998.
5. Thermal and Statistical Physics, R. B. Singh, New Academic Science, 2011.
6. Theory and Experiment on Thermal physics, P K. Chakrabarti, New Central Book Agency (P) Ltd, 2011.

Graduate Attributes

i. Course Objective

- To understand principles of thermodynamics
- To provide concepts of thermodynamic functions
- To address the basic framework of kinetic theory of gases

ii. Learning outcome

Upon completion of this course, students will be able to learn thermal properties of gas molecules and their collisions. With this course, students will acquire knowledge of thermodynamics with practical insights into thermal physics, which will help them to understand real world situations.

Theory Credit: 03 (Three)

Practical Credit: 01 (One)

No. of Required Classes: 45

No. of Contact Classes: 45

No. of Non-Contact Classes:

Particulars of Course Designer (Name, Institution, email id):

1) **Dr. Bimal Kumar Sarma**, Gauhati University (AssamJobz.Com), bimal@gauhati.ac.in
2) **Dr. Krishna Kingkar Pathak** , Arya Bidyapeeth College, kkingkar@gmail.com
3) **Dr. Diganta Sarma**, B. Borooah College, sarma.diganta@gmail.com

Subject: Physics
Semester: Five
Course Name: Electromagnetic Theory
Existing Base Syllabus: HS Physics, Chemistry and Mathematics
Course Level: PHY304
Syllabus showing each unit against class number and marks

Unit no.	Unit content	No. of classes	Marks/Credit
Theory			
Unit I: Maxwell's equations	Maxwell's equations, Displacement Current, Vector and Scaler Potentials, Gauge Transformations: Coulomb and Lorentz Gauge, Boundary Conditions at Interface between Different Media, Poynting Theorem and Poynting Vector.	9	Credit - 3
Unit II: EM Wave Propagation in Unbounded Media	Plane EM Waves through Vacuum and Isotropic Dielectric Medium, Transverse Nature of Plane EM Waves, Refractive Index and Dielectric Constant, Propagation though Conducting Media, Relaxation Time, Skin Depth. Wave Propagation through Dilute Plasma (Basic Concepts).	9	
Unit III: EM wave in Bounded Media	Reflection and Refraction of Plane EM Waves at Plane Interface between two Dielectric Media – Laws of Reflection and Refraction, Fresnel's Formula for Perpendicular Polarization Case, Brewster's Law, Reflection and Transmission Co-efficient, Waveguides: Basic Concepts and Propagation of EM Waves in a Rectangular Waveguide.	9	
Unit IV: Polarization of Electromagnetic Waves	Description of Linear, Circular and Elliptical Polarization, Propagation of EM Waves in Anisotropic Media, Symmetric Nature of Dielectric Tensor, Fresnel's Formula, Uniaxial and Biaxial Crystals, Light Propagation in Uniaxial Crystal, Double Refraction, Polarization by Double Refraction, Nicol Prism; Ordinary & Extraordinary Refractive Indices, Production & Detection of Plane, Circularly and Elliptically Polarized Light; Phase Retardation Plates: Quarter-Wave and Half-Wave Plates, Babinet	11	

	Compensator and its Uses, Analysis of Polarized Light.		
Unit V: Rotary Polarization	Optical Rotation. Biot's Laws for Rotatory Polarization, Fresnel's Theory of Optical Rotation, Calculation of Angle of Rotation, Experimental Verification of Fresnel's Theory, Specific rotation, Laurent's Half-shade Polarimeter.	4	
Unit VI: Optical Fibres	Numerical Aperture, Step and Graded Indices (Definitions Only), Single and Multiple Mode Fibres (Concept and Definition Only)	3	
Laboratory			
	<u>At least four from the following:</u> 1. To verify the law of Malus for plane polarised light. 2. To determine the specific rotation of sugar solution using Polarimeter. 3. To analyze elliptically polarised light by using Babinet's compensator. 4. To study dependence of radiation on angle for a simple Dipole antenna. 5. To determine the wavelength and velocity of ultrasonic waves in a liquid (Kerosene Oil, Xylene etc.) by studying the diffraction through ultrasonic grating. 6. To study the reflection and refraction of microwaves. 7. To study polarization and double slit interference in microwaves. 8. To determine the refractive index of liquid by total internal reflection using Wollaston's air-film. 9. To determine the refractive index of (1) glass and (2) a liquid by total internal reflection using a Gaussian eyepiece. 10. To study the polarisation of light by reflection and determine the polarizing angle for air-glass interface. 11. To verify the Stefan's law of radiation and to determine Stefan's constant. 12. To determine the Boltzmann constant using V-I characteristic of pn junction diode.		Credit-1

Reading list

1. Introduction to Electrodynamics, D. J. Griffiths.
2. Electromagnetics, B. B. Laud, New Age International Publishers.
3. Elements of Electromagnetics, M. N. O. Sadiku, 2001, Oxford University Press.
4. Introduction to Electromagnetic Theory, T. L. Chow, 2006, Jones & Bartlett Learning.
5. Feynman Lectures Vol. 2, R. P. Feynman, R. B. Leighton, M. Sands, 2008, Pearson Education.
6. Fundamentals of Electromagnetics, M. A. W. Miah, 1982, Tata McGraw Hill.
7. Electromagnetic Field Theory, R. S. Kshetrimayun, 2012, McGraw Hill.
8. Engineering Electromagnetic, Willian H. Hayt, 2012, McGraw Hill.
9. Electricity and Magnetism [With electromagnetic theory and special theory of relativity], D. Chattopadhyay and P. C. Rakshit, 2013, New Central Book Agency (P) Limited.

Graduate Attributes

i. Course Objective

- To lay the foundation of electromagnetism through Maxwell's equations.
- Behaviour of electromagnetic waves as it propagates through vacuum and other media.
- Various effects that occur as electromagnetic waves propagate from one medium to another medium.
- Basic concepts of waveguides and fibre optics.
- Various aspects of electromagnetic wave polarisation

ii. Learning outcome

After the successful completion of the course, students will acquire the concepts of Maxwell's equations, propagation of electromagnetic (EM) waves in different homogeneous-isotropic as well as anisotropic unbounded and bounded media, production and detection of different types of polarized EM waves, general information of waveguides and fibre optics.

Theory Credit: 03 (Three)

Practical Credit: 01 (One)

No. of Required Classes: 45

No. of Contact Classes: 45

No. of Non-Contact Classes:

Particulars of Course Designer (Name, Institution, email id):

1) Dr. Manos Pratim Chakrapani Kalita, Gauhati University (AssamJobz.Com), mpckalita@gauhati.ac.in
2) Dr. Rudra Kumar Das, Jagiroad College, das1.rudra@gmail.com

Subject: Physics
Semester: Six
Course Name: NUCLEAR & PARTICLE PHYSICS
Existing Base Syllabus: HS Physics, Chemistry and Mathematics
Course Level: PHY351
Syllabus showing each unit against class number and marks

Unit no.	Unit content	No. of classes	Marks/Credit
Theory			
Unit I: Basic Properties of Nuclei	Constituents of a nucleus: proton-electron hypothesis -Thompson atom model, failure of proton-electron hypothesis, discovery of neutrons, Rutherford gold foil experiment (qualitative) and atom model- mass, radius, volume, matter density of nuclei and their units. Binding energy, binding energy per nucleon, stability of a nucleus- neutron to proton ratio, stability line, stability limit against beta decays.	8	Credit - 4
Unit II: Radioactivity and Radioactive Laws	Types of Radioactivity – alpha, beta, and gamma decay. Laws of radioactive decay, disintegration constant, half-life and mean life. Activity of a radioactive source, units of radioactivity. Alpha decay: range, ionization and stopping power, range-energy relation, Geiger-Nuttall law, Fine structure of alpha energy spectrum. Beta decays: types of beta decays, essential conditions of beta decays, beta ray spectra, end point energy, Pauli's neutrino hypothesis. Gamma decay: origin of gamma radiation, its property, attenuation of gamma radiation in matter	10	
Unit III: Nuclear Instrumentation	Detectors: Interaction of Radiation with Matter: Energy loss by a charged particle due to ionization (Bethe- Block formula), energy loss of electrons, Cerenkov radiation. Interaction of photon with matter – Photoelectric effect, Compton effect, and Pair production. Gas filled detectors: Ionization chamber,	10	

	proportional counter, and GM counter – construction and working principle. Charged particle accelerators: Need of charged particle accelerators, Linear accelerator (LINAC) – Construction and working principle.		
Unit IV: Fission and Fusion	Energy consideration in Nuclear Reaction, Mass defect and Q-value of a nuclear reaction, Einstein's mass-energy equivalence principle and generation of nuclear energy. Nuclear Fission: Spontaneous and induced fission – definition and examples, Fission chain reactions and nuclear reactor: peaceful use of fission energy. Fusion and thermonuclear reactions: Energy production in stars (brief qualitative discussions).	10	
Unit V: Elementary Particles	Classification of elementary particles and their quantum numbers, conservation laws, Allowed and forbidden reactions, Types of interactions – strong, electro-magnetic and weak interactions.	7	

Reading list

1. Basic ideas and concepts in Nuclear Physics: An introductory approach by K Heyde, third edition, IOP Publication, 1999. 87
2. Nuclear Physics by S N Ghoshal, First edition, S. Chand Publication, 2010.
3. Introductory Nuclear Physics by K S Krane, Wiley-India Publication, 2008.
4. Nuclear Physics: principles and applications by J Lilley, Wiley Publication, 2006.
5. Radiation detection and measurement, G F Knoll, John Wiley & Sons, 2010.
6. Schaum's Outline of Modern Physics, McGraw-Hill, 1999.
7. Concept of Modern Physics by Arthur Beiser, McGraw Hill Education, 2009.
8. Nuclear Radiation Detector by S S Kapoor and V S Ramamurthy , 1st edition, New Age international publisher.

Graduate Attributes

i. Course Objective

- basic knowledge about the nucleus and other subatomic particles and their properties.
- knowledge about the radioactive disintegration of a nucleus and the laws of radioactive decays
- Knowledge on basic nuclear instrumentation and experimental techniques of nuclear physics.
- Basic knowledge of particle physics.

ii. Learning outcome

On successful completion of the course, the students shall be able to understand the structure and properties of a nucleus. They will also know about the properties of strong nuclear force that keeps the nuclei bound. They will learn about the radioactive decays and various laws of radioactive disintegration. Students will have adequate knowledge on the construction and working principles of particle accelerators and detectors. Moreover, students will be introduced to the world of particle physics – types and interactions. The acquired knowledge can be applied in the areas of nuclear medicine, medical physics, archaeology, geology and other interdisciplinary fields of Physics and Chemistry. It will enhance the special skills required for these fields.

Theory Credit: 04 (Three)

Practical Credit: 01 (One)

No. of Required Classes: 45

No. of Contact Classes: 45

No. of Non-Contact Classes:

Particulars of Course Designer (Name, Institution, email id):

1) Prof. Buddhadeb Bhattacharjee, Gauhati University (buddha@gauhati.ac.in
2) Dr. Mausumi Bhuyan, Rangiya College, moubhuyan83@gmail.com
3) Dr. Krishna Kingkar Pathak, Arya Vidyapeeth College, kkingkar@gmail.com

Subject: Physics
Semester: Six
Course Name: Digital Electronics
Existing Base Syllabus: HS Physics, Chemistry and Mathematics
Course Level: PHY352
Syllabus showing each unit against class number and marks

Unit no.	Unit content	No. of classes	Marks/Credit
Theory			
Unit I: Integrated Circuits (qualitative treatment only)	Active & Passive Components. Discrete components. Wafer. Chip. Advantages and drawbacks of ICs. The scale of integration: SSI, MSI, LSI, and VLSI (basic idea and definitions only). Classification of ICs. Examples of Linear and Digital ICs.	3	Credit - 3
Unit II: Digital Circuits	Difference between Analog and Digital Circuits. Binary Numbers. Decimal to Binary and Binary to Decimal Conversion. BCD, Octal, and Hexadecimal numbers. AND, OR, and NOT Gates (realization using Diodes and Transistor). NAND and NOR Gates as Universal Gates. XOR and XNOR Gates	10	
Unit III: Boolean Algebra	Unit III: (Lectures 10) De Morgan's Theorems. Boolean Laws. Simplification of Logic Circuit using Boolean Algebra. Fundamental Products. The idea of Minterms and Maxterms. Conversion of a Truth table into Equivalent Logic Circuit by (1) Sum of Products Method and (2) Karnaugh Map.	10	
Unit IV: Arithmetic Circuits	Binary Addition. Binary Subtraction using 2's Complement. Half and Full Adders. Half & Full Subtractors, 4-bit binary Adder/Subtractor.	5	
Unit V: Timers: IC 555	Timers: IC 555 (Lectures 03) Block diagram and applications: Astable multivibrator and Monostable multivibrator.	3	
Unit VI: Sequential Circuits	(Lectures 04) SR, D, and JK Flip-Flops. Clocked (Level and Edge Triggered) Flip-Flops. Preset and Clear operations. Race-around conditions in JK Flip-Flop. M/S JK Flip-Flop.	4	

Unit VII: Shift Registers	Serial-in-Serial-out. Serial-in-Parallel-out. Parallel-in-Serial-out and Parallel-in-Parallel-out Shift Registers (only up to 4 bits).	4	
Unit VIII: Computer Organization	Input/output Devices. Data storage (the idea of RAM and ROM). Computer memory. Memory organization & addressing.	6	
Laboratory			
	At least four from the following:		Credit 1
	1. To design a switch (NOT gate) using (i) a PNP transistor and (ii) an NPN transistor. 2. To verify and design AND, OR, NOT, and XOR gates using NAND gates. 3. To design a combinational logic system for a specified Truth Table. 4. To convert a Boolean expression into a logic circuit and design it using logic gate ICs. 5. To design a Half Adder and Full Adder 6. To design a 4-bit binary Adder. 7. To design Half Subtractor and Full Subtractor 8. To design Adder-Subtractor using Full Adder IC. 9. To design an astable multivibrator of given specifications using 555 Timer. 10. To design a monostable multivibrator of given specifications using 555 Timer. 11. To build a D flip-flop circuit using NAND gates. 12. To build a JK flip-flop circuit using NAND gates. 13. To build JK Master-slave flip-flop using flip-flop ICs. 14. To make a 4-bit Shift Register (serial and parallel) using D-type/JK Flip-Flop ICs. 15. To build SR flip-flop circuit using NAND gates		

Reading list

1. Digital Principles and Applications, A. P. Malvino, D. P. Leach and Saha, 7th Ed., 2011, Tata McGraw
2. Fundamentals of Digital Circuits, Anand Kumar, 2nd Edn, 2009, PHI Learning Pvt. Ltd.
3. Digital Circuits and systems, Venugopal, 2011, Tata McGraw Hill.
4. Digital Electronics G. K. Kharate ,2010, Oxford University Press
5. Digital Systems: Principles & Applications, R. J. Tocci, N. S. Widmer, 2001, PHI Learning

6. Logic circuit design, Shimon P. Vingron, 2012, Springer.
7. Digital Electronics, Subrata Ghoshal, 2012, Cengage Learning.
8. Digital Electronics, S. K. Mandal, 2010, 1st edition, McGraw Hill
9. Electronics Fundamentals and Applications, D. Chattopadhyay and P. C. Rakshit, 17th Ed, 2023, New Age International Publisher

Graduate Attributes

i. Course Objective

- To introduce the students to the basics of digital electronics and applications with handson experience in implementing some hardware.
- To help students develop a digital logic and apply it to solve real-life problems
- To analyze, design and implement various combinational and sequential logic circuits
- To classify different semiconductor memories.

ii. Learning outcome

After successful completion of the course student will be able to develop, implement and analyze digital logic circuits and apply them to solve real-life problems and classify different semiconductor memories

Theory Credit: 04 (Three)

Practical Credit: 01 (One)

No. of Required Classes: 45

No. of Contact Classes: 45

No. of Non-Contact Classes:

Particulars of Course Designer (Name, Institution, email id):

1) Prof. Banty Tiru, Gauhati University (AssamJobz.Com), btiru@gauhati.ac.in
2) Dr. Shakeel Zaman, Handique Girls College,

Subject: Physics
Semester: Six
Course Name: Astronomy and Astrophysics
Existing Base Syllabus: HS Physics, Chemistry and Mathematics
Course Level: PHY353
Syllabus showing each unit against class number and marks

Unit no.	Unit content	No. of classes	Marks/Credit
Theory			
Unit –I: Fundamentals of astronomy	Basic components of the universe – stars, planets and galaxies; celestial sphere and celestial coordinates system - altitude-azimuth (Alt-Az) and right ascension-declination (RA-DEC); Introduction to constellations through sky observation and Stellarium; concept of time – universal time, solar and mean solar time, sidereal time, local sidereal time, Julian day; flux and luminosity of celestial objects; stellar magnitude scale – apparent and absolute magnitude; measurement of stellar distances – trigonometric parallax; introduction to HIPPARCOS and GAIA.	8	Credit - 4
Unit- II: Astronomical techniques	Telescopes –size and light gathering power; resolving power; different types of optical telescopes (reflecting and refracting); space telescopes; concept of virtual observatory; virtual observatory tools in astronomy – SIMBAD, Aladin; SDSS, AAVSO, Sky-View; introduction to photometry; CCD –an introduction; spectroscopy and polarimetry.	7	
Unit – III: Stellar astrophysics	Star formation from interstellar medium (introduction only); properties of stars – mass, luminosity, radius and effective surface temperature; mass-luminosity, mass-radius and luminosity-radiustemperature relation; variable stars-cepheids; star clusters – open and globular, their ages (introduction only). Gravity and thermodynamics – hydrostatic equilibrium of stars; virial theorem; internal temperature and pressure of stars; spectral classification –	13	

	HR diagram; stellar evolution- idea of nucleosynthesis in main sequence phase- pp and CNO cycle; evolution of Sun-like stars off the main sequence -red giants and white dwarfs- Chandrasekhar mass limit (introduction only); evolution of massive stars – neutron stars and black holes (introduction only).		
Unit-IV: The solar system	(Lectures 5) The Sun; properties of photosphere, chromospheres and corona; Formation of the solar system – Kant-Laplace nebular hypothesis; asteroid belt and meteorites; Distances and atmospheres of planets; Pluto and dwarf planets; comets – Kuiper belt and Oort cloud; extra-solar planets – transit method of detection (introduction only).	5	
Unit- V: Galaxies and cosmology	(Lectures 12) The Milky Way-shape, size and its components; classification of galaxies –Hubble's tuning fork diagram; types – spirals, elliptical and lenticular; difference between spirals and ellipticals. Large scale structure of the universe – galaxies, clusters, superclusters, filaments, walls and voids; Cosmological Principle; Hubble's law; Newtonian cosmology and derivation of Friedman equation; closed and oscillating universe, flat and open universe; the Hot Big Bang model; Cosmic Microwave Background (CMB); steady state universe (introduction only); flat rotation curves in galaxies and evidence of dark matter; dark energy (introduction only).	12	

Reading list

1. Astrophysics for physicists, A. Rai Choudhuri, Cambridge University Press.
2. An introduction to the theory of stellar structure and evolution, D. Prialnik, Cambridge University Press.
3. Astrophysics- Stars and galaxies, K. D. Abhyankar, Tata McGraw Hill Pub.
4. Textbook of astronomy and astrophysics with elements of cosmology, V. B. Bhatia, Narosa Pub.
5. Astronomy Methods - A Physical Approach to Astronomical Observations, Hale Bradt, Cambridge University Press.
6. Introduction to astrophysics, H.L. Duorah and K. Duorah, Mani Manik Prakash (Guwahati) Digital Principles and Applications, A. P. Malvino, D. P. Leach and Saha, 7th Ed., 2011, Tata McGraw
7. The physical universe – An introduction to astronomy, F. H. Shu, University of Science Books.

8. The structure of the universe, J.V. Narlikar, Oxford University Press.
9. Introduction to cosmology, B. Ryden, Cambridge University Press

Graduate Attributes

i. Course Objective

- To introduce the students with fundamental concepts and observational techniques in astronomy including virtual observatory tools,
- to introduce them with physical processes occurring inside the celestial objects and
- to introduce the physical concepts required for the study of recent frontiers in astrophysics.

ii. Learning outcome

On successful completion of this course students will be able to understand the fundamental concepts in astronomy. They will be able to apply physics of celestial objects in understanding the universe. They will be equipped with the skills required for (i) observational astronomy (ii) virtual observatory tools and (iii) physical concepts of recent frontiers in astrophysics.

Theory Credit: 04 (Three)

No. of Required Classes: 45

No. of Contact Classes: 45

No. of Non-Contact Classes:

Particulars of Course Designer (Name, Institution, email id):

1) Dr. Biman Jyoti Medhi, Gauhati University (AssamJobz.Com), biman@gauhati.ac.in
2) Dr. Sanjeev Kalita, Gauhati Universit pratimadta2019@gmail.com,

Subject: Physics
Semester: Six
Course Name: Statistical Mechanics
Existing Base Syllabus: HS Physics, Chemistry and Mathematics
Course Level: PHY354
Syllabus showing each unit against class number and marks

Unit no.	Unit content	No. of classes	Marks/Credit
Theory			
Unit I: Classical Statistics	Microstate and macrostate, distributions of particles in compartments, principle of equal a priori probability. Phase space, volume of phase space. Elementary concept of ensembles, Types of ensembles. Ergodic hypothesis. Entropy and thermodynamic probability, Stirling's approximation, Maxwell-Boltzmann distribution function, Partition functions. Gibbs Paradox, Sackur Tetrode equation, Law of Equipartition of Energy (with proof) — Applications to specific heat and its limitations. Thermodynamic parameters (internal energy, entropy, free energy, enthalpy) using partition functions.	15	Credit - 4
Unit II: Classical and Quantum Theory of Radiation	Properties of thermal radiation. Blackbody radiation. Spectral distribution of Blackbody radiation, Kirchhoff's law. Stefan-Boltzmann law: Thermodynamic proof. Radiation pressure (for Normal and diffused case). Wien's Displacement law. Wien's Distribution Law. Saha's ionization formula. Rayleigh-Jean's Law (with proof). Ultraviolet catastrophe. Need of quantum statistics. Planck's quantum postulates. Planck's law of blackbody radiation: Experimental verification. Deduction of (1) Wien's Distribution Law, (2) RayleighJeans Law, (3) Stefan- Boltzmann Law, (4) Wien's Displacement law from Planck's black body radiation formula	12	

Unit III: Bose-Einstein Statistics	Bose-Einstein (BE) distribution, Pressure of a Bose gas, Bose Einstein Condensation (qualitative description only), Properties of liquid Helium (qualitative discussion only), Radiation as a photon gas and Bose's derivation of Planck's blackbody radiation formula, Thermodynamic functions of photon gas – energy, entropy, and free energy	8	
Unit IV: Fermi-Dirac Statistics	Fermi-Dirac (FD) distribution, FD function and Fermi Energy, Degenerate Fermi gas, strongly degenerate case (qualitative discussion only), Thermodynamic functions - energy and pressure of a completely degenerate Fermi gas, Heat capacity at low temperature, Free electron gas in metals and electronic specific heat, Relativistic Fermi gas, thermodynamics of white dwarf star (qualitative discussion only).	10	

Reading list

1. Statistical Mechanics, R K Pathria and P D Beale, Elsevier Science, 2021.
2. Statistical Physics, F. Reif, McGraw-Hill Education India, 2008.
3. Statistical and Thermal Physics, S. Lokanathan and R. S. Gambhir, PHI Learning, 1991.
4. Modern Thermodynamics with Statistical Mechanics, Carl S. Helrich, Springer, 2009.
5. An Introduction to Statistical Mechanics & Thermodynamics, R. H. Swendsen, Oxford University Press, 2012.
6. A Primer of Statistical Mechanics, R. B. Singh, New Age International Publishers, 2006.

Graduate Attributes

i. Course Objective

- To provide basic concepts of statistical mechanics
- Describing various thermodynamical phenomena using probability theory
- To learn classical and quantum statistics

ii. Learning outcome

Upon completion of the course, students will get accustomed to the microscopic origin of thermodynamic processes. After successful completion of the course, students will be able to perceive classical and quantum pictures of physical and chemical events

Theory Credit: 04 (Three)

No. of Required Classes: 45

No. of Contact Classes: 45

No. of Non-Contact Classes:

Particulars of Course Designer (Name, Institution, email id):

1) **Dr. Bimal Kumar Sarma**, Gauhati University (AssamJobz.Com), bimal@gauhati.ac.in
2) **Dr. Krishna Kingkar Pathak** , Arya Bidyapeeth College,

Syllabi

Four Year Undergraduate Programme (FYUGP)

Gauhati University

Effective from Academic Year 2023-24

GAUHATI UNIVERSITY
Guwahati-781014

Syllabi for

Four Years' Undergraduate Program (FYGP)
in Zoology

under

Gauhati University

As per instructions of the NEP Implementation Committee, Gauhati University, the syllabicover02 (Two) CORE and 04(Four) COMPULSORY Major papers and 15 (Fifteen) DISCIPLINE SPECIFIC (DSE) major papers to be offered by the Department

Prepared by-

Department of Zoology
Gauhati University

Structure of Four Years Undergraduate Programme (FYGP) in Zoology under Gauhati University
Subject: Zoology
Stream: Science
In all courses:
Theory credit: **3**/Practical credit: **1**
No. of contact hours in each theory paper: **45**
No. of contact hours in each practical paper: **30**
Existing base syllabi: **CBCS Syllabi ,2016, GU**

Semester	Course Name	Paper Code*	Credit
I	**Core A1**: Diversity of Non-chordates	CORE	3
	Practical	**ZOO-1011**	1
II	**Core A2**: Diversity of Chordates	CORE	3
	Practical	**ZOO-1021**	1
III	**Compulsory:** Principles of Genetics	MAJOR	3
	Practical	**ZOO-2011**	1
IV (Any three DSE papers)	**Compulsory:** Animal Taxonomy, Systematics & Biostatistics	MAJOR	3
	Practical	**ZOO-2021**	1
	DSE 1-Animal Physiology & Endocrinology	MAJOR	3
	Practical	**ZOO-2022**	1
	DSE 2- Principles of Ecology & Evolution	MAJOR	3
	Practical	**ZOO-2023**	1
	DSE 3- Comparative Anatomy of Vertebrates	MAJOR	3
	Practical	**ZOO-2024**	1
	DSE 4- Animal Behaviour and Chronobiology	MAJOR	3
	Practical	**ZOO-2025**	1
	DSE 5- Parasitology	MAJOR	3
	Practical	**ZOO-2026**	1
V (Any Three DSE papers)	**Compulsory:**Fundamentals of Biochemistry	MAJOR	3
	Practical	**ZOO-3011**	1
	DSE 6- Biochemistry of metabolic processes & regulation	MAJOR	3
	Practical	**ZOO-3012**	1
	DSE 7- Entomology & Fisheries	MAJOR	3
	Practical	**ZOO-3013**	1
	DSE 8- Immunology	MAJOR	3
	Practical	**ZOO-3014**	1
	DSE 9- Reproductive Biology	MAJOR	3
	Practical	**ZOO-3015**	1
	DSE 10- Molecular Biology	MAJOR	3
	Practical	**ZOO-3016**	1
VI (Any Three DSE papers)	**Compulsory:**Cell Biology	MAJOR	3
	Practical	**ZOO-3021**	1
	DSE 11- Developmental Biology	MAJOR	3
	Practical	**ZOO-3022**	1
	DSE 12- Wildlife Conservation & Management	MAJOR	3
	Practical	**ZOO-3023**	1
	DSE 13- Computational Biology	MAJOR	3
	Practical	**ZOO-3024**	1
	DSE 14- Advanced Entomology	MAJOR	3
	Practical	**ZOO-3025**	1
	DSE 15- Animal Cell Culture & Genetic Engineering	MAJOR	3
	Practical	**ZOO-3026**	1

*The paper code should be read as follows-ZOO-Zoology; 10-Year I; 20-Year II; 30-Year III; 1-Odd semester;2-Even semester; Last Digit-Serial Number; ZOO-1011 stands for Zoology first year, odd semester, first paper

CORE A1
DIVERSITY OF NON-CHORDATES
Code: ZOO-1011
Credit: 3 (T) + 1 (P)

Course Objectives:

1. The course would provide an insight to the learner about the existence of different life forms ontheEarth,andappreciatethediversityofanimallife.
2. It willhelpthestudenttounderstandthefeatures of Kingdom Animalia and systematic organization of the animals based on theirevolutionaryrelationships,structuralandfunctionalaffinities.
3. Thecoursewillalsomakethestudents aware about the characteristic morphological and anatomical features of diverseanimals;economic,ecologicalandmedicalsignificanceofvariousanimalsin humanlife;andwillcreateinterestamongthemtoexploretheanimaldiversityinnature.

Learning Outcomes:

Uponcompletionofthecourse,studentsshouldbeableto:

1. Learn about the importance of systematics, taxonomy and structural organization ofanimals.
2. Understand evolutionary history and relationships of different non-chordates throughfunctionalandstructuralaffinities.
3. Critically analyze the organization, complexity and characteristic features of non-chordatesmakingthemfamiliarizewiththemorphologyandanatomyofrepresentativesofvariousanimalphyla.
4. Comprehendtheeconomicimportanceofnon-chordates,theirinteractionwiththeenvironmentandroleintheecosystem.
5. Enhancecollaborativelearningandcommunicationskillsthroughpracticalsessions,teamwork,groupdiscussions,assignmentsandprojects.

CORE A1
DIVERSITY OF NON-CHORDATES
Code: ZOO-1011
Credit: 3 (T) + 1 (P)

THEORY	Hours
Unit1: GeneralcharacteristicsandClassificationup toclasses of Protista, Porifera, Cnidaria, Ctenophora, Platyhelminthes, Nemathelminthes.	7
Unit2: Evolution of coelom and metamerism GeneralcharacteristicsandClassificationup toclasses of Annelida,	8

Arthropoda, Mollusca and Echinodermata.	
Unit 3: LocomotionandReproductioninProtista Evolution of symmetryandsegmentationof Metazoa Canalsystemandspiculesin sponges Polymorphism inCnidaria Corals andcoralreef formation Parasiticadaptationsinhelminths- *Fasciola hepatica* and *Wuchereriabancrofti* Excretion in Annelida Vision and respiration in Arthropoda Evolutionary significance of Onychophora Torsion and detorsion in Gastropoda Water vascular system of Echinodermata	30

DIVERSITY OF NON-CHORDATES

PRACTICAL	Hours
1. Study of the whole mount of *Euglena*, *Amoeba* and *Paramecium* collected from different water sources. 2. Study of minimum of two representatives (specimen/slide/model) of each phylum of non-chordates. 3. Study of larval forms of Arthropoda/Echinodermata 4. T.S. through pharynx, gizzard and typhlosolar intestine of earthworm. 5. Tosubmit aProjectReportonlife cycle of helminth parasite by students	30

Suggested Readings:

1. Ruppert, E.E. and Barnes, R.D. (2006). Invertebrate Zoology, 8th Edition. Holt Saunders International Edition.
2. Pechenik, J. (2015). Biology of the Invertebrates. 7th Edition, McGraw Hill
3. Schierwater, B. & DeSalle, R. (2021). Invertebrate Zoology: A Tree of Life Approach. 1st edition, CRC Press
4. Jordan, K. and P. S. Verma (2019). Invertebrate Zoology, S. Chand and Co. Ltd.
5. Kotpal, R. L. (2020). Modern text book of Zoology, Invertebrates,12th Edition, Rastogi Publications

CORE A2
DIVERSITY OF CHORDATES
Code: ZOO-1021
Credit: 3 (T) + 1 (P)

Course Objectives:

The course is designed with an aim to provide scope and historical background of chordates. Itwillimpartknowledgeregardingbasicconceptsoforiginofchordatesandmakethestudentsunderstand the characteristics and classification of animals with notochord. The exclusivephenomenainchordateslikebitingmechanisminsnakes,flightadaptationsinbirdsetc. willbe explained. The adequate explanation to the students regarding various mechanisms involvedin thriving survival of the animals within their geographic realms will create interest amongstudents

Learning Outcomes:

Uponcompletionofthecourse,thestudentswillbeableto:

1. Understanddifferentclassesofchordates,leveloforganizationandevolutionaryrelationshipbetweendifferentsubphylaandclasses,withinandoutsidethephylum.
2. Studyaboutdiversityinanimalsmakingstudentsunderstandabouttheirdistinguishingfeatures.
3. AppreciatesimilaritiesanddifferencesinlifefunctionsamongvariousgroupsofanimalsinPhylumChordata.
4. Comprehendthecirculatory,nervousandskeletalsystemofchordates.
5. Know about the habit and habitat of chordates in marine, freshwater and terrestrialecosystems.

CORE A2
DIVERSITY OF CHORDATES
Code: ZOO-1021
Credit: 3 (T) + 1 (P)

THEORY	Hours
Unit 1: Origin of Chordates-Dipleurula concept and Echinoderm theory Generalcharacteristicsandoutlineclassification	8
Unit2: Generalcharacteristicsof Hemichordata, Urochordata and Cephalochordata Study of larval forms of protochordates.	7
Unit3: Advanced features of vertebrate over protochordata	30

Overviewofaxialandappendicularskeleton,Jawsuspensorium, Visceral arches Generalcharacteristicsandclassificationof cyclostomesupto class General characteristics of Chondrichthyes and Osteichthyes, classification uptoorder. Origin of Tetrapoda Generalcharacteristicsandclassificationof Amphibia, Reptilia, Aves and Mammaliaupto order Migration in Fishes; Parental care in Amphibia; Biting mechanism in snakes; Archaeopteryx as a connecting link; Flight adaptation in birds; Affinities in Prototheria.	

DIVERSITY OF CHORDATES

PRACTICAL	**Hours**
1. Study of museum specimens/ Models -Protochordata (*Balanoglossus, Herdmania, Amphioxus*), Agnatha (*Petromyzon, Myxine*), Fishes (*Scoliodon, Torpedo, Mystus, Heteropneustes, Labeo, Hippocampus, Tetraodon*), Amphibia (*Ichthyophis, Necturus, Bufo, Hyla*), Reptilia (*Chelone, Hemidactylus, Varanus, Chamaeleon, Bungarus, Naja*), Aves (ten different species of birds commonly found in Assam), Mammalia (Bat, common primates, common ungulates, Gangetic River Dolphin). 2. Study of T.S. of *Amphioxus* through pharyngeal, intestinal and caudal regions. 3. Identification key of venomous and non-venomous snakes. 4. PowerPoint presentation on the study of any two vertebrates from two different classes by students.	30

Suggested Readings:

1. Young, J. Z. (2004).The Life of Vertebrates. 3rd Edition. Oxford University press.
2. Pough F. H. & Janis, C. M. (2018). Vertebrate Life. 10th Edition, Sinauer Associates
3. Verma, P. S. & Jordan, E. L. (2013). Chordate Zoology. 14th edition, S. Chand
4. Kotpal, R. L. (2019). Modern text book of zoology: Vertebrates (Z-3). 5th edition, Rastogi Publications

MAJOR
COMPULSORY
PRINCIPLES OF GENETICS
Code: ZOO-2011
Credit: 3 (T) + 1 (P)

Course Objectives:

Human beings had been applying the principles of genetics by engaging in selective breeding of domesticated animals for many centuries. However, it was only with the work of Mendel and advent of 20th century, that basic principles of the science of genetics were formulated. In about a century of its existence, this field has generated tremendous amount of knowledge through observational and experimental research. The information amassed in the last century has laid the foundation for more discoveries in this important field of life science. This course aims to provide an overview of genetics starting from the work of Mendel to the current understanding of various phenomena like gene mapping, sex determination and mutations. The course will help in building sound fundamental knowledge of the principles of genetics, to be used as a stepping stone for higher studies and research in this field.

Learning Outcomes:

Upon completion of the course, students will be able to:

1. Understand the basic principles of inheritance.
2. Analyze Mendelian Law and gene interactions leading to development of analytical skills and critical thinking enabling the students to present the conclusion of their findings in a scientific manner.
3. Know the mechanisms of mutations, the causative agents and the harmful impact of various chemicals and drugs being used in day-to-day life.
4. Gain knowledge on genetic and environmental basis of sex determination.

MAJOR 1
PRINCIPLES OF GENETICS
Code: ZOO-2011
Credit: 3 (T) + 1 (P)

THEORY	**Hours**
Unit 1: Principles of inheritance, Incomplete dominance and co-dominance; Multiple alleles; Lethal alleles, penetrance and expressivity; Epistasis; Pleiotropy; Sex-linked, sex-influenced and sex-limited characters inheritance and concept of gene. Linkage and crossing over, Cytological basis of crossing over, Recombination frequency as a measure of linkage intensity; Two factor and three factor crosses; Linkage map; coefficient of coincidence and Interference; Gene mapping by Somatic cell hybridization.	15
Unit 2: Gene mutations; Chromosomal aberrations – Deletion, duplication, inversion, translocation, aneuploidy and polyploidy; Induced versus spontaneous	20

mutations; Backward and forward mutations; Suppressor mutations; Molecular basis of mutations in relation to UV light and chemical mutagens; Detection of mutations in *Drosophila*: CLB method, attached *X* method.

Unit 3:	10
Basis of sex determination: Genetic and environmental; Sex determination in *Drosophila* and human; Mechanism of dosage compensation. Comparison of nuclear and extra nuclear inheritance; Organelle inheritance: Antibiotic resistance in *Chlamydomonas*, Mitochondrial mutations in *Saccharomyces* and human disorders, Infective heredity in *Paramecium*. Maternal effects: Shell coiling in *Limnaea*, pigmentations in *Ephestia*. Polygenic inheritance and Transgressive variation	

PRINCIPLES OF GENETICS

Practical	**Hours**
1. To study Mendelian laws and gene interactions and their verification by Chi-square analyses using seeds/beads/*Drosophila*. 2. Study of linkage maps based on data from *Drosophila* crosses. 3. Identification of various mutant types of *Drosophila*(through culture/photomicrograph) 4. Study of human karyotype (normal and abnormal) using photomicrograph. 5. Preparation of polytene chromosomes from *Chironomus/Drosophila* larvae. 6. Preparation of metaphase chromosome from fish/mammal.	30

Suggested Readings:

1. Gardner, E.J., Simmons, M.J., Snustad, D.P. (2008). Principles of Genetics. 8thEdition. Wiley India.
2. Snustad, D.P., Simmons, M.J. (2009). Principles of Genetics. 5thEdition. John Wiley and Sons Inc
3. Klug, W.S., Cummings, M.R., Spencer, C.A. (2020). Concepts of Genetics. 10thEdition. Benjamin Cummings.
4. Russell, P. J. (2009). Genetics- A Molecular Approach. 3rdEdition. Benjamin Cummings.
5. Griffiths, A.J.F., Wessler, S.R., Lewontin, R.C. and Carroll, S.B. Introduction to Genetic Analysis. 9thEdition. W. H. Freeman and Co.
6. Tamarin R. H. (2017). Principles of Genetics. Tata McGraw Hill Edition.
7. Brown, T. A. (2023). Genomes 5. 5th edition, CRC Press

MAJOR
COMPULSORY
ANIMAL TAXONOMY, SYSTEMATICS & BIOSTATISTICS
Code: ZOO-2021
Credit: 3 (T) + 1 (P)

Learning Objectives:

1. To introduce and familiarize the basic concepts of animal systematics
2. To inculcate the importance of taxonomy and nomenclature in biology
3. To provide a framework on understanding interrelationship among taxa
4. To impart knowledge on the theory and practice of phylogeny

Learning Outcomes:

The students will be able to

1. Understand the general principles of taxonomy and systematics
2. Explain the importance of Zoological nomenclature and its rules
3. Understand the importance of systematics in biology and comprehend the taxonomic categories and explain the concept of species
4. Acquire basic knowledge of phylogeny and understand important terminologies to represent phylogenies

MAJOR
COMPULSORY
ANIMAL TAXONOMY, SYSTEMATICS & BIOSTATISTICS
Code: ZOO-2021
Credit: 3 (T) + 1 (P)

THEORY	**Hours**
Unit 1: Animal Taxonomy andSystematics; Taxon and Phenon; Chemotaxonomy and cytotaxonomy and concept of molecular taxonomy Taxonomic categories; concepts of species – typological, nominalistic, biological and evolutionary Taxonomic keys – various types; dichotomous nature of keys Taxonomic characters – morphological, behavioural, ecological, and geographical Zoological Nomenclature – International Code of Zoological Nomenclature (ICZN), Principles, functions, and importance of the Code of nomenclature; principle of priority, homonymy and synonymy, principle of typification and use of types for specimens	30

Unit 2:
Characters (ancestral vs. derived), homology and analogy, parallelism and convergence, monophyly, polyphyly, paraphyly; representing phylogenies – Rooted and unrooted phylogenetic trees; clades; Cladograms and Phenograms

Unit 3: Concept, Importance and Application of Biostatistics Collection and Classification of statistical data, Frequency distribution, Types of presentation of statistical data Measures of central tendency - Mathematical average, Average of position Measures of Partition values Measures of Dispersion - Range, Quartile deviation, Mean deviation, Standard deviation, Co-efficient of Variation, Standard errors Testing of Hypothesis; Confidence Intervals; Chi-square test, student's t-test, Analysis of variance.	15

ANIMAL TAXONOMY, SYSTEMATICS & BIOSTATISTICS

PRACTICAL	**Hours**
1. To identify and distinguish species of insects/fishes/amphibians/reptiles/birds of NE India using appropriate taxonomic keys. 2. Morphometry and meristic study of insect and fish. 3. Preparation and study of skeleton of fish. 4. Preparation, mounting and stuffing of Indian Major Carps. 5. Graphical representation of statistical data with the help of computer (e.g., MS-Excel). 6. Calculation of two-sample t-test for a given set of data. 7. Calculation of F value (ANOVA) for a given set of data. 8. Calculation of Karl Pearson's Coefficient of Correlation for a given set of data. 9. Field visit to any Natural History Museum/Zoo and scientific report preparation and submission.	30

Suggested Readings:

1. Kapoor, V.C. (2019). Theory and Practice of Animal Taxonomy, 8th Edition, Oxford & IBH Publishing.
2. Simpson, G.G. (2012). Principles of Animal Taxonomy, Scientific Publishers (Indian Edition)
3. Mayr, E. (2022). Principles of Systematic Zoology, United Book Prints (Indian Edition)
4. Wiley, E. O. & Lieberman, B. S. (2011). Phylogenetics: Theory and Practice of Phylogenetic Systematics, Wiley Blackwell
5. Zar, J. H. (1999). Biostatistical Analysis, IV Edition, Pearson Education Inc and Dorling Kindersley Publishing Inc.USA.

6. Antonisamy, B., Christopher S. & Samuel, P. P. (2010). Biostatistics: Principles and Practice. Tata McGraw Hill Education Private Limited, India.
Pagana,M.&Gavreau, K.(2000).Principles of Biostatistics, Duxberry Press, USA

DSE-1
ANIMAL PHYSIOLOGY AND ENDOCRINOLOGY
Code: ZOO-2022
Credit: 3 (T) + 1 (P)

Learning Objectives:

1. This course will offer an overview on the functioning of the animal body.
2. It will help students to understand the fundamentals of animal physiology and histological structures.
3. They will understand the concept of homeostasis in response to changes to the outside environment.
4. They will be provided with practical knowledge on investigating the physiological questions, collecting, analysing and interpreting experimental data and applying them in day-to-day life.
5. Further, the students will be encouraged to pursue further studies in physiology and other related courses.

Learning Outcomes:

Upon completion of the course, students will be able to:

1. Understand the principles of normal biological function of the animal body.
2. Understand basic animal physiology and correlate it with the various histological structures.
3. Understand the homeostasis in animals in response to changes in their external environment.
4. Perform practical related to animal physiology.

DSE-2
ANIMAL PHYSIOLOGY AND ENDOCRINOLOGY
Code: ZOO-2023
Credit: 3 (T) + 1 (P)

THEORY	**Hours**
Unit 1: Structure and Function of Epithelial, Connective, Muscular tissues, Characteristics of Muscles, Mechanism of Muscle Stimulation and Contraction Neurons Structure of neurons, Nerve Impulse, physiology of nerve impulse conduction and Propagation, Neuro - Muscular Junction and neurotransmitter in smooth muscle and cardiac muscle. Anatomy of digestive system in mammals, digestive enzymes, digestion and absorption of food stuff.	15

Unit 2: Respiratory Organs in Different Animals, Transport of Oxygen and Carbon dioxide, Respiratory Pigments, Types and structure of heart, Concepts of Neurogenic and Myogenic Hearts, Cardiac cycle, ECG patterns in Mammals, Homeostasis and Blood Clot Formation, Functions of Kidney, Types of Nitrogenous Wastes in Different Animal Groups and their Excretion Urea production – Hans Krebs and Kurt Henseleit cycle, Urine Formation.	15
Unit 3: Endocrine glands of invertebrates and vertebrates, Structure and function of insects' neuroendocrine glands, Hypothalamus and pituitary structures, hormones and its functions. Hypothalamus-hypophyseal blood vessel. Thyroid and parathyroid gland structure in mammal. Endocrine pancreas structure and function Structural Organizations of Adrenals, Functions of Cortical and Medullary Hormones and mechanism of action. Male and female gonads in mammal structure and function.	15

ANIMAL PHYSIOLOGY AND ENDOCRINOLOGY

PRACTICAL	**Hours**
1. Preparation squamous epithelium and striated muscle fibres. 2. Preparation of blood smear and staining techniques 3. Haemoglobin estimation using Sahli's haemoglobinometer. 4. Dissection of insect neuroendocrine system in cockroach 5. Dissect and display of pituitary glands and gonads of fish. 6. Histological study using fish tissues-method of collection, preparation for microtome 7. Examination and detailed study of permanent histological sections of lungs, stomach, duodenum, liver, kidney, pancreas, adrenal, pituitary, thyroid, parathyroid. 8. Study of placoid, cycloid and ctenoid scales through permanent slides/photographs 9. Study of disarticulated skeleton of Frog, Fowl, Rabbit	30

Suggested Readings:

1. Tortora, G.J. and Derrickson, B.H. (2012). Principles of Anatomy and Physiology.XIIIth Edition, John Wiley and Sons, Inc.
2. Hill, R. (2021) Animal Physiology. Sinauer Associates Inc; 5th edition.
3. Widmaier E, Raff H and Strang K. (2013). Vander's Human Physiology: The Mechanism

of Body Functions. XIIIth Edition, McGraw-Hill Education.
4. Guyton, A.C. and Hall, J.E. (2011) Textbook of Medical Physiology. XII Edition, Harcourt Asia Pvt. Ltd/ W.B. Saunders Company.
5. Kesar, S. and Vashisht, N. (2007) Experimental Physiology. Heritage Publishers.
6. Prakash, G. (2012) Lab Manual on Blood Analysis and Medical Diagnostics. S. Chand and Company Ltd
7. Cinnamon, V., Regan J., Russo A.F. (2022) Seelay's Anatomy and Physiology. McGraw Hill Education.

DSE 2
PRINCIPLES OF ECOLOGY & EVOLUTION
Code: ZOO-2023
Credit: 3 (T) + 1 (P)

Course Objectives:

The primary aim of the syllabus is to sensitize the students about the role and importance of nature and ecosystem functioning. The study of Ecology also provides the knowledge about the judicious use of existing ecological resources for sustainable development. Ecology is the only branch of science which explain the ways and means of surviving with nature for mutual benefit. Study of ecology will provide students opportunity to understand its practical aspects and helps them to solve many current ecological issues such as global warming, habitat degradation, habitat loss, desertification and pollution etc. The field training experiences will also enable students to understand the ecosystem functioning and ecology processes in a better way.

Learning Outcomes:

After completion of the course, students will be able to learn about the:

1. Understanding of key concepts in ecology with emphasis on historical perspective, role of physical factors and concept of limiting factors etc.
2. Figure out the population characteristics, population dynamics, growth models and interactions.
3. Recognize the community characteristics, ecosystem development and climax theories.
4. Know about the types of ecosystems, food chains, food webs, energy models, and ecological efficiencies.
5. Apply the basic principles of ecology in wildlife conservation and management.
6. Instill scientific quantitative skills, evaluate experimental design, read graphs, and analyse and use information available in scientific literature.

DSE 2
PRINCIPLES OF ECOLOGY & EVOLUTION
Code: ZOO-2023
Credit: 3 (T) + 1 (P)

THEORY	**Hours**
Unit1: Basic concept of ecology and ecosystem, Autecology, Synecology, Level of organization, Study of physical factors, Laws of limiting factors, Structural	12

components of Ecosystem, Functional attributes of Ecosystem-Trophic structure, food chain, food web, Energy flow, Ecological Pyramids, Ecological Efficiencies; Types of Ecosystems with examples.

Unit2: Definition, Unitary and Modular populations, Population attributes-Abundance, Density, Natality and Mortality, Life table and survivorship curve, Dispersion, Dispersal, Age distribution, Sex ratio, Biotic potential and Environmental resistance, Population growth form-Exponential and Logistic; Population regulation-density dependent and independent factors. Population interactions, Gauss's principle; Definition of community, Community characteristics, Community structure, Ecological succession and types, Theories pertaining to climax community Ecotone and Edge effect.	17
Unit3: Theoriesof origin of life – Chemogenesis,Biogenesis, Experimental evidences Evolutionary theories: Lamarkism, Darwinism and Neo-Darwinism Paleontological evidences of evolution, Geological timescale Natural selection – concept of fitness, selection coefficient, kin selection, sexual selection Population genetics –Concept of speciationand Hardy-Weinberg Law (statement and derivation), concept of gene flow, Natura selection and survival of the fittest – sources of variations and role in evolution, Genetic Drift (Founder's and Bottleneck effect), Role of migration and mutation in changing allelic frequencies Evolution of man	16

PRINCIPLES OF ECOLOGY & EVOLUTION

PRACTICAL	**Hours**
1. Study of life tables and plotting of survivorship curves of different types from thehypothetical/realdataprovided	30
2. Determination of population density by quadratmethod and calculation of Shannon-Weinerdiversityindex in a natural/hypothetical community.	
3. Study of an aquatic ecosystem: the method of phytoplankton and zooplankton collection and identification, measurement of temperature, turbidity, determination of pH, and dissolved oxygencontent(Winkler'smethod),freeCO_2 determination in aquatic environment.	
4. Studyoffossilsfrommodels/pictures	
5. Studyofhomologyandanalogyfromsuitable specimens (insects, birds and mammals)	
6. StudyandverificationofHardy-Weinberg Law byChi-square analysis	
7. Preparation and submission of scientific reportonavisittoNationalPark/BiodiversityPark/Wildlifesanctuary/any other important ecosystems.	

Suggested Readings:

1. Colinvaux, P.A. (1973). Ecology. 2ndEdition. JohnWiley and Sons Inc.
2. Krebs, C. J. (2001). Ecology. 6thEdition. Benjamin Cummings.
3. Odum, E.P. (2008). Fundamentals of Ecology. Indian Edition. Brooks/Cole
4. Smith, R. L., Smith, T.M. (2000). Ecology and field biology Harper and Row publisher
5. Ricklefs, R.E. (2000). Ecology. V Edition. Chiron Pres
6. Hall B.K. & Hallgrimsson B. (2013). Strickberger's Evolution. 5th Edition, Jones and Bartlett Publishers, Inc.
7. Futuyama, D. J. (2017). Evolution. 4thEdition, Sinauer Associates
8. Ridley, M. (2020). Evolution. 2nd edition (South Asia Edition), Oxford University Press.

DSE-3
COMPARATIVEANATOMYOF VERTEBRATES
Code: ZOO-2024
Credit: 3 (T) + 1 (P)

Learning Objectives:

This course aims to provide the undergraduate students a thorough knowledge of structuraldetails and comparativeaccount of thedifferent organ systems ofthebody from lower tohighervertebrates,andprotochordates,thusenablingthemtoappreciatetheincrediblevertebratediversity.Thecoursefurnishesanunderstandingofevolutionarybasisofmorphologicalandanatomicaldifferencesaswellassimilaritiesthatoccuramongvertebrates. Ithelps students propose possiblehomology between structures, and understandhow they evolved as the vertebrates dwelled different habitats. The structural modifications ofdigestive, circulatory, respiratory and skeletal system relate to the distribution of animals intheirdifferentcomfortzonesofhabitatandecologicalniches.Theunderstandingofanatomical details of organ systems of mammals like rat and mice aims to gives the basicinformationfortheiruseinresearchindifferentbranchesofZoology.

Learning Outcomes:

Uponcompletionofthecourse,studentsshouldbeableto:

1. Explaincomparativeaccountofthedifferentvertebratesystems and understand thepatternofvertebrateevolution,organization.
2. Learn the comparative account of integument, skeletal components, their functions andmodificationsindifferentvertebrates.
3. Understandtheevolutionofbrain,senseorgansandexcretoryorganstoacomplex,highlyevolvedforms;
4. Learn to analyse and critically evaluate the structure and functions of vertebrate systems,which helps them to discern the developmental, functional and evolutionary history ofvertebratespecies.

DSE-3
COMPARATIVEANATOMYOF VERTEBRATES
Code: ZOO-2024

Credit: 3 (T) + 1 (P)	
THEORY	**Hours**
Unit1: IntegumentarySystem-Structure,functionsandderivatives. SkeletalSystem- Overviewofaxialandappendicularskeleton,Jawsuspensorium, Visceral arches. Digestivetrack-Alimentary canals and associated glands in vertebrates, dentition in mammals.	15
Unit 2: RespiratorySystem-Skin,gills,lungsandairsacs;Accessoryrespiratoryorgans in vertebrates. Circulatory System-Generalplanofcirculation,comparative anatomyofheartandaorticarches. UrinogenitalSystem-Succession of kidney, Evolution of urinogenital duct	20
Unit 3: NervousSystem-Comparativeaccountofbrain, Autonomicnervoussystem,Spinalcord, Cranialnervesinmammals. SenseOrgans-Classificationofreceptors; Briefaccountofvisualandauditoryreceptorsinman	10

COMPARATIVEANATOMYOF VERTEBRATES	
PRACTICAL	**Hours**
1. Study of types scales in fishes (which is available) and preparation ofpermanentslides. 2. Study of disarticulatedskeletonofFrog/Fowl/Rabbit 3. Study of carapaceplastronand skull ofturtle/tortoise (which is available). 4. Study of mammalian and avianskulls:Oneherbivorousandonecarnivorousanimal 5. Preparation and submission of report on comparative study of internal and external anatomical structure of any vertebrate (excluding IUCN Red listed or scheduled species of W(P)A, 1972).	30

Suggested Readings:

1. Kardong, K.V. (2005) Vertebrates' Comparative Anatomy, Function and Evolution. IV Edition. McGraw-Hill Higher Education
2. Kent, G.C. and Carr R.K. (2000). Comparative Anatomy of the Vertebrates. IX Edition. The McGraw-Hill Companies
3. Hilderbrand, M and Gaslow, G.E. Analysis of Vertebrate Structure, John Wiley and Sons
4. Walter, H.E. and Sayles, L.P. Biology of Vertebrates, Khosla Publishing House

DSE-4

ANIMAL BEHAVIOUR AND CHRONOBIOLOGY

Code: ZOO-2025

Credit: 3 (T) + 1 (P)

Course objectives

1. To create a knowledge base on concepts of animal behaviour
2. To inculcate scientific enquiry on animal cognition and its application in conservation and welfare of animals
3. To develop skills on methods of studying animal behaviour
4. To offer a basic understanding of the subject of chronobiology
5. To highlight the adaptive significance of biological timekeeping in animals

Learning Outcomes:

After the completion of this course, the students will be able to

1. Acquire a comprehensive understanding of the behaviour of animals and gain knowledge on profiles of behavioural biologists and their contributions to the field of animal behaviour.
2. Understand and analyse the causes and patterns of behaviour.
3. Understand the social nature of animals and communication among individuals of animal societiesand utilise scientific methods of studying animal behaviour.
4. Understand basic terms and concepts of chronobiology and comprehend the significance of biological rhythms.

DSE-4

ANIMAL BEHAVIOUR AND CHRONOBIOLOGY

Code: ZOO-2025

Credit: 3 (T) + 1 (P)

THEORY	**Hours**
Unit 1: Origin and history of ethology Patterns of behaviour - instinct vs. learned behaviour; Animal orientation- Taxis vs. Kinesis; Navigation;	20

Proximate and ultimate causes of behaviour Methods of studying behaviour.	
Unit 2: Animal Communication-Dance Language in honey bees; Eusocial organization - honey bee, termite, and ant; Schooling behaviour in fishes; Social behaviour in monkeys.	10
Unit 3: Historical developments; biological oscillations - concept of average, amplitude, phase and period. Biological timekeeping-adaptive significance and importance; Concept of biological rhythms-Circadian, circalunar/infradian and circannual rhythms with example in animal models/humans Phenomenon of bird migration Concept of biological clock: functions in animal systems Concept of zeitgebers; photoperiodand Concept clock genes,sleep-wake cycle.	15

ANIMAL BEHAVIOUR AND CHRONOBIOLOGY	
Practical	**Hours**
1. To study nest and nesting habits of birds/social insects 2. To study geotaxis behaviour in earthworm. 3. To study scan and focal animal sampling in waterbirds/mammals. 4. To study circadian functions in human with special reference to body temperature. 5. To study behavioural activities of animals in home/backyard/locally available wild/domestic animals and prepare a short report.	30

Suggested Readings:

1. Manning, A. & Dawkins, M. S. (2012). An Introduction to Animal Behaviour. Cambridge University Press, 6th edition.
2. Barnard, C. (2003). Animal Behaviour: Mechanism, Development, Function and Evolution. Pearson, 1st edition.
3. Lehner, P. N. (1996). Handbook of Ethological Methods. Cambridge University Press, 2nd edition
4. Kumar, V. (2017). Biological Timekeeping: Clocks, Rhythms and Behaviour. Springer, 1st edition

DSE 5
PARASITOLOGY
Code: ZOO-2026
Credit: 3 (T) + 1 (P)

Course Objectives:
To skill the students to visualize, appreciate and understand the diversity of parasites in the animal kingdom.
To make the students aware about the possible scopes of the subject including research and applied aspects
To diagnose medical parasites correctly, understand their life cycle and effective control
To use some of parasites as possible biocontrol agents

Learning Outcomes:
After completion of the course the students will be able to:

1. Understand the variation among parasites, parasitic invasion with special reference to medical and agricultural aspects.
2. Help to know the stages of the life cycle of parasites and their respective infective stages.
3. Develop skills and realize significance of diagnosis of parasitic attack and treatment of host.
4. Mapping of the parasites available in regional/national importance/zoonotic diseases

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DSE 5
PARASITOLOGY
Code: ZOO-2026
Credit: 3 (T) + 1 (P)

THEORY	**Hours**
Unit 1: Brief introduction of Parasitism; Parasite, Parasitoid and Vectors; Host-parasite relationship; types of parasites and hosts; evolution of parasitism Study of Morphology, Life Cycle, Prevalence, Epidemiology, Pathogenicity, Diagnosis, Prophylaxis and Treatment of *Trypanosoma gambiense, Leishmania donovani*and*Plasmodium*	12

Unit 2: Study of Morphology, Life Cycle, Prevalence, Epidemiology, Pathogenicity, Diagnosis, Prophylaxis and Treatment of *Schistosoma haematobium, Taenia solium*and *Hymenolepis nana.* Study of Morphology, Life Cycle, Prevalence, Epidemiology, Pathogenicity of *Ascaris lumbricoides*, *Ancylostoma duodenale*, *Wuchereriabancrofti*and *Trichinella spiralis*	21
Unit 3: External parasites in domesticated animals with examples (cattle, goat, sheep, buffalo and dogs), control of ticks, mites, *Pediculus humanus*(Head and Body louse),*Xenopsylla cheopis*and *Cimex lectularius* A brief account of parasitic vertebrates – Candiru and Vampire bat	12

PARASITOLOGY

Practical	**Hours**
1. Study of life stages of *Entamoeba histolytica*, *Giardia intestinalis, Trypanosoma gambiense, Leishmania donovani*and *Plasmodium vivax* through permanent slides/photographs. 2. Study of adult and life stages of *Fasciolopsishaepatica, Schistosoma haematobium, Taenia solium*and *Hymenolepis nana* through permanent slides/photographs. 3. Study of adult and life stages of *Ascaris lumbricoides, Ancylostoma duodenale, Wuchereriabancrofti*and *Trichinella spiralis* through permanent slides 4. Study and preparation of scientific report of any two common protozoan/ helminth/ arthropod parasites 5. Study of *Pediculus humanus*(Head louse and Body louse), *Xenopsylla cheopis*and *Cimex lectularius* through permanent slides/ photographs. 6. Study of nematode/cestode parasites from fish or intestine of poultry birds/pigs. 7. Submission of at least two arthropod parasites.	30

Suggested readings:

1. Chernin, J. (2000). Parasitology. Taylor & Francis Group.
2. Arora, D. R and Arora, B. B. (2018) Medical Parasitology. 5th Edition, CBS Publications and Distributors Pvt Ltd
3. Noble, E.R. and Noble, G.A. (1982) Parasitology: The Biology of Animal Parasites. 5th Edition, Lea &Febiger
4. Ahmed, N., Dawson, M., Smith, C. and Wood, Ed. (2007) Biology of Disease. Taylor and Francis Group
5. Taylor, M. A., Coop, R. L., & Wall, R. L. (2016). Veterinary Parasitology. 4th edition, Wiley Blackwell
6. Loker, E. S. &Hofkin, B. V. (2015). Parasitology – A conceptual approach. Taylor & Francis Group

MAJOR
COMPULSORY
FUNDAMENTALS OF BIOCHEMISTRY
Code: ZOO-3011
Credit: 3 (T) + 1 (P)

Learning Objectives:
This course offers a basic insight about the biomolecules, its structure and function. Further the students will be provided with practical knowledge which can be applied to understand the chemistry of the biomolecules. It will also encourage students to pursue core biochemistry related fields as well as multi-disciplinary subject for better understanding of biochemistry in research.

Learning Outcomes:
Upon completion of this course, students will be able to understand the basic principle, structure and function of biomolecules like carbohydrates, proteins and nucleic acids. They will also be able to understand the role of these molecules in the functioning of animal systems. The students will learn about the characteristics, kinetics, regulation and inhibition of enzymes-the biological catalysts and as such will have a brief overview of the biochemical system of the body. Additionally, they will also gain practical knowledge about the different functional groups present in these molecules.

MAJOR
COMPULSORY
FUNDAMENTALS OF BIOCHEMISTRY
Code: ZOO-3011
Credit: 3 (T) + 1 (P)

THEORY	**Hours**
Unit1: Carbohydrates: Structure and Biological importance: Monosaccharides, Disaccharides, Polysaccharides and Glycoconjugates Lipids: Structure and Significance: Physiologically important saturated and unsaturated fatty acids, Tri-acylglycerols, Phospholipids, Glycolipids, Steroids	15
Unit 2: Amino acids: Structure, Classification and General properties of α- amino acids; Physiological importance of essential and non-essential α- amino acids. Proteins: Bonds stabilizing protein structure; Levels of organization in proteins; Denaturation; Introduction to simple and conjugate proteins.	15

Nucleic Acids: Structure: Purines and pyrimidines, Nucleosides, Nucleotides, Nucleic acids Cot Curves: Base pairing, Denaturation and Renaturation of DNA. Types of DNA and RNA, Complementarity of DNA**.**	
Unit 3:	15
Nomenclature and classification; Cofactors; Specificity of enzyme action; Isozymes; Mechanism of enzyme action; Enzyme kinetics; Factors affecting rate of enzyme-catalyzed reactions; Derivation of Michaelis-Menten equation, Concept of Km and Vmax, Regulation of enzyme action and Different types of Enzyme Inhibition (Competitive, Non-competitive and Uncompetitive Inhibition).	

FUNDAMENTALS OF BIOCHEMISTRY

Practical	**Hours**
1. Qualitative tests of functional groups in carbohydrates, proteins and lipids. 2. To determine the iodine number of given oil/fat. 3. Estimation of a reducing sugar in a given sample. 4. To find the pKa value of acetic acid. 5. To study the activity of Salivary Amylase and Determination of Amylase Number. 6. To study the absorption spectrum of proteins and DNA. 7. Demonstration of proteins separation by SDS-PAGE.	30

Suggested Readings:

1. Cox, M.M and Nelson, D.L. (2008). Lehninger's Principles of Biochemistry, V Edition, W.H. Freeman and Co., NewYork.
2. Berg,J.M.,Tymoczko,J.L.andStryer,L.(2007).Biochemistry,VIEdition,
3. W.H. Freeman and Co., New York. Murray,R.K.,Bender,D.A.,Botham,K.M.,Kennelly,P.J.,Rodwell.
4. V.W.and Well, P.A. (2009). Harper's Illustrated Biochemistry, XXVIII Edition, International Edition, The McGraw- Hill CompaniesInc.
5. Hames, B.D. and Hooper, N.M. (2000). Instant Notes in Biochemistry, II Edition, BIOS Scientific Publishers Ltd.,U.K.
6. Watson, J.D., Baker, T.A., Bell, S.P., Gann, A., Levine, M. and Losick, R. (2008). Molecular Biology of the Gene, VI Edition, Cold Spring Harbor Lab. Press, PearsonPub.
7. Das M, Dutta A and Kalita A (2022). Advanced Biochemistry. Kalyani Publications.

DSE 6
BIOCHEMISTRY OF METABOLIC PROCESSES AND REGULATION
Code: ZOO-3012
Credit: 3 (T) + 1 (P)

Course Objectives:

1. This course will give the students a brief overview of both catabolic and anabolic processes.
2. It will give them a better understanding of the various reactions involved in the process of carbohydrate, protein and lipid metabolism.
3. It will help in understanding the process of energy production in our body by the mitochondrial respiratory chain.
4. Give them practical knowledge on the various methods and assays used to understand the metabolic processes.
5. Encourage them to take up further studies on understanding the metabolic processes of the body.

Learning Outcomes:

Upon completion of the course, students will be able to:

1. Understand the principles of catabolic and anabolic processes.
2. Understand carbohydrate, protein and lipid metabolism and correlate it practical observations.
3. Understand the process of energy production in the body.
4. Perform practicals related to metabolic processes.

DSE 6
BIOCHEMISTRY OF METABOLIC PROCESSES AND REGULATION
Code: ZOO-3012
Credit: 3 (T) + 1 (P)

THEORY	**Hours**
Unit 1: Catabolism vs. Anabolism, ATP as "Energy Currency of cell"; coupled	15

reactions; Use of reducing equivalents and cofactors.

Unit 2: Sequence of reactions and regulation of glycolysis, Citric acid cycle, Phosphate pentose pathway, Gluconeogenesis, Glycogenolysis and Glycogenesis Redox systems; Mitochondrial respiratory chain, Inhibitors and un-couplers of Electron Transport System	20
Unit 3: β-oxidation and omega-oxidation of saturated fatty acids with even and odd number of carbon atoms; Ketogenesis Catabolism of amino acids: Transamination, Deamination, Urea cycle.	10

BIOCHEMISTRY OF METABOLIC PROCESSES AND REGULATION

Practical	Hours
1. Estimation of total protein in given solutions by Lowry'smethod.	30
2. Extraction of lipids from insect.	
3. Spectrophotometric analysis of lipids using Sulpho-Phospho-Vaniline.	
4. Detection of SGOT and SGPT in serum/tissue	
5. To perform the Acid and Alkaline phosphatase assay from serum/tissue.	
6. Determination of Urea in Urine sample.	

Suggested Readings:

1. Cox, M.M and Nelson, D.L. (2008). Lehninger Principles of Biochemistry, V Edition, W.H. Freeman and Co., NewYork.
2. Berg,J.M.,Tymoczko,J.L.andStryer,L.(2007).Biochemistry,VIEdition, W.H. Freeman and Co., New York.
3. Murray, R.K., Bender, D.A., Botham, K.M., Kennelly, P.J., Rodwell, V.W. and Well, P.A. (2009). Harper's Illustrated Biochemistry, XXVIII Edition, International Edition, The McGraw-Hill CompaniesInc.
4. Hames, B.D. and Hooper, N.M. (2000). Instant Notes in Biochemistry, II Edition, BIOS Scientific Publishers Ltd.,U.K.

DSE 7
ENTOMOLOGY AND FISHERIES
Code: ZOO-3013
Credit: 3 (T) + 1 (P)

Course objectives:

Insects are the most successful group of organisms on earth with some unique attributes. These diverse group of organisms alone comprises 80% of all animal species with 450 million years of existential history. They dominantly occupy all the spheres of earth except deep sea. The course will give an overview of diverse insects' species and their basis of classification, morphological structures and some beneficial and harmful role of insects.

1. To provide practical and academic skills in identifying important freshwater fish groups of northeast India
2. To provide basic concepts on the biology of fishes
3. To create a knowledge base on fisheries resources of India
4. To inculcate the scope and importance of aquaculture and fisheries in research as well as applied aspects

Learning Outcomes:

Upon completion of the course, the students will be able to:

1. Identify different insects and classify them based on their morphological characters
2. Get an idea about diversity and causes of success of insects on earth
3. Familiar with the best body design in simpler form
4. Get concept on the common vectors of human diseases and common phytophagous pests
5. Identify and characterize economically important freshwater fishes of NE India
6. Acquire basic knowledge on morphology and physiology of fishes
7. Compare and contrast capture fisheries resources of India
8. Understand the utility and application of different fishing gears
9. Understand the rules and regulations governing Indian capture fisheries
10. Gain knowledge on the impact of climate change on fisheries
11. Understand methods and types of culture fisheries
12. Demonstrate the induced breeding of Indian Major Carps including collection and preservation of fish pituitary gland, and broodstock and hatchery management
13. Acquire practical knowledge on the role soil and water quality in aquaculture
14. Identify the importance of fish as a model organism in research

DSE 7
ENTOMOLOGY AND FISHERIES
Code: ZOO-3013
Credit: 3 (T) + 1 (P)

THEORY	**Hours**
Unit 1: General Features of Insects, Classification of insects up to orders, causes of success of insects on earth, role of insects in pollination, Basic concept on collection, preservation and culture techniques of insects General Morphology of insects -compound Eyes, antennae, Mouth parts and legs. Structure of integument. Molting and metamorphosis. Insects as Vectors & Pest: Insects as mechanical and biological vectors of pathogens and parasites, Common insect vectors (Aedes, Culex, Anopheles, Phlebotomus, Musca domestica), Insects as plant pests.	23
Unit 2: Introduction to fish - General description of a fish; Account of systematic classification of freshwater teleosts of NE India (up to Order) Morphology and Physiology - Types of fins and their modifications; Locomotion in fishes; Types of Scales; Structure and functions of Gills, basic mechanism of gas exchange; Swim Bladder - types, role in Respiration and buoyancy; Osmoregulation in Elasmobranchs; Electric organs	09
Unit 3: **Capture Fisheries** - Inland Capture Fisheries resources of India; marine fisheries; Fishing crafts and Gears; Application of remote sensing and GIS in fisheries; Fisheries rules and regulations; Climate change and its impact on fisheries; Fishery by-products **Culture fisheries** - Extensive, semi-intensive and intensive culture of fish; Pen and cage culture; Polyculture; Composite fish culture; Brood stock management; Induced breeding of Indian Major Carps; Management of hatcheries; Role of soil and water quality in aquaculture **Fish in research** - Transgenic fish, Zebrafish as a model organism in research	13

ENTOMOLOGY AND FISHERIES

Practical	Hours
1. Study of different types of mouth parts/ antenna of insects through slides/specimens.	30
2. Study of insect vectors through permanent slides or photographs or model: *Aedes, Culex, Anopheles*, *Pediculus*, *Cimex*, *Phlebotomus* (sand fly), and *Musca domestica* (house fly).	
3. Preparation of project report on any one vector and diseases transmitted by the vector (*Aedes/Culex/Anopheles*/ lice/ bed bug, sand fly/ house fly).	
4. Identification of insects belonging to different orders, common insect pest of paddy, tea, stored grain, citrus and sugarcane.	
5. Classification and characterization of commercially important food and ornamental fishes of NE India.	
6. Study of different types of indigenous/locally available fishing gears.	
7. Estimation and interpretation of pH of pond soil; dissolved oxygen (D.O.) and free carbon dioxide (fCO_2) in pond water.	
8. Dissection and display of Pituitary Gland of Indian Major Carp.	
9. Demonstration of induced breeding of IMCs (video)	

Suggested Readings:

1. Pradhan, S. (1969). Insect Pests of Crops. National Book Trust, India Book House.
2. Atwal, A.S. (1993) Agricultural pest of India and South East Asia. Kalyani Pub., New Delhi.
3. Chapman, R. F. The Insects: Structure and Function. Cambridge University Press, UK
4. S. Hill. (2005) Agricultural Insect pests of the tropics and their management, Cambridge University press.
5. Pedigo L. P. (2002). Entomology and Pest Management, Prentice Hall Publication
6. Tembhare, D.B. Modern Entomology
7. David, B.V. and Ananthakrishnan (2004). General and Applied Entomology.
8. Bone, Q. & Moore, R. H. (2008). Biology of Fishes. 3rd edition, Taylor & Francis
9. Evans, D. H., Claiborne, J. B. & Curie, S. (2014). The Physiology of Fishes. 4th edition, CRC Press
10. Handbook of Fisheries and Aquaculture (2013). Published by the Indian Council of Agricultural Research, New Delhi
11. Khanna, S. S. & Singh, H. R. (2014). Textbook of Fish Biology and Fisheries. 3rd edition, Narendra Publishing House
12. Jayaram, K. C. (2010). The Freshwater Fishes of the Indian Region. 2nd edition, Narendra Publishing House
13. Vishwanath, W. (2021). Freshwater Fishes of the Eastern Himalayas. 1st edition, Elsevier

DSE 8
IMMUNOLOGY
Code: ZOO-3014
Credit: 3 (T) + 1 (P)

Learning Objectives:

1. This course will give the students a brief overview on the cells and organs of the immune system.
2. It will give them a better understanding about antigens, antibodies and their use as tools for research.
3. It will help in better understanding the functioning of the immune system and the role of vaccines in preventing diseases.
4. Give them practical knowledge on the immune system and its functioning in mammals.
5. Encourage them to take up further studies on the topics related to immunology.

Learning Outcomes:

Upon completion of the course, students will be able to:

1. Understand about the various cells and organs of the immune system.
2. Understand the concepts of antigens, antibodies and their interactions.
3. Gain knowledge on the functioning of the immune system and the role of vaccines in preventing diseases.
4. Perform practicals related to immunology and its functioning in mammals.

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DSE 8
IMMUNOLOGY
Code: ZOO-3014
Credit: 3 (T) + 1 (P)

THEORY	**Hours**
Unit 1: Introduction to basic concepts of immunology; components of immune system; principles of innate and adaptive immune system. Haematopoiesis, Cells of immune system and organs (primary and secondary lymphoid organs) of the immune system	15
Unit 2: Basic properties of antigens, B and T cell epitopes, haptens and adjuvants. Structure, classes and function of antibodies, monoclonal antibodies, antigen antibody interactions as tools for research and diagnosis	20
Unit 3: Structure and functions of MHC, exogenous and endogenous pathways of antigen presentation and processing, basic properties and functions of cytokines, Complement system: Components and pathways. General introduction to vaccines, various types of vaccines.	10

IMMUNOLOGY

Practical	**Hours**
1. Histological study of spleen, thymus and lymph nodes through slides/ photographs. 2. Preparation of stained blood film to study various types of blood cells. 3. ABO blood group and Rh factor determination. 4. Demonstration of- a) ELISA; b) Immunoelectrophoresis 5. Isolation of lymphocytes from blood.	30

Suggested Readings:

1. Kindt, T. J., Goldsby, R.A., Osborne, B. A. and Kuby, J (2006). Immunology, VI Edition. W.H. Freeman and Company.
2. David, M., Jonathan, B., David, R. B. and Ivan R. (2006). Immunology, VII Edition, Mosby, Elsevier Publication.
3. Abbas, K. Abul and Lechtman H. Andrew (2003.) Cellular and Molecular Immunology. V Edition. Saunders Publication.

DSE 9
REPRODUCTIVE BIOLOGY
Code: ZOO-3015
Credit: 3 (T) + 1 (P)

Course Objectives:

1. This course will give the students a brief overview on the reproductive endocrinology of mammals.
2. It will give them a better understanding about the functional anatomy of the male reproductive system and the various hormones and processes involved in it.
3. It will help in better understanding the functional anatomy of the female reproductive system and the various hormones and processes involved in it.
4. Give them practical knowledge on the reproductive biology of mammals.
5. Encourage them to take up further studies on the topics related to reproductive biology.

Learning Outcomes:

Upon completion of the course, students will be able to:

1. Understand about the process of reproductive endocrinology in mammals.
2. Understand the functional anatomy of male and female reproductive systems in mammals.
3. Gain knowledge on the various hormones involved in the process of reproduction

and also the roles that they perform in the body.

4. Perform practicals related to understanding the reproductive biology in mammals.

DSE 9
REPRODUCTIVE BIOLOGY
Code: ZOO-3015
Credit: 3 (T) + 1 (P)

THEORY	**Hours**
Unit 1: Gonadal hormones and mechanism of hormone action, steroids, glycoprotein hormones and prostaglandins, hypothalamo–hypophyseal–gonadal axis, regulation of gonadotrophin secretion in male and female; Reproductive System: Development and differentiation of gonads, genital ducts, external genitalia, mechanism of sex differentiation.	15
Unit 2: Outline and histological study of male reproductive system in rat and human; Testis: Cellular functions, germ cell, system cell renewal Spermatogenesis: kinetics and hormonal regulation; Androgen synthesis and metabolism; Epididymal function and sperm maturation; Accessory glands functions; Sperm transportation in male tract	20
Unit 3: Outline and histological of female reproductive system in rat and human; Ovary: folliculogenesis, ovulation, corpus luteum formation and regression; Steroidogenesis and secretion of ovarian hormones; Reproductive cycles (rat and human) and their regulation, changes in the female tract; Fertilization, implantation and pregnancy in mammals	10

REPRODUCTIVE BIOLOGY
Credit: 3 (T) + 1 (P)

Practical	**Hours**
1. Study of estrous cycle in rat/mice. 2. Study of histological sections from photomicrographs/ permanent slides of rat/human: testis, epididymis and accessory glands of male reproductive systems. 3. Study of histological sections from photomicrographs/ permanent slides of sections of ovary, fallopian tube, uterus (proliferative and secretory	30

stages), cervix and vagina.

4. Total sperm count and determination of sperm motility in mammal

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Suggested Readings:

1. Austin,C.R.and Short,R.V. ReproductioninMammals. Cambridge University Press.
2. Degroot,L.J.andJameson,J.L. (eds).Endocrinology. W.B. Saunders and Company.
3. Knobil,E.etal.(eds).ThePhysiology of Reproduction. Raven Press Ltd.
4. Hatcher, R.A. et al. The Essentials of Contraceptive Technology. Population Information Programme.
5. Johnson, M.H. (2018). Essential Reproduction, Wiley-Blackwell, 8th Edition
6. Zarrow, M. (1964). Experimental Endocrinology-A source book of basic techniques, Elsevier, 1st Edition

DSE 10
MOLECULAR BIOLOGY
Code: ZOO-3016
Credit: 3 (T) + 1 (P)

Course Objectives:

1. Students will learn about different types of nucleic acids, their structures and mechanism of DNA replication.
2. The students will learn about the mechanism of transcription and translation and processing of RNA in both prokaryotes and eukaryotes.
3. Students will be able to learn about the mechanism of transcriptional regulation and importance of RNA interference technology
4. Students will learn about different types of DNA damage and their repair mechanism.

Learning Outcomes:

Upon completion of the course, students will be able to:

1. Students will able to appreciate how structure of DNA was discovered and how their structures are influenced by both internal and external factors.
2. Students will also able to understand why DNA synthesis is always occurs in 5'-3' direction. The students will also understand how processing of RNA protects and regulate theie translation.

3. Students will understand the basic of interaction of different polymerase with the nucleic acids and how their functions are enhanced or suppressed by different cofactors.
4. Students will understand what factors causes damages to the DNA and how cellular repair mechanism prevent and repair such damage to DNA.

DSE 10
MOLECULAR BIOLOGY
Code: ZOO-3016
Credit: 3 (T) + 1 (P)

THEORY	**Hours**
Unit 1: Nucleic Acids: Structure and types of DNA and RNA, Watson and Crick model of DNA. DNA Replication: Enzymes used in DNA Replication, DNA Replication in prokaryotes and eukaryotes, mechanism of DNA replication, Semi-conservative, bidirectional and semi-discontinuous replication, Telomere and replication of telomeres	15
Unit 2: Transcription: RNA polymerase structure and transcriptional Unit, mechanism of transcription in prokaryotes and eukaryotes Post Transcriptional Modifications and Processing of Eukaryotic RNA: Split genes: concept of introns and exons, splicing mechanism and alternative splicing Translation: Genetic code, Degeneracy of the genetic code and Wobble Hypothesis; aminoacyl tRNA synthetases and charging of tRNA; Proteins involved in initiation, elongation and termination of polypeptide chain; Mechanism of translation, Inhibitors of protein synthesis	15
Unit 3: Regulation of gene expression: Operon concept, Transcription regulation in prokaryotes (lac operon and tryptophan operon) Transcription regulation in eukaryotes: Activators, repressors, enhancers, silencer elements; Gene silencing and Genetic imprinting. DNA Damage and Repair Mechanisms RNA interference	15

MOLECULAR BIOLOGY

Practical	**Hours**
1. Study of Polytene chromosomes from Chironomous / Drosophila larvae **2.** Preparation of metaphase chromosome from the bone marrow of mice **3.** Quantitative estimation DNA using colorimeter (Diphenylamine reagent)	30

4. Quantitative estimation of RNA using Orcinol reaction
5. Isolation of DNA from tissues and qualitative analysis by agarose gel electrophoresis.
6. Study and interpretation of electron micrographs/ photograph showing: DNA replication, Transcription and Split genes

Suggested Readings:

1. Cooper, G. M. (2018). 8th Edition. The cell: A molecular approach. Massachusetts, USA: Sinauer Associates. ISBN-13:978-1605357072
2. Alberts, B et al. (2014). 6th edition. Molecular Biology of the Cell. W. W. Norton & Company. ISBN-13 : 978-0815345244
3. Lodish H et al. (2003). 5th Revised edition. Molecular Cell Biology. W.H.Freeman& Co Ltd; ISBN13 : 978-0716743668
4. Karp, G. (2019). 9th Edition. Cell and molecular biology: New Jersey, USA: Wiley Publishers. ISBN-978—1-119-59816-9
5. Brown, T. A. (2020). 8thEdition. Gene cloning and DNA analysis: An introduction. New York, USA: John Wiley and Sons, ISBN-13: 978-1119640783.

MAJOR
COMPUSORY
CELL BIOLOGY
Code: ZOO-3021
Credit: 3 (T) + 1 (P)

Course Objectives:

1. Structure and functions of various cellular compartments and organelles
2. Cell growth, cell-division and cell-cycle control mechanisms.
3. Cell to cell communication and mechanism of signal transduction across the cellular target.
4. Cell death and mechanism

Learning Outcomes:

Uponcompletionofthecourse,studentsshouldtobeableto:

1. Students will learn about different cell types.
2. Students will acquire knowledge about the composition of cells and cellular compartments and detail study about the functioning of these organelles.
3. Students will acquire knowledge about cellular energetic and concept of protein sorting
4. Students will learn about the different level of DNA packaging within the cells and also learn about different types of chromosomes.

5. Students will learn about the growth and cellular division, communication among different cells and mode of cellular homeostasis by apoptosis and necrosis.

MAJOR
COMPULSORY
CELL BIOLOGY
Code: ZOO-3021
Credit: 3 (T) + 1 (P)

THEORY	**Hours**
Unit 1 **Over view of Cells**: Prokaryotic and Eukaryotic cells, Virus, Viroids, Mycoplasma, Prions. **Plasma Membrane:** Various models of plasma membrane structure, Transport across membranes: Active and Passive transport, facilitated transport, Types of transporters **Cell junctions:** Structure and functions of Tight junctions, Desmosomes, Gap junctions **Endomembrane System**: Structure and Functions of Endoplasmic Reticulum, Golgi Apparatus and Lysosomes	15
Unit 2 **Mitochondria:** Structure, Semi-autonomous nature, Endosymbiotic hypothesis, Mitochondrial Respiratory Chain, Chemi-osmotic hypothesis **Peroxisomes:** Structure and functions **Cytoskeleton**: Structure and Functions of Microtubules, Microfilaments and Intermediate filaments, Cillia and flagella **Nucleus**: Structure of Nucleus (Nuclear envelope, Nuclear pore complex, Nucleolus)	15
Unit 3 **Chromosomes:** Giant chromosome (Polytene and lampbrush), Types of eukaryotic chromosomes based on centromeres, Euchromatin and Hetrochromatin, DNA packaging within the nucleus (nucleosome model) **Cell Division**: Mitosis, Meiosis, Cell cycle and its regulation **Cell to Cell communications:** Types of signalling molecules, Cell surface receptors and its types, second messengers, Mechanism of signal transductions of peptide and steroid hormones. **Cell Deaths:** Necrosis and apoptosis, significance of apoptosis in cellular homeostasis, Mechanism of apoptosis	15

CELL BIOLOGY

Practical	**Hours**
1. Preparation of temporary stained squash of onion root tip to study various stages of mitosis	30

2. Study of various stages of meiosis in testis (Grasshopper/Cockroaches/Mice/Rat).
3. Preparation of permanent slide to show the presence of Barr body in human female blood cells/cheek cells.
4. Preparation of permanent slide of blood and study of different types of blood cells
5. Preparation of histological slides from tissues as liver, Lung, Stomach, Intestine, Kidney, Pancreas, Testes and Ovary.
6. Preparation of permanent slide for cytochemical demonstration of
    a. DNA by Feulgen reaction
    b. Mucopolysaccharides and Glycogen by PAS reaction
    c. Proteins by Mercuro bromophenol blue/FastGreen
    d. Lipid by Sudan black B

Suggested Readings:

1. Cooper, G. M. (2018). 8th Edition. The cell: A molecular approach. Massachusetts, USA: Sinauer Associates. ISBN-13:978-1605357072
2. Alberts, B et al. (2014). 6th edition. Molecular Biology of the Cell. W. W. Norton & Company. ISBN-13 : 978-0815345244
3. Lodish H et al. (2003). 5th Revised edition. Molecular Cell Biology. W.H.Freeman& Co Ltd; ISBN13 : 978-0716743668
4. Hardin, J. Bertoni, G. P. Kleinsmith, L.J. and Becker, W.M. (2016). 9th Edition. The world of the cell. San Francisco, USA: Benjamin Cummings Publishers, ISBN-13: 978 -0321934925.
5. Karp, G. (2019). 9th Edition. Cell and molecular biology: New Jersey, USA: Wiley Publishers. ISBN-978—1-119-59816-9

DSE 11
DEVELOPMENTAL BIOLOGY
Code: ZOO-3022
Credit: 3 (T) + 1 (P)

Course Objectives:

1. Students will be given an exposure to gametogenesis and different types of fertilization.
2. Students will learn about the course of development after fertilization and development of different organs.
3. Students will learn about the post embryonic development, metamorphosis and teratogenesis.

Students will learn about in vitro fertilization.

Learning Outcomes:

Upon completion of the course, students will be able to:

1. The students will be able to understand about the role of mitosis and meiosis cell division, cellular differentiation during gametogenesis.
2. The students will be able to understand how fertilization happens and the factors that affect fertilization event.
3. The students will be given exposure to understand the basic embryonic development and organogenesis.
4. The students will be able to understand the role different hormones and of cellular

signalling during development through metamorphosis and teratogenesis.

5. The students will learn and appreciate the importance of IVF, amniocentesis and embryonic stem cells.

DSE 11
DEVELOPMENTAL BIOLOGY
Code: ZOO-3022
Credit: 3 (T) + 1 (P)

THEORY	**Hours**
Unit 1: Spermatogenesis and Oogenesis Type of animal eggs, egg membrane and vitellogenesis, Fertilization**:** External and internal fertilization**,** sperm-egg interactions, biochemical events, post-fertilizations events. Parthenogenesis: Natural haploid, diploid and cyclic parthenogenesis. Artificial stimulus for parthenogenesis and its significance.	15
Unit 2: Planes and patterns of cleavage; Types of Blastula; Embryonic induction and Organizer, Fate map construction in frog and chick. Organogenesis:Development of heart and eye in vertebrates Development of chick embryo up to three germ layer formation. Extra embryonic membranes in bird and mammal.	15
Unit 3: **Placenta:** Types, function and physiology **Metamorphosis: types of metamorphosis, metamorphic changes**, hormonal regulations of metamorphosis in insects and amphibians. **Teratogenesis:** Teratogenic agents and their effects on embryonic development In vitro fertilization, Embryonic Stem cell (ESC), Amniocentesis.	15

DEVELOPMENTAL BIOLOGY

Practical	**Hours**
1. Collection and study of different type of eggs 2. Examination of gametes of frog/rat/mice: Sperm and ova through permanent slides or photomicrographs. 3. Study of developmental stages of Frog: Whole mounts and sections through permanent slides of cleavage stages, blastula, gastrula, neurula, tail bud stage, tadpole external and internal gill stages. 4. Study of developmental stages of Chick embryo: Whole mounts of chick through permanent slides (Hamburger and Hamilton Stages): Stage 3 (Intermediate Streak, 13 hours), Stage 4 (Definitive Streak, 18 hours), Stage 5 (Head Process, 21 hours), Stage 7 (24 hours), Stage 8	30

(28 hours), Stage10 (33 hours), Stage 11 (40 hours), Stage 13 (48 hours), Stage 19 (72 hours) and Stage 24 (96 hours) of incubation
5. Study of different types of placenta: Histological sections through permanent slides or photomicrographs.

Suggested Readings:

1. Gilbert, Scott F. *Developmental Biology*. 7th ed. Sunderland, MA: Sinauer Associates, 2003. ISBN: 9780878932580.
2. Wolpert, Lewis. *Principles of Development*. 2nd ed. New York, NY: Oxford University Press, 2001. ISBN: 9780198792918.
3. Kalthoff, Klaus. *Analysis of Biological Development*. 2nd ed. Boston, MA: McGraw-Hill, 2001. ISBN: 0071180788.
4. Slack, J. M. W. *Essential Developmental Biology*. Malden, MA: Blackwell Science, 2001. ISBN: 9780632052332.
5. Bier, Ethan. *The Coiled Spring: How Life Begins*. Plainview, NY: Cold Spring Harbor Laboratory Press, 2000. ISBN 9780879695637.
6. Gerhart, John, and Marc Kirschner. *Cells, Embryos, and Evolution: Toward a Cellular and Developmental Understanding of Phenotypic Variation and Evolutionary Adaptability*. Malden, MA: Blackwell Science, 1997. ISBN: 9780865425743.
7. Russo, V. E. A., et al., eds. *Development: Genetics, Epigenetics, and Environmental Regulation*. New York, NY: Springer, 1999. ISBN: 9783540627548.
8. Arias, Alfonso Martinez, and Alison Stewart. *Molecular Principles of Animal Development*. New York, NY: Oxford University Press, 2002. ISBN: 9780198792840.
9. Rao, Mahendra S., and Marcus Jacobson, eds. *Developmental Neurobiology*. 4th ed. New York, NY: Springer-Verlag, 2005. ISBN: 9780306483301.

DSE 12
WILDLIFE CONSERVATION AND MANAGEMENT
Code: ZOO-3023
Credit: 3 (T) + 1 (P)

Course Objectives:

The Discipline Specific Paper on Wildlife Conservation and Management is designed to acquaint students with varied aspects of wildlife conservation, including its importance, major threats, and management of their habitats and populations. The emphasis will be on developing interest and invoking a sense of responsibility among students toward wildlife conservation. The course also explores different techniques, perspectives, and approaches to both identify and achieve wildlife management goals. This course will motivate students to pursue careers in the field of wildlife conservation and management.

Learning Outcomes:

Upon completion of the course, students will be able to:

1. Become aware of the importance of wildlife in general, and its conservation and management in particular.
2. Comprehend the application of the principles of ecology and animal behaviour to formulate strategies for the management of wildlife populations and their

habitats.

3. Understand the management practices required to achieve a healthy ecosystem for wildlife populations along with an emphasis on conservation and restoration.
4. Know the key factors for the loss of wildlife and important strategies for their in-situ and ex-situ conservation.
5. Recognize the techniques for estimation, remote sensing, and Global Position Tracking for wildlife.
6. Gain knowledge about wildlife diseases and quarantine policies.
7. Know about the Protected Area Networks in India, Ecotourism, Ecology of perturbation, and Climax persistence.
8. Perform critical thinking, literature review; scientific writing as well as presentations; and participation in citizen science initiatives with reference to wildlife

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MAJOR 12
WILDLIFE CONSERVATION AND MANAGEMENT
Code: ZOO-3023
Credit: 3 (T) + 1 (P)

THEORY	**Hours**
Unit 1: Concepts of wildlife, wildlife definition, wildlife conservation, history of wildlife, and conservation ethics. Values and importance of wildlife; Causes of depletion of wildlife in India; Wildlife habitat ecology and its management; Biological and ecological basis of wildlife management. Conservation vs. preservation, Wildlife population survey	13
Unit 2: Concepts pertaining to wildlife population, density, types of density, natality, mortality sex ratio and age structure, population growth patterns and concept of carrying capacity; Habitat management of wildlife in a forested and aquatic ecosystem, the definition of wildlife cover and cover characteristics. Wildlife habitat succession and management; Restoration of degraded habitats, Concepts of GIS and Remote sensing and their utility in wildlife habitat management.	16
Unit 3: Concepts of protected areas, wildlife protected areas in India; Protected area network, National Parks, Sanctuaries, Man and Biosphere Reserve, Ecological	16

sensitive zones, Conservation reserves, Community reserves, Secret Groves. Concepts of elephant and tiger reserves, Ramsar sites; Recent challenges of the management of Tiger reserves and Ramsar sites. Concepts and management of renewable natural resources and wildlife's welfare factors.

WILDLIFE CONSERVATION AND MANAGEMENT

Practical	Hours
1. Identification of flora (Common plant species associated with wildlife) and fauna (Mammals, Birds, Herpetofauna, and Butterflies)	30
2. Demonstration and applicability of basic equipment needed for wildlife studies (Compass, Range finder, GPS, Camera Traps).	
3. Demonstrations of field study techniques: line transect and quadrate sampling.	
4. Importance of indirect evidences in wildlife survey and its identification [Animal Footprints (Pugmark & hoof mark), Animal Droppings (Scat, Dung, Pellet), Other animal signs, Antlers, Nests of birds]	
Animal trail survey or trail monitoring, use of plaster of Paris for wildlife survey (for the indirect survey).	

Suggested Readings

1. Caughly, G. and Sinclair, A. R. E. (1994). Wildlife Ecology and Management. Blackwell Scientific Publications, 1-334pp.
2. Shekhar, S. Kolipaka, (2014). A Field Guide to Tracks & Signs of Indian Wildlife. 1-385pp.
3. Sinclair, A.R. E., John M. Frysell, and Graeme Caughley (2006). Wildlife Ecology, Conservation, and Management, Blackwell Publishing, 1-463, pp.
4. Raj, M. (2012). Wildlife Ecology and Management (With special reference to Northeast India). Assam Book Depot, Panbazar, Guwahati-1, 1-294pp.
5. Berwick S. H. and Saharia, V. B. (1995). Development of International principles of Wildlife Research and Management (Asian and American approaches). Oxford University Press, Delhi, Bombay, Madras. 1-481. pp.
6. Vivek Menon, (2014). Indian mammals, A Field Guide; Hachetta Book Publishing India Pvt. Ltd.4th and 5th Floor Corporate centre, Plot No. 94, Sector 44, Gurgoan, 122001, India.
7. Hunter M. L., Gibbs, J. B. and Sterling, E. J. (2008). Problem-Solving Conservation Biology and Wildlife Management: Exercise for class, Field and laboratory, Blackwell Publishing.
8. Southerland, W. J. (2000). The conservation handbook: Research management and Policy. Blackwell Sciences.
9. Bookhout, T. A. (1996). Research and management techniques for wildlife and habitats, 5th edition. The Wildlife Society, Allen Press.
10. Woodroffe, R., Thirgood, S. and Rabinowitz, A. (2005). People and Wildlife, Conflict or Co-existence? Cambridge University.

DSE 13
COMPUTATIONAL BIOLOGY
Code: ZOO-3024
Credit: 3 (T) + 1 (P)

Course Objectives:

Bioinformatics is the science of storing, extracting, analyzing, interpreting and using information. This course is designed for students interested in molecular biology, genetics, information technology and computer science. It helps in the analysis of organism geneme, development of new algorithm, study of structural and functional relationship and molecular evolution.

Learning Outcomes:

The course helps to understand the basic principles of biology, computer science and mathematics. Existing software effectively helps students to extract information from

large databases and to use this information to solve biological problems. It also provides an understanding of the intersection of life and information science, the core of shared concepts, language of structure and function relationship, gene expression, phylogenetic analysis through database.

DSE 13
COMPUTATIONAL BIOLOGY
Code: ZOO-3024
Credit: 3 (T) + 1 (P)

THEORY	**Hours**
Unit I: Introduction to Bioinformatics and Biological Databases Importance, Goal, Scope; Genomics, Transcriptomics, Systems Biology, Functional Genomics, Metabolomics, Molecular Phylogeny; Applications and Limitations of Bioinformatics, Introduction to biological databases; Primary, secondary and composite databases; Nucleic acid databases (GenBank, DDBJ, EMBL and NDB); Protein databases (PIR, SWISS-PROT, TrEMBL, PDB); Metabolic pathway database (KEGG, EcoCyc, and MetaCyc); Small molecule databases (PubChem, Drug Bank, ZINC, CSD)	15
Unit 2: Sequence submission tools (BankIt, Sequin, Webin); Sequence file format (flat file, FASTA, GCG, EMBL, Clustal, Phylip, Swiss-Prot); Sequence annotation; Data retrieval systems (SRS, Entrez)	15
Unit 3: Basic Concepts of Sequence Alignment and Applications of Bioinformatics Scoring Matrices (PAM, BLOSUM), Methods of Alignment (Dot matrix, Dynamic Programming, BLAST and FASTA); Local and global alignment, pair wise and multiple sequence alignments; Similarity, identity and homology of sequences. Structural Bioinformatics (3-D protein, PDB), Drug discovery method (Basic concepts)	15

COMPUTATIONAL BIOLOGY

Practical	**Hours**
1. Retrieval of sequence data from Entrez, gene expression from GEO, structural data of protein using PDB, motif information of protein using Prosite. **2.** Primer Designing **3.** Perform pair-wise alignment of sequences (BLAST) and interpret the output. **4.** Perform multiple sequence alignment using MEGA **5.** Phylogenetic analysis using PHYLIP (rooted and unrooted).	30

Suggested Readings:

1. Ghosh Z and Mallick B. (2008). Bioinformatics:
2. Principles and Applications, Oxford UniversityPress.
3. Pevsner J. (2009). Bioinformatics and Functional Genomics, II Edition, Wiley Blackwell.
4. Zvelebil,MarketaandBaumO.Jeremy(2008).Understanding Bioinformatics, Garland Science, Taylor and Francis Group,USA.

DSE 14
ADVANCE ENTOMOLOGY
Code: ZOO-3025
Credit: 3 (T) + 1 (P)

Learning Objectives:

Insects are the most diverse and successful group of organisms inhabiting almost all spheres on earth. Learning of physiological system of insects gives an overview of how their bodies organize, function and work. This study also bears economic and toxicological importance as understanding the internal body system and mechanism only helps to tackle any insects and insects related measures. Insect pests are the common occurrence of crops, household etc. Therefore, learning pest, common pest of crops and pest control strategies help to develop an overall idea about insect pests, their damages and rational control strategies. Moreover, insects play tremendous beneficial role in ecosystem and to human being. Another learning objective is to introduce the most common beneficial insects and their products used by human being in diverse field.

Learning Outcomes:

After completion of the course, the students will be able to:

1. Understand the basic physiological systems of Insects
2. Develop basic concept on pest and pest control strategies.

3. Develop concept on common insect pest of crops and stored grains
4. Develop idea on life history of the beneficial insects
5. Get knowledge on the diverse applications of insect products.
6. Get practical knowledge on visiting insect rearing field & preparing report/ studying and collecting and identifying common insects or pests/ physiological and anatomical structures performing dissections.

DSE 14
ADVANCE ENTOMOLOGY
Code: ZOO-3025
Credit: 3 (T) + 1 (P)

THEORY	**Hours**
Unit 1: Physiological systems of insects- Digestive System, Excretory System, Circulatory System, Respiratory System, Reproductive System, and Nervous system	30
Unit 2: Definition of pest, types of pests according to damage (sub economic, occasional, perennial), concept of economic injury level, economic threshold level, pest resurgence, secondary pest outbreak, cultural control, biological control of pest, pheromonal control of pest. Life history and control of following plant pests: Agricultural pests (*Papilio demoleus, Leucinodesorbonalis, Spodoptera litura*); Stored grain pests (*Callosobruchus chinensis, Sitophilus oryzae*), Tea pest (*Helopeltistheivora, Buzurasuppressaria*), Paddy pest (*Dicladispaarmigera, Leptocorisa* sp.), Host-plant selection by phytophagous insects	08
Unit 3: Life history of two silk producing insects in North East India. Life history of lac insects. Applications of lac, silk and honey.	07

ADVANCE ENTOMOLOGY

Practical	**Hours**
1. Collection, preservation, identification of common phytophagous pest	30
2. Submission of life cycle of silkworm/ lac insects	
3. Dissection of digestive and nervous system of cockroach/ grasshopper	
4. Study on biological agents- (identification, classification and	

significance): pathogens, parasites, predators

5. Visit to field and prepare a report (agriculture/ sericulture/ apiculture/ lac culture field)

Suggested Readings:

1. Pradhan, S. (1969). Insect Pests of Crops. National Book Trust, India Book House.
2. Atwal, A.S. (1993) Agricultural pest of India and South East Asia. Kalyani Pub., New Delhi.
3. Chapman, R. F. The Insects: Structure and Function. Cambridge University Press, UK
4. Dennis, S. Hill. (2005) Agricultural Insect pests of the tropics and their management, Cambridge University press.
5. Pedigo L. P. (2002). Entomology and Pest Management, Prentice Hall Publication
6. Tembhare, D.B. Modern Entomology, Himalaya Publishing House.
7. David, B.V. and Ananthakrishnan (2004). General and Applied Entomology. McGraw Hill India.
8. Ghosh, M.R. (1995). Concepts of Insect Control. New Age International Limited, New Delhi.
9. Srivastava, K.P. (1996) A Textbook of Applied Entomology. Kalyani Publisher.
10. Nation, J.L. (2008). Insect Physiology and Biochemistry. CRC Press, New York

DSE 15
ANIMAL CELL CULTURE AND GENETIC ENGINEERING
Code: ZOO-3026
Credit: 3 (T) + 1 (P)

Course Objectives:

1. The students will be given an idea of in vitro animal cell culture techniques and their utilization in modern biological research.
2. The students will be given exposure to frequently used modern biological techniques.
3. The students will learnt the basic concept of genetic engineering and their utilization.

Learning Outcomes:

Upon completion of the course, students will be able to:

1. Learn about basic cell culture techniques and key concepts that are used in isolation and culture of animal cells.
2. Develop basic understanding of the modern robust techniques with wide applications

(such as PCR, DNA sequencing, DNA fingerprinting, DNA microarrray and blotting techniques.

3. The student will be able to understand the importance of gene cloning in biotechnology and utilization of different cloning vectors such as plasmids and bacteriophages.
4. Understand the importance of construction of genomic libraries and their specialized screening methods to identify gene of interest.

DSE 15
ANIMAL CELL CULTURE AND GENETIC ENGINEERING
Code: ZOO-3026
Credit: 3 (T) + 1 (P)

THEORY	**Hours**
Unit 1: Basic requirement of animal cell culture, cell culture media Basic techniques of cell culture, Development of primary cell cultures: cell separation, harvesting and maintenance of cell lines; Transformation and differentiation of cell cultures, Types of cell culture: monolayer, suspension, Measurement of viability and parameters of growth. Cell culture Bioassays: Cell proliferation assays	15
Unit 2: Polymerase Chain Reaction DNA sequencing: Sanger's method, Next generation sequencing Southern, Northern and Western blotting DNA Finger Printing and DNA microarray,	15
Unit 3: Basic concept of gene cloning, Restriction enzymes and DNA modifying enzymes. Cloning vectors: Plasmids, Lambda Bacteriophage, M13, YAC and Expression vectors (characteristics). Cell Transformation techniques: Calcium chloride method, electroporation and biolistic method. Construction of genomic and cDNA libraries and screening by colony and plaque hybridization	15

ANIMAL CELL CULTURE AND GENETIC ENGINEERING

Practical	**Hours**
1. Genomic DNA isolation from *E. coli* ***2.*** Plasmid DNA isolation (pUC 18/19) from *E. coli* **3.** Demonstration of Restriction digestion of Plasmid/Lambda DNA. **4.** To demonstrate following techniques: (Optional) Southern/	30

Northern/Western blotting (Any one) PCR DNA fingerprinting DNA Sequencing (Sanger's Method)

5. Project report on animal cell culture OR on a visit to any biotechnology Institute

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Suggested Readings:

1. Freshney, R. Ian Culture of Animal Cells: A Manual of Basic Technique, 4th Edition ISBN 13: 9780471348894
2. Leslie Wilson, Paul Matsudaira, (1998), Animal Cell Culture Methods, eBook ISBN: 9780080859552
3. Cooper, G. M. (2018). 8th Edition. The cell: A molecular approach. Massachusetts, USA: Sinauer Associates. ISBN-13:978-1605357072
4. Alberts, B et al. (2014). 6th edition. Molecular Biology of the Cell. W. W. Norton & Company. ISBN-13 : 978-0815345244
5. Lodish H et al. (2003). 5th Revised edition. Molecular Cell Biology. W.H.Freeman& Co Ltd; ISBN13 : 978-0716743668
6. Karp, G. (2019). 9th Edition. Cell and molecular biology: New Jersey, USA: Wiley Publishers. ISBN-978—1-119-59816-9
7. Brown, T. A. (2020). 8thEdition. Gene cloning and DNA analysis: An introduction. New York, USA: John Wiley and Sons, ISBN-13: 978-1119640783.
8. Cantor, C. R. and Smith, C. L. (2004). 1st Edition. Genomics: The science and technology behind the human genome project. New York, USA: John Wiley and Sons. ISBN-13: 978-0471461869.
9. Old, R. W. and Primrose, S. B. (1994). 7th Edition. Principles of Gene Manipulation: an Introduction to Genetic Engineering. Boston: Wiley. ISBN-13: 978-0632037124.
10. Joseph Sambrook, E.F. Fritsch, T. Maniatis. (1989). 2nd Edition. Molecular Cloning: A Laboratory Manual. New York, USA: Cold Spring Harbor Laboratory. Press ISBN- 978-0879693732.
11. Glick, B. R. and Patten, C. L. (2022). 6thEdition. Molecular Biotechnology: Principles and Applications of Recombinant DNA. USA: ASM press, ISBN-13: 978-1683673668.
12. Primrose, S. B. and Twyman, R. B. (2014). 7th Edition. Principles of Gene Manipulation and Genomics. New York, USA: John Wiley and Sons. ISBN-13: 978-1118653883.
13. Green, M. R. and Sambrook, J. (2012). 4th Edition. Molecular Cloning: A Laboratory Manual (three-volume set). New York, USA: Cold Spring Harbor Laboratory Press ISBN-13: 978- 1936113422

DEPARTMENT OF STATISTICS

GAUHATI UNIVERSITY

Four Year Undergraduate Syllabus in Statistics under NEP

Effective from Academic Year 2023 – 24

Summary Structure

Semester	Course Code	Course Name	Credit
I	STA101	Descriptive Statistics& Probability-1	4 (Theory 3 +Practical 1)
2	STA201	Correlation & Regression, Probability Distributions, Statistical Inference-I & Finite Difference	4 (Theory 3 +Practical 1)
3	STA301	Survey Sampling& Design of Experiments-1	4 (Theory 3 +Practical 1)
4	STA401	Probability-2 and Probability Distributions-2	4 (Theory 4 +Practical 0)
4	STA402	Mathematical Methods	4 (Theory 4 +Practical 0)
4	STA403	Linear Algebra and System of Equations	4 (Theory 4 +Practical 0)
4	STA404	Practical 4	4 (Theory 00 +Practical 4)
5	STA501	Sampling Distributions and Test of Significance	4 (Theory 4 +Practical 0)
5	STA502	Statistical Inference-2	4 (Theory 4 +Practical 0)
5	STA503	DESIGN OF EXPERIMENTS 2	4 (Theory 4 +Practical 0)
5	STA504	Practical 5	4 (Theory 0 +Practical 4)
6	STA601	Applied Statistics	4 (Theory 4 +Practical 0)
6	STA602	Bivariate/Multivariate Analysis, Stochastic Process & Computer Programming	4 (Theory 4 +Practical 0)
6	STA603	Operations Research	4 (Theory 4 +Practical 0)
6	STA604	Practical 6	4 (Theory 0 +Practical 4)

Semester 1

Course code : STA101

Course Name : Descriptive Statistics & Probability

Credits: 4 (Theory: 03 credits, Practical/Lab: 01 credit)

Course Level : 100-199

Number of Contact classes : 60

Number of Non contact classes : 0

Prerequisites : NIL

Course Objectives: The objective is to give students foundational ideas about the various statistical methods, measures of central tendency and basics of probability. The students are introduced to the methods of collecting data, their representational formats and basic statistical tools.

Learning Outcomes: At the end of the course, students will be able to analyse a data set, represent the data in tabular and diagrammatic form, prepare the frequency distribution, find the summary measures viz. the measures of central tendency, measure of dispersion, measures of skewness and kurtosis of a univariate data.

Unit I: Statistical Methods: (No. of classes: 09, Weightage: 15%)

Definition and scope of Statistics, concepts of statistical population and sample. Data: quantitative and qualitative, attributes, variables, scales of measurement - nominal, ordinal, interval and ratio. Presentation: tabular and graphical, including histogram and ogives, boxplot. Collection and Scrutiny of Data: Primary data-designing a questionnaire and a schedule; Secondary data- their Major sources including some government publications.

Unit 2: Measures of Central Tendency, Dispersion and location:
(No. of classes: 12, Weightage: 20%)

Mathematical measures of central tendency. Measures of Dispersion: range, quartile deviation, mean deviation, standard deviation, coefficient of variation, Moments, skewness and kurtosis, Deciles, percentiles, quartiles.

Unit 3 : Probability: (No. of classes: 15 , Weightage : 25%)

Introduction, random experiments, sample space, events. Definitions of Probability – classical, statistical, and axiomatic. Conditional Probability, laws of addition and multiplication, independent events, theorem of total probability, Bayes' theorem and its applications.

Unit 4: Random variables and Expectations: (No. of classes: 9, Weightage: 15%)

Discrete and continuous random variables, p.m.f., p.d.f. and c.d.f., illustrations and properties. Expectation of univariate random variables.

Unit 5 : Practical 1 (No. of classes: 15 Weightage: 25%)
Note : Students can use calculators / Ms Excel / R programming as convenient**.**

1. Graphical representation of data.
2. Problems based on measures of central tendency & dispersion.
3. Problems based on measures of location.
4. Problems based on combined mean, variance and coefficient of variation.
5. Problems based on moments, skewness and kurtosis.

SUGGESTED READING:

1. Goon A.M., Gupta M.K. and Dasgupta B. (2002): Fundamentals of Statistics, Vol. I & II, 8th Edn. The World Press, Kolkata.

2. Miller, Irwin and Miller, Marylees (2006): John E. Freund's Mathematical Statistics with Applications, (7th Edn.), Pearson Education, Asia.

3. Mood, A.M. Graybill, F.A. and Boes, D.C. (2007): Introduction to the Theory of Statistics, 3rd Edn., (Reprint), Tata McGraw-Hill Pub. Co.Ltd.

4. Medhi, J., Statistical Methods: An Introductory text (New Age International (P) Ltd. 2000).

Course designed by : Amit Choudhury, Kishore Kr. Das and Rajan Sarma, Dept of Statistics GU .

Semester 2

Course code : STA201

Course Name : Correlation & Regression, Probability Distributions, Statistical Inference-I & Finite Difference

Credits: 4 (Theory: 03 credits, Practical/Lab: 01 credit)

Course Level : 100-199

Number of Contact classes : 60

Number of Non contact classes : 00

Prerequisites : NIL

Course Objectives: The course will expose students to the need and nuances of correlation and basic probability distributions alongwith notions of Uncertainty and Randomness, Probability & Random variables and Basic Data Analysis.

Learning Outcomes: At the end of the course, students will be able to apply the tools of correlation and model building in data analysis alongwith learning the use of basic probability distributions.

Unit 1: Bivariate data analysis: (No. of classes: 09, Weightage: 15%)

Definition, scatter diagram, Karl Pearson's correlation coefficient and its properties, partial and multiple correlation (3 variables only), rank correlation, correlation ratio. Simple linear regression, principle of least squares.

Unit 2: Basic Probability Distributions: (No. of classes: 12, Weightage : 20%)

Standard probability distributions: Binomial, Poisson, Uniform, Normal. Fitting of these distributions.

Unit 3 : Testing of Hypothesis: (No. of classes: 12, Weightage : 20%)

Null and alternative hypotheses, level of significance, Type I and Type II errors, their probabilities and critical region, size and power, Large sample tests, single mean, difference of two means (technique only; without derivation),

t – test for testing single mean, difference of two means, paired t test (technique only without derivation),

F – test for testing equality of variance (technique only without derivation).

Categorical Data Analysis: Categorical data: Tests of proportions (testing single proportion, difference of two proportions,) tests of association, independence of attributes and goodness-of-fit using Chi- square Test (technique only without derivation),

Unit 4: Finite Difference: (No. of classes: 12, Weightage : 20%)

Definition, Operators Δ & E, their properties, Difference table, missing terms, Interpolation: Definition, Newton's Forward and Backward interpolation formula, Gauss Interpolation formula. Divided Difference (DD): Definition, DD table, Newton's DD formula. Lagrange's interpolation formula. Numerical Integration: Introduction, General quadrature formula, Trapezoidal, Simpson's 1/3rd & 3/8th rules, Newton-Raphson method.

Unit 5 : Practical 2 (No. of classes: 15, Weightage : 25%)

Note : Students can use calculators / Ms Excel / R programming as convenient.

1. Fitting of binomial distributions for n and p=q =½.
2. Fitting of binomial distributions for given n and p.
3. Fitting of binomial distributions after computing mean and variance.
4. Fitting of Poisson distributions for given value of lambda.
5. Fitting of Poisson distributions after computing mean.
6. Problems based on area property of normal distribution.
7. To find the ordinate for a given area for normal distribution.
8. Fitting of normal distribution when parameters are given.
9. Fitting of normal distribution when parameters are not given.
10. Practicals on Unit-1
11. Practicals on Unit-3
12. Practicals on Unit-4

SUGGESTED READING:

1. Goon,A.M.,Gupta,M.K.andDasgupta,B.(2003): An Outline of Statistical Theory, Vol. I, 4th Edn. World Press, Kolkata.
2. Rohatgi V. K. and Saleh, A.K. Md. E. (2009): An Introduction to Probability and Statistics. 2nd Edn. (Reprint) John Wiley and Sons.
3. Hogg, R.V. and Tanis, E.A. (2009): A Brief Course in Mathematical Statistics.

Pearson Education.
4. Johnson, R.A. and Bhattacharya, G.K.(2001): Statistics-Principles and Methods, 4th Edn. John Wiley and Sons.
5. Mood, A.M., Graybill, F.A. and Boes, D.C. (2007): Introduction to the Theory of Statistics, 3rd Edn. (Reprint).Tata McGraw-Hill Pub. Co. Ltd.

Course designed by : Rajan Sarma, Dept of Statistics, GU .

Semester 3

Course code : STA301

Course Name : Survey Sampling and Design of Experiments-1

Credits: 4 (Theory: 03 credits, Practical/Lab: 01 credit)

Course Level : 200-299

Number of Contact classes : 60

Number of Non contact classes : 00

Prerequisites : NIL

Course Objective : This course is designed to provide students with knowledge about the techniques of data collection.

Learning Outcomes: At the end of the course, students will be able to know the basic designs of sampling schemes.

Unit1: Survey Sampling: (No. of classes: 09, Weightage: 15%)

Complete enumeration, controlled experiments, observational studies and sample surveys, Concept of population and sample, complete enumeration versus sampling, principal steps in a sample survey, sampling and non-sampling errors. Types of sampling: non-probability and probability sampling, basic principle ofsample survey.

Unit 2: Simple random sampling: (No. of classes: 06, Weightage: 10%)

Simple random sampling with and without replacement, definition and procedure of selecting a sample, estimates of : population mean, total and mean square. Determination of sample size- preliminary formulas only.

Unit 3: Stratified random sampling and Systematic Sampling: (No. of classes: 15, Weightage: 25%)

Technique of stratified sampling, estimates of population mean and total, variances of these estimates (with derivation), proportional and optimum allocations and their comparison with SRS (with derivation), determination of sample size (in case of proportional allocation only).

Systematic Sampling: Technique, estimates of population mean and total, variances of these estimates (N=n x k). Comparison of systematic sampling with SRS (with derivation).

Unit 4 : Design of Experiments : (No. of classes: 15, Weightage: 25%)

Basic principles of Design, Basic designs: Completely Randomized Design (CRD), Randomized Block Design (RBD)– layout, model and statistical analysis (without derivations), (analysis with missing observations not required).

One way and two way ANOVA.

Unit 5 : Practical 3 (No. of classes: 15, Weightage : 25%)
Note : Students can use calculators / Ms Excel / R programming as convenient.

List of Practicals : Practicals on Unit-2, 3 & 4.

SUGGESTED READING

1. Cochran, W.G. (1984): Sampling Techniques (3rd Ed.), Wiley Eastern.

2. Sukhatme, P.V., Sukhatme, B.V. Sukhatme, S. Asok,C.(1984). Sampling Theories of Survey

With Application, IOWA State University Press and Indian Society of Agricultural Statistics

3. Murthy, M.N. (1977): Sampling Theory & Statistical Methods, Statistical Pub. Society,

Calcutta.

5. Goon, A.M., Gupta, M.K. and Dasgupta, B. (2001): Fundamentals of Statistics (Vol.2), World

Press.

6. Cochran, W.G. and Cox, G.M. (1959): Experimental Design. Asia Publishing House.

7. Das, M.N. and Giri, N.C. (1986): Design and Analysis of Experiments. Wiley Eastern Ltd.

8. Goon, A.M., Gupta, M.K. and Dasgupta, B. (2005): Fundamentals of Statistics. Vol. II, 8th Edn. World Press, Kolkata.

Course designed by : Rajan Sarma, Pallabi Medhi, Arpita Basak Dept of Statistics, GU .

Semester 4

Course code : STA401

Course Name : Probability-2 and Probability Distributions-2

Credits: 4 (Theory: 04 credits, Practical/Lab: 00 credit)

Course Level : 200-299

Number of Contact classes : 60

Number of Non contact classes : 00

Course Objective: This course has the objective of providing exposure to random variable and large scale properties of probability distributions. This is a fundamental course on probability theory, random variables and their distributions to make further progress on statistical analysis. Students in this course This course also introduces the ideas of Statistical Inference and its importance in real world applications

Learning Outcomes: At the end of the course, students shall be able to appreciate the large sample implications of various statistical measures and also learn about a number of statistical distributions. They will be able to determine whether or not moments exist of any given random variable and if so, to determine them. They will also be able to use tools like Probability Generating function and Moment generating functions to study distributions in addition to learning several univariate discrete and continuous distributions and their characterizations.

Unit 1: Functions of Random variables .(No. of classes: 12, Weightage: 20%)

Two dimensional random variables: discrete and continuous type, joint, marginal and conditional p.m.f, p.d.f., and c.d.f., independence of variables, bivariate transformations, conditional expectations, conditional variance.

Moments, factorial moments, Cumulants, Generating functions – mgf, pgf, cgf together wih their properties.

Unit2: Probability–II (No. of classes: 12 , Weightage: 20%)

Chebyshevs Lemma (with proof), Weak Law of Large Numbers (WLLN) due to Bernoulli, Khintchine and Lyapunov. Central Limit Theorem (CLT)-De-Moivre's and Levy – Lindeberg CLT (with proof) -

Unit3: Probability Distributions II : (No. of classes: 24, Weightage: 40%)

Geometric, Negative Binomial, Hypergeometric, Multinomial, Exponential, Weibull, Cauchy, Beta and Gamma distributions along with their properties and limiting/approximation cases, Lognormal.

Normal distribution – harder problems and theory (over and above what is covered in unit 2 of paper STA201).

Unit 4 : Order Statistics:(No. of classes: 12, Weightage: 20%)

Introduction, distribution of the rth order statistic, smallest and largest order statistics. Joint distribution of rth and sth order statistics, distribution of sample median and sample range.

List of reference books:

1. Hogg, R.V., Tanis, E.A. and Rao J.M. (2009): Probability and Statistical Inference,

Seventh Ed, Pearson Education, New Delhi.

2. Miller, Irwin and Miller, Marylees (2006): John E. Freund's Mathematical Statistics

with Applications, (7th Edn.), Pearson Education, Asia.

3. Myer, P.L. (1970): Introductory Probability and Statistical Applications, Oxford &

IBH Publishing, New Delhi

Course designed by : Kishore Kr Das and Rajan Sarma Dept of Statistics, GU .

Semester 4

Course code : STA402

Course Name : Mathematical Methods

Credits: 4 (Theory: 04 credits, Practical/Lab: 00 credit)

Course Level : 200-299

Number of Contact classes : 60

Number of Non contact classes : 00

Course Objective: This course has the objective of providing student with the necessary mathematical basics of Calculus and Algebra in so far as they are used in the study of Statistics.

Learning Outcomes: At the end of the course, students shall be able to use the mathematical results of Calculus and Algebra to study different distribution.

Unit1: Calculus (No. of classes: 24, Weightage: 40%)

Indeterminate forms: L-Hospital's rule, Maxima and minima of functions of one and two variables, constrained optimization techniques (with Lagranges multiplier) along with some problems. Jacobian- transformation of variables. Beta and Gamma functions: properties and relationship between them.

Exact differential equations, Integrating factors, change of variables, Total differential equations, Differential equations of first order and first degree, Homogeneous and non-homogeneous linear differential equations of order n with constant coefficients, Different forms of particular integrals.

Unit 2 : Infinite Series: (No. of classes: 12, Weightage: 20%)

Infinite series, positive termed series and their convergence; Comparison test, D'Alembert's ratio test, Cauchy's n^{th} root test, Raabe's test (For all the tests, statement only is required, without proof. Applications only).

Unit 3: Numerical Analysis: (No. of classes: 24 , Weightage: 40%)

Factorial notation, Zero differences, Central differences due to Bessel. Stirling's approximation to factorial n. Solution of difference equations of first order, Numerical

methods for determination of approximate solutions of equations – Regula Falsi method, Bisection method.

SUGGESTEDREADINGS:

1. GorakhPrasad: Differential Calculus, Pothishala Pvt. Ltd., Allahabad (14th Edition-1997).
2. Gorakh Prasad: Integral Calculus, Pothishala Pvt. Ltd., Allahabad (14th Edition-2000).
3. Zafar Ahsan: Differential Equations and their Applications, Prentice-Hall of India Pvt. Ltd., New Delhi
4. Piskunov, N: Differential and Integral Calculus, Peace Publishers, Moscow.
5. Bartle, R. G. and Sherbert, D.R. Introduction to Real Analysis (John Wiley and Sons, New Delhi, 2007).
6. Simmons, G.F. Differential Equations with Applications and Historical Notes (Tata McGraw- Hill, New Delhi, 1991).

Course designed by : Amit Choudhury, Rajan Sarma, Dept of Statistics, GU .

Semester 4

Course code : STA403

Course Name : Linear Algebra and System of Equations

Credits: 4 (Theory: 04 credits, Practical/Lab: 00 credit)

Course Level : 200-299

Number of Contact classes : 60

Number of Non contact classes : 00

Course Objective: This course has the objective of providing student with the necessary mathematical basics on matrices.

Learning Outcomes: At the end of the course, students shall be able to explain the basics of matrices and Solve numerical problems based on basics of matrices in addition to solving systems of linear equations .

Unit 1: Linear Algebra (No. of classes: 30, Weightage : 50%)

Rank of a matrix, standard theorems on ranks, rank of the sum and the product of two matrices. Partitioning of matrices and simple properties. Characteristic roots and Characteristic vector, Properties of characteristic roots, Cayley Hamilton theorem, Quadratic forms, Linear orthogonal transformation and their diagonalization.

Vector spaces, Subspaces, sum of subspaces, Span of a set, Linear dependence and independence, dimension and basis, dimension theorem.

Unit 2: Determinants and System of Linear Equations:

(No. of classes: 30, Weightage : 50%)

Definition, properties and applications of determinants for 3rd and higher orders, evaluation of determinants of order 3 and more using transformations. Symmetric and Skew symmetric determinants, Jacobi's Theorem, product of determinants. Use of determinants in solution of linear equations, the system of linear equations, row reduction and echelon forms, the matrix equations AX=B, solution of linear equations, linear independence, Applications of linear equations, inverse of a matrix.

SUGGESTED READINGS:

1. Lay David C.: Linear Algebra and its Applications, Addison Wesley ,2000.
2. Schaum's Outlines: Linear Algebra, Tata McGraw-Hill Edition, 3rd Edition, 2006.

3. Krishnamurthy, V., Mainra, V.P. and Arora J.L.: An Introduction to Linear Algebra (II, III, IV, V).
4. Jain, P.K. and Khalil Ahmad: Metric Spaces, Narosa Publishing House, New Delhi, 1973
5. Biswas, S.(1997): A Textbook of Matrix Algebra, New Age International, 1997.
6. Gupta,S.C.: An Introduction to Matrices (Reprint). Sultan Chand & Sons, 2008.

7. Artin, M.: Algebra. Prentice Hall of India, 1994.
8. Datta, K.B.: Matrix and Linear Algebra. Prentice Hall of India Pvt. Ltd., 2002.
9. Hadley, G.: Linear Algebra, Narosa Publishing House (Reprint), 2002.
10. Searle, S.R.: Matrix Algebra Useful for Statistics. John Wiley & Sons., 1982.

Course designed by : Jagriti Das, Rajan Sarma, Kishore Kr Das, Dept of Statistics, GU .

Semester 4

Course code : STA404

Course Name : Practical 4

Credits: 4 (Theory: 00 credits, Practical/Lab: 04 credits)

Course Level : 200-299

Number of Contact classes : 60

Number of Non contact classes : 00

Course Objective: This course has will expose students to the art of applying mathematical skills in practical situations

Learning Outcomes: At the end of the course, students shall be able to apply mathematical techniques to practical situations.

Note: Students can use Excel/Spreadsheet/ R programming

Practicals based on the following:

(a) **Unit** 1: Practicals based on Unit 3 (Numerical Analysis) of paper STA402 (No. of classes: 30 Weightage 50%)

(b) **Unit** 2: Practicals based on Rank of a matrix, inverse of a matrix, quadratic forms, Solutions of linear equations, of paper STA 403 (No. of classes: 24 Weightage 40%)

(c) **Unit** 3: Practicals based on Unit 1 and fitting of negative binomial and exponential distribution of paper STA 401 (No. of classes: 06 Weightage :10%)

SUGGESTED READINGS:

Biswas, S. (1997): A Textbook of Matrix Algebra, NewAgeInternational,1997.

Course designed by : Dept of Statistics, GU .

Semester 5
Course code : STA501
Course Name : Sampling Distributions and Test of Significance
Credits: 4 (Theory: 04 credits, Practical/Lab: 00 credit)
Course Level : 300-399
Number of Contact classes : 60
Number of Non contact classes : 00

Course Objective: This course will enable students to infer about the population characteristics, based on the corresponding sample analogues. Since the sample quantities are random, it is required to find their exact or asymptotic probability distributions.
Learning Outcomes: At the end of the course, students shall be able to understand the concepts of variability in sample measures and their distributions.

Unit 1: Sampling Distributions: (No. of classes: 06, Weightage: 10%)

Definitions of random sample, parameter and statistic, sampling distribution of a statistic, sampling distribution of sample mean, standard errors of sample mean, sample variance and sample proportion.

Unit 2: Exact sampling distributions- Chi square distribution:

(No. of classes: 18, Weightage: 30%)

Definition and derivation of p.d.f. of $\chi^2$with n degrees of freedom (d.f.) using m.g.f., nature of p.d.f. curve for different degrees of freedom, mean, variance, m.g.f., cumulant generating function, mode, additive property and limiting form of χ^2distribution.Applications of this distribution, Tests of significance and confidence intervals based on distribution. Non central chi square distribution (derivation of pdf).

Unit 3: Exact sampling distributions- t distribution:

(No. of classes: 18, Weightage: 30%)

Student's and Fishers t- distribution, Student's and Fishers t distribution, Derivation of its p.d.f., nature of probability curve with different degrees of freedom, mean, variance, moments and limiting form of t distribution, Applications of this distribution**.** Non Central t distribution (with derivation of pdf)

Unit 4: Exact sampling distributions- F distribution:

(No. of classes: 12, Weightage: 20%)

Snedecor's F -distribution: Derivation of p.d.f., nature of p.d.f. curve with different degrees of freedom, mean, variance and mode. Distribution of $1/F(n_1,n_2)$. Relationship between t, F and χ^2 distributions, Applications of this distribution. Test of significance and confidence Intervals based on t and F distributions. Non Central F distribution (with derivation of pdf)

Unit 5 : Large sample tests (No. of classes: 06, Weightage: 10%)

Large sample tests, testing single proportion, difference of two proportions, single mean, difference of two means.

SUGGESTEDREADING:

1. Goon, A.M., Gupta,M.K. and Dasgupta, B. (2003): AnOutline of Statistical Theory, Vol. I, 4th Edn. World Press, Kolkata.
2. Rohatgi V.K. and Saleh, A.K. Md.E. (2009): An Introduction to Probability and Statistics. 2nd Edn. (Reprint) John Wiley and Sons.
3. Hogg, R.V. and Tanis, E.A. (2009): A Brief Course in Mathematical Statistics. Pearson Education.
4. Johnson, R.A. and Bhattacharya, G.K. (2001): Statistics-Principles and Methods, 4th Edn. John Wiley and Sons.
5. Mood, A.M., Graybill, F.A. and Boes, D.C. (2007): Introduction to the Theory of Statistics, 3rd Edn. (Reprint). Tata McGraw-Hill Pub.Co.Ltd.

Course designed by : Kishore Kr Das, Rajan Sarma, Dept of Statistics, GU .

Semester 5

Course code : STA502

Course Name : Statistical Inference-2

Credits: 4 (Theory: 04 credits, Practical/Lab: 00 credit)

Course Level : 300-399

Number of Contact classes : 60

Number of Non contact classes : 00

Course Objective: This course has the objective of exposing students to concepts of estimation and testing of hypothesis - its types, and desirable properties of an estimator and how to find a good estimate from a sample data

Learning Outcomes: At the end of the course, students shall be able to apply how to examine the properties of estimators and how to test different types of statistical hypothesis.

Unit 1: Estimation: (No. of classes: 24, Weightage: 40%)

Concepts of estimation, unbiasedness, sufficiency, consistency and efficiency. Factorization theorem. Minimum variance unbiased estimator (MVUE). Cramer-Rao inequality and MVB estimators.

Methods of estimation - Method of moments, method of maximum likelihood estimation

Unit 2 : Hypothesis Testing II (No. of classes: 24 Weightage: 40%)

Null and alternative hypotheses, level of significance, Type I and Type II errors, their probabilities and critical region- harder problem and concepts (over and above what is covered in unit 3 of paper STA 201). Testing of hypothesis based on traditional and p-value approach

MP test, UMP test, unbiased test, Neyman Pearson Lemma (with proof) and it use, power curve. Likelihood ratio test, properties of likelihood ratio tests (without proof).

Unit 3: Non-parametric Tests: (No. of classes: 12, Weightage: 20%)

Nonparametric Tests: Introduction and Concept, Concept of Distribution free procedure, Test for randomness based on total number of runs, Empirical distribution function, Kolmogrov-Smirnov test for one sample, Sign tests-one sample

and two samples, Wilcoxon-Mann-Whitney test, Kruskal-Wallis test – all without derivation.

SUGGESTED READING:

1. Goon, A.M., Gupta, M.K.: Das Gupta, B. (2005), Fundamentals of Statistics, Vol. I, World Press, Calcutta.
2. Rohatgi, V.K. and Saleh, A.K. Md.E. (2009): An Introduction to Probability and Statistics. 2nd Edn. (Reprint) John Wiley and Sons.
3. Miller, I. and Miller, M. (2002): John E.Freund's Mathematical Statistics (6th addition, low price edition), Prentice Hall of India.
4. Dudewicz, E. J., and Mishra, S. N. (1988): Modern Mathematical Statistics. John Wiley & Sons.
5. Mood, A.M, Graybill, F.A. and Boes, D.C,: Introduction to the Theory of Statistics, Mc Graw Hill.
6. Bhat, B.R, Srivenkatramana, T and Rao Madhava, K. S. (1997) Statistics: A Beginner's Text, Vol. I, New Age International (P) Ltd.
7. Snedecor, G.W and Cochran, W.G. (1967) Statistical Methods. Iowa State University Press.

Course designed by : Rajan Sarma, Jagriti Das, Sahana Bhattacharjee, Dept of Statistics, GU .

Semester 5
Course code : STA503
Course Name : DESIGN OF EXPERIMENTS 2
Credits: 4 (Theory: 04 credits, Practical/Lab: 00 credit)
Course Level : 300-399
Number of Contact classes : 60
Number of Non contact classes : 00

Course Objective: This course has the objective of providing student the knowledge of art of analysis of field experiments
Learning Outcomes: At the end of the course, students shall be able to understand the different types of commonly used field experimental techniques.

Unit 1: Analysis of Variance: (No. of classes: 12, Weightage : 20 %)

1. Definitions of fixed, random and mixed effect models, analysis of variance and covariance in one-way classified data for fixed effect models, analysis of variance and covariance in two-way classified data with one observation per cell for fixed effect models.

Unit 2: Design of Experiments (No. of classes: 24 , Weightage : 40 %)

Role, historical perspective**,** terminology, experimental error, basic principles, uniformity trials, choice of size and shape of plots and blocks. Review of Completely Randomized Design (CRD),Randomized Block Design (RBD) – one observation and more than one observations per cell, Latin Square Design (LSD) – layout, model and statistical analysis, relative efficiency, analysis with missing observations (one missing observation), Split Plot Design, Strip Plot Design.

Unit 3: Factorial Experiments: (No. of classes: 18, Weightage : 30 %)

Factorial experiments : advantages, notations and concepts,2^2, 2^3, . . . , $2^n$and 3^2 factorial experiments, design and analysis, Total and Partial confounding for $2^n(n \leq 5)$. 3^2experiment.

Unit4: Regression Analysis: (No. of classes: 06, Weightage : 10%)

Simple regression analysis, Estimation and hypothesis testing in case of simple regression models.

SUGGESTEDREADING:

1. Cochran, W.G. and Cox, G.M. (1959): Experimental Design. Asia Publishing House.
2. Das, M.N. and Giri, N.C. (1986): Design and Analysis of Experiments. Wiley Eastern

Ltd.

3. Goon, A.M., Gupta, M.K. and Dasgupta, B. (2005): Fundamentals of Statistics. Vol.

II, 8thEdn. World Press, Kolkata.

4. Kempthorne, O. (1965): The Design and Analysis of Experiments. John Wiley.
5. Montgomery, D. C. (2008): Design and Analysis of Experiments, John Wiley
6. Goon, A.M., Gupta, M.K., Das Gupta, B. (2005), Fundamentals of Statistics, Vol. I, World Press, Calcutta.

Course designed by : Arpita Basak, Paramita Roy, Dept of Statistics, GU
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Semester 5
Course code : STA504
Course Name : Practical 5
Credits: 4 (Theory: 00 credits, Practical/Lab: 04 credit)
Course Level : 300-399
Number of Contact classes : 60
Number of Non contact classes : 00

Course Objective: This course has the objective of teaching students how to apply concept of statistical inference and field experiments in practice.

Learning Outcomes: At the end of the course, students shall be able to practically apply field experimentation techniques as well as sampling techniques.

Note: Students can use (Calculator/ Ms Excel/R Programming)

Practicals from the following :

(a) Units 2-5 of paper 501 (No. of classes: 12 Weightage: 20%)

(b) Units 2 and 3 of 502 (No. of classes: 24 Weightage: 40%)
(c) Units 2-4 of 503 (No. of classes:24 Weightage: 40%)

SUGGESTED READING:

1. Goon, A.M., Gupta, M.K. and Dasgupta, B. (2005): Fundamentals of Statistics. Vol.
II, 8thEdn. World Press, Kolkata.
2. Kempthorne, O. (1965): The Design and Analysis of Experiments. John Wiley.
3. Montgomery, D. C. (2008): Design and Analysis of Experiments, John Wiley.

Course designed by : Dept of Statistics, GU .

Semester 6
Course code : STA601
Course Name : Applied Statistics
Credits: 4 (Theory: 04 credits, Practical/Lab: 00 credit)
Course Level : 300-399
Number of Contact classes : 60
Number of Non contact classes : 00

Course Objective: This course has the objective of exposing students the different domains of applied statistics.

Learning Outcomes: At the end of the course, students shall be able to understand how statistics is directly applied in economic analysis, govt. and society.

Unit 1: Time Series: (No. of classes: 12 , Weightage: 20%)

Economic Time Series: Components of time series, Decomposition of time series- Additive and multiplicative model with their merits and demerits, Illustrations of time series. Measurement of trend by method of free-hand curve, moving average method, method of semi-averages and method of least squares (linear, quadratic and modified exponential), Measurement of seasonal variations by method of ratio to trend.

Unit 2: Index Numbers: (No. of classes: 12 , Weightage: 20%)

Index numbers: Definition, Uses and limitations of index numbers.

Criteria/tests for a good index number, different types of index numbers- price, quantity, value. Wholesale price index number, Index of Industrial Production.

Construction of index numbers of prices and quantities – Laspeyres' , Paasche's, Fisher's and Marshal-Edgeworth's Index numbers.

Consumer price index number.

Unit 3: Statistical Quality Control: (No. of classes: 12 , Weightage: 20%)

Statistical Quality Control: Importance of statistical methods in industrial research and practice. Rational subgroup., Determination of tolerance limits. Causes of variations in quality: chance and assignable.

General theory of control charts, process & product control, Control charts for variables: X-bar, R-charts and sigma chart. Control charts for attributes: p and c-charts. Product control – basic ideas of Single sampling and double sampling plans .

Unit4: Demography and official Statistics: (No. of classes: 12, Weightage: 20%)

Demographic Methods: Introduction, measurement of population, rates and ratios of vital events. Measurement of mortality: CDR, SDR (w.r.t. Age and sex), IMR, Standardized death rates. Life (mortality) tables: definition of its main functions and uses – differences between complete and abridged life table.

Measurement of fertility and reproduction: CBR, GFR, and TFR. Measurement of population growth: GRR, NRR.

Present Official Statistical System in India, Methods of collection of official statistics, their reliability and limitations. Role of Ministry & Program Implementation (MoSPI), Central Statistical Office (CSO), National Sample Survey Office (NSSO), and National Statistical Commission. Government of India's Principal Publications containing data on the topics such as population, Industry, Economy, Development and Finance.

Unit5: Demand Analysis: (No. of classes: 12, Weightage: 20%)

Demand Analysis: Theory of consumption and demand, demand function, elasticity of de-mand, determination of elasticity of demand by family budget method, Lorentz curve and Gini's coefficient, Engel's law and Engel's curve, Pareto's law of income distribution.

SUGGESTEDREADING:

1. Mukhopadhyay,P.(1999):AppliedStatistics,NewCentralBookAgency,Calcutta.
2. Gun, A.M., Gupta, M.K. and Dasgupta, B. (2008): Fundamentals of Statistics, Vol. II,9thEditionWorldPress,Kolkata.
3. Gupta, S. C. and Kapoor, V.K. (2008): Fundamentals of Applied Statistics, 4th Edition(Reprint), Sultan Chand & Sons.
4. Montogomery,D.C.(2009):Introduction to Statistical Quality Control, 6th Edition, Wiley India Pvt. Ltd.
5. Mukhopadhyay, P. (1999): Applied Statistics, Books and Allied(P)Ltd.

6. Gun, A.M., Gupta, M.K. and Dasgupta, B. (2008): Fundamentals of Statistics, Vol. II, 9th Edition, World Press.
7. Biswas,S.(1988):Stochastic Processes in Demography & Application, Wiley Eastern Ltd.
8. Croxton, Fredrick E., Cowden, Dudley J. and Klein, S. (1973): Applied General Statistics, 3rd Edition. Prentice Hall of India Pvt. Ltd.
9. Keyfitz N., Beckman John A.: Demography through Problems S-Verlag New York.

Course designed by : Rajan Sarma and Paramita Roy, Dept of Statistics, GU .

Semester 6

Course code : STA602

Course Name : Bivariate/Multivariate Analysis, Stochastic Process and Computer Programming

Credits: 4 (Theory: 04 credits, Practical/Lab: 00 credit)

Course Level : 300-399

Number of Contact classes : 60

Number of Non contact classes : 00

Course Objective: Students have to move from univariate to higher dimensional analysis. Moreover, this course will enable students to understand the transition from fundamental probability theory to stochastic process. It covers the structure of discrete time and continuous time stochastic process. This course will also expose students to elements of programming logic.

Learning Outcomes: On completion of the course, students will be able to understand the basics of stochastic process, Markov models, Poisson process and its applications, learn the analysis of higher dimensional random variables. They will also be able to write basic computer programs.

Unit 1: Bivariate Distributions: (No. of classes: 12, Weightage: 20%)

Bivariate Normal Distribution (BVN): p.d.f. of BVN, properties of BVN, marginal and conditional p.d.f. of BVN.

Unit 2: Multivariate Normal Distributions**:**
(No. of classes: 12, Weightage: 20%)

Multivariate Data: Random Vector: Probability mass/ density functions, Distribution function, Mean vector & Dispersion matrix, Marginal & Conditional distributions.

Multivariate Normal distribution and its properties. Marginal and conditional distribution, Sampling distribution for mean vector and variance- covariance matrix without derivation). Hotelling T^2–concept and applications.

Unit 3: Computer Programming in C (No. of classes: 12, Weightage: 20%)

History and importance of C. Components, basic structure programming, character set, C tokens, Keywords and Identifiers and execution of a C program. Data types: Basic data types, Enumerated data types, derived data types. Constants and variables: declaration and assignment of variables, Symbolic Constant.

Operators and Expressions: Arithmetic, relational, logical, assignment, increment/decrement, operators, precedence of operators in arithmetic, relational and logical expression.
library functions. Decision making and branching - if…else, nesting of if…else, else if, . Looping in C: for, nested looping.

Unit 4: Stochastic Process (No. of classes: 24, Weightage: 40%)

Stochastic Process: Introduction, Stationary Process. Definition of Markov Chain, transition probability matrix, order of Markov chain, Markov chain as graphs, higher transition probabilities. Generalization of independent Bernoulli trials, classification of states and chains. Poisson Process: postulates of Poisson Process, properties of Poisson Process with applications.

SUGGESTEDREADING:

1. Anderson,T.W.(2003):AnIntroductiontoMultivariateStatisticalAnalysis,3rd Edn.,JohnWiley.
2. Muirhead,R.J.(1982):AspectsofMultivariateStatisticalTheory,JohnWiley.
3. Kshirsagar, A.M.(1972):MultivariateAnalysis,1stEdn.MarcelDekker.
4. Johnson, R.A. and Wichern, D.W.(2007): Applied Multivariate Analysis, 6thEdn., Pearson & Prentice Hall.
5. Mukhopadhyay, P.: Mathematical Statistics.
6. Balagurusamy, E. (2011): Programming in ANSI C, 6th Edition, Tata McGraw Hill.
7. Medhi, J. (2009): Stochastic Processes, New Age International Publishers.
8. Basu, A.K. (2005): Introduction to Stochastic Processes, Narosa Publishing.

Course designed by : Amit Choudhury, Kishore Kr Das, Pallabi Medhi, Dept of Statistics, GU .

Semester 6

Course code : STA603

Course Name : Operations Researach

Credits: 4 (Theory: 04 credits, Practical/Lab: 00 credit)

Course Level : 300-399

Number of Contact classes : 60

Number of Non contact classes : 00

Course Objective: This course has the objective of inculcating the skills of Operations Research

Learning Outcomes: At the end of the course, students shall be able to use techniques of operations research to obtain optimization in field level problems.

Unit 1: Linear Programming Problem: (No. of classes: 18, Weightage: 30%)

Linear Programming Problem, Mathematical formulation of LPP, Graphical solution of an LPP, Simplex procedure for solving LPP (without derivation) (three more variables variable) , slack and surplus variable

Unit 2: Transportation problem: (No. of classes: 06 , Weightage: 10%)

Transportation Problem, Initial solution by North West corner rule, Least cost method

Unit 3: Replacement problem: (No. of classes: 12 , Weightage:20%)

Replacement of items with deterministic deterioration (items that deteriorate with time), case of money value changing with time, group replacement policy.

Unit 4: Network problems-CPM & PERT: (No. of classes: 18 , Weightage: 30%)

Conception of network, idea of network node, activities, dummy activity, construction of network diagram. Network scheduling using C.P.M: determination of different types of floats and slacks, determination of critical path.

Unit 5 : Inventory Control: (No. of classes: 06, Weightage:10%)

Inventory Management: ABC inventory system, characteristics of inventory system. EOQ Model and its variations (with and without shortages).

Suggested Reading :

1. Taha, H. A. (2007): Operations Research: An Introduction, 8th Edition, Prentice Hall of India.

2. Kanti Swarup, Gupta, P.K. and Manmohan (2007): Operations Research, 13th Edition, Sultan Chand and Sons.

3. Hadley, G: (2002) : Linear Programming, Narosa Publications

4. Hillier, F.A and Lieberman, G.J. (2010): Introduction to Operations Research Concepts and cases, 9th Edition, Tata McGraw Hill

Course designed by : Amit Choudhury, Rajan Sarma, Sahana Bhattachrjee, Dept of Statistics, GU .

Semester 6
Course code : STA604
Course Name : Practical-6
Credits: 4 (Theory: 00 credits, Practical/Lab: 04 credit)
Course Level : 300-399
Number of Contact classes : 60
Number of Non contact classes : 00

Course Objective: This practical level course has the objective of providing student hands on training on application of skills of operations research and applications of Statistics.

Learning Outcomes: At the end of the course, students shall be able to use techniques of operations research to attain optimality as well as apply applied statistical techniques to field levels problems in industry, govt and society.

Practicals on the following:

(a) all units of STA601(Applied Statistics) (No. of classes: 30 Weightage: 50%)

(b) all units of STA603(Operations Research) (No. of classes: 30 Weightage: 50%)

Reference books :

1. Taha, H. A. (2007): Operations Research: An Introduction, 8th Edition, Prentice Hall of India.
2. Kanti Swarup, Gupta, P.K. and Manmohan (2007): Operations Research, 13th Edition, Sultan Chand and Sons.
3. Hadley, G: (2002) : Linear Programming, Narosa Publications
4. Hillier, F.A and Lieberman, G.J. (2010): Introduction to Operations Research Concepts and cases, 9th Edition, Tata McGraw Hill
5. Parimal Mukhopadhyay, Applied Statistics

Course designed by : Dept of Statistics, GU .

8. Earth Sciences

MDC-1: Understanding Physical Formations of the Earth

Unit	Contents	Lecture
Unit-I Origin of the Earth	Views on origin and age of the earth; Components of the earth system and the characteristics of the Lithosphere from the perspective of geological formations; Geological time scale	7
Unit-II Internal structure of the earth	General constitution of the earth; Layers of the earth and their composition and characteristics: Crust, mantle, outer core and inner core	7
Unit-III Rocks and minerals	Definition of rock and mineral; Mineral: Properties and types; Rock: Classification and types	6
Unit-IV Landform dynamics on the earth	Landform and its classification; Geomorphic forces, associated processes and landform development: Endogenic and exogenic; Folding and faulting; Erosion, mass wasting and landslide; Earthquake and volcanic eruption-Causes, consequences and distribution	14

Books Recommended:

1. Klein, C. and Philpotts, A. (2016). Earth Materials: Introduction to Mineralogy and Petrology, 2nd edition, Cambridge University Press, 616p.
2. Patwardhan, A. M. (2020). The Dynamic Earth System. 4th edition, PHI Learning Pvt. Ltd., 576p.
3. Plummer, C. C., Carlson, D., and Hammersley, L. (2015). Physical Geology., 15th edition, McGraw Hill, 672p.
4. Reynolds, S. and Johnson, J. (2021). Exploring Geology. 6th edition, McGraw Hill, 704p.
5. Singh, S. (2012). Geomorphology, Pravalika Prakashans, Allahabad, 652p.

MDC-2: Understanding the Changing Environment

Unit	Contents	Lect.
Unit-I Environment as s system	Meaning of environment; Components of earth's environment system and their characteristics and interrelationship: Lithosphere, Hydrosphere, Atmosphere and Biosphere; Ecosystem, its components and functioning; Concept of balanced environment	8
Unit II Changing man and environment relationship	Impact of natural environment on man and his activities (Agriculture, food, dress, house, power development, human adjustment in different	10

	environments); Population growth and environmental changes; Impact of man on natural environment (Deforestation, soil erosion, soil degradation, depletion of mineral resources, air and water pollution)	
Unit-III Environmental changes and associated environmental problems	Global environmental changes: Global warming, Ozone layer depletion, Climate change Environmental problems: Sea level change; Extreme weather events; Land, air and water pollution; Desertification; Deforestation, biodiversity loss and man-animal conflicts	10
Unit-IV Environmental Management	Meaning of environmental management; Conservation of natural environment and its resources; Management of environmental problems; Concept of sustainable development	6

Recommended Books:

1. S. C. Santra (2011): Environmental Science, New Central Book Agency
2. Michael Allaby (2000): Basics of Environmental Science (2nd Ed.), Taylor & Francis
3. R. W. Jackson and J. M. Jackson (1998): Environmental Science – The natural environment
   and human impact, Longman
4. 4.D. D. Mishra (2019): Fundamental Concepts in Environmental Studies, S Chand Publication

MDC-3: Land and People of Assam

Unit	Contents	Lect.
Unit-I	Locational significance of Assam; Assam as an administrative division - Pre and Post-Independence Changes; Present administrative divisions	8
Unit II	Physical Characteristics (Relief, drainage, climate and vegetation) and associated problems (River-bank erosion, landslides and floods	10
Unit-III	Natural resources (Forests, wildlife and biodiversity, mineral resources)	8

Environmental Studies

Total marks: 50

Course level:100-199

No. of Credits: 2 **No. of hours: 30**

Unit1: Introduction to Environmental Studies **5 lectures**

- Multidisciplinary nature of environmental studies;
- Scope and importance;
- Basic concepts: Renewable resources, no renewable resources, Common Property resources, Tragedy of commons, Climate change, global warming
- Concept of sustainable development

Unit 2: Ecosystems **10 lectures**

- What is an ecosystem? Difference between ecology and ecosystem. Structure and function of ecosystem: Energy flow in an ecosystem: food chains, food web and ecological succession.
- Case studies on any one of the following
  a) Forest ecosystem
  b) Grassland ecosystem
  c) Aquatic ecosystems (ponds, streams, lakes, rivers)
  d) Mountain ecosystem

Unit 5: Environmental Pollution and laws **15 lectures**

- Environmental pollution: types, causes, effects and controls; Air, water, soil and noise pollution
- Solid waste management: Control measures of urban and industrial waste.

- Environment Laws: Environment Protection Act; Air (Prevention & Control of Pollution) Act; Water (Prevention and control of pollution) Act; Wildlife Protection Act; Forest Conservation Act. International agreements, policies and treaties

Suggested Readings:

1. Bharucha Erach : Text book on Environmental Studies, UGC, New Delhi
2. Carson, R 2002. Silent Spring. Houghton Mifflin Harcourt.
3. De A.K.: Environmental Chemistry, Wiley Eastern Ltd.
4. Kaushik Anubha and C.P.Kaushik : Perspective in Environmental Studies, New Age International
5. Rajagopalan, R. (2018). Environmental Studies. (3rd Edition) Oxford University Press

Gauhati University

Syllabus for FYUGP, Skill Courses (SEC): 2023-24

List of Skill Coursesfor First Semester-

- **Colleges/Departments can select any curses from the list, asper their Faculty/Facility availability, and as per the suitability/demand**

- **For courses not having Detailed Syllabus in this document, Colleges/Departments may propose Detailed Syllabus, and submit to the Academic Registrar, GU for approval**

Sl No	Skill Course Name	Semester
1	Academic Writing	1st
2	Agricultural Production System in North East India	1st
3	Anthropological Tourism	1st
4	Anuvad Charcha (Bengali-English/IndianLanguages)	1st
5	Apiculture	1st
6	Art of Acting	1st
7	ASAMIYA AKHAR JOTANI	1st
8	BAKERY SCIENCE	1st
9	Bamboo and Cane Technology	1st
10	Basic Analytical Chemistry	1st
11	Basic Animation and Graphic Design	1st
12	Basic Instrumentation Skills	1st
13	Basic Programming in C	1st
14	Basic Science Laboratory Skills	1st
15	Basics of Laboratory Practices in Zoology	1st
16	Basics of Photography	1st
17	Beautician and Makeup	1st
18	Bhasha Skhsan Ra Prabridhi in Nepali	1st
19	Bodo Cuisine and FOOD PROCESSING Skills	1st
20	BUSINESS COMMUNCATION	1st
21	Byabaharik Asomiya	1st
22	বাংলাভাষার বভিন্নি ব্যাবহারকি দকি ও সম্ভাবনা	1st
23	Computer and Office Automation	1st
24	COMPUTER APPLICATIONS	1st
25	CSSD Technology-I	1st
26	Cyber Laws	1st
27	Data Collection and Presentation	1st
28	DEMOCRACY AND LEADERSHIP BUIDING	1st

29	Developing Soft Skills in English	1st
30	Digital Photography and editing	1st
31	Document Presentationand Presentation Software	1st
32	Domestic and Industrial Electrical wiring	1st
33	Early Childhood Care and Development	1st
34	Ecology and Environmental Management	1st
35	Electronic Circuit Design	1st
36	Electronic Data Processing	1st
37	Elements of Art and Design	1st
38	ELT Skill-1	1st
39	Ethno botany	1st
40	Field Survey: Techniques and Application	1st
41	Floriculture	1st
42	Folk Dance of Goalpara	1st
43	Food Processing & Quality Management	1st
44	Foundamentals of Disaster Management	1st
45	Functional Assamese	1st
46	Functional Persian	1st
47	Fundamentals of Typography	1st
48	Fundamentals of Weather and Climate Sciences	1st
49	Gender Sensitization	1st
50	Geography of Tourism	1st
51	Geological Laboratory Techniques	1st
52	Grammar and Composition Skills	1st
53	Gymnasium Skills	1st
54	Handloom and Textile	1st
55	Herbarium Techniques and its role in Modern Science	1st
56	HINDI BHASA SHIKSHAN	1st
57	Hindi Vyakaran Aur Asomiya Vyakaran Mein Samya Tatha Vasmya	1st
58	Legal Literacy & its application	1st
59	Legislative Support	1st
60	Life Skill Education	1st
61	Managing Stress	1st
62	Manipuri indigenous game & festivals	1st
63	Microbiological Analysis of Air and Water	1st
64	Microsoft Excel (Beginners)	1st
65	Mushroom Cultivation Technology	1st
66	Nepali Language learning	1st
67	Non-Mulberry Sericulture	1st
68	Nursery and Gardening	1st
69	Organic Farming	1st

70	Ornamental Fish and Fisheries	1st
71	Page Maker	1st
72	Panchayati Raj and Practice	1st
73	Paramporagato Asomiya Lokanityar Paribekhan Soili	1st
74	Pest Management	1st
75	Philosophical Counseling	1st
76	Photo Journalism	1st
77	Photoshop	1st
78	Physics Workshop Skills	1st
79	Political Institutions and Its practices in India	1st
80	Post Harvesting Technology	1st
81	Principals & techniques of food processing & preservation	1st
82	Programming in C	1st
83	Quantitative Apptitude and Reasoning	1st
84	Rachna Lekhan in Nepali	1st
85	Reasoning & Logic	1st
86	Renewable Energy and Energy Harvesting	1st
87	Report Writing and presentation	1st
88	Retail Management	1st
89	River Basin Studies	1st
90	Rural Marketing	1st
91	Sankritik Paryatan aru Bhraman Byabasthapana	1st
92	Sattriya Dance Skill	1st
93	SCILAB	1st
94	Secretarial Practice	1st
95	Small Poultry Farming	1st
96	Small Tea Garden Management	1st
97	Social Media Marketing	1st
98	Soft Skill-1	1st
99	Soil and Water Analysis	1st
100	Spoken Arabic-1	1st
101	Spoken English	1st
102	Spoken Hindi	1st
103	Stress Management	1st
104	Teaching Skill	1st
105	Tools & Techniques for Local Handicraft Entrepreunership	1st
106	Tour Packaging Management	1st
107	Traditional Medicinal System in Mayong, Assam	1st
108	Understanding Psychology	1st
109	Video editing for social media	1st
110	Weaving, Basic Weaves and Standard Febrics	1st
111	Web Front-end Designing	1st

112	Workshop Practice (Mechanical, Carpentry and Electronics)	1st
113	Abrittikala / Art of Recitation	1st
114	Mental Health and Hygine	1st

Detailed Syllabus are available for following courses:

- **For courses not having Detailed Syllabus in this document, Colleges/Departments may propose Detailed Syllabus, and submit to the Academic Registrar, GU for approval**

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7	Basic Instrumentation Skills	1st
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11	Bodo Cuisine and FOOD PROCESSING Skills	1st
12	BUSINESS COMMUNCATION	1st
13	Byabaharik Asomiya	1st
14	বাংলাভাষার বভিন্নি ব্যাবহারকি দকি ও সম্ভাবনা	1st
15	Computer and Office Automation	1st
16	COMPUTER APPLICATIONS	1st
17	Data Collection and Presentation	1st
18	DEMOCRACY AND LEADERSHIP BUIDING	1st
19	Early Childhood Care and Development	1st
20	Ecology and Environmental Management	1st
21	Electronic Circuit Design	1st
22	Electronic Data Processing	1st
23	Elements of Art and Design	1st
24	ELT Skill-1	1st
25	Field Survey: Techniques and Application	1st
26	Floriculture	1st
27	Fundamentals of Disaster Management	1st
28	Fundamentals of Weather and Climate Sciences	1st

29	Gender Sensitization	1st
30	Geography of Tourism	1st
31	Grammar and Composition Skills	1st
32	Herbarium Techniques and its role in Modern Science	1st
33	Life Skill Education	1st
34	Mushroom Cultivation Technology	1st
35	Non-Mulberry Sericulture	1st
36	Nursery and Gardening	1st
37	Ornamental Fish and Fisheries	1st
38	Panchayati Raj and Practice	1st
39	Philosophical Counseling	1st
40	Photo Journalism	1st
41	Photoshop	1st
42	Physics Workshop Skills	1st
43	Political Institutions and Its practices in India	1st
44	Programming in C	1st
45	Quantitative Apptitude and Reasoning	1st
46	Reasoning & Logic	1st
47	Renewable Energy and Energy Harvesting	1st
48	Retail Management	1st
49	Rural Marketing	1st
50	Sattriya Dance Skill	1st
51	Soft Skill-1	1st
52	Spoken Arabic-1	1st
53	Spoken English	1st
54	Spoken Hindi	1st
55	Teaching Skill	1st
56	Tools & techniques for Local Handicraft Entrepreunership	1st
57	Tour Packaging Management	1st
58	Traditional Medicinal System in Mayong, Assam	1st
59	Understanding Psychology	1st
60	Web Front-end Designing	1st
61	Workshop Practice (Mechanical, Carpentry and Electronics)	1st
62	Abrittikala / Art of Recitation	1st
63	Mental Health and Hygine	1st
64	HistoricalTourisminNorthEastIndia	1st

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--Detailed Syllabus--

1.Academic Writing

Subject Name: English SEC FYUGP

Course Name: ACADEMIC WRITING

EXISTING BASE SYLLABUS: NIL

Objectives: This course is designed to -

- Ease the students into the domain of writing that measures up to academic standards.
- Introduce the central ideas and forms of academic writing, and guide the students through them in an orderly way.
- Facilitate and encourage methodical thinking and analyzing. Such processes would then enable the students to work on and improve the quality of their writing.

COURSE LEVEL: 100-199 (FOUNDATION AND INTRODUCTORY) **COURSE**

OUTCOMES (GRADUATE ATTRIBUTES):

Upon the end of this course, students should be able to:

- Understand the features of professional and academic writing.
- Enhance vocabulary, communicative and writing skills.
- Write grammatically cohesive and articulate sentences in their own words. • Engage in critical thinking and brainstorming ideas.
- Form cogent arguments and compose analytical drafts.
- Review their essays to maintain academic integrity and avoidplagiarism.

TOTAL CREDITS: 3

COURSE CONTENT:

UNIT I: Introduction to the Writing Process

- Basics and Conventions of Academic Writing
- Reading and Developing Ideas
- Understanding Paragraph Formats
- Annotating
- Note-making

UNIT II: Organizing Paragraphs and Research Work

- Summarizing
- Paraphrasing

- Outlining Essays
- Planning and Structuring Arguments
- Introductions and Conclusions

UNIT III: Critical Analysis and Finalizing Drafts

- Citing quotations and Referencing
- Checking for Plagiarism
- Revision and Re-writing
- Final Editing
- Proofreading

REFERENCE BOOKS & MATERIALS:

Bailey, Stephen. *Academic Writing: A Practical Guide for Students*. RoutledgeFalmer, 2004. Booth, Wayne C., et al. *The Craft of Research*. The University of Chicago Press, 2016. Day, Trevor. *Success in Academic Writing*. Palgrave Macmillan, 2013.

Sivia, Paul J. *How to Write a Lot: A Practical Guide to Productive Academic Writing*. American Psychological Association, 2007.

Zemach, Dorothy E., and Lisa A. Rumisek. *Academic Writing: From Paragraph to Essay*. Macmillan, 2005

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2. Agricultural Production System in North East India

Credit: (2+1)

Course Description: This course is designed to introduce the students to the nature of agricultural production system that exist in North-East India. The course intends to familiarise the students with various cropping systems, farming systems and post-harvest management systems.

Unit 1- Introduction- Nature and scope of agriculture. Agricultural Scenario in north east India and Assam, Trends of agricultural production in India and Assam. Agriculture and economic development, Agro-climatic zones, Climate change, Land holding and farmers' categories, Plant propagation and Nursery management, Diversification of agriculture.

Unit 2- Cropping systems in agriculture & horticulture -Crop rotation, Intercropping, Mixed Cropping, Relay cropping, Multi-storied cropping, kharif, rabi and zaid crops. Integrated Farming System, Tillage and soil preparation, Pre and post harvest management of agri-horti crops.

Unit 3- Practical –Plant propagation techniques, Model preparation on diversified integrated farming systems,

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3. Apiculture

(Syllabus 1)

Skill enhancement course
Apiculture
Code: ZOO-
Credit: 2(T) + 1 (P)

Course Objectives:

Apiculture is the scientific method of rearing or management of colonies of honey bees for obtaining honey and other bee products as well as getting pollination services. Bee keeping covers entomology, horticulture, agriculture, animal husbandry, forestry etc. This field bears tremendous potential of generating sustainable livelihood as the honey bee products has high market value in medicinal, pharmaceutical, cosmetics, food industries etc. The objectives of the course are to impart knowledge on biology, rearing techniques, diseases and enemies of bees, prospects of the field to venture in entrepreneurship development by their own or to pursue higher studies in the field.

Course Learning Outcome:

Upon completion of the course, students should be able to:

- Understand the biology and rearing methods, tools and techniques of honey bees
- Acquire practical skill of identifying stages of honey bees, structure of bee hives etc
- Understand the value and economics of honey bee products in the market.
- Develop curiosity to venture in the field as entrepreneur or to pursue research in future.

Skill enhancement course
Apiculture
Code:
Credit: 2(T) + 1 (P)

THEORY	**Hours 30**
Unit 1: Biology of Bees, Diseases and Enemies Types and Biology of HoneyBees, Social Organization of Bee Colony, Bee Diseases and Enemies, Control and Preventive measures	12h

Unit 2: Rearing of Bees Artificial Bee rearing (Apiary), Beehives – Newton andLangstroth, Bee Pasturage, Selection of Bee Species forApiculture, Bee Keeping Equipment, Methods of Extraction of Honey (Indigenous and Modern)	12h
Unit 3: Bee Economy and Entrepreneurship in Apiculture Apiculture Industry and products of bees and their Uses (Honey, Bees Wax, Propolis, Pollenetc)	8h

Apiculture

PRACTICAL	**Hours15**
1. Study of the various stages of Life cycle of Honey bee. 2. Identification of various equipment of bee keeping. 3. Methods of Extraction of Honey (Indigenous and Modern). 4. Structure of bee hives (Newton and Langstroth). 5. Preparation of slide- pollen basket, sting-apparatus 6. Testing of purity of honey. 7. Preparation of a report on pathogens and pests of honey bees	

Suggested Readings:

1.Prost, P. J. (1962). Apiculture. Oxford and IBH, New Delhi.

2. Bisht D.S., Apiculture, ICAR Publication.

3. Singh S., Beekeeping in India, Indian council of Agricultural Research, NewDelhi.

Syllabus2

GU FYUGP-2023
Sub: ZOOLOGY
SKILL ENHANCEMENT COURSES
APICULTURE

CREDITS-4

Unit 1: Biology of Bees

History, Classification and Biology of Honey Bees
Social Organization of Bee Colony

Unit 2: Rearing of Bees

Artificial Bee rearing (Apiary), Beehives–Newton and Langstroth
Bee Pasturage
Selection of Bee Species for ApicultureBee Keeping Equipment
Methods of Extraction of Honey (Indigenous and Modern)

Unit 3: Diseases and Enemies

Bee Diseases and Enemies
Control and Preventive measures

Unit 4: Bee Economy

Products of Apiculture Industry and its Uses (Honey, Bees Wax, Propolis),Pollen etc

Unit5: Entrepreneurship in Apiculture

Bee Keeping Industry–Recent Efforts, Modern Methods in employing artificial Bee hives for cross pollination in horticultural gardens

SUGGESTED READINGS

- Prost, P. J. (1962). *Apiculture*. Oxford and IBH, New Delhi.
- Bisht D.S., *Apiculture*, ICAR Publication.
- Singh S.,*Bee keeping in India*, Indian council of Agricultural Research, New Delhi.

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4.Art of Acting

Paper name:**– Art of Acting**

Credits: 3 **Total Marks: 100**

Theory classes: 17 classes (one hour each – 17 hrs) Theory: 50 Marks

Practical classes: 16 classes (two hours each – 32 hrs) Practical: 50 Marks

Course Description: Individuals at this job need to enact various characters for various theatre & media productions like; feature film, advertising film, documentaries, short films, television series, daily soaps etc

Objectives: This job requires the individual to have the essential to perform i.e. excellent communication skills, control over body, mind and voice, flair for mimicry and drama, sense of humour, emotional rendering, flexibility of body and voice, versatility, language skills etc. The individuals must be able to perform confidently and adapt performance to different emotions and characters accordance to requirements. The individuals must be able to understand and interpret requirements correctly and be capable of offering suggestions/alternatives to his/her director during shooting.

Specific Objectives:

1. Performance techniques and principles

2. The essential elements for performance(good health, voice, communication skills, body language, body flexibility, emotional rendering, control over voice and body, voice modulation etc)

3. How to maintain continuity of voice quality and physic throughout the performance

4. How to maintain the same tempo, tone, volume and pitch during the role/character performed earlier

5. How to increase and maintain body flexibility

6. How to concentrate on a particular role/character and focus on the performance

7. How to breathe correctly and have control over it

8. The basic of media industry and different roles different professionals play

9. How to listen to instructions carefully

10. How to infer the meaning of dialogues and action

11. How to enact and emote through voice, accent and body

12. How to use his/her body and voice to convey emotions and different characters through developed techniques

13. How to sing, dance (optional) if required/demanded by the role/character

14. How to come up with answers and suggestions/alternatives to offer his/her director during performance.

15. How to overcome performance pressure and anxiety and perform confidently

Course Outcome: Individuals at this job need to enact various characters for various theatre & media productions like; feature film, advertising film, documentaries, short films, television series, daily soaps etc

Course Content:

Unit 1: Basic knowledge about Acting **Marks: 10**

- What is Acting?
- Types of Acting
- Types of Actor
- Camera acting versus Stage acting

Unit 2:Introduction to different School of Acting **Marks: 10**

- Analyzing and practicing the different schools of Acting.

(Western Schools of Acting including Stanislavsky's Method Acting, Michael Chekhov's Psycho-physical approach', Meisner technique, DevidMamet and William H. Macy's Practical Aesthetics, Brecht's Epic Drama etc.)

- Natyashastra and Rasa Theory

Unit 3: Actors Preparation (basic information and practice) **Marks: 10**

- Voice & Music:
  To develop voice range, scale, rhythm etc.
- Speech: Accents and Dialects
- Body Movement & Yoga: To develop flexibility of body, impulse etc.

Unit 4: Characterization **Marks: 10**

- Play reading and Play analysis
- Character Analysis

Unit 5: Improvisation **Marks: 10**

- Improvisation: To enhance an actor's abilities,
  To develop Skills such as: *active listening, being in the moment, following intuition and making strong choices.*
- Actors preparation: The Embodied Voice:
  Acting: Scene Study
  Movement: Exploration
  Improvisation: Spontaneity in Action & speech
- Actors skill : Writing Your Story
  Expand Your Range
  Experimentation and Performance
- Audition: How to prepare for different kind of Audition

PRCTICL -Improvisation, Characterization, Presentation or Production: 50 marks

Text book:(ANY ONE OR TWO)

1. Hamlet by William Shakespeare.
2. Mritchakatikam by Shudrak.
3. EjakJonakirJilmil by Dr.BhabendraNathSaikia.
4. Rupaleem by JyotiprassadAgarwala.
5. AshadKaEk Din by Mohan Rakesh.
6. The Cherry Orchard Anton Chekhov.

References:

1. Natya Shastra by Bharatmuni.

2. The Stanislavsky System by Sonia Moore.
3. An actor prepares by Konstantin S. Stanislavsky.
4. Creating a role by Konstantin S. Stanislavsky.
5. Building a character by Konstantin S. Stanislavsky.
6. To the Actor by Michael Chekhov.
7. On the technique of acting by Michael Chekhov.

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5. ASAMIYA AKHAR JOTANI
প্রথমষান্মাষিক

(Skill Course) Syllabus

অসমীয়াআখৰজোঁটনি

-By Ratnapith College

(উদ্দেশ্য:

অসমীয়াভাষাবৃত্তিগতভাৱেব্যৱহাৰকৰিবলৈশুদ্ধআখৰজোঁটনিৰজ্ঞানঅপৰিহার্য।এইপাঠ্যতঅসমীয়াআখৰজোঁটনিৰনিয়মআৰুকৌশলসম্পর্কীয়জ্ঞানসন্নিবিষ্টহৈছে)

প্রথমগোট : বর্ণাশুদ্ধিৰকাৰণ :

স্বৰধ্বনিগতবর্ণাশুদ্ধি - স্বৰধ্বনিআৰুআখৰৰসম্পর্ক, স্বৰচিহ্ন।

দ্বিতীয়গোট : ব্যঞ্জনধ্বনিগতবর্ণাশুদ্ধি :
ব্যঞ্জনধ্বনিআৰুআখৰৰসম্পর্ক, যুক্তাক্ষৰ।

তৃতীয়গোট : ভুলপ্রয়োগ :
বিভক্তি, প্রত্যয়, চন্দ্রবিন্দু, যতিচিহ্ন, তৎসমশব্দৰবানান, থলুৱাশব্দৰবানান

চতুর্থগোট : লিপ্যন্তৰপদ্ধতিআৰুপ্রয়োগ

সহায়কগ্রন্থ (নির্বাচিত)

অসমীয়াআখৰ-জোঁটনিআৰুলিপ্যন্তৰপদ্ধতি : গুৱাহাটীবিশ্ববিদ্যালয়

অসমীয়াআখৰ-জোঁটনিঅসমীয়া: গোলকচন্দ্রগোস্বামী

ব্যাকৰণতত্বআৰুতাত্বিক : খগেশসেনডেকা

নিকাঅসমীয়াভাষা : মহেশ্বৰনেওগ

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6. Basic Analytical Chemistry

--By Nabajyoti College Kalgachia

Skill Enhancement Course (SEC)
CHEMISTRY
Course Code:
(Contact Hours-45 Lectures; Credits:)
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Full Marks = 80 [End Semester Exam (60) Internal Assessment (20)**]**

Unit I: Introduction
Introduction to Analytical Chemistry and its interdisciplinary nature. Concept of sampling. Importance of accuracy, precision and sources of error in analytical measurements. Presentation of experimental data and results, from the point of view of significant figures.

6 Lectures, Marks –6

Unit II: Basic principles of quantitative analysis
Estimation of metal ions from aqueous solution, geometrical isomer, keto-enol tautomers, determination of metal complex composition using Job's method of continuous variation and mole ratio method.

6 Lectures, Marks – 8

Unit III: Analysis of soil
Composition of soil, Concept of pH and pH measurement, Complexometric titrations, Chelation, Chelating agents, use of indicators
a. Determination of pH of soil samples.
b. Estimation of Calcium and Magnesium ions as Calcium carbonate by complexometric titration.

8 Lectures, Marks - 10

Unit IV: Analysis of water
Definition of pure water, sources responsible for contaminating water, water sampling methods, water purification methods.
a. Determination of pH, acidity and alkalinity of a water sample.
b. Determination of dissolved oxygen (DO) of a water sample.

8 Lectures, Marks - 12

Unit V: Analysis of food products
Nutritional value of foods, idea about food processing and food preservations and adulteration.
a. Identification of adulterants in some common food items like coffee powder, asafoetida, chilli powder, turmeric powder, coriander powder and pulses, etc.
b. Analysis of preservatives and colouring matter.

9 Lectures, Marks - 12

Unit VI: Chromatography
Definition, general introduction on principles of chromatography, paper chromatography, TLC etc.

a. Paper chromatographic separation of mixture of metal ion ($Fe^{3+}$and Al^{3+}).
b. To compare paint samples by TLC method.

8 Lectures, Marks - 12

Suggested Applications
a. To study the use of phenolphthalein in trap cases.

Suggested Instrumental demonstrations:
a. Estimation of macro nutrients: Potassium, Calcium, Magnesium in soil samples by flame photometry

Reference Books

1. Willard, H.H., Merritt, L.L., Dean, J. & Settoe, F.A. *Instrumental Methodsof Analysis*, 7th Ed. Wadsworth Publishing Company Ltd., Belmont, California, USA,1988.
2. Skoog, D.A., Holler, F.J. & Crouch, S. *Principles of Instrumental Analysis*, Cengage Learning India Edition, 2007.
3. Skoog, D.A.; West, D.M. & Holler, F.J. *Analytical Chemistry: An Introduction 6th Ed.,* Saunders College Publishing, Fort Worth, Philadelphia (1994).
4. Harris, D. C. *Quantitative Chemical Analysis*, 9th ed. Macmillan Education, 2016.
2. Dean, J. A. *Analytical Chemistry Handbook*, McGraw Hill, 2004.
3. Day, R. A. & Underwood, A. L. *Quantitative Analysis*, Prentice Hall of India, 1992.
4. Freifelder, D.M. *Physical Biochemistry 2nd Ed.,* W.H. Freeman & Co., N.Y. USA (1982).
5. Cooper, T.G. *The Tools of Biochemistry,* John Wiley & Sons, N.Y. USA. 16 (1977).
6. Vogel, A. I. *Vogel's Qualitative Inorganic Analysis 7th Ed.,* Prentice Hall, 1996.
7. Mendham, J., *A. I. Vogel's Quantitative Chemical Analysis 6th Ed.,* Pearson, 2009.
8. Robinson, J.W. *Undergraduate Instrumental Analysis 5th Ed.,* Marcel Dekker, Inc., NewYork (1995).
9. Christian, G.D. *Analytical Chemistry*, 6th Ed. John Wiley & Sons, New York, 2004.

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Course Code:
Basic Analytical Chemistry (Lab Work)
(Contact Hours- Lectures; Credits:)
Full Marks = 20

I. Any one Experiment to be Set in the Examination 1X8=8

a. Separation and identification of monosaccharides present in a given mixture (Glucose and Fructose) by paper chromatography. Report Rf Values.
b. Separation of organic compounds present in a given mixture by TLC method.
c. Estimate the Ni (ii) present in a given solution by gravimetric analysis.
d. Estimate the alkali present in a given antacids.

e. Determine the dissolve oxygen in water.

II. Identification of different analytical instruments.	4
II. Practical Note Book	3
III. Viva-Voce	5

Reference Books

1. Vogel, Arthur I: A Test book of Quantitative Inorganic Analysis (Rev. by G. H. Jeffery and others) 5th Ed., The English Language Book Society of Longman.

2. Willard, Hobert H. et al.: Instrumental Methods of Analysis, 7th Ed., Wardsworth Publishing Company, Belmont, California, USA, 1988.

3.Khopkar, S.M. Basic Concepts of Analytical Chemistry. New Age, International Publisher, 2009.

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7.Basic Instrumentation Skills

Credits: 3 (Theory: 3, Lab: 1)

Theory: 20 Lectures

Preferred minimum qualifications of the teacher/instructor: Assistant Professor of Physics/B.E./B.Tech in Instrumentation/Mechanical Engineering.

This course is to get exposure with various aspects of instruments and their usage through hands-on mode. Experiments listed below are to be done in continuation of the topics.

Theory

UnitI:BasicofMeasurement(Lectures3)

Instruments accuracy, precision, sensitivity, resolution range etc. Errors in measurements and loading effects. Multimeter: Principles of measurement of dc voltage and dc current, ac voltage, ac current and resistance. Specifications of a multimeter and theirsignificance.

Unit II: Electronic Voltmeter (Lectures 3)

Advantage over conventional multimeter for voltage measurement with respect to input impedance and sensitivity. Principles of voltage, measurement (block diagram only). Specifications of an electronic Voltmeter/ Multimeter and their significance. AC millivoltmeter: Type of AC millivoltmeters: Amplifier- rectifier, and rectifier- amplifier. Block diagram ac millivoltmeter, specifications and their significance.

Unit III: Cathode Ray Oscilloscope (Lectures 4)

BlockdiagramofbasicCRO.ConstructionofCRT,Electrongun,electrostaticfocusingandacceleration(Explanation only– no mathematical treatment), brief discussion on screen phosphor, visual persistence & chemical composition. Time base operation, synchronization. Front panel controls. Specifications of a CRO and theirsignificance.

Unit IV: (Lectures 4)

Use of CRO for the measurement of voltage (dc and ac frequency, time period. Special features of dual trace, introduction to digital oscilloscope, probes. Digital storage Oscilloscope: Block diagram and principle of working.

Unit V: Signal Generators and Analysis Instruments (Lectures 6)

Block diagram, explanation and specifications of low frequency signal generators, pulse generator, and function generator. Brief idea for testing, specifications. Distortion factor meter, wave analysis.

The test of lab skills will be of the following test items:

1. Use of anoscilloscope.
2. CRO as a versatile measuring device.
3. Use of Digital multimeter for measuringvoltages
4. Circuit tracing of Laboratory electronicequipment,
5. Winding a coil /transformer.
6. Study the layout of a circuit.
7. Trouble shooting a circuit

Lab

1. Toobservetheloadingeffectofamultimeterwhilemeasuringvoltageacrossalowresistanceandhigh resistance.
2. To observe the limitations of a multimeter for measuring high frequency voltage andcurrents.
3. Measurement of voltage, frequency, time period and phase angle usingCRO.
4. Measurement of rise, fall and delay times using aCRO.
5. Measurement of R, L and C using a LCR bridge/ universal bridge.

Open Ended Experiments:

- Using a Dual TraceOscilloscope
- Converting the range of a given measuring instrument (voltmeter,ammeter)

Reference Books

[1] Electronic Measurements and Instrumentation, K. Lal Kishore, PearsonIndia

[2] ElectricalandElectronicsMeasurementsandInstrumentation,PrithwirajPurkait,BudhadityaBiswas,Santanu Das, Chiranjib Koley, McGraw HillIndia.

[3] A text book in Electrical Technology - B L Theraja - S Chand andCo.

[4] Performance and design of AC machines - M G Say ELBSEdn.

[5] Digital Circuits and systems, Venugopal, 2011, Tata McGrawHill.

[6] Logic circuit design, Shimon P. Vingron, 2012,Springer.

[7] Digital Electronics, Subrata Ghoshal, 2012, CengageLearning.

[8] Electronic Devices and circuits, S. Salivahanan & N. S.Kumar, 3rd Ed., 2012, Tata McGrawHill

[9] Electronic circuits: Handbook of design and applications, U.Tietze, Ch.Schenk, 2008,Springer

[10] Electronic Devices, 7/e Thomas L. Floyd, 2008, PearsonIndia

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8. Basic Programming in C

(Skill Enhancement Course)

---By Dept of Computer Science, GU

1. Learning Outcomes: After completing this course, the students will be

- Familiar with what a programming language is
- Familiar with flowchart and pseudo code
- Familiar with the constructs of C programming languages
- Capable of writing basic C programs

2. Prerequisites: NIL

3. Semester: 1

4. Course type: Skill Enhancement Course

5. Course level: 100-199

6. Theory credit:2

7. Practical credit: 1

8. Number of required hours:

a) Theory: 30 hrs (30classes)

b) Practical: 30 hrs (15 classes)

9. Reference books:

- B.S. Gottfried, "Schaum's Outline of Theory and Problems of Programming with C", Mcgraw-Hill, 2007.
- B. Kernighan, D. Ritchie, "The C Programming Language", Second Edition, Prentice Hall, 1988
- E. Balaguruswami, "Programming in ANSI C", 2nd Ed., Tata McGraw Hill, 2004.

10. Contents of Syllabus:

Unit 1: Programming Basics (3 Lectures)

Introduction to programming languages. Low-level and high-level language and their characteristics. Compiler vs. interpreter. IDE. Bugs and its types. Algorithms, pseudocodes and flowcharts. Overview of the C programming language. Structure of a C program.

Unit 2: Data types and Operators **(6 Lectures)**

Basic data types in C - integers, floats, doubles, characters, and void. Size and range of values of data types. Variables. Declaring variables. Operators and expressions, Input and output statements – getchar(), getc(), getch(), putchar(), putc(), puts(), scanf(), printf(), format specifiers. Typecasting. Operators in C – binary and unary operators. Arithmetic, assignment, logical, comparison, bitwise and conditional operators. Order of precedence of operators. Associativity of operators. Expressions and statements in C. L-value and R-value. Basic syntax and semantics for expressions and statements.

Unit 3: Control Structures, Functions and Header files **(8 Lectures)**

Control structures in C. Decision making with if, if-else, switch statements. Nested conditions. Looping with while, do-while, and for statement. Break and continue statements. Nested loops. Introduction to functions. Function prototypes and arguments. Defining and calling functions in C. Return values and types. Formal and actual parameter. Call by value, Call by reference. Introduction to recursion. Writing recursive functions in C. Importance of main() function, return type of main() function. Preprocessor directives. Include and Define statements. Header files.

Unit 4: Arrays and Strings **(4 Lectures)**

Introduction to arrays. Declaration and initialization of arrays. Accessing array elements. Multidimensional arrays. Introduction to strings. Declaration and initialization of strings. String input and output in C. String manipulation functions in C – strlen(), strcpy(), strcat(), strcmp().

Unit 5: Pointers and Memory Allocation **(3 Lectures)**

Introduction to Pointers. Pointer declaration and initialization. Pointers and addresses. Pointers and arrays. Pointers and functions. Review of call by reference. Pointer arithmetic.

Unit 6: Structure and Union **(3 Lectures)**

Introduction to structures. Declaration and initialization of structures. Accessing structure members. Nested structures and arrays of structures. Unions in C. Declaration and initialization of unions. Accessing union members. Differences between structures and unions.

Unit 7: File Handling and Preprocessor Directives **(3 Lectures)**

Introduction to file handling in C. Opening and closing files – fopen(), fclose(). Modes of opening a file. Binary files and text files. Reading and writing files – fgetc(), fgets(), fread(), fputc(), fputs(), fwrite(). File pointers.

List of Practical

(This is a suggestive list only. Problems need not be restricted to this list.)

1. Write a program in C to print "Hello World"
2. Write a program to take input of two numbers and print their sum, product and difference.
3. Write a program to find the smallest or greatest of three numbers given as input.
4. Write a program to compute simple interest from user given inputs.
5. Write a program to compute factorial of a user given number.
6. Write a program to print the sum and product of digits of an integer.
7. Write a program to print a triangle of stars as follows (take number of lines from user as input):

```
*
***
*****
*******
*********
```

8. Write a program to reverse a number.
9. Write a program to compute the sum of the first n terms of the following series
   S = 1+1/2+1/3+1/4+……
10. Write a program to compute the sum of the first n terms of the following series
    S =1-2+3-4+5……
11. Write a function that checks whether a given string is Palindrome or not.
12. Write a function to find whether a given no. is prime or not.
13. Write a program to compute the factors of a given number.
14. Write a program that accepts 10 numbers from the user, stores the numbers in an array and finally displays the maximum and minimum of the numbers.
15. Write a program to perform following operations on strings:
    a) Convert all lowercase characters to uppercase
    b) Convert all uppercase characters to lowercase
    c) Calculate number of vowels in the string
    d) Reverse the string
16. Write a program to implement struct in C. Create a structure of Student with RNo, Name and other credentials with proper datatype and print the same.
17. Write a program to implement union in C. Create a structure of Person with Pid, Name and other credentials with proper datatype and print the same.
18. Write a C program that opens a file for reading and displays the contents of the file in binary mode and text mode.

19. Write a C program that opens a file for reading and displays the contents of the file character by character and line by line on the screen.
20. Write a C program to open a file and count the number of characters and lines in the file.
21. Write a C program that opens a file in append mode and allows the user to add text to the end of the file.

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9.Basics of Laboratory Practices in Zoology

(Total: 3 credits)

THEORY (2 credits)

Unit 1: Introduction to Biological Lab (5)

Practical and observation notebook maintenance, Instrument calibration, Glass waresand lab instruments cleaning and maintenance, museum specimens, specimen cataloging and preservation

Unit 2: Bioinstrumentation (9)

Basics of microscopy, spectrometry, colorimetry and microtomy. Autoclave, incubator, laminar air flow, centrifuge, pH meter, chromatography, electrophoresis, and pipetting (traditional and automatic)

Unit 3: Solution preparation (5)

General Math skills in reagent preparation, percent solutions, molarity, molality, normality, buffer solutions, reagents, and stains

Unit 4: Laboratory safety (3)

Basics of laboratory safety, handling and storage of chemicals and reagents, precautions in handling hazardous chemicals

PRACTICAL (1 credit)

1. Instrument calibration
2. Reagent preparation
3. Specimen submission

Reference books:

1. Ananta Swargiary. Biological Tools and Techniques. Kalyani Publications.
2. S.C. Nigam and Omkar. Experimental Animal Physiology and Biochemistry. New Age International Publishers.
3. Gerardus Blokdyk. Good Laboratory Practice - A complete guide. 5 Star Cooks Publishers.

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10.Beautician and Makeup

BEAUTICIAN COURSE

Total Marks = 100 (Theory 30 marks + Practical 70 Marks)

The syllabus of basic beautician course covers the basics of various beauty services. The basic beauty parlor course syllabus is designed from a perspective of a beginner and covers the basics such as threading, facial stokes, bridal make up, party makeup, waxing, hair styling and more.

Threading (face, forehead, upper lips, etc.)	Facial Stokes
Skin care	Waxing
Manicure & pedicure	Head Massage
Basic Bridal Make-up	Basic Hair Cutting
Basic Make-up	SPA
Hairstyle	Hair Care & Bun
Bleaching	

COURSE OUTCOME:

This skill enhancement course will be designed in a way to develop the student's practical skill and theoretical knowledge to a level that they can expect to make a career in the beauty industry. This will encourage thefemale students to develop entrepreneurial skills, which in turn, would make them self-dependent and also boost their self confidence.

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11. Bodo Cuisine and FOOD PROCESSING Skills

BOD-Skill Enhancement Course
Marks= 50 (Theory) + 50 (Practical)=100

Paper Title: Food processing system of the Bodos: Tradition to Modernity (1st)

Course outcomes:

- Come to know about the food processing system of the Bodos from past to present

Unit I: An introduction to the food processing system: method and types 20

Unit II: Food preservation system of the Bodos: Past, present and future prospect 20

Unit III: Impact of modern foods on Bodo food habits 10

Note: Practical will be taken from prescribed topics given below:

1. Collection and documentation of materials for traditional Bodo food recipes
2. Presentation on traditional Bodo food presentation system
3. Presentation on traditional Bodo beverage

Suggested Readings:

1. Boro-KocharirSomajAruSanskriti: BhabenNarzee
2. Principle of Food Science Part-II :Physcal Method of Food Preservation- M. Kare, O.R.
3. Fennema and D.B. Lurd, Marcel Dekkar
4. Principles of Food Preservation- V. Kyzlimk, Elsevier Press
5. Modern Food Microbiology- Jemes M Jay, D. Van Nostrand
6. Nutrition and dietics- Rose
7. Nutrition and dietics- Joshi

12. BUSINESS COMMUNCATION

By- Ratnapith College

DEPARTMENT OF ENGLISH

CREDITS- 2 TOTAL MARKS- 100

Learning Objectives

After studying this course, students will be able to improve presentation skills to be learnt by effective use of verbal and non-verbal communication for the professional field. The students will also be able to acquire practical employability skills to be disseminated through focused sessions on practical employable knowledge and will be able to enhance professional communication.

UNIT 1- THEORY OF BUSINESS COMMUNICATION

- Introduction
- What is Business Communication?
- Language of Business Communication
- Miscommunication & Effective Communication

UNIT 2 -Writing Skills

- Summarising & Paraphrasing
- Job-Oriented Skills- CV, Resume & Bio- Data, Job Application Letter.
- Documentation.
- Letter Writing- Applications, Business Letters
- Report- Analytical Report, Project Report

UNIT 3- PRACTICE SESSIONS-

- Advertisements & Invitation
- Making Online Academic/Work Profile- LinkedIn.
- Speaking Skills, Presentation Skills- Oral Presentation, Ppt. Preparation, Ppt. Presentation.
- Interview- Promotion Interview, Job Interview, Business Interview

The recommended readings given at the end are only suggestive; the students and teachers have the freedom to consult other materials on various units/topics given below.

Suggested Readings

- Kaushik, J.C. and K.K. Sinha eds., English for Students of Commerce, Oxford University Press, New Delhi.
- Sethi, Anjana & Bhavana Adhikari, Business Communication, Tata McGraw Hill.
- Anjana Neira Dev, et.al, eds. Business English, Department of English, University of Delhi, 2011, Pearson Publications, New Delhi.

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13. Byabaharik Asomiya

--By Laharighat College

প্ৰথমগোটঃ

আৰ্হিপাঠঃপদ্ধতিআৰুকৌশল।

দ্বিতীয়গোটঃ

ছপাআৰুবৈয়ুতনিমাধ্যমৰাবেজ্ঞাপনলখেন, ইংৰাজীহনি্দীবজ্ঞাপনৰ অসমীয়াঅনুবাদ।

তৃতীয়গোটঃ

অনুবাদঃসংবাদ,প্ৰবন্ধ, সাক্ষাকাৰ।

চতুৰ্থগোটঃ

চিত্ৰনাট্যনৰি্মাণঃসাহিত্যৰচিত্ৰায়ণ।

(Syllabus 2)

Byabaharik Asomiya

--By Nabajyoti College, Kolgachai

SEC Syllabus of FYUGP

Gauhati University

B.A 1st semester

Subject: Assamese

Paper Name : ব্যৱহাৰিক অসমীয়া

Total Marks : 100

প্রথম গোট : ২০

আর্হি পাঠ : পদ্ধতি আৰু কৌশল

দ্বিতীয় গোট: ২০

ছপা আৰু বৈদ্যুতিন মাধ্যমৰ বাবে বিজ্ঞাপন লেখন, ইংৰাজী হিন্দী বিজ্ঞাপনৰ অসমীয়া অনুবাদ।

তৃতীয় গোট : ২০

অনুবাদ : সংবাদ , প্রবন্ধ , সাক্ষাৎকাৰ

চতুর্থ গোট : ২০

চিত্রনাট্য নির্মাণ: সাহিত্যৰ চিত্রায়ণ

পঞ্চম গোট :

বৈদ্যুতিন মাধ্যমৰ বিজ্ঞাপনৰ ভিডিঅ'গ্রাফী/ চিত্রনাট্য প্রদর্শন ২০

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14. বাংলাভাষার বভিন্নি ব্যাবহারকি দকি ও সম্ভাবনা

Paper Code - BEN SEC PAPER- 1		**Credits**-3
Paper Title -বাংলা ভাষার বভিন্নি ব্যাবহারকি দকি ও সম্ভাবনা(প্রুফ সংশোধন, পরভিাষা ওসম্পাদনা)		**External Marks—80** **Internal Marks—20***
Units	**Topics**	**Marks**
I	**বাংলা বানান বধিি ও প্রুফ সংশোধন** বাংলা বানান বধিরি প্রাথমকি ধারণা, প্রুফ সংশোধন চহ্নি, প্রুফ সংশোধনরে সংজ্ঞা, বশৈষ্ট্যি, সমস্যা, প্রয়োজনীয়তা, রীতি ও ব্যাবহারকি প্রয়োগ	20
II	**বাংলা পরভিাষা** পরভিাষার সংজ্ঞা, বশৈষ্ট্যি ও আবশ্যকতা, বষিয়ভত্তিকি পরভিাষার ধারা (সাহত্যি-শল্পিরে পরভিাষা, বাণজ্যিরে পরভিাষা, বজ্ঞিানরে পরভিাষা, প্রশাসনকি ও রাজনতৈকি পরভিাষা)	20
III	**সম্পাদনা** পত্রকিা এবং গ্রন্থ সম্পাদনা, সম্পাদনা পদ্ধতি, বশৈষ্ট্যি, সম্ভাবনা, সমস্যা, প্রত্যাহ্বান গ্রন্থরে বভিন্নি অংশ: প্রচ্ছদ, আখ্যাপত্র, উসর্গপত্র, সম্পাদকীয়, ভূমকিা, সূচপিত্র, পুস্তানি, লখেক পরচিতি, ISBN ও ISSN সম্পর্কতিপ্রাথমকিধারণা, পরশিষ্টি, গ্রন্থপঞ্জি, নর্িঘণ্ট	20
IV	**আন্তর্জালরে বৃত্তমিূলক প্রয়োগ** কন্টটে রাইটংি, ফ্রলিান্সংি, বজ্ঞিাপন নর্িমাণ, শক্ষিামূলক ভডিওি নর্িমাণ, ই-মার্কটেংি, ব্লগ নর্িমাণ কৌশল, স্বত্ব-বষিয়ক আইন (copyright Act), গ্রন্থস্বত্বরে গুরুত্ব ও প্রয়োজনীয়তা	20

*Candidates have to attend one Sessional Exam, of 40 marks and submit two Home Assignments each of 20 Marks for Internal Assessment Marks. Internal Assessment marks will be given out of 20 marks by averaging the marks obtained in Sessional Examination and Home Assignments.

Reference Books:

১। সুভাষ ভট্টাচার্য – তষ্ঠি ক্ষণকাল, আনন্দ পাবলশিার্স
২। নীরন্দ্রনাথ চক্রবর্তী (সম্পা.) – বাংলা কী লখিবনে কনে লখিবনে, আনন্দ পাবলশিার্স
৩। সুভাষ ভট্টাচার্য – লখেক ও সম্পাদকরে অভধিান, আনন্দ পাবলশিার্স
৪। পরভিাষা কোষ – সুপ্রকাশ রায়, বদ্যিোদয় লাইব্ররেী
৫। পরভিাষা অভধিান – বাংলা একাডমেি, ঢাকা
৬। রাজশখের বসু – চলন্তকিা, এম. সি. সরকার

৭।শলৈেন্দ্র বশি্বাস (সম্পা) – সংসদ বাংলা অভধিান, সাহত্যি সংসদ
৮। বানান অভধিান- পশ্চমিবঙ্গ বাংলা অকাদমেি
৯। প্রুফ সংশে·াধনরে প্রথম পাঠ – অপরাজতিা বন্দ্যে·াপাধ্যায়, প্রজ্ঞা বকিাশ
১০। কম্পউিটার এবং ইন্টারনটে টপিস্ - মে·া. আনসিুর রহমান, তাম্রলপি, ঢাকা
১১। ইন্টারনটেে ইনকাম ও প্রাসঙ্গকি তথ্য – খালকেুজ্জামান এল্জী, মম প্রকাশনী, ঢাকা

Outcome: The course will enable students to develop real-life skills about various applications of Bengali language. They will gather theoretical knowledge about proof reading, Bengali terminologies and journal and book editing.

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15. Computer and Office Automation

Subject: Information Technology in Business
Course: SEC **Total Marks:-100**
Course Level: **(External-50)**
Course Title: Computer and Office Automation **(Internel-50)**

Course Description: The main objective of this course is to make the students aware about the best use of technology to make the business potent. As it is an established fact that technology can become one of the key success factors for the company, enhanced knowledge of technology and advanced computer applications can give added advantage to new generation managers. The entry of big multinationals in Indian market also makes it pertinent for managers to have proficiency in latest technologies so that they can gain an edge over other professionals. This course is designed to provide proper support to the students for better understanding of technology and its application in business today.

Evaluation pattern:

Quiz 10% Assignments / Projects 10% Class participation 10% Mid Semester Examination 30% End Term Examination 40% Pedagogy: Lectures• Case study• Minor projects• Session Course Content Percentile weightage 1 - 4 Information Technology's Role in Business and its Basics 15% 5- 10 Identifying Competitive advantages through technology, Supportive 15% organizational structure for Strategic Initiatives 11 - 17 Strategic Initiatives using IT : SCM, CRM and ERP, Measuring the success of Strategic Initiatives 15% 18 - 25 Extending the organization, Building a Customer Centric Organization, Integrating Organization 15% 26 - 32 Organizational Information, Accessing Organizational Information, Creating Innovative Organizations 10% 33 - 41 Teams, Partnerships and Alliances, Building Software to support an agile organization, 15% 42 - 50 Outsourcing Development, Ethics in using IT, Emerging Trends and Technologies 15%

Text Book: 1. Business Driven Technology by Haag/Baltzan/Philips, 2nd ed Tata McGraw Hill Publication.

Reference Books: 1. Enterprise Systems for Management by Luvai Motiwalla, Guido Tabellini, Jeffrey Thompson, Pearson Education 2. e-Business 2.0 Roadmap for Success by Dr. Ravi Kalakota, Marcia Robinson, Pearson Education 3. Management of Information Technology by Carroll W. Frenzel and John C. Frenzel, fourth Edition, Thomson Press 4. E-commerce – A Managerial Perspective by P. T. Joseph, Prentic Hall India Publications. 5. Marketing of High-Technology Products and Innovations, 3/e by Jakki J Mohr, Sanjit Sengupta, Stanley Slater, Pearson Education.

16. COMPUTER APPLICATIONS

(Syllabus-1)

(This SEC paper is Open to All)

(CREDIT: 1 Theory+ 2 Practical)

UNIT 1: 3 hours

Word Processing: Introduction to word processing, creating and saving a document, paragraph formatting techniques, working with tables. Spreadsheet: Concept of worksheets and workbooks, creating charts and graphics in MS Excel, Power Point presentation: Creating Graphs, tables, charts, use of animation and multimedia.

UNIT 2: 4 hours

Database management system: Definition of Database, Traditional file approach vs DBMS approach, characteristics of the Data base approach, DBMS user, Role of a DBA, advantages and disadvantages of using DBMS, DBMS architecture. ER Model as a tool for conceptual design entities, attributes and relationships, weak and strong entities, conversion of ER model into relational schema. ANSI SQL-92 Standards: DDL, DML.

UNIT 3: 2 hours

System development life cycle: System models and types of models, system analysis, feasibility analysis, cost benefit analysis, payback period.

UNIT 4: 3 hours

TALLY: Basic definition of Tally, Features of Tally, Advantages and disadvantages of Tally, Tally accounting, manual accounting, and financial accounting.

Practical: 48 hours

(i) Preparation of MS Word Document with various features (font, size etc)
(ii) Preparation of MS Excel Document with various features.
(iii) Preparation of PowerPoint presentation.
(iv) Tally, ERP9 Install
(v) GST in Tally. ERP9
(vi) Interest calculation
(vii) Bill of material
(viii) Prepare profit and loss account, balance sheet.

Suggested Books:

1. Computer applications in business. R. Paraeswaram
2. Introduction to database management system. CJ Date
3. Tally ERP9 Training Guide- 4th Revised and updated edition. Ashok K Nadhani

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(Syllabus-2)

COMPUTER APPLICATION COURSE

1. Total Marks = 100 (Practical 60+ Theory 40 Marks)

Syllabus-

Unit 1- Computer Basics (3 Lectures)
Unit 2- MS Office (5 Lectures)
Unit 3- Computer Repair and Maintenance (8 Lectures)
Unit 4- IT Fundamentals (6 Lectures)
Unit 5- Computer Network (3 Lectures)

COURSE OUTCOME:

On completion of this skill enhancement the student will-

- Familiarize with MS Office
- Perform documentation and Accounting Operations
- Student can learn how to perform presentation skills
- Can Maintain and repair computers

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17. Data Collection and Presentation

By Ratnapith College

Credits: 4 **Marks: 100**

Course Outcomes:

This course helps students in understanding use of data, presentation of data using computersoftware like MS-Excel. Students will be involved practically to preparation of questionnaires/interview schedules, collection of both primary and secondary data and itspresentation. Students will also be asked to prepare a report on collected data and will beevaluated accordingly.

Course Outline:

1. Use of Data

Use of data in social sciences; types and sources of data; data collection methods. Population census versus sample surveys. Random sampling.

2. Questionnaires and Schedules

Meaning; how to prepare a questionnaire and interview schedule; use of questionnaire and interview schedule for data collection.

3. Presentation of Data

Data presentation in tabular formats; use of diagrams for data presentation; creating charts and diagrams in MS-Excel – bar, line, pie, scatter, radar, bubble diagrams, population pyramids.

Readings:

1. S P Gupta, *Statistical Methods*, S Chand.
2. Webtech Solutions Inc., *Mastering Microsoft Excel Functions and Formulas*

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18. DEMOCRACY AND LEADERSHIP BUIDING

Course Objective:

- To learn the meaning, structure, challenges and conditions for the success of Democracy.
- To enable students to gain leadership qualities.
- To learn the value of public opinion in Democracy.
- To understand the implementation of 73rd amendment in practice.
- To study the women's participation in PRI.
- To make student understand the activities and responsibilities related to NSS and NCC.
- To learn the students the role of media in dissimilating information among the masses.

UNIT I: Understanding Democracy

a. Meaning
b. Features
c. Kinds
d. Conditions required for success of Democracy
e. Challenges

UNIT II: Leadership

a. Meaning and Theories.
b. Qualities
c. Importance
d. Challenges

UNIT III: Democracy and Leadership

a. Importance of Public Opinion
b. Representation (73rd Amendment and rural Governance in India)
c. Women's Participation
d. Role of NCC and NSS in leadership building
e. Role of Mass Media

READING LIST

NATIONAL SERVICE SCHEME MANUAL (REVISED), available at http://nss.wbut.ac.in/documents/NSS_manual_2006.pdf

ANO Handbook, NCC, Available at https://docs.google.com/viewerng/viewer?url=http://nccindia.nic.in/sites/default/files/ ANO+Hand+Book_1.pdf

NirajaGopalJayalandothers,LocalGovernanceinIndia–DecentralisationandBeyond,OxfordUniversity Press, 2006.

AtulKohli(Ed.).TheSuccessofIndia'sDemocracy.Cambridge:CambridgeUniversityPress.

Ghosh,Buddhadeb&GirishKumar-StatePoliticsandPanchayatsinIndiaNewDelhi:Manohar Publishers,2003

Sudhakar, V. New Panchayati Raj System: Local Self-Government CommunityDevelopment-Jaipur: Mangal Deep Publications, 2002.

R. Erikson and K. Tedin, (2011) *American Public Opinion,* 8th edition, New York: Pearson Longman Publishers,. pp. 40-46.

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19. Early Childhood Care and Development

Skill Enhancement Course 6: Online Early Childhood Care and Education
(Offered by the Department of Education)

Open for All

Total Credit =3(33 Hours)

Unit 1:
Physical, mental, and language development of early childhood period, Methods of study – observation, interview, case study, etc.

Unit 2:
Meaning of early childhood education, Objectives and importance of early, childhood education

Unit 3:
The curriculum of play way approach – Supporting early literacy, numeracy, and reading skills

Unit 4:
Pedagogy in relation to ECE – Constructing, modeling, questioning, and problem-solving

Unit 5:
Concept and importance of guidance for a child, Guidance methods for a child

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20. Ecology and Environmental Management

By Ratnapith College

Credits: 4 **Marks: 100**

Course Outcomes:

This course focuses on economic causes of environmental problems. In particular, economicprinciples are applied to environmental questions and their management through variouseconomic institutions, economic incentives and other instruments and policies. Economicimplications of environmental policy are also addressed.

Course Outline

1. Introduction

Basic concepts: Environment, Ecology, Economy and the ecosystem. Interaction between the environment and the economy, environmental economics and ecological economics, environmental economics and resource economics.

2. The Theory of Externalities

Externalities: meaning and types of externalities, market failure: meaning, market failure in the presence of externalities; market failure and public goods.

3. The Design and Implementation of Environmental Policy

Environmental Policies: command and control (CAC) approach, economic instruments like Pigouvian taxes and effluent fees, tradable permits and mixed instruments.

4. Environmental Improvements and Sustainable Development

Non-Market values: use and non-use values and optional value, Sustainable Development and its origin, weak sustainability, strong sustainability, ecological perspective and social perspective, Rules and indicators of Sustainable Development.

Readings:

1. Charles Kolstad, *Intermediate Environmental Economics*, Oxford University Press, 2nd edition, 2010.
2. Robert N. Stavins (ed.), *Economics of the Environment: Selected Readings*, W.W. Norton, 5th edition, 2005.

3. Gautam Purkayastha, *Environmental Economics: Theory, Problems and Solutions*, Kalyani Publishers, Reprinted 2016

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21. Electronic Circuit Design

Title: Electronic Circuit Design (Credit 2+1 =3)

Target Group: Open for all (Arts, Science and Commerce)

Course Objectives: To make the students able to apply concepts of basic electronic components and design Electronic circuits.

Course Outcomes: By the end of this course, students will be able to

- Explain basic structure, operation and characteristics of different electronic components (Both active and Passive).
- Explainnumbersystemand logic gates.
- Operationofcombinationalandsequentiallogiccircuits.
- Design of basic electronic circuits using analog and digital components.
- Application of electronics components in real life situations.

Theory

Unit-I: Analog Electronics (11 Hours)

Basic Circuit Concepts: Resistors, capacitors and Inductors: Fixed and Variable, Construction and Characteristics, basic concept of current source and voltage source, semiconductors- P and N type, PN junction diode, Zener Diode and their I-V characteristics. Rectifiers- Half wave rectifier, Full wave rectifiers with working principle. Filter in electronic circuits, capacitor as a filter, zener diode as voltage regulator, design of regulated power supply. Bipolar Junction Transistor (BJT) and its types, structure, working principle and characteristics for different configurations, transistor as an amplifier and oscillator. OP-AMP and its applications. 555 timer and its applications.

Unit-II: Digital Electronics (11 Hours)

NumberSystems:Decimal,Binary,HexadecimalandOctalnumbersystems,LogicGates and Boolean algebra: Introduction to Boolean algebra and Boolean operators, Truth Tables ofOR,AND,NOT, XOR, NAND and NOR. De Morgan's theorems, minimization and realization of logic equations using Boolean algebra, Standardrepresentationoflogic functions(SOPand POS),MultiplexersandDe-multiplexers,binaryAdders,Flip flops, S-R Flip flop, J-K Flip flop, T and D type flip flop, Basic concepts of Registers and Counters and applications.

PRACTICAL

Unit-III: Hands on Tutorials / demonstration (22 Hours)

1. Familiarization of different analog electronic components.

2. Use of multimeter to measure current, voltage and resistance.

3. Measurement of Amplitude and Frequency of a signal using CRO.

4. Toverifythe truth table ofAND,OR,NOT, XOR, NAND and NORgates.

5. Realization oflogiccircuits from Booleanexpressions.

6. Design of an electronic circuit in real life application.

Suggested Books

1. Principle of Electronic Devices and Circuits, B.L.Theraja & R.S.Sedha, S.Chand 7 Company Ltd(2004)
2. RobertL. Boylestad, Essentials of Circuit Analysis, Pearson Education(2004)
3. DigitalSystemDesign,M.MorrisMano,PearsonEducationAsia,(FourthEdition)
4. Modern Digital Electronics, R P Jain, McGraw Hill Education (India) Private limited.

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22. Electronic Data Processing

Theory = 2 credit, Practical = 1 credit

Learning Objectives

TheobjectiveofthecoursecoversfundamentalsofComputer,data,spreadsheets,dataprocessingterminology, input or output, database management. Providing insight into method and tools foranalysis and processing of the data generated by modern information systems, handling hugevolumeofdata,qualitativeandquantitativepiecesofinformation,storageandretrievalofdataandsoon arethe main featureof thecourse.

CourseOutcomes

On successful competition of the course, students will be able to understand basic terminology inthe area of information system development and management, data analysis, data processingmethods. Students will also able to create SQL for extracting and grouping data from differenttypes of the database management system (DBMS). Students can work as a data entry operator,trainer,and teacher orMIS co-coordinator inschoolsorcollege.

Unit wise Syllabus

THEORY

UNITI - (5 hours)

INTRODUCTIONTOCOMPUTERANDDATAPROCESSING

Types of Computers, Characteristics and Applications of a Computer System, Component ofcomputer system: Input Units, Output Units, CPU, Computer Memory: Primary and SecondaryMemory; Memory Units; Hardware and Software, Number System: Binary Number System,Conversion, BinaryArithmetic.

DATA PROCESSING: Data, Importance of Data, Data Security, Information, Processing ofData, Data Processing Operations: Data Capture; Data Manipulation: Classification, Sortingand Calculations; Information Management, Information Handling Manual, EAM and EDPMachine.

UNITII - (5 hours)

INTRODUCTIONTOSPREADSHEETS

Introduction: What is Worksheet and Workbook, Features of spread sheets, Components of auser interface in spread sheet, AutoFill Feature, Formatting Numbers **Operators**: Arithmetic,Comparison and Logical Operators; Copying Formulae, Cell Referencing: Relative, AbsoluteandMixed Referencing

Functions:Sum,Average,Count,Max,Min,IF,UsingAutoSum

DataTables: Adding,Deleting, Importing,Exporting,Editingand Formatting

Data Management in Spread sheet: Importing Data from DBMS, Web and Text **What-IfAnalysis:** Scenario Manager, Goal Seek, Data Entry Forms, Sort and Filter, Data Validations,ConditionalFormatting,Hyperlinks, Comments, Pivot Table**UNITIII - (12 hours)**

INTRODUCTIONTODATABASEMANAGEMENTSYSTEMCONCEPTS

WhatIsDatabase?NeedforaDatabase,ComponentsandLevelsofaDatabase,UseofComputerforDatabase,DatabaseManagement System,AdvantagesofusingDBMS,DatabaseExamples,RelationalDatabaseManagement System,

Case Study: A College– Data Redundancy and DataInconsistency,Data Storage Hierarchy,Characters, Fields, Records, Files, Concept of Keys: Primary, Foreign and Candidate Key **DataTypes:**Text,Memo,Number,Date/Time,Currency,AutoNumber,Yes/No,OLEObject,Hyperlink,Lookup Wizard, Fields, Records, File

Libre Office Base/MS Access etc.: Introduction to DBMS, Components of DBMS GUI, Icons andViews of Objects, Components of DBMS, Data Access Packages, Macros, Modules; Launching andExiting of DBMS, Structure of a Table, Design View, Icons and Views, Table Navigation, FieldProperties: Size, Format, Decimal Places, Caption, Default Value, Allow Zero Length, Required,Input Mask, Record Validation, Lookup Values, Queries: Types of Queries, Relationships, Forms,Reports

PRACTICAL

1. SpreadSheets (11 Hours)

a. Creating,savingand openingaWorksheet
i. PayrollSheet
ii. Sales-Report
iii. BalanceSheet
iv. Product,PurchaseandInventory
b. Selecting cells and ranges, Adjusting Row Height And Column Width, Inserting BlankCells,Rows, Columns; Deleting: Cells,Rows,Columns;
c. Dataentry(Numeric andAlpha);ErasingDatainCellsandWorksheet
d. Dataverification
e. DataAnalysisUsingCharts andWhat-IfAnalysis
f. Formulaand Functions
g. Makingcharts usingspreadsheets dataand
h. View:Normal,PageLayout,Page BreakPreview,CustomViews,FullScreen,FreezePanes
i. Copyingdatafromworksheetinto aWordProcessingDocument

2. DBMSlikeLibreOfficeBase/MSAccessetc. (11 hours)

a. StartingandclosingDBApplications
b. OpeningandClosinganalreadyexistingDatabase
c. CreatingaDatabase:Usingthe DatabaseWizard, WithoutusingaDatabaseWizard
d. CreatingTables andenteringdataintoatable;ViewingandEditingDatain aTable;

e. Freezeand UnfreezeColumns;Show orHideColumns
f. Creatingformand enteringdataintoaform
g. CreatingaQuery: UsingWizard
h. CreatingaReport: EditingandDeletingofRecords
i. CreatingMailMerge LabelsUsingWizard

References:

1.Spoken Tutorial- Spoken-Tuitorial.org2.www.nieit.in

3. GeetaSahoo andGaganSahoo,InformaticsPractices(AtextbookofClassXII).Saraswati HousePvt.Ltd.

4. Mysql for Professionals, Ivan Bayross

5. Fundamentals of Database Management system, Elmasari Navathe.

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23. Elements of Art and Design

--By Birina Das, DKGC

PAPER NAME: ELEMENTS OF ARTS AND DESIGN

TOTAL CREDITS: 3(1+2) 1= 1 hour theory per week, 2= 2 hours practical per week

ABOUT THE COURSE:

The fundamental goal of this course is to plan for development of the media and communication students that would help them to imbibe a sense of arts and design. Elements of arts and design shall give them a thorough understanding to work on various projects while abiding by the principles of designs.

OBJECTIVES:

The course is designed to:

- Introduce the elements of art.
- Educate on the principles of design.
- Acquire knowledge to utilize it in creating, designing and editing.

LEARNING OUTCOMES:

- Comprehensive knowledge on designing any multimedia product including print, electronic or traditional.
- Development of a keen eye for all art forms and design incorporated in media.
- Apply analytical thinking in designing.
- Communication of messages in artistic and accurate way.
- Appropriate presentation of any information.
- Effective use of color in creating, editing and designing.

COURSE OUTLINE:

Elements of Art and Design. (40+60)

Unit No.	Unit Content
Unit - I	Introduction to art; Elements of art; Types; Line, form, Texture, Space, Texture, Color, Value;

Unit - II	Art in Photography; Importance, Advantages, Uses; Uses of art in designing, importance, Preparation of multimedia product by applying elements of art
Unit - III	Color wheel: Primary, secondary, tertiary; Color Scheme: Monochromatic, analogous, complementary, triadic, square and rectangle; Uses in photography and designing. Preparation of multimedia product by incorporating color schemes.
Unit - IV	Concept of design; Definitions; Principles of design, Types, Balance, Contrast, Emphasis, Proportion, Hierarchy, Rhythm, Movement, Unity, Pattern; Preparation of multimedia product by applying principles of design
Unit - V	Principles of design in photography; Importance, Uses, Advantages; Uses of principles of design in media product development, importance;

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24. ELT Skill-1

Department of English Language Teaching
Gauhati University

FYUGP Year 1 Semester 1

Skill Enhancement Course (SEC)

Developing Soft Skills in English

Level: 100-199	**Total marks:100 (External:80 + Internal: 20)**	**Nature of Course: Skill Enhancement Course**	**No. of Theory Credits: 3 No. of classes: 36**

Medium of instruction: English(However, local languages will be used in the class along with English for ease of students' understanding.)

Course Description

This course enables students to develop effective soft skills and behaviours that are critical for success in today's competitive job market. It equips students with the essential soft skills that they need to create a positive impression about themselves for both professional and personal success. The key skills introduced in this course include active listening, communicating effectively in groups and use of appropraite body language. It also familiarizes students with presentation skills, and creative and critical thinking skills.

Graduate attributes/Learning outcomes

After completing the course the students will be able to:

- demonstrate their understanding of effective soft skills
- listen actively to interpret both verbal and non-verbal messages
- deliver effective presentations
- identify and solve a given problem by using creative and critical thinking skills
- participate in group discussions confidently

Pre-requisites

There are no prerequisites for this course.

Mode of delivery

Interactive lectures using class discussion, personalized topics, exercises and activities based on class texts and real-life language contexts, collaborative pair and group work, and sharing of feedback. Interactions and discussions can take place in blended mode, through face-to-face classroom teaching and online platforms such as Google Classroom.

Evaluation plan

This course will be assessed through an External(summative) of 80 marks and an Internal (formative) component of 20 marks.

The Internal assessment of 20 marks will be formative, and will be conducted throughout the semester through internal evaluation. It will comprise class assignments, home assignments, participation in class discussions, oral presentations etc. to measure how well students are learning.

Summative assessment will be conducted through a written External examination of 80 marks at the end of the semester to evaluate how far students are able to use the skills and strategies practised in the course.

Course Content

Units	Topics	Teaching Hours
1.	**Making a good impression** ● Good introduction ● Active listening ● Positive body language ● Good communication skills	4
2	**Active Listening skills** ● Techniques to listen actively ● Interpreting verbal and non-verbal messages	5
3.	**Delivering effective presentations** ● Knowing your audience ● Speaking confidently: tone, pace ● Structuring your presentation ● Dealing with Q & A ● Using props and visual images	10
4.	**Creative and critical thinking** ● Identifying the problem ● The problem solving process: brainstorming, analyzing, exploring, and choosing a solution	6
5.	**Group communication** ● Negotiation skills ● Team building skills ● Leadership skills	8
6.	**Body language** ● Maintaining appropriate body posture in different communicative situations ● Using hand gestures effectively ● Maintaining eye contact during communication ● Proxemics	3
	Total Hours	**36**

References:

Freeman, T. (2022). ***Soft Skills I Learned the Hard Way: Lessons in Communication, Public Speaking, Interviewing and Networking*****. Whack Publications**

Raman, M., Upadhyay, S. (2017). ***Soft Skills: Key to Success in Workplace and Life*****. Cengage India Private Limited**

Robbins. S.P. (2015). *Training in Interpersonal Skills (6th Edition)*. Pearson

Walker, T. J. ***(2010). How to Give a Pretty Good Presentation: A Speaking Survival Guide for the Rest of Us.*** **Wiley**

Course developers:

1. Dr Nivedita Malini Barua, Department of ELT, Gauhati University
   Email: nivedita.barua@gauhati.ac.in. Ph: 9864033267

2. Dr. Khamseng Baruah, Department of ELT, Gauhati University
   Email: khamseng.baruah@gauhati.ac.in. Ph: 9864018580

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25. Field Survey: Techniques and Application

By Ratnapith College

Field Survey: Techniques and Application

Credits: 4 **Marks: 100**

Course Outcomes:

This course will help students to proceed with a research problem and the steps he/she should adopt and tools to be used for doing quality research, The students shall get a chance to observe ground reality directly and minutely, It will help to develop understanding about designing and writing a research report

Course Outline:

Unit I: Meaning of Social Surveying; Need and importance of field work in socio-geographical studies

Unit II: Concept of case study and its identification in varying socio- geographical contexts

Unit III: Tools and Techniques of Data Collection: Questionnaire Survey, Participatory Rural Appraisal Techniques, Participant Observation, Focus Group Discussions etc.

Unit IV: Preparation of a report on socio-economic condition of a nearby village and Seminar Presentation (Duration- 10 minutes per participant, which is to be monitored and evaluated by the concerned experts)

Readings:

1) Creswell J., 1994: Research Design: Qualitative and Quantitative Approaches Sage Publications.

2) Dikshit, R.D. 2003. The Art and Science of Geography: Integrated Readings. Prentice - Hall of India, New Delhi.

3) Mukherjee, Neela 1993. Participatory Rural Appraisal: Methodology and Application. Concept Publs. Co., New Delhi.

4) Special Issue on “Doing Fieldwork” The Geographical Review 91:1-2 (2001)

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26. Floriculture

Total lectures: 22T+22P Credits : 3 (Theory 2, Practical 1)

Theory

Unit I: Introduction: Importance and Scope of Floriculture, Types of floriculture, Landscape gardening (landscaping highways and institutions). (2 Lectures)

Unit II:Principles of garden designs: English, Italian, French, Persian, Mughal and Japanese garden, Features of Garden (gate, walls, fencing, hedge, pergolas, edging, shrubbery, water garden).
(6 Lectures)

Unit III:Nursery management and Routine garden operations: Sexual and vegetative methods of propagation; soil sterilization, seed sowing, defoliation, manuring
(3 Lectures)

Unit IV:Ornamental plants and their cultivation: Annual flowers, Perennial flowers, herbaceous plants, indoor plants, succulents and cactus, divine vines, palms and cycads, Bonsai
(5 Lectures)

Unit V:Commercial floriculture: Cultivation of cut flowers (Chrysanthemum, marigold, dahlia, bougainvillea, rose, lilium, orchids), Production and packaging of cut flowers. (6 lectures)

Practicals

1) Preparation of media for propagation (soil, sand, peat, Sphagnum, moss, vermiculite, soil moisture and nursery beds) (3 Lectures)
2) Insect pest and diseases control of plants (3 Lectures)
3) Demonstrate the preparation of Bonsai of horticulture plants. (5 Lectures)

Suggested Readings:

1. Randhawa, G.S. and Mukhopadhyay, A. 1986. Floriculture in India. Allied Publishers.

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27. Fundamentals of Disaster Management

--By Laharighat College

Unit-I: Introduction to Environmental Studies

a)Multidisciplinary nature of environmental studies.
b)Scope and importance.
c)Concept of sustainable development.

Unit-II: Ecosystems.

a)What is an ecosystem? Structure and function of ecosystem; Energy flow in an ecosystem; food chains, food web and ecological succession. Case studies of the following ecosystems.
b)Forest ecosystem.
c)Grassland ecosystem.

Unit-III: Biodiversity and Conservation.

a)Levels of biological diversity; genetic, species and ecosystem diversity; biogeographic zones of India, biodiversity patterns and global biodiversity hot spots.
b)India as a mage-biodiversity nation; endangered and endemic species of India.
c)Ecosystem and diversity services: Ecological, economic, social, ethical, aesthetic and informational value.

Unit-IV: Human Communities and the Environment.

a)Human population growth: Impacts on environment, human health and welfare.
b)Resettlement and rehabilitation of project affected persons; case studies.
c)Disaster management: floods, earthquake, cyclones and landslides.
d)Environmental movements: Chipko, silent valley, Narmada Bachao, Bishnois of Rajasthan.
e) Environmental ethics: Role of India and other religions and cultures in environmental conservation.
f)Environmental communication and public awareness, case studies (CNG electric vehicles, green ehergy, waste minimization)

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28. Fundamentals of Weather and Climate Sciences

Credits: 3 (Theory: 03)

Theory: 30 Lectures

Preferred minimum qualifications of the teacher/instructor: Assistant Professor of Physics with PhD in Atmospheric Physics.

The aim of this course is not just to impart theoretical knowledge to the students but to enable them to develop an awareness and understanding regarding the causes and effects of different weather phenomenon and basic forecasting techniques

Theory

Unit I: Introduction to atmosphere (Lectures 10)

Elementary idea of atmosphere: physical structure and composition; layers of the atmosphere; atmospheric boundary layerand its characteristics; variation of pressure and temperature with height; air temperature; requirements to measure air temperature; atmospheric pressure: its measurement; atmospheric convection and inversion.

Unit II: Measuring the weather (Lectures 4)

Wind; forces acting to produce wind; measurement of wind speed and direction; humidity, clouds and rainfall, radiation: absorption, emission and scattering in atmosphere; radiationlaws.

Unit III: Weather systems (Lectures 6)

Global wind systems; air masses and fronts: classifications; jet streams; local thunderstorms; tropical cyclones: classification; tornadoes; hurricanes, Indian summer, monsoon.

Unit IV: Climate and Climate Change (Lectures 10)

Climate: its classification; causes of climate change; greenhouse effect, global warming and its consequences; natural and anthropogenic causes of greenhouse effect, air pollution; aerosols, ozone depletion, acid rain, environmental issues related toclimate, outlines of United Nations Framework Convention on Climate Change (UNFCCC).

Reference Books:

[1] Aviation Meteorology, I.C. Joshi, 3rd edition 2014, HimalayanBooks
[2] TheweatherObserversHandbook,StephenBurt,2012,CambridgeUniversityPress.
[3] Meteorology, S.R. Ghadekar, 2001, Agromet Publishers,Nagpur.
[4] TextBookofAgrometeorology,S.R.Ghadekar,2005,AgrometPublishers,Nagpur.
[5] Why the weather, Charls Franklin Brooks, 1924, Chpraman & Hall, London.
[6] Atmosphere and Ocean, John G. Harvey, 1995, TheArtemis Press.

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29. Gender Sensitization

Rajiv Gandhi Memorial College, Lengtisinga

Department of Political Science

Skill Enhancement Course

Course objective:

The course will sensitize students to issues related to gender and its related concepts. It will provide them with the tools and skills to develop and integrate a gendered perspective in work and life.

Course outcomes:

The outcomes of the course may be as follows:

- Students will have developed a better understanding of important issues related to gender in contemporary India.
- Students will develop a sense of appreciation and respect for women in all walks of life.
- It will help students to understand violence against women and also at the same time aware them about the provisions in the Indian Constitution that provide protection and relief to women.

Unit-i: Introducing Sex and Gender

a. Concept of sex and gender
b. Nature and Scope of Gender studies
c. Social construction of gender

Unit-ii: Basic Concepts

a. Gender Socialization
b. Gender Role
c. Gender Inequality

Unit-iii: Gender in Social Institution

a. Family
b. Caste
c. Class

Unit-iv: Violence against Women and its Indian Constitutional Provisions

a. Sexual Harassment
b. Domestic Violence
c. Right to Property in Indian Constitution

Reference Books:

- Abbott, et.al. 2005. Introduction to Sociology: A Feminist Perspective, Routledge: London

- Holmes, M.2007. What is Gender? Its Approaches, Sage Publication: New Delhi
- Philcher, J and Whelehan, I. 2004. Fifty Key Concepts in Gender Studies,Sage Publication: New Delhi
- Jones, E.A. and Olson G.A. 1991. The Gender Reader, Allyn and Bacon: USA
- Hirschon, R. 1984 "Introduction: Property, Power and Gender Relations" in R. Hirschon(ed.) Women and Property, Beckenham: Croom Helm.
- Jaggar, A. 1983. Feminist Politics and Human Nature, Brighton: The Harvester Press.
- Engels, F. 1972. The Origin of the Family, Private Property and the State, London.

Syllabus 2

Gender Sensitization

By Ratnapith College

Course objective:this course will sensitize students to issues related to gender and its related concepts. It will provide them with the tools and skills to develop and integrate a gendered perspective in work and life.

Course outcomes:

- Students will have developed a better understanding of important issues related to gender in contemporary India.
- Students will develop a sense of appreciation and respect for women in all walks of life.
- It will help students to understand violence against women and also at the same time aware them about the provisions in the Indian Constitution that provide protection and relief to women.

Unit 1. Introducing Sex and Gender

d. Concept of sex and gender
e. Social construction of gender

Unit 2. Basic Concepts

d. Gender Socialization
e. Gender Role
f. Gender Inequality

Unit 3. Gender in Social Institution

d. Family
e. Caste
f. Class

Unit 4. Violence against Women and its Indian Constitutional Provisions

d. Sexual Harassment
e. Domestic Violence
f. Right to Property in Indian Constitution

Reference Books:

- Abbott, et.al. 2005. Introduction to Sociology: A Feminist Perspective, Routledge: London
- Holmes, M.2007. What is Gender? Its Approaches, Sage Publication: New Delhi
- Philcher, J and Whelehan, I. 2004. Fifty Key Concepts in Gender Studies,Sage Publication: New Delhi
- Jones, E.A. and Olson G.A. 1991. The Gender Reader, Allyn and Bacon: USA
- Hirschon, R. 1984 "Introduction: Property, Power and Gender Relations" in R. Hirschon(ed.) Women and Property, Beckenham: Croom Helm.
- Jaggar, A. 1983. Feminist Politics and Human Nature, Brighton: The Harvester Press.
- Engels, F. 1972. The Origin of the Family, Private Property and the State, London.

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30. Geography of Tourism

SEC Syllabus of FYUGP

(Gauhati University)

B.A 1st Semester **By C K College, Chokla**

Subject:- History

Course:-SEC **Total Marks:-100**

Course Level:- **(External-50)**

Course Title:- GEOGRAPHY OF TOURISM (Internel-50)

Unit 1

Introduction

- Definition of Tourism and Tourist
- Nature and Scope of Tourism
- Role of Geography in Tourism.
- Elements and Concepts of Tourism

Unit 2

- Geography of Northeast India.
- Tourism Attractions in Assam, Arunachal - - - - Pradesh, Meghalaya.
- Indian Heritage Tourism Planning.

Unit 3.

- Principles of Management.
- Tourism Planning.
- Financial Management.
- Marketing Tourism.

Unit 4

- Introduction to Tourism Organisations.

-Tourism operations Human Resource
Development.

- Role of human resources in the tourism industry
- Economics of Tourism.

Unit 5.

- Environmental impact of tourism.
- Environmental impacts of eco tourism.
- Positive and negative impacts of tourism on

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31. Grammar and Composition Skills

PROPOSED SKILL ENHANCEMENT COURSE FOR
DEPARTMENT OF ENGLISH, RAJIV GANDHI MEMORIAL COLLEGE

Course objectives: The objectives of the course are to expose the students to the basic that they require in their day-to-day academic setting at the under graduate level, the grammar is introduced in context through the Text and further practices is providing through exercises. The course also helps students sharpen their reading and writing skills.

Course Outcome: The Course outcome of the English Grammar and Composition are as follows,

1. It helps the students produce grammatically correct English.
2. To develop writing skills for the academic work.
3. Exposes them to the variety of reading text
4. To give them in writing exercise.

Unit-1

Introduction to the basic grammar.

1. Tenses
2. Modals
3. Determiners, pronouns, and Noun phrases
4. Preposition, Adjectives and Adverbs
5. Verb structure
6. Word Formation
7. Conditional, clauses, question, Indirect speech
8. Sentences and variety of English

Unit 2 Reading

1.Prediction and Previewing skill.
2. Skimming skill
3Reading for comprehension
5. Reading for details

Unit 3 Reading

1.Application Writing.
2.Precise writing
3.Comprehensive Test.
4. Letter writing.

Reference Book

1. A Higher English Grammar and Composition by P.K. Dey Sarkar

2. Good English Grammar and Composition by Assam publishing company
3.Modern English Grammar by Assam Publishing Company

Syllabus 2

DEPARTMENT OF ENGLISH

GRAMMAR AND COMPOSITION SKILLS

CREDITS- 2 TOTAL MARKS- 100

By- Ratnapith College

COURSE OBJECTIVES- English grammar is an essential component of competitive exams, as it tests the candidates' understanding of the language and their ability to communicate effectively. The course aims to help participants develop their English language skills, particularly those planning to appear for competitive exams that test their English language abilities. During a span of 90 days, students will be exposed to material that facilitates aspects of grammar, writing and vocabulary.

UNIT-1: Grammar- Basics of tenses, speech and English Spotting Errors, prepositions

UNIT-2: Sentence Completion / Rearrangement

UNIT-3: Reading comprehension.

UNIT-4: Vocabulary- Foreign Expressions Idioms and Phrases, antonyms & synonyms

UNIT-5 Letter Writing (Formal and Informal), Precis/ Essay writing, Story Writing

SUGGESTED READINGS

1. F T Wood: A Remedial English Grammar for Foreign Students. (Macmillan)

2. R.P.Bhatnagar and Rajul Bhargava: English for Competitive Examinations (Macmillan)

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32. Herbarium Techniques and its role in Modern Science

Name of the Paper: **Herbarium techniques and its role in Modern Sciences**

Total Lectures: **36** Credits: **3**

THEORY

UNIT 1: Introduction- Historical account, Significance, Functions, Types of Herbaria, Acronym, important Herbaria of the world, major Herbaria in NE India, Digital Herbarium.

(4 lectures)

UNIT 2: Herbarium Methodology-Herbarium Sheets, Field and Laboratory equipment, colour preservation techniques, basic techniques for herbarium sheets preparation and storage.

(6 lectures)

UNIT 3: Role of Herbarium in- Teaching and Research, Plant Taxonomy, Assessment of Plant Biodiversity, Pharmacy Education and Research, Herbal Drug discovery, Ecology, Forestry,Ethno-botany, Evolution and Conservation biology. (8 lectures)

UNIT 4: Herbarium curation and Digitization techniques, Accession Register, Fumigation, Pest Management, Herbarium specimens on Loan, Herbarium Ethics. (6 lectures)

UNIT 5:PRACTICAL (12 lectures)

Hands-on-Herbarium sheet preparation for Bryophytes, Pteridophytes and Higher Plants.
Searching Digital Herbarium online for consultation.

Suggested Readings:

1. Jain S K andRao RR 1977. A Handbook of Field and Herbarium Methods. Today & Tomorrow's Printers and Publishers, New Delhi.

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33. Life Skill Education

--By Nabajyoti College Kalgachia

Four year Undergraduate programe (FYUGP) 1st Semester

Subject: Education
Course:SEC — TotalMarks-100
CourseLevel:100-199 — (External-50)

Course Title: LIFESKILL EDUCATION — (Internal-50)

Credit-4

Part-I (External)-2 Credit-2

B) Paper Objectives: The overall objectives of this paper is to help student explore their abilities for effectively dealing with the demand and challenges of life. It is to bring together the social, emotional and cognitive capacities of students to enable them to effectively handle issues and problems commonly faced in daily life.

This paper aims at realizing the following general objectives-

1) To promote students ability to help grow fully from inside out and outsidein.
2) To increase emotional competency and emotional intelligences atWorkplace.
3) To provide grounds for practicing various skills related to daily lifeexperience.
4) To help manage competency for achieving excellence in interpersonal skill withethical considerations.

B) Learning outcome:

After completing the subject, the student will be able to attain the following out comes:-

1) Self confidence.
2) Professionalcompetence.
3) Good citizenship and sense of socialcompetence.
4) Self-reliance.

Unit-1

Meaning, nature and concept of life skilleducation.
Objective purpose needs of life skilleducation.
Types of life skills.
Practicing life skills (Methods of life skillteaching).
Assessment of lifeskill.

Unit-2

Communication skills-listening, speaking, reading, writing, digital literacy use ofsocial media, non verbalcommunication.
Professional skills- career skills, team skills, resume, interview, group discussion, exploring career opportunities, presentation skill, social and cultural etiquette, internal communications, collaboration,brainstorming.
leadership and management skills:- leadership quality, leadership practice inschool.

Part-2 (Practical) Credit-2

The department will arrange for practicing any one or more life skill activities by the students which will carry 50 marks as internal.

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34. Mushroom Cultivation Technology
(Syllabus 1)
Mushroom Culture Technology and Production

Total Duration: 55hrs **Credits: 3 (Theory:1, Practical:2)**

Learning Objectives:

To make student aware about

- The diversity and identification of Mushrooms growing in this N.E. region.
- Mushroom growing Techniques.
- Medicinal and Nutritional value of mushrooms
- Low cost input in mushroom cultivation but benefit outcome is high.

LearningOutcomes:

- After completion of the course, student will be able to identify and practice the technique for cultivation of various types edible mushrooms.
- It will help to encourage self-employment by setting up small scale unit for mushroom cultivation.

THEORY (1 CREDITS)

UNIT 1 (2 lectures)

Introduction of mushroom fungi, characteristics and classification types, different types of mushrooms available in India and N.E. regions, Edible mushrooms (*Pleurotus, VolvariellaAgaricus*), Poisonous mushrooms (*Amanita, Cortinarius, Psilocybe*), nutritional and medicinal importances of mushrooms.

UNIT 2 **(4 lectures)**

Methods and preparation of culture of mushrooms, methods of culture preparation, spawn and spawning: forms of spawns (Liquid and substrate/grain spawn), preparation of spawn, mother spawn, spawn formulations and commercial spawn, problems in spawn production, diagnostics and solution, method of spawning.

UNIT 3 **(5 lectures)**

Compost and composting: Methods of composting, quality of good compost; Casing and casing material used in used in mushroom cultivation.

Economic of spawn and mushroom production, post-harvest technology, Processing and value addition, mushroom cultivation and agri-preneurship, Government policies related to the promotion of mushroom cultivation.

PRACTICAL (2 CREDITS)

1. To study the principle and functioning of instruments used in the various techniques.
2. Preparation of various type of compost and media
3. Method of culture preservation
4. Quality testing of compost
5. To study various types of casing and casing material
6. Preparation of spawn & spawning
7. Technique for cultivation of edible mushrooms
8. To study the nutritional, market value, post-harvest technologies like packaging and preservation
9. To study the various requirement for setting up a mushroom cultivation unit (Kuccha or cemented house)
10. Visit to institute and cultivation center.

Suggested Readings:

1. Aggarwal, A., Sharma, Y.P., Angra, E. (2021). A textbook on mushroom cultivation, Theory and Practices. Newrays Publishing House, 2021.
2. Tiwari, S.C. Kapoor, P. (2018). Mushroom Cultivation. Mittal Publications. ISBN - 9788183249232.
3. Bahl, N. (2015). Hand Book on Mushroom. Page no. 1-166. Oxford &IBH Publishing Company. ISBN- 13:978-8120413993.
4. Russell, S. (2014). The Essential Guide to Cultivating Mushroom. Storey Publishing. North Adams, MA 01247-page no. 1-233. ISBN 978-1-61212-146-8.
5. Chang, S.T. Miles, P.G. (2004). Mushrooms Cultivation, Nutritional Value, Medicinal effect and Environmental Impact. Page no. 1-477, CRC Press.
6. Rai, R.D., Arumuganathan, Y. (2008). Post-harvest technology of mushrooms. Pages 172. National Research Center for Mushroom (Indian Council of Agricultural Research) Chambaghat, Solan-173 213 (HP)
7. Ahlawat, O.P., Tewari , R.P. (2007) .Cultivation Technology Of Paddy Straw Mushroom (*Volvariellavolvacea*). Pages 1-44 National Research Center for Mushroom (Indian Council of Agricultural Research) Chambaghat, Solan (HP).

(Syllabus 2)
Mushroom Cultivation Technology

---byBhaben Tanti,GU

Credits: 3

Learning objectives:

- ❖ Understand the basics of mushroom by enabling students to identify edible and poisonous mushrooms
- ❖ Develop interest in mushroom cultivation
- ❖ Provide hands on training for the preparation of spawn and mushroom bed for mushroom cultivation
- ❖ Learn various post-harvest technology associated to mushroom cultivation
- ❖ Identify and manage Insect-Pests affecting mushroom
- ❖ Help the students to learn a means of self-employment and income generation

Learning outcomes:

On successful completion of the course, students will be able to:

- ❖ Identify edible and poisonous mushrooms
- ❖ Gain the knowledge of cultivation of edible mushrooms and spawn production; and various post-harvest technology associated to mushroom cultivation
- ❖ Manage various diseases and pests of mushrooms
- ❖ Learn the way of self-employment and income generation

THEORY

Unit 1: Introduction to mushrooms

Mushrooms - taxonomic rank. Different parts of typical mushroom; structure and texture of fruitbodies - Gilled fungi and pore fungi; Life cycle of mushrooms; various habitats of mushrooms - Lignicolous, Humicolous and Coprophilous; Symbiotic associations - Mycorrhiza.

Unit 2: Cultivation of Mushrooms

History, scope, and opportunities of mushroom cultivation. Problem in cultivation - diseases, pests, and nematodes and their management strategies.

Unit 3: Health benefits of mushrooms

Historical uses of mushrooms; Nutrient profile of mushrooms - Amino acids, Protein, Carbohydrates, fats, minerals, and vitamins; Therapeutic aspects - antioxidant, antimicrobial, antidiabetic, anticancer effect; stimulating vitamin D production in mushrooms.

Unit 4: Common edible and poisonous mushrooms

Edible Mushrooms - Oyster mushroom (*Pleurotus ostreatus*), paddy straw mushroom (*Volvariella volvcea*), Button mushroom (*Agaricus bisporus*); Poisonous mushroom – False parasol or green-spored parasol (*Chlorophyllum molybdites*).

Unit 5: Principles of mushroom cultivation

Structure and construction of mushroom house; Spawn production - culture media preparation, isolation of pure culture, mother spawn, multiplication of spawn; Sterilization of substrates. Composting techniques, mushroom bed preparation; Spawning, spawn running, harvesting. Cultivation of oyster mushroom.

Unit 6: Post harvest technology

Preservation of mushrooms - freezing, drying, and packaging, quality assurance, shelf life, market opportunities. Value added products of mushrooms.

PRACTICAL

1. Preparation of media for mushroom culture
2. Preparation of pure culture
3. Production of spawn
4. Cultivation of oyster mushroom using paddy straw/lignocellulosic wastes.
5. Estimation of antioxidant properties (Reducing power, Total antioxidant capacity) and phytochemical content (phenol, flavonoid, lycopene, β-carotene) of mushroom

Suggested Readings

1. Purkayastha RP, Chandra A (1985) Manual of Indian edible Mushrooms. Today and Tomorrows Printers and Publishers, New Delhi.
2. Pathak VN, Yadav N (1998) Mushroom Production and Processing Technology. Agrobios, Jodhpur.
3. Tripathi DP (2005) Mushroom Cultivation. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
4. Pandey RK, Ghosh SK (1996) A Hand Book on Mushroom Cultivation. Emkey Publications.
5. Hait G (2023) Introductory Botany (Biofertilizer and Organic Farming, Herbal technology, Mushroom Culture Technology). Vol - I, Global Net Publication, New Delhi.
6. Pathak VN, Yadav N, Gaur M (2000) Mushroom Production and Processing Technology. Vedams Ebooks Pvt. Ltd., New Delhi.

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35. Non-Mulberry Sericulture

Skill enhancement course
N0N-MULBERRY SERICULTURE
Code:
Credit: 2 (T) + 1 (P)

Course Objectives:
Sericulture is an agro-based, labour-intensive, eco-friendly industry bearing immense potential of employment generation. In North-Eastern part of India, all the four commercially important silkworm varieties are found of which the non-mulberry silkworms particularly eri and muga silkworms are endemic to this region. The objectives of the course are to apprise the students about the biology, rearing techniques, constrains of rearing in terms of disease occurrences, causes and precautions of diseases, and employment opportunities of non-mulberry sericulture. The aim is to make students competent to venture in sericulture industry by their own or through different state and central organizations and or pursuing higher studies in different research laboratories.

Course Learning Outcome:

Upon completion of the course, students should be able to:

- Understand the biology and rearing techniques of non-mulberry silkworms
- Acquire practical skill of identifying of non-mulberry silkworms, and their disease-causing pathogens and or pests.
- Develop curiosity and awareness about different fields of entrepreneurship in sericulture sector and to help venture in self-employment program.
- Develop competitive expertise to enter in state and central sericulture organizations as well as research laboratories for higher studies.

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Skill enhancement course
N0N-MULBERRY SERICULTURE
Code:
Credit: 2 (T) + 1 (P)

THEORY **Hours 30**

Unit 1: Biology of Non-mulberry Silkworm, Pest & Diseases: 12h

Types and distribution of non-mulberry silkworms in N-E India; Life cycle of non-mulberry silkworms- Eri and Muga; Structure of silk gland; Pests of eri and muga silkworms; Pathogenesis of protozoan, viral, fungal and bacterial diseases of eri and muga silkworms, Prevention and control measures of pests and diseases

Unit 2: Rearing of Silkworms (Eri and Muga Silkworm): 12h

Food plants of Eri and Muga Silkworm; Rearing Operation:Rearing house or site and rearing appliances; Disinfectants: Formalin, bleaching powder; Rearing technology: Early age and Late age rearing; Environmental conditions in rearing-Temperature, Humidity, Light and Air; Types of mountages; Harvesting and storage of cocoons; Spinning and Reeling of silk

Unit 3: Entrepreneurship in Non-Mulberry Sericulture:8h

Nature of Silk; Varieties of Non-Mulberry Silk products and economics in India; Prospectus of Non-Mulberry Sericulture in India: Non-Mulberry Sericulture industry in different states, employment generation and potential; Visit to various sericulture Govt. /Private Farm/ Centres.

N0N-MULBERRY SERICULTURE

PRACTICAL	**Hours15**
1. Identification of Non-Mulberry Sericigenous insects.	
2. Study the various stages of Life cycle of silkworms- Eri and Muga.	
3. Identification of various equipment used in rearing of Silkworms.	
4. Identification of various diseases of Eri and Muga.	
5. Locate the position of silk gland and its structure.	
6. Visit to various sericulture Govt. /Private Farm/ Centres (Report).	

Suggested Readings:

1. Jolly, M. S., S. K. Sen, T.N. Sonwalkar and G.K. Prashad 1979. Non-Mulberry Sericulture. In:

   Manual of Sericulture, Rome, FAO, 4 (29)

2. Chowdhury, S.N. 1981. Muga Silk Industry. Directorate of Sericulture, Govt. of Assam, Guwahati781005,

Assam.

3. Chowdhury, S.N. 1982. Eri Silk Industry. Directorate of Sericulture, Govt. of Assam, Guwahati781005, Assam.
4. Chowdhury, S.N. 1992. Silk and Sericulture. Directorate of Sericulture and Weaving, Govt. of Assam, Guwahati-781005, Assam.

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36. Nursery and Gardening

DEPARTMENT OF BOTANY

NABAJYOTI COLLEGE, KALGACHIA

FYUGP 2023

Nursery and Gardening (SEC)

Credits:4

Unit 1: Nursery: definition, objectives and scope and building up of infrastructure for nursery, planning andseasonal activities - Planting - direct seeding and transplants.

Unit 2: Seed: Structure and types - Seed dormancy; causes and methods of breaking dormancy - Seed storage: Seed banks, factors affecting seed viability, genetic erosion – Seed production technology - seed testing and certification.

Unit 3: Vegetative propagation: air-layering, cutting, selection of cutting, collecting season, treatment of cutting, rooting medium and planting of cuttings - Hardening of plants – green house - mist chamber, shed root, shade house and glass house.

Unit 4: Gardening: definition, objectives and scope - different types of gardening - landscape and home gardening - parks and its components - plant materials and design - computer applications in landscaping - Gardening operations: soil laying, manuring, watering, management of pests and diseases and harvesting.

Unit 5: Sowing/raising of seeds and seedlings - Transplanting of seedlings - Study of cultivation of different vegetables: cabbage, brinjal, lady's finger, onion, garlic, tomatoes, and carrots - Storage and marketing procedures.

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37. Ornamental Fish and Fisheries

--By Nabajyoti College Kalgachia

GU FYUGP-2023
Sub: ZOOLOGY
SKILL ENHANCEMENT COURSES
Ornamental Fish & Fisheries

Credit-4

1. Ornamental Fish Diversity of North East India.
2. Aquarium plant diversity in the wetland of Assam.
3. Construction and management of Home Aquarium.
4. Natural feed of Ornamental Fish
5. Strategies for maintenance of natural colour of Ornamental Fish
6. Natural Breeding of Tricogaster species
7. Health management of Ornamental Fish
8. Feed formulation of Ornamental Fish
9. Development of Biological filtration in Aquarium
10. Pure culture of planktons

Practical's

11. Identification of Ornamental Fish
12. Culture of Indigenous ornamental fish in Aquarium
13. Estimation of Physico-chemical characteristics of Aquarium water
14. Biological filter for removal of Ammonia from Aquarium
15. Culture of Planktons

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38. Panchayati Raj and Practice

Skill Course

--By Ratnapith College

Course Objective: This course acquaints students with the Panchayati Raj Institutions and their actual working. It further encourages a study of Panchayati Raj Institutions in their mutual interaction and their interaction with the people.

Course Outcomes:

- This paper will help students to understand the importance of grass root political institutions in empowering people.
- This paper will highlight the complex challenges faced by Panchayati Raj Institutions in India and mechanisms involved to make it more participatory and inclusive in nature.

Unit 1. Introduction of Panchayati Raj System

a. Definition of Panchayati Raj System
b. Evolution of Panchayati Raj in India and its importance
c. Devolution

Unit 2. Provisions of Panchayati-Raj System in Indian Constitution

a. Role of 73rd Amendment Act of Panchayati-Raj System in India
b. Constitutional Provisions on Panchayat Finances
c. Fiscal Decentralization and Audit System

Unit 3. Problems and Needs of Disadvantaged Groups and their Participation

a. Women
b. Scheduled Tribes, Scheduled Castes and Minorities
c. Panchayat Extension to Scheduled Areas (PESA) Act

Modalities for Practical Component: project Report/Field Study Report based on any activity i.e., visit to Panchayat / local self-bodies, local people's participation in the political system etc.

Reference Books:

- P. Dsouza, (2002) 'Decentralization and Local Government: The second Wind of Democracy in India', in Z. Hasan, E. Sridharan and R. Sudarshan (eds.) India's living Constitution: Ideas, Practices and Controversies, New Delhi: Permanent Black
- M. John, (2007) 'Women in Power? Gender, Caste and Politics of Local Urban Governance', in Economic and Political Weekly, Vol.42(39)
- Raghunandan, J.R (2012) Decentralization and local governments: The Indian Experience, Orient Black Swan, New Delhi
- Baviskar, B.S and George Mathew (eds) 2009 Inclusion and Exclusion in Local governance: Field Studies from rural India, New Delhi, Sage
- M.Venkatarangaiya and M. Pattabhiram- Local Government in India, Allied Publishers-1969 SR Maheswari, Local Government in India, Lakshmi Narain Agarwal, 2008.
- Bidyut Chakraborty and Rajendra Kumar Pandey, Modern Indian Political Thought- Text and Context, Sage, New Delhi, 2009

Syllabus 2

--By Nabajyoti College Kalgachia

GUFYUGP2023,Skill Course(SEC)

Subject: Political Science

Paper: Skill Enhancement Course{SEC)

Panchayatirajand Practice·

UNIT.1-
DemocraticDecentralization,GrassrootsDemocracyandGrassrootsPoliticalinstitutionsinempowering People.

1.1-Meaningand concept of democratic decentralization and grassroots democracy and grassroots political institutions.

1.2-Democratic functionof Grassroots Political institutions in the Empowerment of people.

1.3-TheoryandPracticeofgrassrootsDemocraticPoliticalinstitutions-
TherealassessmentandEvaluationofthefunctioningofgrassrootsDemocraticpoliticalinstitutionsin the interest of empowering people.

UNIT2.

2.1-GrassrootDemocraticPoliticalinstitutionsinIndia-ThePanchayotirajsystem

2.2.Evolution, Genesis and Development of Panchaytiraj system in India.

2.3-Structures and function of Panchayatiraj system in India. UNIT3.

3.1-Democratic functioning of Panchayatiraj system in the empowerment of weaker and disadvantaged groups of people.

3.2-PoeplesparticipationinPanchayatirajsystem- Assessment of Panchayatiraj System,participatory and inclusive nature

3.3-Contribution of Panchayatiraj system in empowering and upliftment of theweaker section of people-An assessment of the proper democratic functioning of Panchayatiraj to empower the people.

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39. Philosophical Counseling

--By Nabajyoti College Kalgachia

Skill Enhancement Course (SEC)
Department of Philosophy
Philosophical Counseling
Total Marks: 100

Part A : (Theory) Marks 50

Unit I. Introduction to Philosophical Counseling: 25

a) Philosophical Counseling-its meaning, scope and importance
b) History of Philosophical Counseling
c) Philosophical Counseling and Psychological Counseling
d) Freedom, responsibility and self-determination

Unit II. Approaches to Philosophical Counseling: 25

a) Critical thinking approach- Logic based therapy (LBT)-Philosophical principle of LBT, LBT fallacies
b) Wisdom approach
c) Existential approach-Existentialism based therapy-) Authentic Life and) Inauthentic Life

Part B (Practical) **Marks 50**

- Project/Dissertation
- Given below is the list of problems out of which any one may be chosen for addressing in the project/dissertation.

- Moral issues
- Value disagreements
- Time management issues
- Financial issues
- Career issues
- Adult children of aging parents
- Problems with family
- Friendship issues
- Breakups and divorce
- Religion and Race related issues

Syllabus 2

By Ratnapith College

Philosophical Counseling

Department of Philosophy

Syllabus

1. Introduction, General Counseling, Definition and meaning, nature and scope

2. What is Philosophical counseling, Philosophical Activities

3. Bhagavat Gita, Emotional stability, idea of Samatvam, non soul theory of Buddhism and suffering, Buddhism of self realization

4. Yoga theory of eight paths, Gandhi's Practical non-violence, Vivekananda- Four Yoga

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40. Photo Journalism

Unit 1 – Basics of Photography, Difference between photography and Photo journalism, Photography, Understanding journalism through photography, Five W's and one H.

Concept and history of photojournalism, Photo Journalism across the globe, Impact of photo Journalism, Understanding news photography, wildlife photography, fashion photography,studio photography, candid photography, travel and lifestyle photography, Development journalism through photography, Role of a Photo Editor: Different aspects of photojournalism

Unit 2 –Basics of photo editing- adjusting brightness, contrast, color,resolution, crop

Developing captions, Writing and Editing Captions for Still, Accuracy, Spelling, Edit theCaptions, Roles and responsibilities of a photo journalist

Unit 3 – **Practical**

Should be given assignment for collecting photos with news element using mobile phones, should be given task of photo composition and photo caption writing, additional marks for publication at any media outlets (WebPages, newspapers, magazines or photo blogs).

Key Reading

1. Photojournalism: Telling Stories with Pictures and Words: Volume 1

2. Associated Press Guide to Photojournalism (Associated Press Handbooks)

3. Photojournalism: The Professionals' Approach Paperback

4. National Geographic Photography Field Guide 2nd Edition: Secrets to Making Great Pictures (NG Photography Field Guides) Paperback – by Peter Burian (Author), Bob Caputo (Author)

5. Practical Photojournalism: A Professional Guide

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41. Photoshop

DEPRTMENT OF PHYSICS
NABAJYOTI COLLEGE, KALGACHIA
FYUGP 2023
SKILL COURSE SYLLABUS

Photoshop (20 Lectures)

1. Introduction **(4Lectures)**

Openandcreatenewimages,Theinterface,Zoominandoutandpanaround,Toundo, Save animage

2. Image editing **(2 Lectures)**

Resize an image, Image resolution, Crop and straighten an image, Canvas size adjustments

3. Work with layers **(2Lectures)**

ViewandselectlayersintheLayerspanel,WorkwithlayersintheLayerspanel,Resize layers, Add images to design, Backgroundlayer

4. Image quality **(2 Lectures)**

Image exposure, Color vibrance, Hue and saturation of colors, Work with adjustment layers

5. Make selections **(2Lectures)**

Make a selection to edit part of an image, Selection tools, Select and mask workspace

6. Retouch images **(1Lectures)**

Remove objects, Clone stamp tool, Remove objects with content-aware fill

7. Use color **(2Lectures)**

Brush tool, Foreground and background color boxes, Color picker

8. Text and shapes **(2Lectures)**

Add and edit text, Create a shape (pre-defined and custom)

9. Combine images **(2Lectures)**

Add texture to an image, Add an object to an image using a layer mask, Use a layer mask to hide a background

10. Apply filters **(1Lectures)**

Use of filter gallery, Use of Smart Filter

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42. Physics Workshop Skills

Credits: 3 (Theory: 2, lab: 1)

Theory: 20 Lectures

Preferred minimum qualifications of the teacher/instructor: Assistant Professor of Physics or a B.E/B.Techin MechanicalEngineering

The aim of this course is to enable students to get familiar with various mechanical and electrical tools in hands-on mode

Unit I: Introduction (4 Lectures)

Measuring units. conversion to SI and CGS. Familiarization with meter scale, Vernier calliper, Screw gauge and their utility. Measure the dimension of a solid block, volume of cylindrical beaker/glass, diameter of a thin wire, thickness of metal sheet, etc. Use of Sextant to measure height of buildings, mountains, etc.

Unit II: Mechanical Skill (6 Lectures)

Concept of workshop practice. Overview of manufacturing methods: casting, foundry, machining, forming and welding. Types of welding joints and welding defects. Common materials used for manufacturing like steel, copper, iron, metal sheets, composites and alloy, wood. Concept of machine processing, introduction to common machine tools like lathe, shaper, drilling, milling and surface machines. Cutting tools, lubricating oils.

Unit III: Electrical and Electronic Skill (4 Lectures)

Use of Multimeter. Soldering of electrical circuits having discrete components (R, L, C, diode) and ICs on PCB. Operation of oscilloscope. Making regulated power supply. Timer circuit, Electronic switch using transistor and relay.

Unit III: Introduction to prime movers: (6 Lectures)

Mechanism, gear system, wheel, Fixing of gears with motor axel. Lever mechanism, Lifting of heavy weight using lever, use of pulley, braking systems, working principle of electrical power generation systems.

Lab:

1. To study the use of meter scale, vernier caliper, screwgauge.
2. Tomeasuredimension of solidblock,volumeofcylindricalbeaker/glass,diameterofthinwire,thicknessof metalsheet.
3. To measure height of building, mountain usingsextant
4. To study the use of digital multimeter and CRO.
5. To do soldering of electrical circuit having discrete components onPCB.
6. To construct a regulated powersupply with capacitor filter.
7. Demonstration of lifting of heavy weight usinglever

Reference Books:

[1] A text book in Electrical Technology-B L Theraja – S. Chand andCompany.
[2] Performance and design of AC machines – M.G. Say, ELBSEdn.
[3] Mechanical workshop practice, K.C. John, 2010, PHI Learning Pvt.Ltd.
[4] Workshop Processes, Practices and Materials, Bruce J Black 2005, 3rd Edn., Editor Newnes [ISBN: 0750660732]
[5] NewEngineeringTechnology,LawrenceSmyth/LiamHennessy,TheEducationalCompany ofIreland[ISBN: 0861674480]

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43. Political Institutions and its practices in India

Target Group: Open For All (Arts, Science and Commerce)

Theory = 2 Credit, Practical = 1 Credit

Learning Objective:

The learning objectives of this course are:

(1) To facilitate students in analyzing and evaluating concepts, institutional practices of governance in India to assess their relevance and impact on societies.
(2) It also fosters an understanding of active engagement in political processes and democratic principles thereby advocating the importance of participation in collective decision making.
(3) This course would also enhance the intersection of political Science with other disciplines towards a holistic understanding of public discourse.
(4) This will further the need for reasoned judgment and accountability of political office bearers towards a broader understanding and vibrant citizenry.
(5) To understand the functioning and the role of a modern nation state

Course Outcomes:

1. The course is designed to sensitize and equip students with a better understanding of the functioning and working of the political institutions of the country.
2. The students will acquire knowledge of their representatives in the institutions and their accountability to the people.
3. It will give a comprehensive idea of thestate structure and the mannerism in which the Indian State befits itself as an institutional set-up.
4. The course is designed for students preparing for Civil Services, Law and other Allied Services of the State or Central Government.

Unit wise Syllabus:

THEORY

UNIT I-(8 Hours)

Union Parliament: Structure, role and functioning, Parliamentary Committees, President of India.

Legislature in the States: Governor, State Legislature, role and functioning.

Local Government Institutions: Rural and urban local government, 73rd and 74th constitutional Amendment Acts, 11th and 12th Schedule of the Indian Constitution. (12 Classes)

UNIT II- (5 Hours)

Judiciary: Supreme Court, High Court, Judicial review, Judicial Activism, PIL. (10 classes)

UNIT III-(5 Hours)

Constitutional and Statutory Bodies in India: ECI, UPSC, SPSC, NHRC, SHRC, CVC, NGT (12 Classes)

UNIT IV-(4 Hours)

Federalism: Strong Centre Framework, Asymmetrical Federal Provisions, Inter-State council, Union-state relations. (10 Classes)

PRACTICAL(22 Hours)

Modalities for Practical Component: Project Report / Study Report based on Field work i.e. Visit in Panchayats, Municipalities, APSC, DC Office, SHRC etc.

Reading List:

(1) Chakraborty, Bidyut. Pandey, Rajendra K. (2023) 'Indian Political System: Institutions and Processes' Routledge India.
(2) Rupavath Ramdas, (2022) 'Indian Politics: Institutions and Processes' Raut Pulications.
(3) Laxmikanth, M. (2012) 'Indian Polity for civil service examinations' Tata McGraw Hill Education Private Limited, New Delhi.
(4) Raghumandan, J. R. (2012). Decentralization and Local Governments: The Indian Experience,Orient Black Swan, New Delhi.
(5) Niraja Gopal Jayal and others, (2006), Local Governance in India- Decentralization and Beyond, Oxford University Press.
(6) Kaul, M. N. & S. L. Shakhdher (2016), Practice and Procedure of Parliament, New Delhi: LokSabha Secretariat.
(7) D. A. Rondinelli and S. Cheema, (1983), Decentralisation and Development, Beverly Hills: SagePublishers.
(8) Paylee M.V. (2016), 'India's Constitution', S. Chand and Pvt. Ltd.

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44. Programming in C

PROGRAMMING IN C

Total Marks: 100 (Theory 60, Practical 20, Internal Assessment 20)
Per week: 2 Lectures 1 Practical, Credits 3(2+1) *Each unit carry equal credit*

Course Objectives: This course introduces C programming in the idiom and context of mathematics and imparts a starting orientation using available mathematical libraries, and their applications.

Course Learning Outcomes: After completion of this paper, student will be able to:
i) Understand and apply the programming concepts of C which is important to mathematical investigation and problem solving.

ii) Learn about structured data-types in C and learn about applications in factorization of an integer and understanding Cartesian geometry and Pythagorean triples.

iii) Use of containers and templates in various applications in algebra.

iv) Use mathematical libraries for computational objectives.

v) Represent the outputs of programs visually in terms of well formatted text and plots.

vi) In practical students learn about the roots of a quadratic equation, solution of an equation using N-R algorithm, sin(x), cos(x) with the help of functions .

Unit 1: Variables, constants, reserved words, variable declaration, initialization, basic data types, operators and expression (arithmetic, relational, logical, assignment, conditional, increment and decrement), hierarchy of operations for arithmetic operators, size of and comma operator, mixed mode operation and automatic (implicit) conversion, cast (explicit) conversion, library functions, structure of a C program, input/output functions and statements. Control Statements: if-else statement (including nested if-else statement), switch statement. Loop control Structures (for and nested for, while and do-while). Break, continue, go to statements, exit function.

Unit 2: Arrays and subscripted variables: One and Two-dimensional array declaration, accessing values in an array, initializing values in an array, sorting of numbers in an array, addition and multiplication of matrices with the help of array. Functions: function declaration, actual and formal arguments, function prototype, calling a function by value, recursive function.

Programs for practical:

To find roots of a quadratic equation, value of a piecewise defined function (single variable), factorial of a given positive integer, Fibonacci numbers, square root of a number, cube root of a number, sum of different algebraic and trigonometric series, a given number to be prime or not, sum of the digits of any given positive integer, solution of an equation using N-R algorithm, reversing digits of an integer. Sorting of numbers in an array, to find addition, subtraction and multiplication of matrices. To find sin(x), cos(x) with the help of functions.

Text Books:

1. T. Jeyapoovan, A First Course in Programming with C T. Jeyapoovan, Vikash Publishing House Pvt. Ltd.

Reference books:

1. E. Balaguruswamy, Programming with C, Schaum Series.
2. Y. Kanetkar, *Let us C*, B.P. Publication.

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45. Quantitative Aptitude and Reasoning
(Syllabus 1)

Title: QUANTITATIVE APTITUDE AND REASONING
Target group: Open for all (Arts, Science and Commerce)
Theory: 2 credit; Practical: 1 credit

Learning Objective(s):
The course is designed for all in view of assessing cognitive abilities of students in various competitive examinations. Therefore, it is desired that a Graduate must possess cognitive skill attributes to pursue further avenues in higher education and other sectors. This Skill Enhancement Course is expected to enhance employability of students pursuing FYUGP.
The main objective of the course are as follows,
1. Students will develop skills to prepare themselves for the competitive world for better job opportunities
2. Efforts will be made to accommodate fundamental and mathematical aspects to instil confidence among students
3. Students will enrich their knowledge and develop their logical reasoning thinking ability
4. Students will know the tricks and methods to solve quantitative and reasoning problems with accuracy and in a time-bound manner

Course Outcome(s):
On successful completion of the Course, students are expected to
1. Develop cognitive abilities
2. Build analytical skills
3. Understand the structure of arguments and reasoning
4. Solve problems efficiently in less time

Unit-wise Syllabus

THEORY
Unit I – (4 hours)
MENTAL ABILITY
Number System, Ages, Averages, Time and Calendar, Speed and Distance

Unit II – (6 hours)
NUMERICAL APTITUDE
Ratios and Proportions, Profit and Loss, Simple and Compound Interest

Unit III - (7 hours)
LOGICAL REASONING
Alphanumeric series, Blood relations, Directions, Seating Arrangement, Deductive-Inductive Reasoning, Coding-Decoding

Unit IV - (5 hours)
DATA HANDLING
Data: meaning, types, sources; Data Representation using Diagrams and Charts; Data Interpretation, Data sufficiency

PRACTICAL

Practical Worksheet **(22 hours)**

Problem-solving questions on,
1. Age
2. Speed and Distance
3. Averages
4. Family-tree
5. Ratios and Proportions
6. Coding-Decoding
7. Time and Calendar
8. Simple Interest
9. Compound Interest
10. Profit and Loss
11. Seating Arrangement
12. Inductive reasoning
13. Deductive reasoning
14. Directions
15. Alphanumeric series
16. Construction of various Diagrams and Charts
17. Interpretation of various Diagrams and Charts
18. Data sufficiency

Reference(s):

1. Aggarwal, R.S, "Quantitative Aptitude for Competitive Exams", S.Chand
2. Tyra, M., "Quicker Maths", BSC Publishing Co. Pvt. Ltd.
3. Trueman's Specific Series "UGC NET/SET"

(Syllabus 2)

Skill Enhancement Course 4: Quantitative Aptitude
(Offered by the Department of Mathematics)

Open for All
Duration: 24 Hours

Unit 1: Vedic Mathematics (4 hrs)
Multiplication, Square and Square Roots, Cube and Cube Roots, Relation Between Percentage and Reciprocals
Unit 2: Numbers (6 hrs)
HCF & LCM, Averages, Equation, Inequalities
Unit 3: Percentage (6 hrs)
Profit, Loss and Discount, Simple and Compound Interest
Unit 4: Time, Speed, and Distance (4 hrs)
Boats & Streams (Upstream and Downstream Motion), Train Problems, Race Problems
Unit 5: Indices and Logarithms (4 hrs)
Surds, Age Problems Ratio & Proportion
Unit 6: Geometry (4 hrs)
Unit 7: Clocks (4 hrs)
Partnership, Alligation, Progression
Unit 8: Chain Rule (4 hrs)
Time & Work, Pipes & Cisterns
Reference books:
1. Quantitative aptitude for Competitive examination By R S Agarwal
4. Magical Book on Quicker Maths by M. Tyra

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46. Reasoning & Logic

Title: APTITUDE AND LOGICAL REASONING COURSE

Total Marks = 100 (Final Exam 80 Marks + Project 20 Marks)

Unit 1- Quantitative Ability (Basic Mathematics) (6 Lectures)

(Number system, LCM and HCF, Decimal Fractions, Simplifications, Square roots and Cube roots, Average, Problems on Age, Surds and Indices, Percentages, Problems on Numbers)

Unit 2- Quantitative Ability (Applied Mathematics) (6 Lectures)

(Logarithm, Permutation and Combinations, Probability, Profit and Loss, Simple and Compound Interest, Time- Speed and Distance, Time & Work, Ratio and Proportion, Area, Mixture and Allegation)

Unit 3- Data Interpretation (7 Lectures)

(Data Interpretation , Tables, Column Graphs, Bar graphs, Line Charts, Pie Chart, Venn

Diagrams) (8 Lectures)

Unit 4- Logical Reasoning

(Analogy, Blood relation, Directional Sense, Number and letter series.

Coding-Decoding, Calendars,Clocks, Venn Diagrams, Seating Arrangement, Syllogism and

Mathematical Reasoning) (4 Lectures)

COURSE OUTCOME:

On completion of this skill enhancement course the students will be able to

- Understand the basic concept of Quantitative Ability.
- Understand the basic concept of Logical Reasoning Skills
- Acquire satisfactory competency in use of reasoning
- Solve campus placements aptitude papers covering Quantitative Ability, Logical Reasoning
- Compete in various competitive examinations like CAT, CMAT, GATE, GRE, UPSC

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47. Renewable Energy and Energy Harvesting

Credits: 3 (Theory: 3)

Theory: 30 Lectures

Preferred minimum qualifications of the teacher/instructor: Assistant Professor of Physics with PhD in Condensed Matter Physics.

The aim of this course is not just to impart theoretical knowledge to the students but to provide them with exposure and hands-on learning wherever possible

Theory

Unit I: Fossil fuels and Alternate Sources of energy (Lectures 3)

Fossil fuels and Nuclear Energy, their limitation, need of renewable energy, non-conventional energy sources. An overview of developments in Offshore Wind Energy, Tidal Energy, Wave energy systems, Ocean Thermal Energy Conversion, solar energy, biomass, biochemical conversion, biogas generation, geothermal energy tidal energy, Hydroelectricity.

Unit II: Solar energy (Lectures 6)

Solar energy, its importance, storage of solar energy, solar pond, non-convective solar pond, applications of solar pond and solar energy, solar water heater, flat plate collector, solar distillation, solar cooker, solar green houses, solar cell, absorption air conditioning. Need and characteristics of photovoltaic (PV) systems, PV models and equivalent circuits, and sun tracking systems.

Unit III: Wind Energy harvesting (Lectures 3)

Fundamentals of Wind energy, Wind Turbines and different electrical machines in wind turbines, Power electronic interfaces, and grid interconnection topologies.

Unit IV: Ocean Energy (Lectures 3)

Ocean Energy Potential against Wind and Solar, Wave Characteristics and Statistics, Wave Energy Devices.

Unit V: (Lectures 2)

Tide characteristics and Statistics, Tide Energy Technologies, Ocean Thermal Energy, Osmotic Power, Ocean Bio- mass.

Unit VI: Geothermal Energy (Lectures 2)

Geothermal Resources, Geothermal Technologies.

Unit VII: Hydro Energy (Lectures 2)

Hydropower resources, hydropower technologies, environmental impact of hydro power sources.

Unit VIII: Piezoelectric Energy harvesting (Lectures 4)

Introduction, Physics and characteristics of piezoelectric effect, materials and mathematical description of piezoelectricity, Piezoelectric parameters and modeling piezoelectric generators, Piezoelectric energy harvesting applications, Human power.

Unit IX: Electromagnetic Energy Harvesting (Lectures 2)

Linear generators, physics mathematical models, recent applications

Unit X: (Lectures 3)

Introduction to Carbon capture technologies

Unit XI: (Lectures 1)

Environmental issues and Renewable sources of energy, sustainability

Reference Books

[1] Non-conventional energy sources - G.D Rai - Khanna Publishers, NewDelhi

[2] Solar energy - M P Agarwal - S Chand and Co.Ltd.

[3] Solar energy - Suhas P Sukhative Tata McGraw - Hill Publishing CompanyLtd.

[4] GodfreyBoyle,"RenewableEnergy,Powerforasustainablefuture",2004,OxfordUniversityPress,in association with The OpenUniversity.

[5] Dr.PJayakumar,SolarEnergy:ResourceAssesmentHandbook,2009 J.Balfour,M.ShawandS.Jarosek, Photovoltaics, Lawrence J Goodrich(USA).

http://en.wikipedia.org/wiki/Renewable_energy

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48. Retail Management
(Syllabus 1)

OBJECTIVES:

Enable students to acquire skills in Retail Management.

- to familiarize the students with the latest retail business .
- Is to familiarize Retail marketing mix.

LEARNING OUTCOMES:

To implement about business and the external forces that influence retailing.

- To make the students understand the business transformation and effective utilization
- of retail store To accustom the students to the various retail operation in the field of marketing.

UNIT 1:

Introduction to Retail Business: 04 HRS

Definition-functions of retailing-types of retailing-forms of retail business ownership. Retail formats-Retail theories-Wheels of retailing-Retail life cycle. Retail business in India: influencing factors- Present Indian retail scenario. International perspective in retail business

UNIT 2:

Consumer behavior in retail business: 04HRS

Buying decision process and its implication on retailing-influence of group and individual factors, customer shopping behavior, customer service and customer satisfaction. Retail planning process: factors to consider in preparing a business plan-implementation-risk analysis.

UNIT 3

Retail operations: 04 HRS

Factors influencing location of store-market area analysis-Trade areas analysis-rating plan method-site evaluation. Retail operations: stores layout and visual merchandising, stores designing, space planning, inventory management, merchandise management, category management.

UNIT 4:

Retail marketing mix: 10 hrs

HRS Introduction-product: decisions related to selection of goods (Merchandise Management Revisited)-Decisions related to delivery of services. Pricing: influencing factors-approaches to pricing price sensitivity-value pricing-markdown pricing. Place: supply channel-SCM principles-Retail logistics-computerized replenishment system-corporate replenishment policies. Promotion: setting

objectives-communication effects-promotional mix. Human resource management in retailing - Manpower planning-recruitment and training compensation-performance appraisal methods.

UNIT 5

Impact of information technology in retailing: 08 HRS

Non-store retailing (E-Retailing)-The impact of information technology in retailing-integrated systems and networking-EDI-Bar Coding-Electronic Article surveillance-electronic shelf labels-customer database management system. Legal aspects in retailing, social issues in retailing, ethical issues in retailing.

SKILL DEVELOPMENT

Draw a retail life cycle chart and list the stages.

- Draw a chart showing a store operations
- List out the major functions of a store manager diagrammatically
- List out the current trends in e-retailing
- List out the Factors Influencing in the location of a New Retail outlet.

REFERENCES:

1. Suja Nair; Retail Management,HPH
2. .Karthic –Retail Management, HPH
3. S.K. Poddar&others –Retail Management, VBH.
4. R.S Tiwari ; Retail Management, HPH 18
5. Barry Bermans and Joel Evans: "Retail Management –A StrategicApproach", 8th edition,PHI/02
6. A.J.Lamba, "The Art of Retailing", 1st edition, Tata McGrawHill, NewDelhi, 2003.
7. Swapna Pradhan : Retailing Management, 2/e, 2007 & 2008, TMH 8. K. Venkataramana, Retail Management, SHBP.
9. James R. Ogden & Denise T.: Integrated Retail Management
10. A Sivakumar : Retail Marketing , Excel Books
11. Ogden : Biztantra, 2007
12. Levy & Weitz : Retail Management -TMH 5th Edition 2002
13. Rosemary Varley, Mohammed Rafiq-: Retail Management
14. Chetan Bajaj : Retail Management -Oxford Publication.
15. Uniyal &Sinha : Retail Management -Oxford Publications.
16. Araif Sakh ; Retail Managem

(Syllabus 2)

Paper Name**: -Retail Sales Specialist cum Cashier**

Credit 3 **Total Marks: 100**

Theory classes :17 classes (one hour each-17 hrs) **Theory:50 marks**

Practical classes:16 classes (Two hours each-32 hrs) **Practical:50 Marks**

Practical classes will include : 12 hours of Retail Lab practical, 12 hours of presentation preparation, 6 hours of Group Discussion. 2 hours of assignment preparation

CourseDescription:

This course on"**Retail SalesSpecialistcumCashier**"for undergraduatestudentsbuildsbasicallyon thesoft skills alreadypossessed bythestudentsapartfrom preparingthem foran entrylevel profession in theretailindustry.It aims to develop thetechnicalskillsrequiredforthejobapartfrom improvingtheir communicationand problem-solvingskills.

CourseObjective:

This course is aimed attrainingstudentsforthe job of"**Retail SalesSpecialistcumCashier**",in the"Retail"Sector/Industryand bytheend ofthesemesteraims at buildingthejob specifickeycompetenciesamongst thelearners

SpecificObjectives:

The courseaims to enablestudents to–

- Understand thebasic concepts oftheretailindustry
- Understand the jobdescription and dutiesof"**RetailSalesSpecialistcum Cashier**"
- Understand thebasicsof retailbusinessprocessmanagement
- Understand theimportanceofsalessupport andcustomer relationshipmanagement
- Understand theimportanceofmaintenanceofstorehygiene, safetyand securityoftheretailstore
- Gives an idea ofvariousproblem-solvingskills related to theindustry
- Givean exposure tothe practicalaspectsoftheindustry
- Develop softskills

CourseOutcome:

After thecompletionofthecourse, thestudents will beableto

- Understand thebasicsoftheretailindustry
- Know therequirements oftheprofessionof**RetailSalesSpecialistcumCashier**
- Develop theskillsrequired for beingasuccessful**Retail SalesSpecialistcumCashier**
- Communicatewith peoplewith confidenc

CourseContent:

Unit1:INTRODUCTION TO RETAIL MANAGEMENT Marks: 10

* FundamentalsofRetail
* Evolution ofRetailin India
* Indian Retail Industry
* Organized and Unorganized Retail Sector
* Types ofRetail Formats
* Retail LifeCycle
* Retail MarketingMix

Unit2: INTRODUCTION TO RETAIL SALES SPECIALIST CUMCASHIER Marks: 10

* Retail SalesSpecialistcum Cashier-Definition, Job Description, Duties

Unit 3:SALESSUPPORT Marks: 10

* Importanceofproduct demonstration:
* Specialist support tocustomers in facilitatingpurchases
* Maximizationofprofitthrough sales ofgoods&services
* Personalizedsales&post-salesservicesupport

Unit 4:CUSTOMER RELATIONSHIP MANAGEMENT Marks: 10

* CRM-Concept, Importance
* Importanceof monitoringand resolvingserviceconcerns/grievances
* Importanceofcreatingpositiveimageofself&organization in thecustomers mind

Unit 5:STORE HYGIENE, SAFETY&SECURITY Marks: 10

* Concept &ImportanceofStoreHygieneandCleanliness
* Concept &ImportanceofStoreSafety& Security

Readerlist:

Pradhan,S.,RetailingManagement:Textand CasesMadanR.L., A
Textbook ofRetailManagement
QualificationPackofRetailSalesSpecialistcumCashierprescribed byRASCI

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49. Rural Marketing

Rajiv Gandhi Memorial College, Lengtisinga
Department of Economics
Skill Enhancement Course

Course Objectives: The objective of the course rural marketing is to familiarize the students with the conceptual understanding of rural marketing and is corresponding development practices in Indian context.

Course Outcome: The course outcome of Rural Marketing may be as follows:

- Understanding the agricultural marketing system and role of price discovery in our economic system
- To Understand, defined, and explain value added processing
- To Understand, define and explain competition in the market place.
- To Understand, define and explain consumer demand issues.
- To understand the role of information technology in rural marketing.

Unit – I: Introduction to Rural Marketing:

Meaning, Scope, Definition and Importance of Rural versus Urban Marketing, Growth of Rural Market, Basic Different between Rural, Semi-Urban and Urban Markets, Profile of Rural Consumer Behavior.

Unit – II: Role of Government in the Development of Agricultural Marketing:

Government Intervention in Marketing System, Role of Agencies like State Agricultural Marketing Boards, Co-Operative Marketing, Types of Co-Operative Marketing Societies, AGMARK, National NCDC (National Co-operative Development Corporation), Publics Distribution System, Self-Help Group in Assam (SHGs), North Eastern Regional Agricultural Marketing.

Unit – III: Agricultural Credit and Crop Insurance:

Agricultural Credit Policy, Institutional Agreement for Agricultural Credit, Crop Insurance, Agricultural Insurance.

Unit – IV: Role of Information Technology in Rural Marketing:

Infrastructure, Importance and Scope, Modern Techniques for Rural Distribution.

Reference Books:

1. Rural Marketing: Ashok Jain, Varun Jain.
2. Rural Marketing Text and Cases: Krishnamacharyulu and Lalitha Ramkrishnan
3. Rural Marketing: Pradeep Kashyap.

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50. Sattriya Dance Skill

Course Title: SATTRIYA DANCE

SYLLABUS

THEORY

- Extensive study of Sattriya Dance.
- Introduction of various types of classical dance forms of India.
- Brief knowledge about Srimanta Sankardev and Madhavdev.
- General knowledge of Tandav and Lashya forms of dance.
- Knowledge of Hastamudra (According to Sri Hasta Muktawali). Asangjukta, Sangjukta and Nritya Hasta, its description and uses.
- Introduction knowledge of Matiakhara. The types of Matiakhara.
- The name of Sattras along with the place of Assam.
- Few names of Gurujis of the Sattriya Dance.
- Basic knowledge of drishti, Griba karma, and its types.
- Basic knowledge of Aanga, Pratyanga and Upanga.
- Basic knowledge of Nayak-NayikaBheda as discussed in the Ntyashastra.
- Introduction of the pure dance of Sattriya -JhumuraRamdani and its description.
- Introduction of pure dance-JhumuraGeetorNaach, MelaNaach, and its description.
- Basic knowledge of SaliNach.
- Life history of SattriyaNritya Gurus or Adhyapaks.
- Knowledge of Taal, Taali, Chapori, Matra, Loy,Shachar, Bhangani, Ghat, Chok.

PRACTICAL

- Practical introductory knowledge of Matiakhora like – Ora, Sota, Jhalak, Chalana, Sitika, HaatSalowa, Harbhanga, PosolaTola, Panihisa, Gerowasowa, Muruka, Jatani, Tewai, Haatpokowa, Pak, Kokilakhosa, Jaap, Moropa, Ketela, Athuwa, Satrawali.
- Practical knowledge ofTaal – SutaTaal, ThukoniTaal,Ektaal, Jatitaal.
- Practical knowledge of Hastamudra – Asangjukta and Sangjukta Hasta, Nritya Hasta and its uses.

- Practical knowledge of Navarasa and its types.
- Practical knowledge of dance form – JhumuraRamdani, JhumuraGeetorNach, JhumuraMelaNaach.
- One Ramdani of SaliNaach- Takjiddhei di didhei.

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51. Soft Skill-1

Syllabus: First Semester

Total marks: 100(External: 50 + Internal/Practical: 50)	Nature of Course: SEC	No. of Credits: 3(two theory and one practical credits) No. of hours: 2x11+1x22=44 hours

Course Description

This course on Sot Skills for undergraduate students builds on the Skill Enhancement Courses under FYUGP offered in the first semester. It aims to the soft skills of the students. The sustained content in this course is based on Reading and Writing pedagogy, and uses authentic materials to teach students. The accessible short texts used will help the students develop their speaking, reading, writing, vocabulary and grammar skills.

Objectives/

This course will enable students to

- Equip the students with the skills to communicate effectively through innovative teaching methods.
- motivate the students to speak according to the context and with confidence
- train the students in interview skills, group discussions and presentation skills
- expose the students to other important skills such and computing and programming
- enhance the students' interpersonal skills
- improve the students' critical thinking skills
- make them ready to face any interview and group discussion
- inculcate positive attitude in students
- inculcate overall employability skills especially leadership skills, emotionalintelligence and other personal attributes crucial for success in business or career.

Learning Outcomes

This course will well equipped the students with necessary skills for their career building and growth**.**

Courses it feeds into

This course will feed into all the students across all streams /disciplines and will help them in their preparation for career goals.

Mode of delivery

Interactive discussions, digital tasks, personalization of topics, exercises and activities based on the selected texts, on the spot writing assignments, pair and group discussions, and feedback sharing.

Evaluation

Students will be evaluated through an internal component of 50 marks comprising sessional examination, Class test, class assignments, home assignments, class discussions, oral presentations, and so on. There will also be a written end-of-term External examination of 50 marks where students will be evaluated on their understanding of the course and their ability to use the skills and strategies studied in the course.

Course Content:

UNITS	CONTENTS	T	T/P	Total Hours
Unit -I	• Introduction to Soft Skills- define and understand Soft Skills • List and overcome the filters/barriers in Soft Skills	2	0	02
Unit -II	• Soft Skills Communication Skills (without being language specific) • Essential and basic rules of Body Language	08	04	12
Unit -III	• Leadership development • Time management • Teamwork • Critical thinking • Problem solving • interpersonal skills • Manners and attitudes	08	06	14
Unit -IV	• Handling a Smart Phone in a better way • Basic Computer Knowledge	01	04	05
Unit -V	• Writing a CV/job applications • GD Skills • Interview skills	03	08	11

Suggested Readings:

1. English and Soft Skills. S.P. Dhanavel. Orient Black Swan 2013

2. Business English. Sharmistha Panja et al. Pearson, 2009.
3. Fluency in English - Part II, Oxford University Press, 2006.
4. Any other books related to the course.

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52. Spoken Arabic-1

--By Abu Bakkar Siddiqui, Dept of Arabic, GU

GAUHATI UNIVERSITY
DEPARTMENT OF ARABIC
FYUGP SEMESTER: I

SPOKEN ARABIC-I
(SEC PAPER)

UNIT-I: Fundamentals of Arabic Language

- ✓ Introduction to Arabic Alphabets
- ✓ Listening to texts, listening to Arabic audio-videos
- ✓ Introduction to Arabic phonetic Symbols, consonants & Vowels with illustrations in use
- ✓ Pronunciation Practice preferably using ICT tools

UNIT-II: Development of Reading and writing Skill

- ✓ Recognition of Arabic letters
- ✓ Reading comprehension and Combination of Letters
- ✓ Description of Human vocal organs (مخارج الحروف)
- ✓ Writing Practices

UNIT-III: Vocabulary Enrichment

Arabic vocabulary related to

- ✓ Nature e.g. Earth, Moon, Sun, river mountain. and seasonsetc.
- ✓ Relatives e.g. father, mother, brother etc.
- ✓ Body parts, dresses and time related words like Month, Week, Day and Direction etc.
- ✓ Arabic numeral (1 to 100), Plants, Vegetables, Flowers, Fruits etc.

UNIT-IV: Basic Grammar and Conversation Practices

- ✓ Parts of Speeches
- ✓ Person, Number and Gender
- ✓ Conversation Practices using demonstrative pronouns
- ✓ Conversation Practices using simple sentences

Reading References:

1. معلم اللغة العربية, Standard-I, Published by MESCO-ALEEF, Hyderabad
2. معلم اللغة العربية (الثروة اللغوية) Published by MESCO-ALEEF, Hyderabad
3. Teach Yourself Arabic by Prof. S. A. Rahman
4. Arabic for Beginners by. S. Ali
5. Madina Arabic, Vol. I by Dr. V. Abdur Rohim
6. Let's Speak Arabic By Prof. S. A. Rahman

Graduate attributes:

1. Creativity
2. Communication skill
3. Learning how to learn skill

Learning outcomes:

1. The learners will be able to recognize Arabic alphabet and pronounce them correctly.
2. The course will help the learners in social interactions and will help them convey basic information in Arabic.
3. The course will guide the learners to comprehend simple written texts on common topics.
4. At the end of the course the students will be at ease to compose simple texts in Arabic.
5. The course will lead the students to comprehend simple audio-video texts in Arabic.

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53. Spoken English
(Syllabus 1)

---By Bibhash Choudhury, Dept of English, GU

SUBJECT NAME: ENGLISH

COURSE NAME: VAC(SPOKEN ENGLISH)

COURSE LEVEL: 100-199(FOUNDATION AND INTRODUCTORY)

GRADUATE ATTRIBUTES: This introductory course in Spoken English is designed to equip students from all disciplines with spoken English skills which have become absolutely necessary in our personal, social, and professional lives in this age of globalization and the internet.Students will be familiarized with the nuances of spoken English and given practice in the use of English in a variety of formal and informal settings so that, by the end of the course, they are able to use the language confidently in different contexts of interpersonalinteraction.The spoken English skills will enable the graduates to confidently collaborate with others and coordinate activities thereby developing their team spirit and social skills. The communicative ability of the graduates will also be seen in their digital and technological skills which they will imbibe through the incorporation of information and communication technology in the teaching process.

Teaching Methodology:Activities in the language lab and appropriate audio-visual aids and ICT will be used wherever necessary to hone the spoken English skills of the students.

Assessment**:** The spoken skills acquired by the students will be tested through an oral examination which may involve components like i. Group discussion, ii. An interview situation, iii. An oral presentation iv. Reading a passage with correct pronunciation and appropriate stress and intonation, v. Description of a scene in a photographor video clipping etc.

THEORY CREDIT: 1

PRACTICAL CREDIT: 1

a) **No. of Contact Classes:** 2 classes per week
b) No. of Non-contact Classes: None (students will be allotted reading and listening exercises and other assignments to be done when they are not attending contact classes.)

UNIT – I: ELEMENTS OF SPOKEN COMMUNICATION

Here students will get a broad understanding of the sound system of English-the vowel and consonant sounds,word stress and sentence stress, weak forms, and intonation patterns. They will be made aware of the importance of using correct pronunciation in speaking. Exercises in listening and repeating preferably in a language laboratory will go a long way in developing pronunciation and in imbibing the features of spoken English communication.The students will also be acquainted with the non -verbal features of spoken communication-gestures and postures, eye contact, and other features of body language so that they acquire the ability to communicate effectively.

UNIT -II GRAMMAR AND VOCABULARY

Students will be offered instruction on avoiding common grammatical mistakes in speaking-mistakes related to tense, subject-verb agreement, prepositions etc. They will be encouraged to listen and read so that they can build up a good vocabulary which will help them in written as well as spoken communication.

UNIT – III SPEAKING ACTIVITIES

Students will be given practice in speaking English in a variety of formal and informal situations. The practice activities will strive to incorporate the following:

- Basic speaking skills like making statements, asking questions, requesting,apologizing, issuing orders etc.
- Description of an event or an incident
- Role play involving dialogue
- Telling a story from outlines given
- Group discussion on a given topic
- Interview (face-to-face, telephonic and video)
- Oral presentationon a topic using audio-visual aids like powerpoint
- Public speaking

REFERENCE BOOKS & MATERIALS:

Eastwood, John.Oxford Guide to English Grammar. OUP, 1994

McCarthy, Michael and Felicity O Dell. English Vocabulary in Use, Upper Intermediate with Cd-rom,Cambridge University Press, 2008.

Yates, Jean. English Conversation. McGraw Hill, 2020

Yule and Brown. Teaching the Spoken Language: An Approach Based on the Analysis ofConversational English(Cambridge Language Teaching Library,1983

(Syllabus 2)

Skill Enhancement Course 8: Spoken English
(Offered by the Department of English) Guwahati College

Open for All

Total Credit =3(33 Hours)

Unit 1: Phonology of English

A brief introduction to English language and its characteristics, Phonemes: Consonants, Vowels and Diphthongs, Articulation of speech sounds, Syllables and CVC pattern, Accent patterns and Intonation

Unit 2: Conversation in English

a) Patterns: Greeting, Invitation, and replies, Making requests, commanding, ordering and asking the question, Seeking permission, Apologizing, Complaining, complementing and congratulating

b) Using English in Real life situations: At the Bank/office, At the shop, At the temple, Meeting friends, Meeting relatives, Visiting a doctor, At the police station At the railway/ bus station, Interviews, Telephonic communication

Unit 3: Basic English Grammar

Parts of speech and their uses, Articles and their uses, Synonyms and antonyms, Word-formation, Punctuation, Sentence pattern

Unit 4: Practical

Definition of terms, Synonyms and antonyms, Word and sentence formation

Loud reading of a poem/passage, Pronunciation of words, Observation of accent, and pronunciation of a given text

Practice Session in Language Lab

Reference Books:

1] Bansal R.K. and Harrison J.B. Spoken English for India. Orient Longman, Mumbai, 2000.
2] Daniel Jones. English Pronouncing Dictionary. 15th edition. Roach, P. & Hartman, J. eds. Cambridge UK: Cambridge University Press, 1997.
3] Katamba, F. An Introduction to Phonology, Longman, 1989.
4] Roach. Peter. English Phonetics and Phonology: A Self-contained comprehensive pronounciatin course.4th edition. Cambridge UK: Cambridge University Press, 1983
5] T. Balasubramanium. A Textbook of English Phonetics for Indian Students. Macmilan, New Delhi, 1999.
6] Bygate, M. Speaking. Oxford: Oxford University Press.
7] G. Radhakrishna, Pillai, K. Rajeevan. Spoken English for You. CIEFL. Emerald Publication.
8] Z.N.Patil. English for Practical Purpose, Mac Millan Ind. Ltd.
9] Assam Publishing Company. Modern English Grammar and Composition. Anglo- Assamese Edition. 2016
10]Bani, Prakashani. An Approach to English Grammar & Composition.
11] Geoffrey, Leech. Margaret Deushar. English Grammar Today.
12] Wren & Martin. High School English Grammar and Composition. Revised by Dr N.D.V Prasada Rao, S. Chand. 1999.
13] W.S. Allen. Living English Structure.
14] Wood, F.T. A Remedial English Grammar for Foreign Students.

(Syllabus 3)

1. SPOKEN ENGLISH COURSE

2. Total Marks = 100 (Theory 70 marks + Practical 30 Marks)

UNIT –A:

i) Listening- Listening to the Texts, Trials of a Good Listener (2 Lectures)

ii) Listening & Comprehension- Interpretation of Texts based on Question-answer and Interaction among students. (3 Lectures)

iii) Vocabulary & Word Formation-From different texts & Dictionary. (3 Lectures)

iv) Practice Exercises on the use of different grammatical constructions in context, Identification of the use of the above given grammatical devices from different texts like newspapers, poems, stories etc.(3 Lectures)

v) Dialogues (1 Lecture)

vi) Telephonic Conversation (1 Lecture)

UNIT-B:

i) Pronunciation –Introduction of English Phonetic Symbols, Consonants & Vowels with illustrations in use. (3 Lectures)

ii) Reading Skill-Techniques of reading, reading Comprehension of unseen pages, Identifying the context & the central idea. (2 Lectures)

iii) Basic Grammar-Both spoken and Written. (3 Lectures)

iv) Words & Phrases used for conversation, questions, order and suggestions. (2 Lectures)

v) Public Speech (2 Lectures)

vi) Translation (2 Lectures)

COURSE OUTCOME:

On completion of this skill enhancement course in Spoken English ‘ a student can develop pronunciation skills and the sounds of English , can have better career prospects, improved academic performance, enhanced communication skills, improved confidence during interviews, access to global resources and enhanced travel experiences.

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54. Spoken Hindi

(Syllabus 1)

स्पोकन हिन्दी

कुल अंक :100
सैद्धांतिक परीक्षण :50
व्यावहारिक परीक्षण50:
क्रेडिट3 :
कक्षाएँ60 :घण्टे

<u>कोर्स-लेवल</u> 199-100 :

<u>पूर्व:योग्यता-</u>हिन्दी**10** सहित-वीं कक्षा उत्तीर्ण-

<u>स्नातक:गुण-</u>*स्पोकन हिन्दी के इस पाठ्यक्रम को इस रूप में प्रस्तुत किया गया है ताकि विद्यार्थियों में खड़ीबोली हिन्दी के कथितबोलचाल के रूप से संबंधित इतनी योग्यता विकसित हो कि वे दैनन्दिन जीवन के सभी संदर्भों में मौखिक स्तर / पर सफलतापूर्वक हिन्दी का प्रयोग कर सकें।*

<u>लक्ष्य</u>: *विद्यार्थियों की हिन्दी-कथन-क्षमता को सम्यक् रूप से विकसित करना प्रस्तुत पाठ्यक्रम का प्रमुख लक्ष्य है।*

इकाई) 1क्रेडिट **: (1 :**स्पोकन हिन्दी **:** अवधारणा, स्वरूप,उपयोगिता ;

हिन्दी की स्वर) विधियाँ-व्यंजन ध्वनियाँ एवं उनकी उच्चारण-ह्रस्व और दीर्घ स्वरों के उच्चारण में अन्तर ; शब्द के आद्य, मध्य और अंत्य 'अ' के उच्चारण की विशेषताएँ;च, छ, ज, झ के उच्चारण की विशेषताएँ ; दंत्य और मूर्धन्य ध्वनियों के उच्चारण में अन्तर; श,ष, स ध्वनियों के उच्चारण में अन्तर;'र' ध्वनि के उच्चारण की विविध स्थितियाँ;'क्ष' और 'च्छ' के उच्चारण की विशेषताएँ ; र, ड़ और ढ़ के उच्चारण में अन्तरइन बातों --**(**पर विशेष ध्यान

इकाई)2क्रेडिट **: (1 :**हिन्दी की आधारभूत शब्द-सम्पदा **:** शरीर के अंग,मनुष्य एवं मानवीय संबंध,

पोशाक, गहने, खाद्य-पदार्थ, साग-सब्जी, फल-फूल, पशु-पक्षी, पेड़-पौधे, घरेलू चीज़ें, काम करने के औज़ार, सवारी, बीमारी-दवा, खेल-कूद, तिथियाँ, दिनों के नाम, महीनों के नाम, संख्या-गिनती, संगीत-वाद्य, अनाज, रंग, व्यवसाय, आकाश, क्रियाएँ इत्यादि सूचक संज्ञा शब्द ;हिन्दी के सर्वनाम, विशेषण और अव्यय शब्द

इकाई)3क्रेडिट **: (1 :**अभिवादन;अपना परिचय प्रदान-; दूसरे की परिचयप्राप्ति-; आत्मीयजनों एवं-मित्रोंके साथ वार्तालाप, अपरिचित-जनों के साथ बातचीत; शिक्षण-संस्थान, बाज़ार, यातायात-परिवहन, बैंक-डाकघर, विभिन्न कार्यालय, खेल-कूद, मनोरंजन, सांस्कृतिक कार्यक्रम,अस्पताल, संचार-माध्यम इत्यादि के संदर्भों में सम्बद्ध जनों के साथ विविध प्रकार)अर्थ और संरचना की दृष्टि से(के वाक्यों के जरिए विचारों का आदान-प्रदान;मुहावरेदार भाषा में बातचीत

<u>द्रष्टव्य</u>: *व्यावहारिक परीक्षण के अन्तर्गत प्रश्नोत्तर,किसी विषय पर भाषण, दो जनों का वार्तालाप, समूह में चर्चा आदि की व्यवस्था रहेगी । विभागीय प्राध्यापकगण, महाविद्यालय के अध्यक्षसंस्थान के प्रमुख अथवा उनके द्वारा शिक्षण/ कार्य सम्पन्न होगा ।-नामित प्रतिनिधि के समक्ष व्यावहारिक परीक्षण एवं मूल्यांकन*

<u>अभ्यास पुस्तकें</u>)सिर्फ पढ़ने के लिए**) :**

.1 *बात–चीत-* असम राष्ट्रभाषा प्रचार समिति, गुवाहाटी ।
.2 *जानने की बातें–* केशव सागर, राजपाल एण्ड संज, दिल्ली ।
.3 *पाँच एकांकी–* असम राष्ट्रभाषा प्रचार समिति, गुवाहाटी ।
.4 *समसरोज–* मुंशी प्रेमचन्द, सरस्वती प्रेस, इलाहाबाद ।

<u>सन्दर्भ ग्रन्थ</u> :

.1 *शुद्ध हिन्दी–* डॉ॰ हरदेव बाहरी,लोकभारती प्रकाशन,इलाहाबाद ।
.2 *आधुनिक हिन्दी व्याकरण एवं रचना–* डॉ॰ वासुदेवनन्दन प्रसाद, भारती भवन, पटना ।
.3 *मानक व्यावहारिक हिन्दी व्याकरण तथा रचना–* श्यामजी गोकुल वर्मा,आर्य बुक डिपो,नई दिल्ली ।
.4 *असमीया हिन्दी लर्निंग कोर्स–* रेपिडेक्स पब्लिकेशन्स।
.5 *शुद्ध हिन्दी कैसे सीखें–* राजेन्द्र प्रसाद सिन्हा, भारती भवन, पटना ।
.6*Complete Hindi Beginner to Intermediate Course: Learn to read, write, speak and understand a new language with Teach Yourself* – Rupert Snell, John Murray Learning.
7.*Spoken Hindi from Scratch* – Atharwa Madbhavi, Notion Press Publisher.

.8*Word Book 4 in 1 (Learn English, Hindi, Assamese and Bengali)* – G.B.D.'s Editorial Board, Good Books Distributors Publishers, Kolkata.

(Syllabus 2)

Skill Enhancement Course 7: Spoken and Communication Hindi
(Offered by the Department of Hindi) Guwahati College

Open for All

Total Credit =3(33 Hours)

Unit 1:
Alphabet (Recognition & Pronunciation), Vowel Signs & Sign of ₹. Conjunct Letters (Part I), Conjunct Letters (Part - II), Numbers & Ordinals

Unit 2:
Reading Practice, Words of Everyday life, Conversation (Monologue & Dialogue), Creative Expression (Extempore)

Unit 3:
Writing Exercise (Creative), CV/Bio-data Preparation, Simple Letter writing (Informal & Formal)

Unit 4:
Grammar: Pronouns, Adjectives, Adverbs, Numbers, Gender, Case, Verb, Tense Direct & Indirect Speech, Simple Sentence, Compound Sentence, Complex Sentence

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55. Teaching Skill

PAPER TITLE: - SKILLS ON PRACTICE TEACHING.

UNIT 1: Concept of teaching and teaching skills, Introduction of some important teaching skills, Phases of Teaching.

UNIT 2: Meaning, nature and importance of Lesson Plan, Criteria of good lesson plan, Herbartian Steps of Lesson Plan.

UNIT 3: Preparation of Lesson Plan for practice teaching (PRACTICAL).

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56. Tools & Techniques for Local Handicraft Entrepreneurship

Unit- I

Entrepreneurship- Concepts, elements, determinants & importance of entrepreneurship.Entrepreneurs- Essential Qualities, characteristics, different types of entrepreneurs andentrepreneurship.

Unit-II

Levels of Entrepreneurship - Micro, Small & Medium. Indian business traditions & Entrepreneurship- Family, Group, Community Society. Traditional values & ethics in relationto business & culture ofentrepreneurship.

Unit-III

Handicrafts Traditions of India - A historical background and its legacy for trade & commerce in handicraft products. Different types of handicrafts in practice in Assam,handicraft traditions of undivided Goalpara District and present position of handicraft inDhubri district.

Unit-IV

Tools & Techniques for establishment of Handicraft based business: Idea for new business,preparation of business plan, writing of project proposal, submission process of project report,detailing of location layout, raw material, marketing facilities, finance, online platform, ecommerce,market place, segment, competitors & rival.

Unit-V

Practical Training on Sales & Marketing, meeting with local craftsman & understanding realtime to real life production of handicraft items, visiting craft bazaars, handicraft fair forpractical selling to marketing experiences through internship programme and to meet real lifeentrepreneurs dealing in handicraft products.

Books and References

l. Robert Hisrich, Michael peters, Dean Sheperd, Entrepreneurship, McGraw-Hill Education.
2. Desai Vasant Dynamics of Entrepreneurial Development and Management. HimalayanPublishing House Mumbai
3. Holt, David H. Entrepreneurship: New Venture Creation. Prentice Hall of India New Delhi.
4. Singh Nagendra P. Emerging Trends in Entrepreneurship DevelopmentASEED. New Delhi.

5. Ranjan Aditi Handmade in India Mapin publishing private limited. (for Library collection)
6. Ranjan M.P. Handmade in India: A Geographic Encyclopedia of Indian Handicrafts.Abbeville Publishing group. (for Library collection)
7. Chottopadhyaya Kamaladevi: Handicrafts of India. Indian Council for Cultural Relation.
8. Handique Krishna Jyoti: Handicrafts inAssam, Kalpaz publication.
9. Sarma Mrinmoy K: Traditional Crafts ofAssam, Shipra Publications.

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57. Tour Packaging Management

Skill Enhancement Course **Title - Tourism Packaging Management**

Course Objectives:

The Course will help the students to gain the knowledge about various concepts, Scope, nature and type of tourism. Further it will help the Students to evaluate the socio - economic, cultural and environmental impact of tourism Industry.

Course out Come :

- Study the fundamental concept of tourism.
- Understand the nature and types of tourism.
- Define the elements, classification and Historical development of Tourism.
- Identify the importance of tourism impacts.
- Elaborate the concepts of sustainable tourism development.

Unit - I : Introduction to tourism.

Unit - II : Tourism Principles, Policies and Practices.

Unit - III : Global tourism History.

Unit - IV : Travel Agency and tour Operations.

Unit - V : Tourism Entrepreneurship.

Reference Books :

- Archer, B.H. (1982) The value of Multipliers and their Policy.
- Bramwell, B. (1993) Tourism and the environment.
- Butler, R.W (1980) The Concept of Tourism: an evolving global approach.
- Evans, N. Cambell, B. & Stakeholders, G (2003) Strategic Management for travel and tourism.
- Freeman R.E (1983) Strategic Management: A Stoker holder approach.

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58. Traditional Medicinal System in Mayong, Assam

Credit: 3 (L2,P2)

Total Marks: 100 (Therory - 50, Internal – 50)

Aim of the course: As in other indigenous societies, the practices of folk medicine have also been in continuance among the tribal and non-tribal societies of Assam since very early age. The Folk Medicinal system in Assam is known as '*BezaliSikitsa'* and the healers or practitioners are popularly called as '*Bez'*, '*Kabiraz'* or '*Oja'.* The *Bezes* or *Ojas*use both herbal medicines and versified incantations or charms for the removal of diseases and other evil spirits from the body of the patients. An enormous amount of the knowledge and practices of magic and medicine is still deeply rooted in some places of Assam among its indigenous societies.The proposed course on Traditional Medicinal System will deal with this problem.

Objectives of the Course:

The underlying objectives of the course are –

i) to transmit the whole body of primitive knowledge and practices of traditional medicinal system of India to the next generation in an innovative and scientific way of thinking.
ii) to create a group of knowledge based professional traditional medicinal practitioners for the wellbeing of the society at the grass root levels.
iii) to create a group of skill man powers and entrepreneurs to develop herbal medicinal parks, production centers of herbal medicines, herbal medicinal plants, centers for traditional treatment etc.
iv) to add value to this branch of Indian traditional knowledge system (People's Primitive Science) which has been continuing till today since time immemorial to mankind.
v) to create an environment for reviving and developing the skill of this Indian system of traditional medicine.
vi) to explore, understand and document the whole body of knowledge and practices of herbal medicines, its different ways and procedures of application traditionally continued in oral form among different indigenous societies.
vii) to explore, understand and document the texts and contexts of the mantras (incantations) having therapeutic uses, its different ways and procedures of application traditionally continued in oral form among different indigenous societies.
viii) to identify, understand and document all the plants and animal materials used by the folk healers as source of medicine.

Expected Output/Outcomes of the Course:

The output/outcomes expected from the course are –

i) The Indian knowledge and practices of magic and herbal medicine could be revived and transmitted to the new generation in an innovative and scientific way of thinking.
ii) A group of knowledge based, skilled professional traditional medicinal practitioners for the wellbeing of the society at the grass root levels could be created.
iii) A group of skill man powers and entrepreneurs to develop herbal medicinal parks, production centers of herbal medicines, herbal medicinal plants, centers for traditional treatment etc. could be created.
iv) Traditional herbal medicinal prescriptions (continued in oral form) could be explored and documented with their methods of preparation and application.
v) Different diseases or ailments with their local names could be identified and documented with their symptoms and causes of the occurrence of diseases as viewed by traditional healers.
vi) Medicinal plants and animal parts used as source of traditional medicine could be identified and documented with their local and scientific names. Which parts of the plants are used as medicine and for what types of diseases could also be explored and documented.
vii) Case studies of traditional herbal healing and magical healing could be carried out with video documentation in a large scale.
viii) Mantras (Incantations) having therapeutic uses (continued in oral form) could be explored and documented with their texts, contexts and procedures of application etc. etc.

Contents of the Course:

Chapter-1 Introduction – Meaning and Concept of different types of Traditional Medicinal Systems of the World

Chapter-2 History of Traditional Medicine in India

Chapter-3 History of Traditional Medicine in Assam and North-East India
Chapter-4 Beliefs in the Causation of Diseasein Traditional Medicinal System- Natural Causes, Supernatural Causes

Chapter-5 Diagnostic Criteria in Traditional Medicinal System - Diagnosis from Symptoms, Diagnosis through Divination, Diagnosis with the help Interrogation, Diagnosis through Astrology, Diagnosis on the basis of Dreams, Diagnosis on the basis of some other Folk Beliefs etc.

Chapter-6 Methods of Healing in Traditional Medicinal System - Magico-Religious Healing- its different types, procedures of application etc., Herbal Healing- procedures of herbal preparation, the Diseases Treated and Herbal Medicines Recommended, Plants, Animals parts used as Medicine etc.

Chapter-7 The Folk Healers: Life Histories of Eminent Folk Healers of Assam/India, General Ethics of the Folk Healers, General Restrictions of Folk Healers, Social Standing of Folk Healers etc.

Chapter-8 Practical- Observation through participating in magic or folk healing related activities and rituals, In-depth Case studies of Magico-Religious Healing and Herbal Healing, Collection of treatment histories of the patients, Audio and video recording of magical and herbal treatments, interviews with expert herbalists or magicians, practice of herbal preparation etc.

Resource Persons for the Course:

Folk healers, Eminent Herbalists, Magic Practitioners, Botanist, Zoologist, Psychologist, Anthropologist, AyurvedicMedical Practitioners,Yuga Masters, Researchers of Traditional Medicinal System etc.

References books:

Will be framed later on.

Syllabus Committee:

Advisor:

Dr Mahananda Borah, Principal, Mayang Anchalik College, Morigaon, Assam.

Member and Coordinator:

Dr Utpal Nath, Assistant Professor, Department of Economics, Mayang Anchalik College, Morigaon, Assam

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59. Understanding Psychology

--By Laharighat College

Unit-I: Nature and scope of study of Educational Psychology:-

Involve concept of psychology, characteristics of psychology different branches of psychology, relation between education and psychology, need of the study of educational psychology, need of the study of educational psychology for the teacher.

Unit-II:- Heredity and Environment:

what is heredity, theoretical study and analysis onheredity and environment, types environment relative importance of heredity and environment role of the Teacher in regard to environment.

Unit-III: Memory and forgetting:-

what is memory characteristics of memory, factors of memory, memory trace, marks of good memory, improve of memory, forgetting, cause of forgetting theories of forgetting.

Unit-IV: Thinking reasoning and problem solving:-

Nature of thinking, constituent characteristics of thought, thought and imagination types of thinking reasoning meaning definition, types of reasoning scientific method of problem solving.

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60. Web Front-end Designing

Title: Web Front-end Designing-1(HTML)

Target Group: Open for all (Arts, Science and Commerce)

Theory= 2 Credits, Practical = 1 Credit

Learning objective(s):

(1) To introduce the basic concepts and techniques of front end web designing.
(2) To enable students to apply the basic concepts and techniques of front end web designing.

Course outcome:

After studying this course, students will be able to design interactive web pages.

Unit wise Syllabus:

THEORY

UNIT 1: (3 Hours)
The Basics Introduction to HTML, the Head, the Body, Colors, Attributes, Check box, Radio Button, Text, TextArea, Lists, ordered and unordered

UNIT 2: (4 Hours)
HTML Formatting: New Paragraph, Line Break, Blank Space, Preformatted text, Div element Bold text, Important text, Italic text, Emphasized text, Marked text, Small text, Deleted text, Inserted text, Subscript text, Superscript text, HTML quotations, HTML Comments, HTML colors

UNIT 3: (3 Hours)
Links Introduction, Relative Links, Absolute Links, Link Attributes, Using the ID Attribute to Link within a Document

UNIT 4: (3 Hours)
Images : Putting an Image on a Page, Using Images as Links, Putting an Image in the Background
UNIT 5: (5 Hours)
Tables : Creating a Table, Table Headers, Captions, Spanning Multiple Columns, Styling Table
UNIT 6: (4 Hours)
Forms: Basic Input and Attributes, Other Kinds of Inputs

PRACTICAL / LAB WORKSHEET TO BE PERFORMED (22 hours)

1. Create an HTML document with the following formatting options:

(i) Bold

(ii) Italics

(iii) Underline

(iv) Headings (Using H1 to H6 heading styles)

(v) Font (Type, Size and Color)

(vi) Background (Colored background/Image in background)

(vii) Paragraph

(vii) Line Break

(ix) Horizontal Rule

(x) Pre tag

2. Create an HTML document which consists of:
   (i) Ordered List

   (ii)Unordered List

   (iii) Nested list

   (iv) image

3. Create an HTML document which implements Internal linking as well as External Linking.

4. Create a table using HTML which consists of columns for Roll No., Student‘s name and grade.

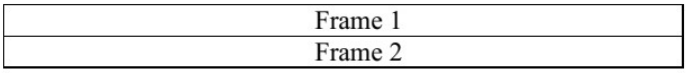
Result		
Roll No	Name	Grade

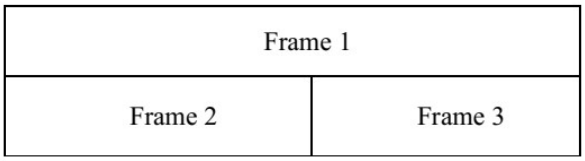
5. Create a Table with the following view:

			Place an Image Here	

6. Create a form using HTML to collect personal information.

7. Create HTML documents (having multiple frames) in the following three formats:





Reading List:

a) David DuRocher -HTML and CSS quickstart guide

b) https://www.w3schools.com/html

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61. Workshop Practice (Mechanical, Carpentry and Electronics)

Skill Enhancement Course 10: Creative electronics workshop skills
(Offered by the Department of Physics) Guwahati College

Open for All

Unit: 1
Introduction to electronic workshop: Familiarization/Application of testing instruments and commonly used tools (multimeter, function generator, power supply, digital cathode ray oscilloscope (DSO), Breadboard, etc. Soldering techniques (soldering iron, desoldering pump, wrapping, crimping), pliers, cutters, wire strippers, screwdrivers, tweezers, etc.]

Unit 2:
Introduction to electronics components: familiarization/identification of electronic components with specification (functionality, type, size, color coding, package, symbol, cost, etc.), Active, Passive, Electro-mechanical, Wires, Cables, Connectors, Fuses, Switches, Relays, Displays, etc.

Unit 3:
Measurement: Measuring of various electrical components like resistance, voltage, current, frequency, phase difference, amplitude, power, and power factor for a. c. supply, Use of various analog, digital meters, Signal Generator, DSO, etc, testing of IC's using IC tester.

Unit 4:
Interconnection methods and soldering practice in general purpose PCB, Crimping, Breadboard assembling of simple circuits – Soldering and testing of electronic components and circuits, safety precautions.

Unit 5:
Assembling of electronic circuit/system on a general-purpose PCB, test and show the functioning (Any Two circuits)

1. Fixed/variable and dual voltage power supply
2. Square wave generation using IC 555 timer in IC base.
3. Sine wave generation using IC 741 OP-AMP in IC base.
4. RC coupled amplifier with transistor BC107
5. Portable PM10 PM2.5 Pollution Analyzer
6. DC Motor Speed Control Using Arduino & Pulse Width Modulation(PWM)

Skill Enhancement Course 11: Certificate Course in Tally
Skill Enhancement Course 12: Certificate Course in Human Rights
Skill Enhancement Course 13: Hands on Training of Basic Chemistry Softwares
Skill Enhancement Course 14: News Writing and Anchoring
Skill Enhancement Course 15: Translation and Translation Technique
Skill Enhancement Course 16: Nursery Management
Skill Enhancement Course 17: Terrace Gardening
Skill Enhancement Course 18: Organic Farming and Hydroponic Farming

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62. Abrittikala/Art of Recitation

--By Ratnapith College

প্রথমষান্মাষিক

আবৃতিকলা (Skill Course) Syllabus

(উদ্দেশ্য: এইপাঠ্যক্রমৰজৰিয়তেকবিতাআবৃতিৰতাত্বিকআৰুপ্রায়োগিকজ্ঞানপ্রদানৰপ্রয়াসকৰাহব)

প্রথমগোট : আবৃতিৰইতিহাসআৰুপৰম্পৰা ; আবৃতিৰউপস্থাপন

দ্বিতীয়গোট : আবৃতিৰপ্রস্তুতি : কাব্যবোধ, ছন্দআৰুযতিৰধাৰণা, স্মৃতিচাৰণ

তৃতীয়গোট : আবৃতিৰকৌশল : স্বৰক্ষেপন, স্বৰকম্পন, সঠিকউচ্চাৰণ, সুৰআৰু লয়ৰপ্রয়োগ

চতুর্থগোট : ব্যৱহাৰিকপৰীক্ষা :

জ্যোতিপ্রসাদআগৰৱালা/ নৱকান্তবৰুৱাযিকোনো এটাকবিতাৰআবৃতি।

সহায়কগ্রন্থ (নির্বাচিত)

অসমীয়াকবিতাৰছন্দ : মহেন্দ্রবৰা

কবিতাৰক্লাছ : নীৰেন্দ্রনাথচক্রৱর্তী

জ্যোতিপ্রসাদৰচনাৱলী : সত্যেন্দ্রনাথশর্মা (সম্পা:)

নৱকান্তবৰুৱাৰকবিতা : তীর্থফুকনসম্পা:)

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63. Mental Health and Hygiene

Total Marks = 100 (Practical 80+ Theory 20 Marks)

Course objectives: After completion of the Course the learner will be able to understand the concept of mental health and development of mental health and the Characteristics of a mentally healthy persons. The relationship between mental health and hygiene will be cleared. They will be able to learn the factors, principles which promoted mental health and the role of school and society for providing proper mantel health. It will also help the learner to develop a positive attitude on life which is most important in today's society.

Unit -I. Concept of mental Health (Meaning, definitions and Scope of Mantal Health, Signs of mentally healthy person)

Unit -2. Concept of Mental Hygiene (Meaning, Nature, Aims and objectives and function of mental Hygiene)

Unit – 3: Need and importance of mantel health and Hugine :

Unit-4: Relationship between Education and Mantel Health

(Role of School, home and Society, Mental Health of teachers)

Unit -5. Preservation of Mental Heaths and Hygiene (Contribution of the Educational psychology (Meaning, Nature and importance of educational psychology)

Unit-6: Various ways of stress Management (Role of Yoga, Steps to create a beautiful mind)

64. HistoricalTourisminNorthEastIndia

Courseobjective:

After completing this course, students will be able to

- Take part in the Tourism industry in North East India as tourist guides as well as engage in destination research with special reference to the historical monuments, cultural and ecological elements and places of the north east India country as tourist and heritage sites of the nation.
- They will be able to relate to the growing vocation of tourism as an industry and the

applicability of historical knowledge for its growth.

In-semester assessment: Students shall carry out a small project (submission not less than 2000 words) based on survey of an area or monument. The project should try to unearth the tourism potential of the surveyed area or monument. The project may also be on an existing tourist site. No sessional examination is required for this paper.

Unit: I	Contact Classes : 8	Non-contact classes : 2	Marks : 25

Theoreticalaspectsoftourism,Elementarygeographyandbio–diversityofNorth East India

[a] :Tourism–Concept,meaningandsignificance
[b] :Differenttypesof Tourism
[c] :Physiographicaldivisions,waterbodiesandclimaticconditions
[d] :Importantwildlifehabitats:Kaziranga,Manas,Orang,Nameri,DibruSaikhowa, Namdapha, Keibul Lamjao, Rain forests of Assam.

Unit: II	Contact Classes : 8	Non-contact classes : 2	Marks : 25

AncientremainsandImportanttouristplacesoftheNorth– East

[a] :Ancientremains:Goalpara,Ambari,Tezpur,Deopahar,Malinithan,Doyang–Dhansiri Valley
[b] :Touristplaces:Shillong,Cherapunjee,Aizwal,Gangtok,Kohima,Tawang,PoaMecca (Hajo), Azan Pir Dargah, Jatinga

Unit: III	Contact Classes : 8	Non-contact classes : 2	Marks : 25

ArchitecturalHeritage

[a] :Dimapur,Kasomari,Maibong,Khaspur
[b] :Charaideo,Garhgaon,SivasagarandRangpur
[c] :Ujayantapalace,NeerMahal
[d] :Kamakhya,HayagrivaMadhava,TripuraSundariTemple,Rumtek monastery
[e] :Kanglafort

Unit: IV	Contact Classes : 8	Non-contact classes : 2	Marks : 25

[a] :Festivals-*Bihu,AliAyeLrigang,Mopin*festival,Tai–BuddhistfestivalsinAssam
[b] :*Bhaona*,*Ras*celebrationinMajuli
[c] :Fairs-JonbilMela,Ambubachifair atKamakhya
[d] :Touristfestivalsbasedonethnicculture–HornBillfestival,Sangaifestival,DihingPatkai festival

Readings:

Bezboruah,M:*TourisminNorthEast India*

Bora,S..,,&Bora,M.C:*TheStoryofTourism:AnEnchantingJourneythroughIndia'sNorth – East,* UBSPD, Delhi, 2004.

:*ParyatanarRuprekha:UttarPurbanchalarItihasAruSanskritir Patabhumi*

Bhatia,A.K.:*InternationalTourism–FundamentalsandPractices*,NewDelhi,1997

:*Tourismin India*

Gogoi, Atanu : *Paryatan Aru Uttar Purbanchal*, Bani Mandir, Guwahati, 2006

Nath,R.M.:TheBackgroundofAssameseCulture,Guwahati, 1978

Sarma,P.:ArchitectureofAssam,Delhi- 1988

Ahmed,Kamaluddin:*TheArtandArchitectureofAssam*,SpectrumPublication,Guwahati,1994.

Bhattacharya,P.:*TourisminAssam*,BaniMandir,Guwahati,2004

Neog, M. : *Pavitra Asom*, LBS, Guwahati

: *Asamiya Sanskritir Ruprekha*, Guwahati - 1970

Boruah,P.:*Chitra-BichitraAsom*,Guwahati,2003

Taher&Ahmed:GeographyofNorthEastIndia,ManiManikPrakash,Guwahati,2010.

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GU-FYUGP

NEP GAUHATI UNIVERSITY

Syllabus

Skill Enhancement Courses

for

Four-Year Undergraduate Programme (FYUGP)

2023-24 Academic Session:: Second Semester

Gauhati University

Gopinath Bardoloi Nagar :: Guwahati-14

Skill Enhancement Courses (SEC) Syllabi for

Four-Year Undergraduate Programme

2023-24 Academic Session:: Second Semester

Gauhati University

Gopinath Bardoloi Nagar, Guwahati- 781014

List of Courses for Second Semester

- **There are total 120 SECs for 2nd Semester**
- **Many are having detailed Syllabus, many are not**
- **Institutes are requested to submit their detailed Syllabus to skill@gauhati.ac.in within 15th February, so that these could be processed for approval and then other Institutes can also use.**

Sl.	Skill Course Name	Paper Code	Credit	Evaluation
1	Academic Reading in English	SEC0200103	3	40-60
2	Advertising and Public Relations	SEC0200203	3	40-60
3	Analytical Clinical Biochemistry	SEC0200303	3	40-60
4	Android App Development	SEC0200403	3	40-60
5	Animation and Media Design	SEC0200503	3	40-60
6	Art of Acting: BUILDING A CHARACTER	SEC0200603	3	40-60
7	Basic Programmin in C++	SEC0200703	3	40-60
8	Basic Skills on Archives and Museum Management	SEC0200803	3	40-60
9	Basic Skills on Electronic Equipment	SEC0200903	3	40-60
10	Basic Skills on Historical Tourism in North-East India	SEC0201003	3	40-60
11	Basics of Adobe Pagemaker	SEC0201103	3	40-60
12	Basics of Scriptwriting I	SEC0201203	3	40-60
13	Biofertilizers	SEC0201303	3	40-60
14	Biofertilizers and Biopesticides	SEC0201403	3	40-60
15	Business Leader/ Multi Outlet Retailer	SEC0201503	3	40-60
16	Byabaharik Asomiya	SEC0201603	3	40-60
17	বাংলাভাষাওসাহিত্য-পাঠপদ্ধতিওসাহিত্যেররূপান্তর	SEC0201703	3	40-60
18	Catering Technology and Hotel Management	SEC0201803	3	40-60
19	Commercial Clothing	SEC0201903	3	40-60
20	Commercial Correspondence in Persian	SEC0202003	3	40-60
21	Computer Assembling and Networking	SEC0202103	3	40-60
22	Computer Oriented Financial Accounting	SEC0202203	3	40-60
23	CONFLICT AND PEACE BUILDING	SEC0202303	3	40-60
24	Costume and Textile Design of the Bodos	SEC0202403	3	40-60
25	Creative Writing	SEC0202503	3	40-60
26	Creative Writing in Persian	SEC0202603	3	40-60
27	Critical Thinking	SEC0202703	3	40-60
28	CV Writing and Interview Skills	SEC0202803	3	40-60
29	Cyber Ethics	SEC0202903	3	40-60
30	Developing Emotional Competence	SEC0203003	3	40-60
31	DEVELOPING TEACHING SKILLS	SEC0203103	3	40-60
32	Drama and Mime	SEC0203203	3	40-60
33	DTP	SEC0203303	3	40-60
34	DUCK RAISING AND BUSINESS	SEC0203403	3	40-60

35	E-Commerce	SEC0203503	3	40-60
36	Educational Psychology	SEC0203603	3	40-60
37	ELT Skill-2	SEC0203703	3	40-60
38	Emotional Intelligence	SEC0203803	3	40-60
39	English Reading & Comprehension	SEC0203903	3	40-60
40	Envirnmental Impact Assessment	SEC0204003	3	40-60
41	Environmental Geology	SEC0204103	3	40-60
42	Enzymology	SEC0204203	3	40-60
43	Extension Activities	SEC0204303	3	40-60
44	Farm Management	SEC0204403	3	40-60
45	Fishery Management	SEC0204503	3	40-60
46	Floristic Methods of Vegetation Description	SEC0204603	3	40-60
47	Folk Music of Goalpara	SEC0204703	3	40-60
48	Food Fermentation Techniques	SEC0204803	3	40-60
49	Fundamentals of Ecology & Wildlife Management	SEC0204903	3	40-60
50	FRONT OFFICE MANAGEMENT	SEC0205003	3	40-60
51	Fundamentals of Social Statistics	SEC0205103	3	40-60
52	Gardening	SEC0205203	3	40-60
53	Geo Chemistry	SEC0205303	3	40-60
54	Geographical Information Systems	SEC0205403	3	40-60
55	Geoinformatics in Geology	SEC0205503	3	40-60
56	Guest Relation Executive	SEC0205603	3	40-60
57	Herbal Technology	SEC0205703	3	40-60
58	Heritage Study of India	SEC0205803	3	40-60
59	Hindi Advertisement	SEC0205903	3	40-60
60	Hindi Patrakarita	SEC0206003	3	40-60
61	Historical Tourism in North East India	SEC0206103	3	40-60
62	HTML Programming	SEC0206203	3	40-60
63	Intellectual Property Rights	SEC0206303	3	40-60
64	Introduction to COREL Draw	SEC0206403	3	40-60
65	Introduction to Drug Delivery System	SEC0206503	3	40-60
66	Karyalini Anuvad in Hindi	SEC0206603	3	40-60
67	Laptop/Desktop/Tab/Mobile/DSLR Repairing	SEC0206703	3	40-60
68	LaTeX	SEC0206803	3	40-60
69	Management of Human Microbial Diseases	SEC0206903	3	40-60
70	MANIPURI TRANSLATION	SEC0207003	3	40-60
71	Manuscript Preparation in Bodo	SEC0207103	3	40-60
72	Marketing of Indigenous Agricultural Products	SEC0207203	3	40-60
73	Maternal and Child Nutrition	SEC0207303	3	40-60
74	Measurement & Evaluation in Sports	SEC0207403	3	40-60
75	Medicinal Botany	SEC0207503	3	40-60
76	Microbial Diagnosis in Health Clinics	SEC0207603	3	40-60
77	Microsoft Excel (Advance)	SEC0207703	3	40-60

78	Natyakala- Abhinay Kaukhal aru Rasanasoili	SEC0207803	3	40-60
79	Nepali Anubad Sahitya	SEC0207903	3	40-60
80	New Venture Planning	SEC0208003	3	40-60
81	Open Source Software	SEC0208103	3	40-60
82	Operation Theater Technology & Dialysis	SEC0208203	3	40-60
83	Oral Culture and Oral History	SEC0208303	3	40-60
84	Pandulipi Prostuti in Bengali	SEC0208403	3	40-60
85	Personal Selling and Salesmanship	SEC0208503	3	40-60
86	Pharmaceutical Chemistry	SEC0208603	3	40-60
87	Photogeology and Remote Sensing	SEC0208703	3	40-60
88	Plant diseases and their Management	SEC0208803	3	40-60
89	Practical Assamese-1	SEC0208903	3	40-60
90	Preparation of Lesson Plan	SEC0209003	3	40-60
91	Print Journalism Production	SEC0209103	3	40-60
92	Proofreading	SEC0209203	3	40-60
93	PSYCHOLOGY IN EDUCATION	SEC0209303	3	40-60
94	Public Speaking skill	SEC0209403	3	40-60
95	Radio Programme Production	SEC0209503	3	40-60
96	Remote Sensing, GIS and GPS	SEC0209603	3	40-60
97	Research and Technical Writing	SEC0209703	3	40-60
98	Sakhyatkar- Prastuti aru Karyakarita	SEC0209803	3	40-60
99	SANSKRIT GRAMMAR and TRANSLATION	SEC0209903	3	40-60
100	Science Communication	SEC0210003	3	40-60
101	SERICULTURE AND ITS PROSPECTS	SEC0210103	3	40-60
102	Soft Skill-2	SEC0210203	3	40-60
103	Spoken Arabic-2	SEC0210303	3	40-60
104	Sports Technology	SEC0210403	3	40-60
105	Statistical Techniques for Research Methods	SEC0210503	3	40-60
106	Statistical Techniques in Geography	SEC0210603	3	40-60
107	Surface Ornamentation	SEC0210703	3	40-60
108	Technical Drawing	SEC0210803	3	40-60
109	Technical Writing	SEC0210903	3	40-60
110	Techniques in Social Research	SEC0211003	3	40-60
111	Testing and Calibration	SEC0211103	3	40-60
112	Textile Processing	SEC0211203	3	40-60
113	Translation : Principles & Practice	SEC0211303	3	40-60
114	Vermicomposting and Organic Farming	SEC0211403	3	40-60
115	Video and Photo Editing	SEC0211503	3	40-60
116	Visual Merchandiser	SEC0211603	3	40-60
117	Web Designing	SEC0211703	3	40-60
118	Wildlife photography and Ecotourism	SEC0211803	3	40-60
119	Proof Sangshodhan in Bengali	SEC0211903	3	40-60
120	French Language, Level-II	SEC0212003	3	40-60

Detail Syllabi

IF the Detailed Syllabus against any SEC is not present in this document, Institutes are requested to submit their detailed Syllabus to skill@gauhati.ac.in within 15th February, so that these could be processed for approval and then other Institutes can also use.

6	**Art of Acting: BUILDING A CHARACTER**	**SEC0200603**	**3**	**40-60**

Art of Acting: BUILDING A CHARACTER

Skill Course: ART OF ACTING
Semester-2
Paper 2: 'BUILDING A CHARACTER'

Total Credits=3
Total Marks=100
Theory=30, Practical=50, Internal=20 (Sessional=10, Practical Demo=6, Attendance=4)

Course Objective:
This is a skill course for students who want to learn skills of acting across various media – theatre, feature films, advertisements, documentaries, short films, television/OTT series, etc. This paperseeks to build up essential performanceskills in theatre: communication, control over body, mind and voice; emotional rendering, versatility, language skills etc. in order to negotiate with themes and narratives and build the characterization through the skills acquired.
There will be no rigid demarcation between theory and practical classes as the idea is to develop practical knowledge.

Course Learning Outcome: This course will enable the students -

i. To intensely involve immerse themselves in their roles through a reading of specific scripts.
ii. To hone their body, voice & diction to render clarity to their performance in different media.
iii. To understand the tools of the actor in order to build a given character.

Course Content:

THEORY: CREDITS – 1: MARKS –30; PRACTICAL: CREDITS – 2; MARKS – 50

UNIT I:The Actor's Body (theory and practice)

- Understanding the Actor's Body
- Voice & Music:
  - Speech: Enunciation, Clarity & Diction
  - Speech: Accents and Dialects
  - Singing:To develop voice range, scale, rhythm etc.
- Body Movement & Yoga: To develop flexibility of body, impulse, reflexes.
- Introduction to Dance / Dance Theatre

UNIT II: Characterization& Improvisation(theory and practice)

- **The Text:**
  - Scriptreading andAnalysis
  - Character Analysis and Graph
  - Texts (any onecharacter each from one film and one play)
    - William Shakespeare,*Macbeth*
    - Arun Sarma, *Siyor*
    - Mohan Rakesh,*AshadKaEk Din*
    - Anton Chekhov,*The Cherry Orchard*
    - Sofia Coppola, *Lost in Translation*
    - RiteshBatra, *The Lunchbox*

- **Actor's Preparation:**
  - The Embodied Voice
  - Acting: Scene Study
  - Movement: Exploration

- **Improvisation Skills:**
  - *Active listening*
  - *Being in the moment*
  - *Following intuition and making strong choices*
  - Spontaneity in Action & speech

UNIT III: ACTIVITY [this component may require the student to put in extra hours]

- Body,Voice & Movement Workshop (Theatre)
- Body, Voice & Movement Workshop (Film)
- Term-end Performances

Suggested Reading:

Sonia Moore, *The Stanislavsky System*
Badal Das,*NatyakalaaruAbhinoySilpo*
Bruce Bartlett and Jenny Bartlett,*Practical Recording Techniques*
Tarit Choudhury,*Manchakala*

Robert Blumenfeld,*Acting with the Voice*
James Thomas*Script Analysis for Actors, Directors and Designers*
Moni Yakim*, Creating a Character: A Physical Approach to Acting*

NOTE ON PEDAGOGY, EXAMINATION & GRADING:

Teaching Modes: This is a skill course and therefore most of the theory components are also expected to be taught through the experiential mode – where theory would be taught both through given texts and practical work. Students may be divided into groups and work distributed.

EXAMINATION & GRADING:

- There will be a term-end theory (written) examination where students will have to answer questions from the various units taught (20 marks) and to write an essay on any of the roles they have chosen to play (10 marks).
- Students will have to vocalize their character analysis of any one role (10 marks) after acting out a particular monologue.
- Students will have to dissect and analyse a scene they have interpreted and performed from any of the prescribed texts (10 marks). They can work solo, in pairs and groups of three/four.
- All Workshops will end with an objective-type examination (10 marks)
- A term-end Performance / Production will carry 20 marks and will involve the entire class. Suitable play-texts / film scripts must be identified to enable this. Students will be marked on the basis of involvement, creativity and ingenuity.

9	**Basic Skills on Electronic Equipment**	**SEC0200903**	**3**	**40-60**

Basic Skills on Electronic Equipments

Objective of the Course:

This course aims at making the students introduced to the working of electronic equipments used in daily life and to repair and maintenance of these equipments

Course Outcome:
At the end of the course, the students shall be able to identify the fault, repair & do maintenance of daily use electronic equipment's.

Credits: 03 (Theory: 01, Lab:02)

Course Outline:

Unit-1: Basic Electronic Components **Lecture: 02**
Introduction to Resistor, Capacitor, Inductor, Diode, Transistor, Transformer, battery / cell **(Brief idea, use and application only)**

Unit-2: Basic Electronic Circuits
Lecture: 02
Ohm's Law, Kirchhoff's current & voltage law, series and parallel circuit's connection, rectifier circuit using diode

Unit-3: Use of laboratory instrument **Lecture: 02**
Use of vernier slide calliper, screw gauge, spherometer, Digital Multi-Meter (DMM), Testers, different type of fuse, electronic balance, breadboard

Unit-4: Soldering Technique **Lecture: 02**
Introduction to Soldering and Desoldering Techniques: Soldering tools, Soldering iron, Solder joint, Dry solder joint, Cold solder joint, Good and bad solder joints

Unit-5: Electrical switch board, Power Supply and PCB
Lecture: 03
Circuit design for electrical switch board. Circuit design and principle of regulated power supply (AC to DC). Fabrication of PCB (Printed Circuit Board): Types of PCBs-Steps involved in development of PCB using FeCl3 solution.

Lab Skill: **Lecture: 12**

1. Identification of electronic components (Active or Passive)
   (a) Resistor (b) Capacitor (c) Inductor (d) Diode (c) LED (d) Transistor (e) IC
2. Use Multimeter to measure the followings:
   (a) AC/DC current (b) AC/DC voltage (c) Resistance (d) capacitance
3. Use Multimeter to check the continuity of the following:
   (a) Diode (b) Transistor (c) LED (d) Cable wire
4. Use of vernier slide calliper, screw gauge, spherometer to measure the following physical quantity of given specimen:
   (a) Length (b) radius (inner /outer) (c) volume (d) thickness (e) depth
5. Soldering and de-soldering of given circuit board
6. Circuit connection of house hold switch board containing both socket, plug and switch
7. To convert AC to DC using (a) Half-wave rectifier (b) full-wave rectifier (c) bridge rectifier
8. Fabrication of printed circuit board (PCB) using FeCl3 solution.

References:
A text of Applied Electronics, R.S. Sedha – S.Chand (2005)
Basic Electronics, B.L Theraja (S.Chand)
EASY Laser Printer Maintenance & Repair By Stephen J. Bioelow

12	**Basics of Scriptwriting I**	**SEC0201203**	**3**	**40-60**

Basics of Scriptwriting I

BASICS OF SCRIPTWRITING - I

3 credits; Class/week: 3
THEORY 2, PRACTICAL 1
Level: 200-399 (UGC)

If you have a story to tell,
if you want to convert your ideas into onscreen moving images,
and think like a filmmaker, this course is for you!

'Basics of Scriptwriting' teaches you to write the poignant logline and a compelling script even if you have no prior experience of writing. It has been designed to train you in writing forthe screen and offers a schematic outline of the stages of scriptwriting and its primary aspects. Throughout the semester, the student will attend theory classes, workshops and engage in rigorous writing exercises. The points of focus will be plot, character arc, scene structure, dialogue and setting as they move from an original impulse toa concept and then, to a film/television script. It will be a truly hands-on experience on writing where peer feedbacks, group activities and brainstorming will be available.

Objectives of this Course are:

- To inculcate the skill of writing a scriptin students
- To guide students to think, express and write logline
- To encourage them to explore their creative energies
- To make them turn an idea into a script
- To make them understand the significance of a script and research in writing any good script
- To read & learn from award winning scripts
- To write a short script as part of the course
- To initiate discussion online and assess scripts of their peers

- To develop analytical thinking
- To learn from peer assessments

Expected Learning Outcomes:

After completion of the course, the student will be able to

- Understand the fundamental elements of a script.
- Analysefilm scripts and identify assumptions, flaws, gaps.
- Ability to create and think in diverse ways.
- Adopt innovative, imaginative and lateral thinking.
- Work independently or with others as a team member.
- Develop an idea to a script.
- Understand the basic structure of a script
- Write a script using software
- Learn different elements ofstorytelling
- Pitch ideas

Pre-requisites:

The course is open to all students who are curious to learn scriptwriting but have no prior experience to those who have written scripts before. It has been designed for all students who have a story to tell and dream of seeing it on the big screen.

A basic knowledge of photography and an enthusiast in cinema will be an added booster though not mandatory.

SECTION A: CONCEPTS (2 credits; 2 contact classes /week)

- What is a script and why do we need one?
- Plot; Character Arc; Dialogue; Conflict/Drama; Denouement.
- Structure (3 part of a script)
- Types of story; Realistic; Fantasy; Horror; Detective; Mystery; Quest/Travel.
  [Story in Images; Dramatic story; Using sound to tell stories;
  Stages of a story; Endings and beginning; Basic concepts of photography & film making;
  Writing an original script]
- Feature film; Documentary; Shorts.

READING (non-contact hour)

- Any one script of an award winning or blockbuster film

(Script will be mentioned in class)

Evaluation:
Written examination 20%
-MCQs (1x10=10) -Short questions (5x2=10)
Assignment: 20%
-show the 5 fundamental features of agiven film script. (4x5=20)

SECTION B: DEVELOPING YOUR SCRIPT: (1 credit; 1 workshop/week)

- Workshop:
  Logline &Writing a script
  Brainstorm-develop a concept-write-discuss- rewrite.
- Assessing scripts of peer groups
- Learning to use apps to write scripts

Assignment: 40%
-Submission of a script (original &10 -- 20 pages including cover page) 20
-Pitching ideas and a log line in a workshop (3+5=8)
-2 peer script reviews to be submitted by each student (6x2=12)

Recommended readings:

- Screenplay- The foundations of Screenwriting- Syd Field.
- The Hero's Journey- Joseph Cambell
- Short essays and audio/visual links will be provided in class.

13	**Biofertilizers**	**SEC0201303**	**3**	**40-60**

Bio-fertilizers

Total Lectures : 33 Credits : 3 (Theory -2, practical -1)

THEORY:

Unit 1: General account about the microbes used as biofertilizer - Rhizobium - isolation, identification, Biological nitrogen fixation and Actinorrhizal symbiosis. **(4 lectures)**

Unit 2: *Azospirillum:* isolation and mass multiplication - carrier based inoculant, *Azotobacter*: classification, characteristics - crop response to *Azotobacter* inoculum, maintenance and mass multiplication. **(4 lectures)**

Unit 3: Cyanobacteria (blue green algae), *Azolla* and *Anabaena azollae* association, nitrogen fixation, factors affecting growth, blue green algae and *Azolla* in rice cultivation **(4 lectures)**

Unit 4: Mycorrhizal association and types, taxonomy, occurrence and distribution, phosphorus nutrition, growth and yield - colonization of VAM and its influence on growth and yield of crop plants. **(5 lectures)**

Unit 5 : Organic farming - Green manuring and organic fertilizers, Recycling of bio-degradable municipal, agricultural and Industrial wastes, biocompost making methods, vermicomposting - field Application. **(5 lectures)**

PRACTICAL:

1. Isolation of root nodule bacteria from leguminous plants. Gram staining. **(3 lectures)**
2. Isolation and inoculum production of VAM, **(3 lectures)**
3. Preparation of vermicompost and field application.. **(5 lectures)**

Suggested Readings

1. Dubey, R.C., 2005. A Text book of Biotechnology S.Chand & Co, New Delhi.
2. Kumaresan, V. 2005, Biotechnology, Saras Publications, New Delhi.
3. John Jothi Prakash, E. 2004. Outlines of Plant Biotechnology. Emkay Publication, New Delhi.
4. Sathe, T.V. 2004. Vermiculture and Organic Farming. Daya publishers.
5. Subha Rao, N.S. 2000, Soil Microbiology, Oxford & IBH Publishers, New Delhi.
6. Vayas,S.C, Vayas, S. and Modi, H.A. 1998 Bio-fertilizers and organic Farming Akta , Prakashan, Nadiad

15	**Business Leader/ Multi Outlet Retailer**	**SEC0201503**	**3**	**40-60**

Business Leader/ Multi Outlet Retailer

Paper Name:***RMT*-SE-3014 – (Business Leader/Multi-outlet Retailer)**

Credit 3 **Total Marks: 100**

Theory classes :17 classes (one hour each-17 hrs) **Theory:50 marks**

Practical classes:16 classes (Two hours each-32 hrs) **Practical:50 Marks**

Practical classes will include : 12 hours of Retail Lab practical, 12 hours of presentation preparation, 6 hours of Group Discussion. 2 hours of assignment preparation

Thiscourseon"**BusinessLeader/Multi-outletRetailer**"for undergraduatestudentsbuildsbasicallyonthesoftskillsandleadershipqualitiesalreadydevelopedbythestudentsapartfrompreparingthemfor aprofessionintheretailindustry.Itaimstodevelopthetechnicalskillsrequiredfortheirresponsibilitiesapartfromimprovingtheircommunicationandproblem-solvingskills.

CourseObjective:

Thiscourseisaimedattrainingstudentsfortheroleof"**BusinessLeader/Multi-outletRetailer**",inthe"Retail"Sector/Industryandbytheendofthesemesteraimsatbuildingthejobspecifickeycompetencies amongst thelearners.

SpecificObjectives:

The courseaims to enablestudents to–

- Understand theimportanceoflegalcompliance
- Understand therole and responsibilitiesofa "**BusinessLeader/Multi-outletRetailer**"
- Understand theprinciples ofleadership
- Understand thebasicsof retailbusinessoperations
- Gives an idea ofvariousproblem-solvingskills related to theretailindustry
- Givean exposure tothe practicalaspectsoftheindustry
- Develop soft skills

CourseOutcome:

After thecompletionofthecourse, thestudents will beableto

- Understand theprinciples ofleadership
- Understand importanceoflegalcompliance
- Understand thebasicsof retailbusinessoperations
- Know therequirements oftheroleof**BusinessLeader/Multi-outletRetailer**
- Developthe skillsrequiredfor beinga successful**BusinessLeader/Multi-outletRetailer**
- Communicatewith peoplewith confidence

CourseContent:

Unit1:Legal Compliance — Marks:15

* Statutory Law, Concept of "Law of theLand",ImportanceofLegalCompliance
* ImportanceofProcess,Policyadherence and accurateReporting
* Laws orActs essentialfor Retail Business
* Definition:Agreement,kinds ofAgreements,
* Definition:Contract,kinds ofContracts

Unit 2: IntroductiontoLeadership — Marks:15

* Understanding Leadership,
* Concept ofLeader
* Differencebetween Manager andLeader
* QualitiesofaGood &EffectiveLeader
* LeadershipStyles

Unit 3:IntroductiontoBusinessLeader/Multi-outlet Retailer — Marks:10

* Business Leader/Multi-outletRetailer:Definition,Job Description, Duties

Unit 4:Retail BusinessOperations — Marks:10

* Increasing operating efficiency, Reducing inventory shrinkage,
* Space management, InventoryManagement,Sales Management,
* SWOTAnalysis,Concept ofCrossselling& Upselling
* Marketing:Meaning, Importance, Strategies
* Concept ofCRM,
* Manpower Planning&Training, Team Management

Readerlist:

Pradhan,S.,RetailingManagement:Textand CasesMadanR.L., A Textbook ofRetailManagement

Levy Michael Barton Weitz Ajay Pandit : Retailing management

QualificationPackofBusinessLeader/Multi-outletRetailerprescribed byRASCI

16	Byabaharik Asomiya	SEC0201603	3	40-60

Byabaharik Asomiya

(Syllabus 1)

প্ৰথমগোটঃ

আৰ্হিপাঠঃপদ্ধতি আৰু কৌশল।

দ্বিতীয়গোটঃ

ছপা আৰু বৈদ্যুতিন মাধ্যমৰ বাবে বিজ্ঞাপন লেখন, ইংৰাজী হিন্দী বিজ্ঞাপনৰ অসমীয়া অনুবাদ।

তৃতীয়গোটঃ

অনুবাদঃসংবাদ, প্ৰবন্ধ, সাক্ষাৎকাৰ।

~~**চতুৰ্থগোটঃ**~~

~~**চিত্ৰনাট্য নিৰ্মাণঃসাহিত্যৰ চিত্ৰায়ণ।**~~

NB: As directed (by HoD, Dept. of Assamese, GU) Fourth Unit (**চতুৰ্থগোট**) has been dropped.

Syllabus 2

Byabaharik Asomiya

SEC Syllabus of FYUGP

Gauhati University

B.A 1st semester

Subject: Assamese

Paper Name : ব্যৱহাৰিক অসমীয়া

Total Marks : 100

প্রথম গোট : ২০

আৰ্হি পাঠ : পদ্ধতি আৰু কৌশল

দ্বিতীয় গোট: ২০

ছপা আৰু বৈদ্যুতিন মাধ্যমৰ বাবে বিজ্ঞাপন লেখন, ইংৰাজী হিন্দী বিজ্ঞাপনৰ অসমীয়া অনুবাদ।

তৃতীয় গোট : ২০

অনুবাদ : সংবাদ , প্রবন্ধ , সাক্ষাৎকাৰ

চতুর্থ গোট : ২০

চিত্রনাট্য নির্মাণ: সাহিত্যৰ চিত্রায়ণ

পঞ্চম গোট :

বৈদ্যুতিন মাধ্যমৰ বিজ্ঞাপনৰ ভিডিঅ'গ্রাফী/ চিত্রনাট্য প্রদর্শন ২০

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17	বাংলাভাষাওসাহিত্য-পাঠপদ্ধতিওসাহিত্যেররূপান্তর	SEC0201703	3	40-60

বাংলা ভাষা ও সাহিত্য-পাঠ পদ্ধতি ও সাহিত্যের রূপান্তর

FYUGP SEC SYLLABUS IN BENGALI

COURSE DETAILS

SEMESTER 2

Paper Code - BEN SEC PAPER- 2 **Credits**-3
Paper Title - বাংলা ভাষা ও সাহিত্য-পাঠ পদ্ধতি ও সাহিত্যের রূপান্তর **External Marks—80**
Internal Marks—20*

Units	Topics	Marks
I	**বাংলা ভাষা ও সাহিত্য পাঠ-পদ্ধতি ও অনুষ্ঠান ব্যবস্থাপনা** গদ্য, পদ্য, উপন্যাস, তুলনামূলক সাহিত্য, আলোচনা চক্রের আয়োজন, অনুষ্ঠান পরিচালনা, উপস্থাপনা, ব্যবস্থাপনা, কর্মশালা পরিচালনা	20
II	**ছোটগল্পের নাট্যরূপদান** কাবুলিওয়ালা, মহেশ, তারিণীমাঝি, পুঁইমাচা	20
III	**গ্রন্থ–পর্যালোচনা** রক্তকরবী, পল্লীসমাজ, পদ্মানদীর মাঝি, রূপসী বাংলা	20
IV	**চিত্রনাট্য বিষয়ক রচনা পাঠ** বিষয় চলচ্চিত্র-সত্যজিৎ রায় ক) চলচ্চিত্র-রচনা : আঙ্গিক, ভাষা ও ভঙ্গি, খ) ডিটেল সম্পর্কে দুচার কথা, গ) আবহসঙ্গীত প্রসঙ্গে	20

*Candidates have to attend one Sessional Exam, of 40 marks and submit two Home Assignments each of 20 Marks for Internal Assessment Marks. Internal Assessment marks will be given out of 20 marks by averaging the marks obtained in Sessional Examination and Home Assignments.

Reference Books:

১। বাংলা ভাষা ও সাহিত্য শিক্ষণ পদ্ধতি – গৌর মোহন রায়, সেন্ট্রাল লাইব্রেরি

২। মাতৃ ভাষা শিক্ষণ পদ্ধতি – বীরেন্দ্র মোহন আচার্য

৩। প্রসঙ্গ : চিত্রনাট্য – সৈকত রাউত, ইউনাইটেড বুক এজেন্সী

৪। সত্যজিৎ জীবন আর শিল্প – সুব্রত রুদ্র (সম্পা.) প্রতিভাস

Outcome: The course will enable students to develop real-life skills about various applications of Bengali language. They will gather theoretical knowledge about proof reading, Bengali terminologies and journal and book editing.

24	Costume and Textile Design of the Bodos	SEC0202403	3	40-60

Costume and Textile Design of the Bodos

FYUGP
BOD-Skill Enhancement Course
Semester II
Marks= 50 (Theory) + 50 (Practical)=100

Paper Title: **Costume and Textile Design of the Bodos (2nd)**

Course outcomes:

- Can come to know about costume and textile design of the Bodos
- Can come to know about changing trend of costume and textile design from designing to modernity

Unit ITraditional costumes, Weaving Designing, adaptation of emerging designing technology in the global perspective 20

Unit II Traditional ornaments, body adornment and decoration, scope and validation in the changing needs of modern perspective 20

Unit IIIBodo textile: Scope of marketing and employment opportunity 10

Note:practical will be taken from prescribed topics given below:

1. Presentation of traditional costume designing
2. Presentation on Bodo adornment and decoration
3. Identification of Bodo textile implement and designs

Suggested readings:

1. Bodo KacharirSomajAruSanskriti: Bhaben Narzaree
2. An Introduction to Cultural and Social Anthropology:Hammond Peter B
3. Anthropology: Carol R &Ember,Melvin
4. Traditional Indian Costume &Textile:ParulBhatnagar
5. BoroAgor : SukumarBasumatary

25	Creative Writing	SEC0202503	3	40-60

Creative Writing

Introduction to Creative Writing

Credits: 3

Objectives:

- To acquaint students with the essential facts and chronology of the history of literatures in English.
- To expose students to well-known literary classics which may act as models to be emulated.
- To train students in writing in different literary forms or genres such as long and short fiction, non-fictional prose works, plays and poems.
- To familiarize students with aspects such as imagining (and writing for) an audience, finding a voice, doing self-editing, peer-editing and revising, keeping a journal, etc.

Expected Learning Outcomes:

After completion of the course the students will not only have an idea about the literary achievements of great writers whose works serve as inspiring models, but also develop some basic and essential skills to do some good writing of their own across genres.

Course Requirements:

FIRST PART: CONCEPTS AND TEXTS FOR EXAMINATIONS,

1 credit, 1 class a week

1. Students will study one or more recommended history of literature and be expected to answer a single question on some outstanding literary movement or literary school.
   Recommended: Andrew Sanders, *The Short Oxford History of English Literature*

2. Students will study the following texts and answer questions on them:
   Charles Dickens, *A Christmas Carol*
   R.K. Narayan, *The English Teacher*
   William Dalrymple, *The City of Djinns,* Chapter 3
   Zadie Smith, "Grand Union," in *Grand Union*

3. As grammatical correctness is a prerequisite to becoming a creative writer, students will be taught some grammar andalso encouraged to study grammar on their own and be expected to answer a few short questions that will test their grammatical skills.
   Recommended texts: *High School English Grammar and Composition* by Wren and Martin
   Intermediate English Grammar by Raymond Murphy

Evaluation: Written Examination (combination of MCQs and short essays):
Grammar: 10 marks, Literary history 10 marks, interpretation/analysis of prescribed literary texts 20 marks

SECOND PART: PROJECTS

2 credits, 2 classes a week, including workshops

1. Translations: As translations ensure close engagement with the nuances of language (both host and target), translations of select works in Assamese will have to be done. The translation will be of a poem, a part of a play, an excerpt from a novel, and an essay, and will be decided by the teacher for the particular semester. Workshops may be held to mentor and tutor the students.

2. Writing creatively:

   The students will write (choice of any one from the following four)

a) 1 novella (20000 words)
b) 10 personal essays
c) 10 poems
d) 1 one act play with scope for divisions into scenes (15000-20000 words)

The themes/topics for the above will be decided in consultation with the teacher. Peer-review sessions and discussions in workshops will guide the students.
Evaluation:
Translation: 10 marks
Discussion and peer-edit: 10 marks
Manuscript: 40 marks

Recommended works for the entire course:
George Orwell, "Why I Write"
Joan Didion, "Why I Write"
Ruskin Bond, "How to be a writer"
Morley, David, and Phillip Neilsen. *The Cambridge Companion to Creative Writing*

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Syllabi-2 by other

TITLE: Introduction to Creative Writing

Target Group: Open for all (Arts, Science, Commerce)

Theory = 2 credit, **Practical** = 1 credit

Learning Objectives:

- To introduce the concept of creative writing
- To familiarize students with the different genres of literature
- To acquaint students with the basic principles and techniques involved in the modes of creative writing
- To introduce creative writing for communication
- To prepare students for professional career in creative writing
- To encourage students to write for publication

Course Outcomes:

The course will explore and hone the creative skills of the students. They will learn and practice the craft elements of writing poetry, fiction and / non-fiction, examine the works of writers in the genres and receive and offer critique in classroom setting/assignments. At the end of the semester, students would be able to use their creative skills for all types of formal communication.

Unit wise Syllabus

THEORY

UNIT I – (6 hours)

INTRODUCTION TO CREATIVE WRITING

Meaning and significance of creative writing, What makes a good piece of creative writing?, Techniques used in creative writing, Genres of creative writing: poetry, fiction, drama

UNIT II – (8 hours)

THE ART AND CRAFT OF WRITING

Rhetoric and prosody, Images and symbols, Figurative language, Sensory details, Imagery, Vocabulary, Paragraph development, Observe the outside world, Use of imagination, Sentence variety, Creative thinking, Memories

UNIT III – (8 hours)

MODES OF CREATIVE WRITING

Poetry: What is good poetry?, Why poetry?, Reading poetry, Modes of poetry – narrative, dramatic and lyrical, Form and technique

Fiction: What is fiction?, What is a good story? Plot, Setting, Character, Dialogue, Point of View, Elements of style

Drama: Types of drama, Plot/sub plot, Characterization

PRACTICAL (22 hours)

- Read aloud sessions: recitation of a poem/ reading aloud a story or article with expression
- Rereading content for better fluency
- Composing lyrics
- Emphasis on correct pronunciation
- Enacting of different scenes/characters from plays
- Presentation of short skits of social relevance
- Critical appreciation of any literary text chosen in consultation with the concerned teachers
- Peer critiquing

Reading list:

a) *Creative writing: A Beginners Manual* by AnjanaNeiraDev, AnuradhaMarwah, Swati Pal. Delhi, Pearson Longman. 2009.

b) *Elements of Literature: Essay, Fiction, Poetry, Drama, Film*. Robert Scholes, Nancy R. Comely, Carl H. Klaus, Michael Silverman. Delhi, Oxford University Press. 2007.

c) *Glossary of Literary Terms*. M. H. Abrams. Boston: Wadsworth Publishing Company. 2005.

d) *The Creative Writing Course-Book* by Steven Earnshaw (ed). Edinburgh: EUP, 2007.

e) *If You Want to Write* by Brenda Ueland. India: General Press, 2019.

f) *Negotiating with the Death: A Writer on Writing* by Margaret Atwood. Cambridge: CUP, 2022.

Paper name: **TSC-SE-5014 – Creative Writing**

Credits: 3 **Total Marks: 100**

Theory classes: 17 classes (one hour each – 17 hrs) Theory: 50 Marks

Practical classes: 16 classes (two hours each – 32 hrs) Practical: 50 Marks

Course Description: Creative writing is a form of artistic expression. This course is designed to teach students about the tools and technicalities of creative writing and creative thinking.
Students will learn how to craft their thought, imagination and thinking. They will learn about writing fiction, poetry, screenplay, Drama and non- fiction.

Course Objective: This course is designed for the students to prepare them to take writing as their career in various sectors. They can practice their role as Play writer, Screen play writer, Story writer, Poet, Novelist, Non fiction writer in Literature, Media & Entertainment Industry.

Specific Objectives: The course aims to enable students to –

- Know and understand the various aspects of literature.
- Know the History of Assamese Literature along with Indian and World Literature.
- Understand the different form of creative writing
- Know and understand the true value of creative writing
- Know and understand the tools of excellent writers
- Be familiar with different types of nonfiction
- Know and understand how to write memories, biographies and autobiographies; how to write articles for newspaper, blogs, journal etc.
- Understand the craft and elements of Basic Storytelling, Screenplay writing, Poetry, Novel etc.
- Understand how to generate Idea—Observation Imagination—Creative Thinking
- How to develop creativity in writing.
- How to get the creative work recognized and published
-

Course Outcome: After the completion of the course, the students will be able to

- Understand the basics of creative writing skills.
- They will be able to work as Professional writer in Literature, Theatre, Media, and Film Industry.
- Develop the skills required for being a Creative Writer.

Course Content:

Unit 1: About Creative Writing **Marks: 10**

- Process of Creative writing
- Concept of Creative Writing: Understand What is Creative Writing— Short Stories, Short Plays, Poetry, Novel, Biography;
  Understand why it is Called Creative Writing-Creative Expression, CreativePresentation.
- Understand how to generate Idea—Observation Imagination—Creative Thinking
- How to develop creativity in writing.

Unit 2: How todevelop the concept. **Marks: 10**

- Detailing out the concept
- Outline key elements of concept
- Story- telling
- The basic principles of story-telling and character psychology

Unit 3: The Different Types or forms of Creative Writing **Marks: 10**

- Fiction
- Journal or Diaries
- Poetry
- Article
- Memories
- Screenplay
- Drama etc.

Unit 4: How to write – **Marks: 20**

- Memories
- Biography

- Autobiography
- Articles for newspaper, blogs, journals
- Poetry
- Fiction
- Screenplay
- Drama
- Documentary Film Script

PRACTICAL(Writing skills-Fiction,Screenplay,Drama etc.): **50 marks**

Reading List:

1. Becoming a writer: Dorothea Brande

3. Natyashastra: Bharatmuni

2. Poetics: Aristotle

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28	**CV Writing and Interview Skills**	**SEC0202803**	**3**	**40-60**

CV Writing and Interview Skills

TITLE: FRAMING BIO-DATA, CURRICULUM VITAE AND RESUME

Target Group: Open for all (ARTS / SCIENCE /COMMERCE)

Theory = 2 credit, Practical = 1 credit

Learning objectives:

- Framing Bio-data, Curriculum vitae and Resume
- Using power point
- Appearing Interview

Course Outcome: At the end of the course the students will be able to write Bio-data, Curriculum Vitae and Resume. They will become confident for facing an interview**.**

Unit wise Syllabus:

THEORY (22 Hours)

Unit – 1 (11 hours)

CONCEPT OF BIO-DATA /CV/RESUME: Definition of Bio-data, Curriculum Vitae and Resume. Need of Bio-data, Curriculum Vitae and Resume. Difference between Bio-Data, Curriculum Vitae and Resume. Bio-data for students. Creation of Bio-data to apply for job.

Unit – 2 (11 hours)

INTERVIEW – Meaning, nature and types. Important interview skills.

PRACTICAL (22 Hours))

POWERPOINT PREPARATION AND PRESENTATION of the format of Bio-data/Curriculum vitae/ Resume.

Mock Interview within the classroom.

References / Suggested Reading

Sidhu K.S (1984) ; Methodology of Research in Education, Sterling Publishers private limited.

DEPARTMENT OF EDUCATION

FRAMING BIO-DATA, CURRICULUM VITAE AND RESUME

SEC 1

Learning objective : To develop the skill of **-**

- Framing Bio-data, Curriculum vitae and Resume
- Using powerpoint
- Appearing Interview

Target students : 50 (Open for all)

Course Outcome : At the end of the course the students will be able to write Bio-data, Curriculum Vitae and Resume. They will become confident for facing an interview**.**

Target students : First semester students (Open for all)

Syllabus :

1	**Concept of Bio-data/CV/Resume (11 classes)**	• Definition of Bio-data, Curriculum Vitae and Resume. • Need of Bio-data, Curriculum Vitae and Resume. • Difference between Bio-Data, Curriculum Vitae and Resume. • Bio-data for students. • Creation of Biodata to apply for job. • Interview – Meaning, nature and types.	15 (Theory)	50

		• Important interview skills.		
2	**Power point and Interview.**	• Power point preparation and presentation of the format of Biodata/Curriculum vitae/ Resume. • Mock Interview within the classroom.	15 (Practical)	25 25

PAPER TITLE: - SKILLS ON WRITING BIODATA AND CURRICULUM VITAE (C.V) FOR FACING INTERVIEW.

UNIT 1: Concept of Biodata – Meaning and its types, Concept of Curriculum Vitae (CV), Differences between Biodata and Curriculum Vitae, Skills on writing various types of Bio-data, Skills on writing a good Curriculum Vitae (CV).

UNIT 2: Meaning and types of Interview, Characteristics of good interview, skills of facing interview.

UNIT 3: Preparation of Bio-data for facing an interview (PRACTICAL).

29	**Cyber Ethics**	**SEC0202903**	**3**	**40-60**

Cyber Ethics

Introduction:

The evolution of Information Communication Technology (ICT) and growing security concerns demands flexible and generally comprehensive approach to the issue of cyber security. The rapid growth of ICT has raised various complex questions which need to be addressed. A need has been felt to address cyber security broadly, as also in sufficient depth so that even students from non-technical streams will develop a more complete picture of the cyber security issues. The syllabus has been prepared with an aim to create more aware, responsive and responsible digital citizens, thereby contributing effectively to an overall healthy cyber security posture and ecosystem.

Why take this course?

 Get an introduction to ethical theory

 Learn how to apply ethical theory to ethical issues arising in the use of the internet

 Develop critical thinking and skills in written expression

Program Educational Objectives:
The exposure of the students to Cyber Security program at Graduate and Post Graduate level should lead to the following: -
(a) Learn the foundations of Cyber security and threat landscape.
(b) To equip students with the technical knowledge and skills needed to protect and defend against cyber threats.
(c) To develop skills in students that can help them plan, implement, and monitor cyber security mechanisms to ensure the protection of information technology assets.
(d) To expose students to governance, regulatory, legal, economic, environmental, social and ethical contexts of cyber security.
(e) To expose students to responsible use of online social media networks.
(f) To systematically educate the necessity to understand the impact of cyber crimes and threats with solutions in a global and societal context.
(g) To select suitable ethical principles and commit to professional responsibilities and human values and contribute value and wealth for the benefit of the society.

This course introduces students to a selection of important topics in the rapidly developing field of cyber ethics. The topics considered are:
1. Net neutrality
2. The use of Block chain technology
3. War and the use of autonomous weapons
4. Information warfare
5. Cyberspace and intelligence gathering
6. Digital health and cyberspace
7. Cyber bullying
8. Computer crime and computer security
9. Software theft and intellectual property rights
10. Computer hacking and the creation of viruses
11. Computer and information system failure
12. Invasion of privacy. Privacy in the Workplace and on the Internet
13. Social implications of artificial intelligence and expert systems
14. The information technology salesman issues
15. Social Media Overview and Security

Introduction to Social networks. Types of Social media, Social media platforms, Social media monitoring, Hashtag, Viral content, Social media marketing, Social media privacy, Challenges, opportunities and pitfalls in online social network, Security issues related to social media, Flagging and reporting of inappropriate content, Laws regarding posting of inappropriate content, Best practices for the use of Social media, Case studies.

REFERENCES:

1. Auditing IT Infrastructures for Compliance By Martin Weiss, Michael G. Solomon, 2nd Edition, Jones Bartlett Learning
2. Bynum, T, W; Rogerson, S, Computer Ethics and Professional Responsibility, Blackwell, 2004.
3. Cyber Crime Impact in the New Millennium, by R. C Mishra, Auther Press. Edition 2010.
4. Cyber Laws: Intellectual Property & E-Commerce Security by Kumar K, Dominant Publishers.
5. Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by Sumit Belapure and Nina Godbole, Wiley India Pvt. Ltd. (First Edition, 2011)
6. Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by Sumit Belapure and Nina Godbole, Wiley India Pvt. Ltd.
7. Data Privacy Principles and Practice by Natraj Venkataramanan and Ashwin Shriram, CRC Press.
8. Electronic Commerce by Elias M. Awad, Prentice Hall of India Pvt Ltd.
9. Fundamentals of Network Security by E. Maiwald, McGraw Hill.
10. Information Security Governance, Guidance for Information Security Managers by W. Krag Brothy, 1st Edition, Wiley Publication.
11. Information Warfare and Security by Dorothy F. Denning, Addison Wesley.
12. Johnson, D, G, Ética Informática, Universidad Complutense de Madrid, 1996; original as Computer Ethics, Englewood Cliffs, New Jersey: Prentice Hall, 2003. The first version of the book is published as Computer Ethics, Prentice-Hall, 1985.
13. Maner, W, Starter Kit in Computer Ethics, Helvetia Press, 1978.
14. Moor, J, "What Is Computer Ethics", Metaphilosophy, Vol. 16, No. 4, October 1985, pp. 266-275. Republished at [6].
15. Network Security Bible, Eric Cole, Ronald Krutz, James W. Conley, 2nd Edition, Wiley India Pvt. Ltd.
16. Parker, D, "Rules of Ethics in Information Processing", ACM, Vol. 11, 1968, pp. 198-201.
17. Rogerson, S, "The Ethics of Computing: The First and Second Generations", The UK Business Ethics Network News, Spring 1996.
18. Security in the Digital Age: Social Media Security Threats and Vulnerabilities by Henry A. Oliver, Create Space Independent Publishing Platform. (Pearson , 13th November, 2001)
19. Security in the Digital Age: Social Media Security Threats and Vulnerabilities by Henry A. Oliver, Create Space Independent Publishing Platform.
20. Weizenbaum, J, Computer Power and Human reason: From Judgment to Calculation, Freeman, 1976.
21. Wiener, N, Cybernetics: or Control and Communication in the Animal and the Machine, Technology Press, 1948.
22. Wiener, N, The Human Use of Human Beings: Cybernetics and Society, Houghton Mifflin, 1950; second edition revised, Doubleday Anchor, 1954.

31	**DEVELOPING TEACHING SKILLS**	**SEC0203103**	**3**	**40-60**

DEVELOPING TEACHING SKILLS

PAPER TITLE: - SKILLS ON PRACTICE TEACHING.

UNIT 1: Concept of teaching and teaching skills, Introduction of some important teaching skills, Phases of Teaching.

UNIT 2: Meaning, nature and importance of Lesson Plan, Criteria of good lesson plan, Herbartian Steps of Lesson Plan.

UNIT 3: Preparation of Lesson Plan for practice teaching (PRACTICAL).

33	**DTP**	**SEC0203303**	**3**	**40-60**

DTP

The Post- Graduate Department of Assamese offers a Skill based course on "Assamese DTP & Proofreading".

Credits: 3

Teaching Method: Theoretical & Practical

Objectives:

- To provide the students understanding skills and professional knowledge about computer programs.
- To familiarize different computer software related to typing (specially Ramdhenu) and proofreading in Assamese language.
- To give knowledge on proofreading and making a competent proofreader.

Course Outcome:

- Acquire a basic understanding about various typing software.
- Be familiar with different Assamese fonts.
- Be proficient in the skills of Assamese typing & layout design.
- Eligible for careers in Print & Electronic media also in publication house.
- Be a freelance proofreader through web content, eBooks, blog posts etc.

Unit: I

Basic knowledge of computer, types of software (MicrosoftWord &Adobe PageMaker)

Unit: II

Uses of Assamese SoftwareRamdhenu&different Fonts specially Gitanjali

Unit: III

Skills & techniques of Proofreading, different types of proofreading and challenges of a proofreader.

Unit: IV
Practical work and Project

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39	English Reading & Comprehension	SEC0203903	3	40-60

English Reading & Comprehension

ENGLISH SEC

PAPER: English Reading and Comprehension

Objectives: This paper is designed

- for students who have had inadequate exposure to English and hence exhibit a very low level of proficiency in the language
- to help students comprehend simple texts andimprove vocabulary
- to enable students from all to broaden their skill-sets in textual interpretation, reading, and writing about texts.

Outcomes (Graduate attributes)

- enhance comprehension skills and enrich vocabulary through the reading of short and simple passages with suitable tasks built around these
- students can engage in short independent compositions

Course Content:

Unit 1: Reading (1 Credit)

- Short and simple passages from the prescribed books
- These texts are to be used to enhance reading and comprehension skills of learners through various textual tasks such as reading aloud, sentence completion, true / false activities, re-ordering jumbled sentences, identifying central ideas, supplying alternative titles, attempting short comprehension questions, etc.

Texts:

1. Short Story: Ismat Chughtai, *Kallu*
2. Essay: VS Naipaul, *East Indian*
3. Poem: AK Ramanujan, *Obituary*

Unit 2: Comprehension (1 Credit)

This unit aims to help students understand that we are surrounded by texts, so thinking about texts, reading, writing, and comprehension are necessary life skills and not merely language skills. Use the texts from Unit 1 to help students enhance the following skills:

- Writing: Descriptive passage making notes drafting points, creating paragraphs outlines, drafts etc
- Speaking: Make short presentations 2-3 minutes long showcasing their understanding of any topical issues
- Listening and responding to short presentations
- Improve their vocabulary

Unit 3: Writing (1 Credit)

This section will introduce students to the structure of a paragraph; they will write a short-guided composition of variable word limits (100- 1000). These skills are to be practiced through activities such as supplying topic sentences to given paragraphs, completing given paragraphs, expressing given facts or information from tables and expressing it in paragraphs, re-ordering jumbled sentences, and then re-writing them as connected paragraphs, using suitable linking devices etc. Relevant sections from the recommended texts in Unit 1 should be used to make students write about contemporary issues like race, gender, caste and violence. Students should be taught to:

- Express concepts through writing
- Think critically and write with clarity
- Write essay length assignments

Reference Books and Materials:

1. Selections from *Individual and Society: Essays, Stories and Poems*, (Pearson/Longman, 2005)
2. *Everyday English*, Delhi: Pearson, 2005
3. *Developing Language Skills I*, Delhi: Manohar, 1997
4. *A Foundation English Course for Undergraduates: Workbook* I, Delhi: Oxford University Press, 1991

44	**Farm Management**	**SEC0204403**	**3**	**40-60**

Farm Management

Credit: (2+1)

Course Description: This course is designed to familiarise the students to the fundamentals of farm management, various types of farming that exist and introduce them to the recent developments in this aspect. The course also expects to enhance the existing knowledge of use of statistical tools of the students and helping them to use such knowledge in practical works.

Unit 1- Farm management: Factors of production, Types of farming: capitalistic farming, specialized farming, dry farming, collective farming, cooperative farming, mixed farming, Integrated Farming,

Shifting cultivation, Role of a farm manager, Record keeping, Budgeting for agricultural production, Farmers' producers' organisation, Marketing of produces, Seed production and certification, Protected cultivation and Precision farming, Agri-preneurship development.

Unit 2- Statistical methods, Central tendency - mean, median, mode,,Use of statistical tools in agriculture- standard deviation, regression and correlation, Methods of data collection, Tabulation, Processing and presentation of data- textual, tables and diagrammatic. Sampling Techniques, probability.

Unit 3- Practical - Project preparation in Agriculture, Horticulture and Integrated Farming, Visit to Agri-preneurs

46	**Floristic Methods of Vegetation Description**	**SEC0204603**	**3**	**40-60**

Floristic Methods of Vegetation Description

Name of the Paper: **Floristic Methods of Vegetation description**

Total Lectures: **36** Credits: **3**

THEORY

UNIT 1: Introduction- Historical account, Functions, biogeography and ecologyof NE India, Terrestrial ecosystem and flora, Wetland flora.Quantitative study and floristic analysis by quadrat methods, Protected areas in NE India. (6 lectures)

UNIT 2: Assessment of Floristic Diversity- Consultations of Herbaria and Literature, Field and Herbarium Methods, Vegetation survey and characterization, Identification and Taxonomic Documentation, Documentation of Endemic, Rare and Threaten plant Taxa, Assessment of anthropogenic factors causing depletion of plant resources.(10 lectures)

UNIT 3: Role ofFloristic studies in Biodiversity conservation. (2 lectures)

UNIT 4: Writing of Flora, Monographs, Revisionary works, Research papers, Description of New taxa. (6 lectures)

UNIT 5: PRACTICAL/ PROJECT (12 lectures)
Assessment of floristic diversity in University/ College campus, Local areas, Wetland, Hills, etc.

Suggested Readings:

1. Jain S K and Rao RR 1977. A Handbook of Field and Herbarium Methods. Today & Tomorrow's Printers and Publishers, New Delhi.

56	**Guest Relation Executive**	**SEC0205603**	**3**	**40-60**

Guest Relation Executive

Skill Enhancement Course (SEC)

Semester II

Paper Name: **Guest Relation Executive**

Credits: 3 **Total Marks: 100**

Theory classes: 17 classes (one hour each – 17 hrs) Theory: 50 Marks

Practical classes: 16 classes (two hours each – 32 hrs) Practical: 50 Marks

Practical classes will include: 16 hours of survey, 4 hours of presentation preparation, 4 hours of group discussion, 8 hours of project work preparation.

Unit – 1: Understanding the Hotel Industry **Marks: 15**

- Different types of accommodation and their significance in hospitality industry
- Categories of hotels
- Different departments of a hotel and functions
- Understanding the Front Office – Departments and functions

Unit – 2: Functions of Guest Relation Executive **Marks: 10**

- Guest relation Executive – definition
- Training of front office employees
- Activity upon arrival of guest
- Activity at the time of guest check out

Unit – 3: Communication **Marks: 15**

- Types of communication
- Communication with guest
- Interacting with superior and colleagues
- Etiquettes and personal grooming

Unit – 4: Dealing with customers **Marks: 10**

- Customer relationship management
- Handling complaints
- Feedback of guest
- Establishing customer rapport

Reading List:

Bhatia, A.K., (2002)*Tourism Principles and Practices.*Sterling Publishers.

Sharma, Sunil., (2005) *Managing Hotel and Tourism Operation*.Akansha Publishing.

57	**Herbal Technology**	**SEC0205703**	**3**	**40-60**

Herbal Technology

Total Lectures : 33 Credits : 3 (Theory -2, practical -1)

THEORY

Unit 1: Herbal medicines: history and scope - definition of medical terms - cultivation harvesting-processing- storage -marketing and utilization of medicinal plants. **(4 Lectures)**

Unit 2: Pharmacognosy - systematic position and medicinal uses of the following herbs in curing various ailments; Tulsi, Ginger, Black pepper, Turmeric. **(6 Lectures)**

Unit 3: Phytochemistry - active principles and methods of their testing -identification and utilization of the medicinal herbs; *Catharanthus roseus* (cardiotonic), *Clerodendron phlomoides* (anti-rheumatic) and *Centella asiatica* (memory booster). **(6 Lectures)**

Unit 4: Analytical pharmacognosy: Biological testing of herbal drugs - Phytochemical screening tests for secondary metabolites (alkaloids, flavonoids, steroids, triterpenoids, phenolic compounds) **(6 Lectures)**

PRACTICAL

1. preparation of herbarium of the medicinal plants included in the syllabus **(5 lectures)**
2. Preliminary Phytochemical screening tests for secondary metabolites (alkaloids, flavonoids, steroids, triterpenoids, phenolic compounds) **(6 lectures)**

Suggested Readings

1. Glossary of Indian medicinal plants, R.N.Chopra, S.L.Nayar and I.C.Chopra, 1956. C.S.I.R,New Delhi.
2. The indigenous drugs of India, Kanny, Lall, Dey and Raj Bahadur, 1984. International Book Distributors.
3. Herbal plants and Drugs Agnes Arber, 1999. Mangal Deep Publications.
4. Ayurvedic drugs and their plant source. V.V. Sivarajan and Balachandran Indra 1994.Oxford IBH publishing Co.
5. Ayurveda and Aromatherapy. Miller, Light and Miller, Bryan, 1998. Banarsidass, Delhi.
6. Pharmacognosy, Dr.C.K.Kokate et al. 1999. Nirali Prakashan.

59	**Hindi Advertisement**	**SEC0205903**	**3**	**40-60**

Hindi Advertisement

HIN-SEC-2

विज्ञापन

कुल अंक: 100

सैद्धांतिक परीक्षण: 50

व्यावहारिक परीक्षण:50

क्रेडिट: 3

कक्षाएँ: 60घण्टे

कोर्स-लेवल: 100-199

पूर्व-योग्यता:हिन्दी-सहित **10**वीं कक्षा-उत्तीर्ण

स्नातक-गुण: *हिन्दी विज्ञापन के इस पाठ्यक्रम को इस रूप में प्रस्तुत किया गया है कि विद्यार्थियों में विज्ञापन से संबंधितइतनी योग्यता विकसित हो कि वे सभी संदर्भों में हिन्दी भाषा में विज्ञापन-लेखन कर सकें ।*

लक्ष्य : *विद्यार्थियों में विज्ञापन-लेखन की क्षमता में वृद्धि लाना प्रस्तुत प्रश्न-पत्र का प्रमुख लक्ष्य है ।*

इकाई1 (क्रेडिट : 1) **:विज्ञापन --**अवधारणा, उद्भव एवं स्वरूप,महत्व एवं उद्देश्य,कार्यक्षेत्र, विज्ञापन का वर्गीकरण,विज्ञापन के सिद्धान्त

इकाई2(क्रेडिट : 1) **:विज्ञापन के विविध माध्यम**(प्रिंट मीडिया, इलेक्ट्रॉनिक मीडिया, ट्रेडिशनल मीडिया, डाक-विज्ञापन, बाह्य विज्ञापन, उपहार विज्ञापन,मनोरंजनविज्ञापन, जनसम्पर्क),विज्ञापन एजेंसी,भारत में विज्ञापन प्रशिक्षण, विज्ञापन में करियर

इकाई3(क्रेडिट:1) : **विज्ञापन लेखन-कॉपी लेखन--** विज्ञापन का शीर्षक,उपशीर्षक,मूल कथ्य(बॉडीकॉपी),बेस लाइन,चित्र एवं फिल्म,विज्ञापन-सज्जा (रंग,ट्रेडमार्क,लोगो,स्लोगन), विज्ञापन में अपील, भाषा

द्रष्टव्य: *व्यावहारिक परीक्षण के अंतर्गत चार प्रकार के विज्ञापनों के प्रस्तुतिकरण की व्यवस्था रहेगी । विभागीय प्राध्यापकगण, महाविद्यालय के अध्यक्ष/शिक्षण-संस्थान के प्रमुख अथवा उनके द्वारा नामित प्रतिनिधि के द्वारा व्यावहारिक परीक्षण एवं मौखिकी-सहित मूल्यांकन-कार्य सम्पन्न होगा ।*

सन्दर्भ ग्रन्थ:

1. *विज्ञापन : सिद्धान्त एवं व्यवहार*-- प्रो॰ रमेश जैन,मलिक एंड कंपनी, जयपुर और दिल्ली ।
2. *विज्ञापन : भाषा और संरचना* –डॉ॰ रेखा सेठी,वाणी प्रकाशन,दिल्ली ।
3. *जनसम्पर्क और विज्ञापन* --संतोष गोयल, श्री नटराज प्रकाशन,दिल्ली ।
4. *विज्ञापन और हिन्दी भाषा* -- डॉ॰ नरेंद्र कुमार संत, श्री नटराज प्रकाशन,दिल्ली ।
5. *आधुनिक विज्ञापन का पहला दौर* --अशोतोष पर्थेश्वर,अनन्या प्रकाशन ।
6. *हिन्दी विज्ञापन : संरचना और प्रभाव*– डॉ॰ सुमित मोहन, वाणी प्रकाशन,नई दिल्ली ।

71	**Manuscript Preparation in Bodo**	**SEC0207103**	**3**	**40-60**

Manuscript Preparation in Bodo

BOD-Ability Enhancement Course (for Sem-VI)

Manuscript Preparation (2nd)

Marks: 80 (Theory) + 20 (Internal Assessment) Total =100

Course outcomes:

- Come to know about manuscript preparation and use of punctuations and symbols
- About benefits of editing and taking into MS word & PageMaker

Unit: I Types of Manuscript: Use of Punctuation, Sign and Symbols 20

Unit: II Importance of Editing and Proof Reading; Symbols used in Proof reading, Proofreader, Proof reading process 20

Unit: III Process, Purpose and benefits of Editing 20

Unit: IV Taking Manuscripts in MS Word Format and Page Maker etc. 20

Suggested readings:

A Few Suggestions to McGraw-Hill Authors-McGraw Hill Book Company, Forgotten Books

Guidelines for manuscript preparation-Gayle Giese & Pick Edmondson

72	Marketing of Indigenous Agricultural Products	SEC0207203	3	40-60

Marketing of Indigenous Agricultural Products

Unit -I Agricultural Marketing:

Nature and Scope of Agricultural Marketing, Objectives of Agricultural Marketing, Classification of Agricultural Products and Markets, Distinction between Agricultural Marketing Vs Rural Marketing, Agricultural Marketing Scenario in India, problems and prospects of Agricultural Marketing in India.

Unit- II Marketing Institutions of Agricultural Products:

Agricultural Produce Market Committee: Meaning, Objectives, History of Market regulation, Features of regulated Market, advantages of regulated Markets, defects of regulated Markets (Mandi Samiti), Government e marketplace (GEM), Cooperative Marketing: Need of cooperative marketing, organization of cooperative marketing and its functions, Pricing- pricing strategies for agricultural products methods of pricing, factors affecting agricultural products price.

Unit -III Agricultural Market Information & channel of Distribution:

Meaning and Importance of market Information in Agricultural Commodities, Types of Information, Essential characteristics of good marketing information, sources of marketing information, Meaning and definition of marketing channels, study of marketing channels for different agricultural committee.

Information Technology: E- Trading, e-choupals, websites and IT tools for marketing, Applications of IT in agricultural marketing.

Unit-IV Value Chain Agricultural Marketing:

Meaning, type, advantages of grading & labeling, AGMARK producers, warehousing, meaning & functions of warehousing, types of warehousing, central warehousing corporation, state warehousing corporation, role of transportation in agricultural marketing, means of transportation, problems in transpiration in agricultural marketing and packaging of different agricultural products.

Unit- V Project related work:

a. Visiting to agricultural product processing unit,
b. Visiting to rural go downs and cold storage,
c. Visiting to fair price shop,

d. Visiting to fertilizers Marketing agencies,
e. Identification of marketing charurels for agricultural commodities
f. Any other related fields.

References:

l. Agricultural Marketing in India, S.S. Acharya & N. L. Agarawal, CBS Publishers
2. Marketing of Agricultural Produce in India, A. P. Gupta
3. Agricultural Marketing, H. R. Krishna Gauda
4. Principles and Practices of Marketing, C. B. Memoria and R. L. Joshi
5. Agricultural Marketing, Trade and Prices, Devendra Prasad & Om Prakash Murya, Rama Publishing House
6. Marketing of Agricultural produces, Richard L Kohis & Joseph N Uhi, Pearson

92	**Proofreading**	**SEC0209203**	**3**	**40-60**

Proofreading

Unit 1- Introduction To General Proof Reading (It will cover who needs a proofreader, the skills one needs to be successful, the difference between proofreading and editing/ copy editing) (3 Lectures)

Unit 2- Proofreading Mindset (Different types of markets that one can specialize in as a proofreader and learn some common terms used in the industry) (5 Lectures)

Unit 3- Proofreading Basics (It includes most common types of error to be watched) (5 Lectures)

Unit 4- Proofreading methods and practices (It includes different types of proofreading methods with through lessons on how to make the word best) (5 Lectures)

Unit5- Turning Proofreading into a business (It will make one to learn how to build own business) (5 Lectures)

COURSE OUTCOME:
On completion of this skill enhancement course the student-

- Understand the use of style sheets and style guides in proofreading
- Demonstrate how to create and use a style sheet
- Describe ones job as proofreader
- Demonstrate basic proofreading skills

Total Marks = 100 (Theory 50+ Practical 50 Marks)

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The Post- Graduate Department of Assamese offers a Skill based course on “Assamese DTP & Proofreading”.
Credits: 3
Teaching Method: Theoretical & Practical
Objectives:

- To provide the students understanding skills and professional knowledge about computer programs.
- To familiarize different computer software related to typing (specially Ramdhenu) and proofreading in Assamese language.
- To give knowledge on proofreading and making a competent proofreader.

Course Outcome:

- Acquire a basic understanding about various typing software.
- Be familiar with different Assamese fonts.
- Be proficient in the skills of Assamese typing & layout design.
- Eligible for careers in Print & Electronic media also in publication house.
- Be a freelance proofreader through web content, eBooks, blog posts etc.

Unit: I
Basic knowledge of computer, types of software (Microsoft Word &Adobe PageMaker)
Unit: II
Uses of Assamese Software Ramdhenu & different Fonts specially Gitanjali
Unit: III
Skills & techniques of Proofreading, different types of proofreading and challenges of a proofreader.
Unit: IV
Practical work and Project

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97	**Research and Technical Writing**	**SEC0209703**	**3**	**40-60**

Research and Technical Writing

Credits: 3 (Theory: 2, Lab: 1)

Theory: 20 Lectures

Preferred minimum qualifications of the teacher/instructor: Assistant Professor of Physics/B.E./B.Tech B.E./B.Tech. in Computer Science/ MCA.

This aim of the course is to make the students aware about importance of research and technical writing. This course provides students with an introduction to technical writing, graphing and data analysis, and computer presentation with LaTex, Origin and Microsoft excel.

Course Outcome: On successful completion of the course students will be able to identify and write different parts of technical reports, write article, thesis, and

presentation in latex, create chart in Microsoft excel, use different format of chart based on need, plot data from different sources using Origin plot.

Theory

Introduction (Lectures 4)

Structure and components of scientific reports - Types of report – Technical reports and thesis– Different steps in the preparation – Layout – Illustrations and tables - Bibliography, referencing and footnotes. Need of scientific word processor, examples of scientific word processors.

Unit II: Technical Writing in LaTex (Lectures 12)

Introduction to LaTeX, advantages of using LaTex, TeX/LaTeX word processor, preparing a basic LaTeX file, Document classes, Preparing an input file for LaTeX, Compiling LaTeX File, LaTeX tags for creating different environments, Defining LaTeX commands and environments, Changing the type style, Symbols from other languages. Equation representation: Formulae and equations, Figures and other floating bodies, Lining in columns- Tabbing and tabular environment, Generating table of contents, bibliography and citation, Making an index and glossary, List making environments, Fonts, Picture environment and colors, errors. Applications of LaTex in article, thesis, slide preparation.

Unit III: Scientific graphing and data analysis (Lectures 14)

Creating chart in Microsoft excel, Types of chart- Column chart, line chart, Pie chart, Doughnut chart, bar chart, area chart, scatter chart, surface chart; Chart elements- Chart style, Chart filter, fine tune of chart; Chart design tools- Design and format.

The Origin Workspace, Multi-sheet Workbooks, Managing Data and Metadata, Importing Data from different sources, Working with Excel and Origin, Basic Data Manipulation, Creating and Customizing Graphs, Custom Graph Templates and Themes, Publishing Graphs, Basic Data Analysis, Customizing Data Import, Post Processing of Imported Data, Creating and Customizing Multi-layer Graphs, Data Exploration and Pre-selection, Advanced Nonlinear Fitting, including Creating Custom Fitting Functions, Analysis Themes, Customizing Reports and Creating Custom Tables in Graphs, Recalculating/Updating Results, Analysis Templates and Custom Reports, Peaks and Baseline

100	**Science Communication**	**SEC0210003**	**3**	**40-60**

Science Communication

Unit 1 – Basic understanding of science and technology communication, need and significance of science communication, historical background, inculcating scientific temperament, science popularisation, Role of media in creating scientific temper in society, Knowledge about scientific experiments in the country: SITE Experiment, Kheda Project, Chambal Project, India's Nuclear Journey, MOM etc. Scientific organisations in India

Unit 2 –Public Understanding of Science, Science in print media, electronic media, social media, science and entertainment, Science in politics and policies, Museum as a tool of science communication, science communication and indigenous knowledge system
Important tenants of science writing, translation in science communication. Science through traditional folk media, science reporting, Qualities of science communicator

Unit 3 – Practical

Student should Publish articles on science related issues at any media outlets (webpages, newspapers, magazines or blogs).
Interviews with scientists and indigenous scientific knowledge experts, additional marks can be allotted for attending seminars /workshops on science communication related matters.

Further Readings:

i. Dawking, Richard. Modern Science Writing; Oxford University Press
ii. Bucchi, Massimiamo .Science & The Media; London & New York
iii. Berger, RoloffSwoldsen . Handbook of Communication Science; Sage Publications
IV. Bijnan Lekhokor Haat Puthi, Edited by Dr. Dinesh Chandra Goswami, Assam Book Hives
v. Indian Science News Association , Communicating Science; Indian Science News Association,Kolkata

vi. Dutta, Ankuran& Ray, Anamika . Science Communication in Assam. DVS Publishers

101	SERICULTURE AND ITS PROSPECTS	SEC0210103	3	40-60

SERICULTURE AND ITS PROSPECTS

(Total: 3 credits)

THEORY **CREDITS: 2**

UNIT-I: AN INTRODUCTION TO SERICULTURE **5**

Mulberry/Non-Mulberry: Origin/History and distribution, Varieties of silk, Types of silkworms, Propagation: Cutting – Layering of host plant.

UNIT- II: BIOLOGY OFSILK WORMS **6**

Life cycle of Mulberry, Eri, Muga and Tasar silk worm, Structure of Silk gland and nature of silk.

UNIT- III: REARING HOUSE AND APPLIANCES 4

Environmental condition for silk worm rearing, Rearing technology, Brushing, Feeding, Mounting, Mountages, Harvesting and storage of cocoons, Spinning and reeling of silk.

UNIT- IV: GRAINAGE TECHNOLOGY 3

Silk worm seed production, Reproduction and commercial seed, Egg laying, Mother moth examination.

UNIT- V: PESTS AND DISEASES OF SILK WORM 2

Pests of silk worm, Diseases of silk worm: Viral, Bacterial, Fungal, Protozoan, Prevention and control measures.

UNIT- IV: ENTREPRENEURSHIP IN SERICULTURE 2

Marketing and Economic status of Sericulture, Future prospects.

UNIT III: PRACTICAL SYLLABUS CREDIT: 1

1. Identification of various larvalstages of different silkworms.

2. Identification of diseased and disease-free silkworms.

3. Visit to various Sericulture research stations/Govt./Private farms and report submission.

BOOKS AND SUGGESTED READINGS

1. Tembhare. D.B. (1997), Modern Entomology, Himalaya Publishing House.

2. Shukla. G. S & Upadhyay. V. B. (2007) Economic Zoology, Rastogi Publications.

3. Chowdhury, S. N. (1981) Muga Silk Industry, Directorate of Sericulture, Govt of Assam, Guwahati, Assam.

4. Chowdhury, S. N. (1982) Eri Silk Industry, Directorate of Sericulture, Govt of Assam, Guwahati, Assam.

5. Chowdhury, S. N. (1982) Silk and Sericulture, Directorate of Sericulture, Govt of Assam, Guwahati, Assam.

OBJECTIVES OF THE COURSE

1. To develop interest in the field of Sericulture among the students.

2. To motivate students for scientific study in the field of Agro-based Industry by performing simple projects and field visits.

3. To develop skills and interest in entrepreneurship in Sericulture.

4. To help the students to learn means of self-employment and income generation.

5. To cultivate studentsawareness and appreciation for Sericulture as a hobby and science.

COURSE OUTCOME

1. Students study the morphology and types of silkworm.

2. Students can identify the pests and diseases of silkworms.

3. Students can start up their entrepreneurship in the field of Sericulture.

4. Students can generate their own income commercially.

5. Students get the knowledge about the rearing and disinfectant techniques for sustainable growth.

113	**Translation : Principles & Practice**	**SEC0211303**	**3**	**40-60**

Translation: Principles & Practice

Title: Translation: A Detailed Perspective

Target Group: Open for all (Arts, Science and Commerce)

Theory= 2 credit, Practical= 1 credit

Learning Objectives:

The objectives of the course are:

(i) To develop practical and technical knowledge of Translation
(ii) To develop Professional skill of the students
(iii) To impart the knowledge of language, literature and culture of different languages.

Course outcomes:

(i) All aspects of written communication, accuracy, readability and flow to a high level of expertise will develop in Assamese, Bengali and Hindi language.
(ii) Technical and ethical skills and knowledge of translation will enhance.
(iii) Knowledge in different languages, literary work and culture will enhance.

(iv) Skills in Assamese, Bengali, English and Hindi will develop.

Unit wise Syllabus

Theory

Unit-I (5 hours)

Translation: Elements and Use
Meaning and definition of translation, Translation: Science or Arts, History of Translation

Unit-II (4 hours)

Problems and Prospects of Translation
Problems related with source text and target text, Qualities of Translator

Unit-III (4 hours)

Types of Translation
Translation on the basis of prose and poetry,Translation on the basis of literary genre,Translation on the basis of subject,Translation on the basis of nature of translation.

Unit-IV (4 hours)

Translation and literature

Process of Translation, Comparative literature and Translation

Unit-V (5 hours)

Employment and translation
Interpreter, translator, journalist, editor, news writer-translator, voice-over artist, dubbing artist, radio-jockey, instructor etc.

Practical (22 hours)

(i) **Translation of Prose**- Story, Essay, Novel (Hindi-English, Assamese-Hindi, Bengali-Assamese, vice-versa) (14 hours)

(ii) **Translation of Poetry** (Hindi-English, Assamese-Hindi, Bengali-Assamese, vice-versa) (8 hours)

References:

1. Anubad Adhyayan : Tatwa Aru Proyog – Madan Sarma
2. Anubad : Tatwa Aru Proyog – Dr. Nirajona Mahanta Bejbora
3. Anubador Kotha – Abdul Leich
4. Anubad Porikroma – Profulla kataki
5. Tulonamulak Sahitya aru anubad kala - Karabi Deka Hajorika
6. Anubad-Sudha , Part I– Dr. Achyut Sarma
7. Anubad-Sudha , Part II– Dr. Achyut Sarma
8. A Handbook of Translation Studies- Bijay Kr. Das
9. Anubad Biggyan : Bholanath Tiwari

114	**Vermicomposting and Organic Farming**	**SEC0211403**	**3**	**40-60**

Vermicomposting and Organic Farming

-by Bhaben Tanti, GU

Credits: 3

Learning objectives:

- Understand the basics of vermicomposting by enabling students to identify suitable wastes for vermicompost production
- Develop interest in waste management
- Provide hands on training for vermicompost production in small and large scale basis.
- Develop an understanding of the identification of suitable earthworm species for vermicomposting
- Create awareness for promoting organic agriculture
- Help the students to learn a means of self-employment and income generation through small and medium scale entrepreneurship.

Learning outcomes:

On successful completion of the course, students will be able to:

- Identify opportunity in the discarded organic wastes
- Acquire knowledge of various earthworm species suitable for vermicomposting
- Construct and maintain small and large scale vermicomposting unit

- Learn the basic principles for drying, packaging, storage and transportation of vermicompost
- Understand the importance of organic agriculture and its relevance it the current scenario

THEORY

Unit 1: Introduction to Vermicomposting

Vermicomposting- Definition, meaning, history, scope, economic importance and significance of vermicompost in the maintenance of soil structure. Vermicomposting for organic waste management- types, characterization and management of solid organic wastes with special reference to four R's principles.

Unit 2: Vermicomposting Types and Methods

Types of vermicomposting- Bed method, pit method, tank method, roof shed method and bin method. Setting up Vermicomposting Unit- Basic Requirements and Maintenance, Preparation of vermicomposting bed, Small and large scale vermicomposting; Size and dimensions of the vermicomposting unit, Enemies of earthworms.

Unit 3: Earthworm Species for Vermicomposting

Criteria for selecting suitable earthworm species for vermicomposting, Ecological Categories of Earthworms, Local and Exotic species of earthworms frequently used in vermicomposting- *Eisenia fetida*, *Eudrilus eugeniae, Perionyx excavatus* and *Lampito mauritii*.

Unit 4: Principles of Vermicomposting

Phases of vermicomposting- Initial activation, thermophilic, mesophilic. Factors affecting vermicomposting process - pH, temperature, moisture content, Electrical Conductivity, Total organic carbon, nutrient budget, water holding capacity, exchangeable acidity and CO2 evaluation. Recent advances in vermitechnology; Greenhouse gas emission during vermicomposting; SWOC analysis of the vermicomposting process.

Unit 5: Vermicompost Harvesting and Applications

Techniques of harvesting vermicompost, vermiwash and earthworms. Maturity assessment of vermicompost: Biological indicators of maturity, C/N ratio, C/P ratio, Humification index, Heavy metals content. Post Harvest preservation and application strategies.

Unit 6: Organic Farming

Introduction- Basic concept, principles, history, scope, importance and relevance in Indian agriculture system; Component of organic farming, Green manuring and organic fertilizers. Organic insecticides and pesticides; Case studies and success stories; Advantages and disadvantages of organic farming. Recent development in organic farming with special reference to GMO.

PRACTICAL

1. Maintenance of earthworm culture for vermicomposting
2. Physico-Chemical characterization of vermicompost
3. Biological characterization of vermicompost
4. Spectroscopic characterization of vermicompost
5. Preparation of vermi tea, vermi-wash, organic insecticides and pesticides.
6. Organic farming strategies for economically important crops

Suggested Readings

1. Tripathi, Y. C., Hazaria, P., Kaushik, P. K., & Kumar, A. (2005). Vermitechnology and waste management. Verms and Vermitechnology, SB Nangia. APH Publishing Corp., New Delhi.

2. Edwards, C. A., & Lofty, J. R. (1977). Biology of Earthworms, Chapman and Hall. London, UK.

3. Lee, K. E. (1985). Earthworms: their ecology and relationships with soils and land use. Academic Press Inc. Sydney, Australia.

4. Munroe, G. (2007). Manual of on-farm vermicomposting and vermiculture. Organic Agriculture Centre of Canada.

5. Singh, K., Nath, G., Shukla, R. C., Bhartiya, D. K. (2014). A Textbook of Vermicompost: Vermiwash and Biopesticides. Astral International, New Delhi.

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Skill Enhancement Course 5: Vermicompost Technology
(Offered by the Department of Zoology)
Open for All
Total Credit =3(33 Hours)
Unit-I
General Vermiculture/ Vermicompost
1. Introduction to vermiculture. definition, meaning, history, economic important, their value in maintenance of soil structure, role as four r's of recycling reduce, reuse, recycle, restore.
2. Role in bio transformation of the residues generated by human activity and production of organic fertilizers.
3. The matter and humus cycle (product, qualities). Transformation process in organic matter.
4. Choosing the right worm. Useful species of earthworms. Local species of earthworms. Exotic species of earthworms.
Unit-II
Earthworm Biology and Rearing
1. Five Key to identify the species of earthworms.
2. Biology of *Eisenia fetida*
a) Taxonomy Anatomy, physiology and reproduction of Lumbricidae.
b) Vital cycle of *Eisenia fetida*: alimentation, fecundity, annual reproducer potential and limit factors (gases, diet, humidity, temperature, PH, light, and climatic factors).
3. Biology of *Eudrilus eugeniae*
a) Taxonomy Anatomy, physiology and reproduction of Eudrilidae.
b) Vital cycle of *Eudrilus eugeniae*: alimentation, fecundity, annual reproducer potential
Unit-III
Vermicompost Technology (Methods and Products)
1. Small Scale Earthworm farming for home gardens
2. Earthworm compost for home gardens
3. Conventional commercial composting
4. Earthworm Farming (Vermiculture), Extraction (harvest), vermicomposting harvest and processing.
5. Nutritional Composition of Vermicompost for plants, comparison with other fertilizers
6. Vermiwash collection, composition &use
Unit-IV
Applied vermiculture.
1. The working group experience with *E. fetida* populations comportment with farm industrial residues (frigorific, cow places, feed-lot, aviaries exploitations,
and solid urban residues).
Practical
1. Key to identify different types of earthworms
2. Field trip- Collection of native earthworms & their identification
3. Study of Sytematic position, habits, habitat & External characters of *Eisenia fetida*

4. Study of Life stages & development of Eisenia fetida
5. Study of Life stages & development of Eudrilus eugeniae
6 Comparison of morphology & life stages of *Eisenia fetida* & *Eudrilus eugeniae*
7. Study of Vermiculture, Vermiwash & Vermicompost equipments, devices
8. Preparation vermibeds, maintenance of vermicompost & climatic conditions.
9. Harvesting, packaging, transport and storage of Vermicompost and separation.
10. Study the effects of vermicompost & vermiwash on any two short duration crop plants.

116	**Visual Merchandiser**	**SEC0211603**	**3**	**40-60**

Visual Merchandiser

Paper Name**: *RMT*-SE-2014 – Visual Merchandiser**

Credit 3 **Total Marks: 100**

Theory classes :17 classes (one hour each-17 hrs) **Theory:50 marks**

Practical classes:16 classes (Two hours each-32 hrs) **Practical:50 Marks**

Practical classes will include : 12 hours of Retail Lab practical, 12 hours of presentation preparation, 6 hours of Group Discussion, 2 hours of assignment preparation

Course Description:

This course on"**VisualMerchandiser**"for undergraduate students buildsbasicallyon thesoftskills andcreativeskillsalreadypossessed bythestudentsapartfrom preparingthem foranentrylevel profession in theretailindustry.It aims to develop thetechnicalskillsrequiredforthejobapartfrom improvingtheir communication and problem-solvingskills.

Course Objective:

This course isaimedat trainingstudentsforthe job of"**VisualMerchandiser**", in the"Retail"Sector/Industryand bytheend ofthesemesteraims at buildingthejob specifickeycompetenciesamongst thelearners.

Specific Objectives:

The courseaims to enablestudents to–

- Understand thebasic concepts ofvisualmerchandising
- Understand thejob description and dutiesof"**VisualMerchandiser**"
- Understand thebasicsofstoreplanningand storelayout

- Understand thebasicsandimportanceofmerchandisepresentation,windowdisplays etc.
- Gives an idea ofvariousproblem-solvingskills related to theindustry
- Givean exposure tothe practicalaspectsoftheindustry
- Develop soft skills

CourseOutcome:

After thecompletionofthecourse, thestudents will beableto

- Understand thebasicsof visualmerchandising
- Know therequirements oftheprofessionof**VisualMerchandiser**
- Develop theskillsrequired for beingasuccessful**VisualMerchandiser**
- Communicatewith peoplewith confidence

CourseContent:

Unit1:IntroductiontoVisualMerchandising Marks:20

* Visual Merchandising: Definitionand Functions
* Elements ofImageMix
* DisplayBasics,ElementsofDisplay:Store Exteriors &Interiors
* Design Basics, PrinciplesofDesign,ColourBlockingconcept
* Signage- Definition, Types,Importance

Unit 2:StorePlanning&Fixtures Marks:10

* StorePlanning- Concept& Importance
* Fixtures: Definition, Types,PurposeofPlanningFixtures
* CirculationPlan:Definition, Rules, Types
* Planograms:Meaning,Importance, Implementation&Maintenance

Unit 3: MerchandisePresentation,WindowDisplays, andotherimportanttools Marks:10

* MerchandisePresentation:Meaning, Principles,Categories,
* Cross Merchandising:Objective,Strategy
* Window Displays:Meaning, Scope, Categories,
* DisplayCalendar, SalesTracking, Mannequins, Props,Lighting,

Unit4:IntroductiontoVisualMerchandiser Marks:10

Visual Merchandiser -Definition, Job Description, Duties

CourseContent:

Unit1:IntroductiontoVisualMerchandising Marks:20

* Visual Merchandising: Definitionand Functions
* Elements ofImageMix
* DisplayBasics,ElementsofDisplay:Store Exteriors &Interiors
* Design Basics, PrinciplesofDesign,ColourBlockingconcept
* Signage- Definition, Types,Importance

Unit 2:StorePlanning&Fixtures Marks:10

* StorePlanning- Concept& Importance
* Fixtures: Definition, Types,PurposeofPlanningFixtures
* CirculationPlan:Definition, Rules, Types
* Planograms:Meaning,Importance, Implementation&Maintenance

Unit 3: MerchandisePresentation,WindowDisplays, andotherimportanttools

Marks:10

* MerchandisePresentation:Meaning, Principles,Categories,
* Cross Merchandising:Objective,Strategy
* Window Displays:Meaning, Scope, Categories,
* DisplayCalendar, SalesTracking, Mannequins, Props,Lighting,

Unit4:IntroductiontoVisualMerchandiser Marks:10

Visual Merchandiser -Definition, Job Description, Duties

Readerlist:

BhallaSwati,AnuraagS.,VisualMerchandisingPradhan,S.,RetailingManagement:Text and Cases
QualificationPackofVisualMerchandiserprescribed byRASCI