Botany (Major)

12 papers theory: 50x12=600 marks; 6 papers practical: 50x6=300 marks

[20% marks internal assessment or 40 marks per paper + 10 marks Internal assessment]

18 papers x 3 credits each = 54 credits

Paper-I: Cell Biology and Biomolecules

Unit-1: Microscopy: Light microscopy, Phase-contrast , TEM and SEM, Cell structure, Cell wall and cell membrane organisation, ion channels, pumps in cellular transport and signalling, Protoplasm.
Unit-2: Cytoplasmic organelles: Mitochnodria, Chloroplast, ER, Ribosomes, Gogi apparatus, Peroxisomes, Nucleus: Nucleolus, Nuclear membrane, Chromosomes.
Unit-3: Cell cycle, Cell division: Mitosis, Meiosis
Unit.-4: Structure and Chemistry of macromolecules: Carbohydrates, Lipids, Proteins, Nucleic acids, DNA structure, Different RNAs.

Paper-II: Microbiology and Algae

Unit-1: Classification of microorganisms: Bergey's manual, Carl Woese's 3 domain concept, Structure and reproduction of bacteria, Conjugation, transformation and transduction, Culture methods for bacteria, growth curve.
Unit-2:Classification of Viruses, structure and multiplication, Viral diseases: TMV, AIDS
Unit-3:Classification, Range of thallus organisation, Origin and evolution of sexuality, life cycles, Economic importance of algae.
Unit-4: Structure and life cycle of selected algae under Cyanophyta (*Oscillatoria, Nostoc*), Chlorophyta (*Chlamydomonas, Chlorella, Ulothrix, Oedogonium, Coleochaete, Zygnema, Chara*), Euglenophyta (*Euglena*), Xanthophyta (*Vaucheria*), Bacillariophyta (Diatoms), Phaeophyta (*Ectocarpus, Dictyota, Fucus*)and Rhodophyta (*Batrachospermum, Polysiphonia*)

Paper-III :Practicals pertaining to Paper I and II

Paper-IV: Fungi, Plant pathology and Lichens

Unit-1:Classification, nutrition, parasexuality, Fructification, asexual spores, spore dissemination, heterothallism in fungi, Phylogeny.
Unit-2:Structure, life history and reproduction in selected fungi under Phycomycetes (*Saprolegnia, Pythium, Phytopthora, Albugo*), Ascomycetes (Asperigillus, Penicilium, Erysiphae, Neurospora), Basidiomycetes (*Ustilago, Puccinia, Agaricus*) and Deutoriomycetes (*Cercospora, Fusarium, Colletotrichum*)
Unit-3: Plant diseases and defence mechanisms in plants, host pathogen relationship, Etiology, Symptoms and control of plant diseases of the following: White rust of crucifers, Late blight of potato, Powdery mildew of Peas, Rust of wheat, rot of sugarcane, wilt of pigeon pea, tikka disease of groundnut, bacterial blight of rice.

Unit-4: Classification, structure and thallus organisation of lichens; Crustose, foliose and fructicose lichens, lichens as ecological indicators.

Paper-V: Bryophyta and Pteridophyta

Unit-1: Classification, morphology, anatomy, life cycle of *Riccia, Marchantia* and *Anthoceros*
Unit-2: Classification, morphology, anatomy, life cycle of Sphagnum, Polytrichum, Phylogeny of Bryophytes, progressive sterilization of sporogenous tissue, Spore dispersal mechanism in Bryophytes.
Unit-3: Classification, morphology, anatomy, life cycle of Pteridophytes, Stelar evolution, heterospory and seed habit.
Unit-4: Morphology, anatomy, life cycle and affinities of *Psilotum, Lycopodium, Selaginella*, *Equisetum, Ophioglossum, Isoetes, Maslelia, Adiantum* and tree ferns.

Paper-VI: Practicals pertaining to paper IV and V

Paper-VII: Genetics, Plant breeding and Evolution

Unit-1: Mendel's experiment and laws of inheritance, back cross and test cross, incomplete dominance, co-dominance, lethal alleles, multiple alleles, quantitative traits.
Unit-2: Sex determination, chromosomal and genetic basis of sex determination, sex-linked genes and their inheritance, linkage and crossing over, Mutation, polyploidy, heterosis.
Unit-3: Plant breeding: Principles and techniques in plant breeding, self and cross pollinated plants, methods and techniques of hybridization, inter-generic and intra-species cross in breeding, mutation breeding, role of breeding in crop improvement.
Unit-4: Origin of life, Theories and evidences of organic evolution, Darwin's theory of natural selection, origin of species, neo-darwinism, Isolation mechanism and speciation, population genetics.

Paper-VIII: Gymnosperm, Fossils and Angiosperm classification

Unit-1: Classification of Gymnosperms, morphology, anatomy, life cycle and phylogeny of *Cycas* and *Pinus*.
Unit-2: Morphology, anatomy, life history and phylogeny of *Ginkgo* and *Gnetum, Ginkgo* as living fossil, Angiospermic characters of *Gnetum*.
Unit-3: Geological time scale, Fossils and fossilization process, morphology, anatomy and affinities of *Rhynia, Calamites, Lepidodendron, Lyginopteris* and *Cyacadeoidea*.
Unit-4: Principles of taxonomy, species concept, nomenclature, rules of ICBN, Systems of classification, Herbaria, Botanical gardens.

Paper-IX: Practicals pertaining to paper VII and VIII

Paper-X: Developmental Biology

Unit-1: Tissue system: Meristems and apical organisation, classification of tissue system, organisation of vascular tissues, conducting tissues, anatomy of monocot and dicot root, stem and leaf, origin of lateral root and shoot, root-stem transition.

Unit-2: Normal and adaptive and non-adaptive anamolous secondary growth, mechanical tissues, their ontogeny, organisation and their distribution, principles involved on organisation of mechanical tissues.
Unit-3: Embryology: Microsporogenesis, male gametophyte, megasporigenesis, fenmle gametophyte (monosporic, bisporic and tetrasporic).
Unit-4: Pollination process, structure of ovule, fertilization in angiosperms, endosperm and embryo formation.

Paper-XI: Plant physiology and Biochemistry

Unit-1: Water relations, mechanism of water absorption, transpiration, mechanism of stomatal movement, translocation of solutes, ion pumps, Macro and micro elements, mineral deficiency symptoms and disorders.
Unit-2: Enzymes and their classification, isoenzymes, co-factors,,mechanism of enzyme action; factors affecting enzyme activity, Saturated and unsaturated fatty acids, Synthesis and degradation of fats, α and β oxidation.
Unit-3: Photosynthesis: Photosynthetic apparatus, photosynthetic pigments, photoprotective carotenoids, electron transport in chloroplast membrane, Photophosphorylation, Calvin cycle, C4 carbon cycle, Crassulacean acid metabolism, Phtorespiration.
Unit-4: Respiration: Aerobic and anaerobic respiration, Glycolysis, Fermentation, Krebs cycle, oxidative phosphorylation, factors affecting respiration.

Paper-XII: Practicals pertaining to paper X and XI

Paper-XIII: Taxonomy of Angiosperms and Economic Botany

Unit-1: Floral variations, Affinities and systematic position of Dicot families (Polypetalae): Ranunculaceae, Magnoliaceae, Papavaraceae, Tiliaceae, Sterculaceae, Rutaceae, Rosaceae, Asteraceae.
Unit-2: Affinities and systematic position of Dicots (Gamopetalae) and Monocot families: Myrtaceae, Cucurbitaceae, Rubiaceae, Apocyanaceae, Conolvulaceae, Acanthaceae, Lmaiaceae, Vebenaceae, Euphorbiaceae, Amarathaceae, Poaceae, Musaceae, Liliaceae, Cyperraceae, Zingiberaceae, Orchidaceae.
Unit-3: Economic importance of cereals, pulses, fibres, timers, vegetables, ornamental and medicinal plants (10 locally available medicinal plants), vegetable and gum yielding plants, herbal drugs, pharmacogonsy.
Unit-4: Origin, botany, ecology and methods of cultivation and utilization of Rice, Green gram, Jute, Sugarcane, Groundnut, Patato, Turmeric, Zinger.

Paper-XIV: Environmental Botany and Biometry

Unit-1: Concepts of ecology: Autecology, Synecology, Population ecology: diversity pattern and population growth, carrying capacity, regulation,, Plant community structure and their composition,species diversity (alpha, beta, gamma), ecological niche, Ecosystem, Energetics, flow of energy and materials within ecosystem, models of energy flow, Bio-geo chemical cycles, major types of ecosystems: aquatic, terrestrial and man made ecosystems.

Unit-2: Ecological adaptation: Ecological factors morphological and anatomical features of hydrophytes, xerophytes, mesophytes and epiphytes, ecological succession.
Unit-3: Applied ecology: Resource management in agriculture and forestry, soil reclamation, land and water resources degradation and their conservation, environmental pollution, environmental toxicology, green house effect, global warming, EIA, Environmental management.
Unit-4: Biostatistics: Population and sample, random sampling, frequency distribution, Central tendency, mean and median, standard deviation, test of significance, t-test, Chi-square test, F-test.

Paper-XV: Practicals pertaining to paper XIII and XIV

Paper-XVI: Nitrogen metabolism, plant growth hormones, plant tissue culture and resource conservation:

Unit-1: Role of light in plant growth and development, phytohormones: auxns, cytokinin, giberllins, absesic acid, ethylene, physiology of flowering, florigin concept, senescence and fruit ripening, dormancy and seed germination, seed vigour, photoperiodism, vernalisation, Biological clock.
Unit-2: Nitrogen cycle, nitrogen fixation, nitrogen metabolism, Central dogma, operon concept, transcription, translation, amino acid biosynthesis, primary, protein synthesis.
Unit-3:Tissue culture techniques, Cellular differentiation and totipotency, organogenesis, anther culture, organ culture, propoplast isolation and culture, protoplast fusion, somatic hybridization, clonal propagation, vectors for gene delivery, *Agrobacterium*- a natural genetic engineer, micropopagation techniques.

Unit-4: Natural resources and their conservation, endangered species, red-data book, plant genetic resources with special reference to India and Odisha, sanctuaries, reserves and biosphere parks, social forestry.

Paper-XVII: Plant Biotechnology

Unit-1: Replication of DNA, gene structure, expression and regulation, southern and northern blotting, PCR, techniques in gene mapping and DNA finger printing, RAPD, RFLP, AFLP, gene cloning, restriction endonucleases, c-DNA libraries.
Unit-2: Production of disease free plants, disease resistant plants, secondary metabolites using r-DNA technology, edible vaccines, Bt cotton, Bt bringel.
Unit-3: Fermentor, fermentation process and down stream processing, Industrial production of vaccines, antibiotics, enzymes, organic acids and alcohols.
Unit-4: Waste water treatment, oxidation pond, trickling filter, recycling of industrial and domestic effluents, superbugs, bio-hydro metallurgy for recovery of ore, second and third generation biofuel, biogas plant.

Paper-XVIII: Practicals pertaining to paper XVI and XVII

B.Sc. ZOOLOGY (Major)

There will be two theory papers of 50 marks (Semester 40 + Internal 10 marks) having 3 credits each and one practical paper of 50 marks having 3 credits in a semester. In total there are Six semesters in the Honours course

1st SEMESTER

Paper-I: Animal Diversity (Non Chordata)

Unit I: Protozoa and Porifera

Unit II: Coelenterates and Helminthes

Unit III: Annelida and Arthropoda

Unit IV: Mollusca and Echinodermata

Paper-II:

Unit I: Cell Biology: Basic structure, shape, size and theory

Unit II: Cell Biology: Cell organelles and cellular functions

Unit III: Histology

Unit IV: Taxonomy

Paper-III: Practical related to Paper-I and II

2nd SEMESTER

Paper-IV: Animal Diversity (Protochordata and Chordata)

Unit I: Protochordata

Unit II: Pisces

Unit III: Amphibia and reptiles

Unit IV: Aves and Mammals

Paper-V:

Unit I: Evolution: Concept and evidences

Unit II: Evolution: Theory and mechanisms

Unit III: Ecology: Concept, Factors and ecosystems

Unit IV: Ecology: Community and population

Paper-VI: Practical related to Paper-IV and V

3rd SEMESTER

Paper-VII:

Unit I: Development Biology: Gametes to Embryo

Unit II: Development Biology: Molecular basis of development

Unit III: Classical Genetics

Unit IV: Applied Genetics

Paper-VIII:

Unit I: Structural Comparative Anatomy

Unit II: Functional Comparative Anatomy

Unit III: Physiological Systems

Unit IV: Molecular Physiology

Paper-IX: Practical related to Paper-VII and VIII

4th SEMESTER

Paper-X:

Unit I: Biochemistry: Chemical nature of life, Macromolecules

Unit II: Biochemistry: Enzymes and Vitamins

Unit III: Endocrinology: Endocrine glands

Unit IV: Endocrinology: Mechanism of hormone action

Paper-XI:

Unit I: Immunology: Concept, types and structure

Unit II: Immunology: Immunological abnormalities

Unit III: Economic Zoology: Applied Entomology

Unit IV: Economic Zoology: Aquaculture and animal husbandry

Paper-XII: Practical related to Paper-VII and VIII

5th SEMESTER

Paper-XIII:

Unit I: Microbiology: Bacteria

Unit II: Microbiology: Viruses

Unit III: Parasitology: Types, characteristics and structure

Unit IV: Parasitology: Parasitic diseases

Paper-XIV:

Unit I: Conservation Biology

Unit II: Biostatistics & Computer application

Unit III: Animal Behavior

Unit IV: Biotechniques & Instrumentation

Paper-XV: Practical related to Paper-XIII and XIV

6th SEMESTER

Paper-XVI:

Unit I: Biophysics

Unit II: Bioinformatics

Unit III: Genetic Engineering

Unit IV: Genomics and Proteomics

Paper-XVII:

Unit I: Reproductive Technology

Unit II: Fermentation Technology

Unit III: Animal Biotechnology

Unit IV: Bioethics

Paper-XVIII: Practical related to Paper-XVI and XVII

Botany (Minor)

4 papers theory: 50x4=200 marks; 2 papers practical: 50x2=100 marks

[20% marks internal assessment or 40 marks per paper + 10 marks Internal assessment]

6 papers x 3 credits each = 18 credits

Paper-I: Microbiology and Cryptogams

Unit-1: Microbiology: History and classification of microorganisms (whittakar, Bergey's manual, Carl Woese), Ultrastructure, reproduction and economic importance of Bacteria, Salient features of Archaea, Structure and multiplication of virus.
Unit-2: Algae: Structure of Blue-green algae (Cyanobacteria) cell and heterocyst, Morphology, Reproduction, Life cycle and affinities of *Nostoc, Volvox, Ulothrix, Oedogonium, Coleochaete, Chara, Vaucheria, Ectocarpus, Batrachospermum* and diatoms.
Unit-3: Fungi and Plant Pathology: Morphology, reproduction, life cycle, affinities and economic importance of *Phytopthora, Albugo Saccharomyces, Penicillium, Puccinia*, and *Agaricus*. Structure, reproduction and economic importance of Lichens. Symptoms, Mode of infection and control of Late blight of potato, Smut of sugar cane, Blight of rice.
Unit.-4: Bryophyta and Pteriodophyta: General characters, morphology, anatomy, reproduction, life cycle and affinities of *Riccia, Marchantia, Anthoceros* and *Sphagnum.*
General characters, morphology, anatomy, reproduction, life cycle and affinities of Lycopodium, Selagenella, *Equisetum* and *Marselia*.

Paper-II: Phenerogams, Cell biology, Genetics and Evolution

Unit-1: Gymnosperms and Fossils: Fossils and fossilization process, *Rhynia* and *Lyginodendron*, Morphology, Anatomy, Reproduction, Life cycle and affinities of *Cycas, Pinus* and *Gnetum*.
Unit-2:Angiosperms and Taxonomy of Flowering plants: Principles of Taxonomy, ICBN, Herbarium, Classification of flowering plants (Benthan and Hooker and Engler and Prantle's system of classification). Study of plant families: Ranunculaceae, Rutaceae, Cucurbitaceae, Rubiaceae, Apocyanaceae, Asclepidiaeae, Acathaceae, Lamiaceae, Euphorbiaceae, Cyperaceae, Musaceae. Poaceae, Orchidaceae.
Unit-3:Cell and Molecular biology: Structure of cell and cell organelles (Chloroplast, Mitochondria, ER, Golgi bodies, Microtubules), Structure of nucleus, Structure and chemistry of chromosomes, Cell cycle and Cell division (Mitosis and Meiosis).
Unit-4: Genetics, Plant breeding and Evolution: Genetic inheritance, Mendelism, Interaction of genes (Supplementarry and complementary), Linkage, Crossing over, Mutation, Polyploidy. Heterosis, hybrid vigour, Back cross, test cross, Role of plant breeding in crop improvement. Theories and evidences of orgaic evolution (Darwinism and Lamarkism).

Paper-III: Practicals pertaining to Paper I and II

Paper-IV: Developmental Botany, Plant Physiology and Biochemistry

Unit-1:Plant anatomy: Different types of tissues, classification of tissue system, Meristematic tissue system, Organisation of root and shoot apex, Normal and secondary growth in dicot stems (*Bignoia, Boerhavia, Aristolochia, Chenopodium*), Mechanical tissues and their distribution in plants.
Unit-2:Embryology: Microsporangia, Male gametophyte, Megasporangia, Female gametophyte (Monosporia and Bisporic), Fertilization, Endosperm and Embryo.
Unit-3: Plant Physiology (Water relation, Dormancy, Phytohormones): Absorption and conduction of water, Transpiration, Mineral nutrition, Translocation of solute, Dormancy, Phytohormones (Auxin, Gibberllin, Cytokinin, Ethelene), Photoperiodism, Vernalisation.
Unit-4: Plant Biochemistry (Enzymology, Metabolism): Structure and properties of Carbohydrates, Amino acids, Proteins and Lipids, Enzymes, their classification and mode of action, Photosynthesis: Photophosphorelation, Calvin cycle, Respiration: Glycolysis, Krebs cycle, Electron transport, Nitrogen fixation (Symbiotic and asymbiotic), nitrogen assimilation, Protein synthesis.

Paper-V: Plant ecology, Economic Botany and Plant Biotechnology

Unit-1: Plant ecology: Ecosystem, ecological factors, ecological succession: Structure and components of ecosystem, Food chain, food webs, Ecological pyramids, energy flow; Bio-geo chemical cycles (Carbon, nitrogen, phosphorus), Ecological succession (.Hydrosere, Xerosere)
Unit-2: Ecological adaptation, Environmental Pollution: Morphology and anatomy of hydrophytes, xerophytes, halophytes and the adaptive features; Causes, consequences and control methds of environmental pollution (Soil, air, water).
Unit-3: Economic Botany , Plant resource conservation: Botany, cultivation and economic importance 9f rice, jute, sugar cane and potato. Economic importance f oil yielding (groundnut, mustard), Pulses (green gram), timber yielding (Sal, Teak), beverages (tea, coffee) and 5 medicinal plants of the region.
Unit-4: Plant Biotechnology: Plant tissue culture, totipotency, organogenesis, micropopagation, protoplast fusion, Ex-situ and In-situ conservation of germplasms, tools and techniques in recombinant DNA technology, Cloning vectors, DNA library, transgenic plants, Bioprocess, Production of alcohol. Antibiotics and vaccines, Biofuel,

Paper-VI: Practicals pertaining to paper IV and V

Books recommended:

1. College Botany Vol II. By. Gangulee and Kar
2. Microbiology By. H.C. Dube/ Sullia and Santharam/ Dube and Maheswari/ O.P. Sharma/Pelzar
3. Introductory Phycology By H.D. Kumar
4. Cryptogamic Botany, Vol I and II By. G.M. Smith
5. Bryophyta By N.S. Parihar/ A. Rashid
6. Mycology By C.J. Alexopolus/H.C. Dube

7. Plant Pathology By R.P. Singh/B.P.Pandey
8. Pteridophytes By. A. Rashid/ N.S. Parihar
9. Gymnosperms By. R.S. Sharma/ Chamberlin
10. Paleobotany By, Scott/ Arnold
11. Cell Biology: By N.S. Cohn/ C.B. Power/ De Robertis
12. Cell and Molecular Biology: By P.K. Gupta
13. Genetics: By Gardner/ Strickbirger/ P.K. Gupta/ B.D. Singh
14. Plant Physiology: By Devlin/Salisbury and Ross/Noorgle and Fitz.
15. Biochemistry: By Lelinger/ Cohn and Stumpf
16. Plant Breeding By B.D. Singh
17. Cytogentics and evolution By. B.B. Rastogi/ Singh and Chaturvedi
18. Plant Anatomy: By.M.S. Tayal/ B.P. Pandey /Haberlandt/Essu
19. Embryology By P. Maheswari/Bhojwant and Bhatnagar
20. Taxonomy By J.N. Mitra/ G.H.M. Lawrence/ Heyward and Moore/G.L. Chopra/ Saxena/ Singh and Jain.
21. Ecology By. E.P. Odum/ H.D. Kumar/G.L. Clarke/ M;C; Das/ Weaver and Clements/P.D. Sharma.
22. Economic Botany By. Hill/ O P. Saharma/ S.L. Kochhar
23. Biostatstics by m.k. Mishara and B.N. Mishra/ Chainy and Mishra/ Satguru
24. Plant tissue culture: By S.S. Bhojwani
25. Biotechnology and Genomics: By P.K. Gupta/ B.D. Singh
26. Environmental Biology: By Asthana and Asthana/ S. Arora/ Kumar and Adhikary/ P K Mohapatra
27. Botany of field crops By Sundarraj and Tulsidas

Microbiology (Minor)

4 papers theory: 50x4=200 marks; 2 papers practical: 50x2=100 marks

[20% marks internal assessment or 40 marks per paper + 10 marks Internal assessment]

6 papers x 3 credits each = 18 credits

Paper-I: Microbial diversity and methods of study

Unit-1: History and scope of Microbiology
Unit-2: Diversity of microorganisms
Unit-3: Methods of study of microbes
Unit.-4: Microbial growth and factors affecting their growth

Paper-II: Viruses and Eu-bacteria

Unit-1: Structure and reproduction of Viruses, classification of Virus
Unit-2:Morphology and Ultrastructure of bacteria, multiplication, Plasmids
Unit-3:Bacterial genetics, mutation, gene expression
Unit-4: Structure and phylogeny of Cyanobacteria and Actinomycetes

Paper-III: Practicals pertaining to Paper I and II

Paper-IV: Microbial diseases and Food microbiology

Unit-1:Structure and classification of Algae and Fungi, Microbial diseases
Unit-2:Structure and phylogeny of Archaea and Mycoplasma
Unit-3: Microbial diseases: host-parasite relationship, Microbial toxins
Unit-4: Food microbiology, microbial standards and criteria for different foods and products

Paper-V: Applied microbiology

Unit-1: Bioreactor, Down stream processing, product isolation and preparation
Unit-2: Natural resistance and defense, antigen and antibodies, diagnostics.
Unit-3: Chemotherauptic agents and antibiotics
Unit-4: Industrial production of organic acids, antibiotics,vaccines, enzymes, SCPs and bioful

Paper-VI: Practicals pertaining to paper IV and V

Biotechnology (Minor)

4 papers theory: 50x4=200 marks; 2 papers practical: 50x2=100 marks

[20% marks internal assessment or 40 marks per paper + 10 marks Internal assessment]

6 papers x 3 credits each = 18 credits

Paper-I. Cell biology and Macromolecules

Unit-1: Cell structure and organelles
Unit-2: Chromosomes, Cell cycle and cell division
Unit-3: Carbohydrates, Lipids, Proteins and Nucleic acids
Unit.-4: Enzymes

Paper-II. Molecular biology, r-DNA Technology and Genetic Engineering

Unit-1: Structure and function of DNA, Replication, transcription and Translation
Unit-2: r-DNA technology, restriction endonucleases, Southern, Northern & Western blotting
Unit-3: Cloning vectors, c-DNA library, gene sequencing sequencing
Unit-4: Genetically engineered plants and animals – case studies

Paper-III: Practicals pertaining to Paper I and II

Paper-IV: Microbiology, Virology and Immunology

Unit-1: Diversity of microbes, structure and classification of bacteria, replication
Unit-2: Structure and characteristics of Archaea, Actinomycetes, Mycoplasma, Algae and Fungi and their role in Biotechnology
Unit-3: Diversity and classification of viruses of animals, plants and bacteriophases
Unit-4: Natural resistance and defence, antigen and antibodies, diagnostics, Immunological diseases and their treatment.

Paper-V: Bioprocess Engineering, Bioinformatics, Bioethics and Patent

Unit-1: Bioreactor, Down stream processing, product isolation and purification
Unit-2: Industrial production of organic acids, antibiotics,vaccines, enzymes, SCPs and bioful
Unit-3: Biodegradation of xenobiotics, Bioremediation for environmental clean-up
Unit-4: Bioinformatics-introductory, Bioethics and Patenting

Paper-VI: Practicals pertaining to paper IV and V

Industrial Fish and Fisheries (Minor)

4 papers theory: 50x4=200 marks; 2 papers practical: 50x2=100 marks

[20% marks internal assessment or 40 marks per paper + 10 marks Internal assessment]

6 papers x 3 credits each = 18 credits

PAPER-I

Unit-I

Taxonomy: Recent classification, Data required for classification & their mode of collection, morphology of typical elasnobranch & telecast, Variation in forms & Structure used in taxonomic studies.

Commericlly important fish-Important orders, geuera & species of elasnobranch and telecast of India origin.

Unit-II

Food & Feeding: Natural food & feeding habite of fishes. Qualitative and Quantitative estimation, Food consumption & Stomach content analysis, seasonal change & food preferable, food selectivity & Feeding Intensity.

Unit-III

Anatomy: Alimentary Canal & Associated glands, Respiratory system & Accessory, respiratory organ, circulatory system, Nervous & haterialline system.

Unit-IV

Behaviour and Reproduction: Fish behaviours with reference to parental, care social & Migration and visual and reproductive; Reproductive system of fishes, different types, sex differences, sexual maturity, classification of maturity stages, pituitary gland of Carps.

PAPER-II

Unit-I

Growth & Ageing: Growth, Absolute and Relative growth, Isometric & allometric growth, Determination of growth length frequency analysis, Determination of Age.

Unit-II

Genetics: Principles, Chromosomes, Sex – determination, Hybridization and Cryopreservation.

Unit-III

Capture Resources: Inland capture fishery resources of India, Reverine, Reservoirs & Estuarine fisheries, Fisheries of Chilika lake, Conservation and Management of Resources; Aquarium – Construction, Maintenance of home aquarium, Ornamental fishers & fresh water aquarium Plants.

Unit-IV

Marine Fisheries Resources of India: Historical background and recent trends, problems of inshore fisheries, Hilsa fishery, saradine fishery & Shark fishery.

PAPER-III Practical pertaining to paper I and II

PAPER-IV

Unit-I

Pond Construction: Preparation and Management of fresh water pond. Soil and water characteristic, Construction of fish farm, fertilization Aquatic weeds and their eradication, Weeds fish.

Unit-II

Hatchery Technology: Fish BreeQuing, Induced breeding, hatchery technology, Transport of board fish & fish seed, fry preservation.

Unit-III

Aquaculture: Defination, history, Scope & types – Systerms of Aquaculture, composite fish, culture, polyculture, Air breathing Fish culture, Sewage Fed aqua Culture, Integrated fish culture; culture of pearl oyster, Shrimp culture, Brachish Water Aquaculture.

Unit-IV

Prawn Culture: Fresh Water Prawns, Breeding & Culture, Polyculture, Nuitrition and feeding technique, Fresh water Pearl Culture.

PAPER-V

Unit-I

Pathology: Fish diseases, Infections diseases like protozoan, bacterial & fungal etc. Common pathogens and pathological changes, precaution & control of disease.

Unit-II

Fishing Methods:

Unit-III

Post harvest technology: Principles of fish preservation (Traditional & advanced Methods). Processing of fish products & byproducts, Edible & Industrial Product.

Unit-IV

Fishery Economics: Defination, Application of Economics Principles, Law of Diminishing returns, risk & profits in Fisheries, Fish' Marketing & resource Management, Co-operative & Marketing.

Unit-V

Fisheries methods and Fisheries Extension: Crafts and gears; Fisheries as a tool in Rural Development, Extension strategies etc.

PAPER-VI :Practical pertaining to paper IV and V

Sericulture (Minor)

4 papers theory: 50x4=200 marks; 2 papers practical: 50x2=100 marks

[20% marks internal assessment or 40 marks per paper + 10 marks Internal assessment]

6 papers x 3 credits each = 18 credits

PAPER-I

Unit-I

Introduction, Definition, Scope, Origin and History of sericulture, world silk industry, silk industry in India, Silk producing states in India, World output of silk, Silk production in India, Export and Indigenous utility.

Unit-II

Characteristic of sericulture industry, its prospects and problems, different types of textile fibers, superiority and specialty of silk fibers.

Unit-III

Different types of silkworm and their systematic position, distribution, climate and host plant requirements; Anatomy of organ systems, silk gland, development and metamorphosis, Factors influencing growth and development.

Unit-IV

Moultinism, and Voltinism, Life History of Bombay-x-mori and Antharea Mylleta Morphology of egg, larva, pupa, adults.

PAPER-II

Unit-I

Agro-climate for mulberry Tasar/Eri/Muga cultivation; Soil quality, Physiochemical properties of soil for mulberry Tasar/Eri/Muga cultivation.; Manures, fertilizer and Water management.

Unit-II

Pruning and harvesting of mulberry Tasar/Eri/Muga leaves.; Economic of Mulberry Tasar/Eri/Muga cultivation.; Diseases of mulberry Tasar/Eri/Muga, leaves; Fungal, bacterial, Viral and mycoplasmal disease of mulberry, Tasar/Eri/Muga.

Unit-III

Mulberry Tasar/Eri/Muga pests – classification; Life cycle, Symptoms of infection of mulberry Tasar/Eri/Muga pests; Period of occurance and types of damage, Integrated pest management.

Unit-V

Infection and damage caused by caterpillars, grass hoppers, melay bugs scale insects; Damage caused by aphids, termiles, mites and slugs Root knot, mineral deficiency of mulberry, Tasar/Eri/Muga; control of diseases; Fungicides and methods of application; Weeds of mulberry Tasar/ Eri/ Muga and its control.

PAPER-III Practical pertaining to paper I and II

PAPER-IV

Unit-I

Silk Physiology – Food, Feeding behavior, food digestion, utilization and assimilation efficiency in silkworm; Metabolic rates and growth of larval, instars and moulting.

Unit-II

Mating behaviours of Bomby-x-mori A. Mylitta, P. Ricini patterns of egg laying, clutch size, Fecundity and fertility.

Unit-III

Viability of egg, Laval survival and mortality, Adult life span.

Unit-IV

Histology of silk gland and secretion of silk, kritting of cocoon, Eclosion.

PAPER-V

Unit-I

Collection and grading of cocoons and silks, silk seed technology, seed production techniques, Grairage.

Unit-II

Post cocoon technology, stifing, cooking and reeling techniques, manual and mechanical reeling, reeling machines.

Unit-III

Chemistry, structure and physical characteristics of different types of silks, silkworm genetics.

Unit-IV

Marketing of cocoons, Market set up and network, Role of co-operative, Testing of silk; Direct and indirect employment generation and potential in sericulture and silk industry.

PAPER-VI : Practical pertaining to paper IV and V

Food Science and Quality Control (Minor)

4 papers theory: 50x4=200 marks; 2 papers practical: 50x2=100 marks

[20% marks internal assessment or 40 marks per paper + 10 marks Internal assessment]

6 papers x 3 credits each = 18 credits

PAPER-I

Unit-I Basic Nutrition

i. Introduction to Nutrition, Food as a source of nutrients, function of foods Defination of nutrition, nutrients, adequate, optimum and good nutrition. Inter relationship between nutrition and health Visible symptoms of good health.
ii. Food Guide: Basic five food groups, how to use food guide.
iii. Types of nutrients present in food: Sources, Classification, Physiological function and deficiency diseases of protein, carbohydrate, lipids, Vitamins & Minerals. Importance of fruits and vegetables in Human diet and their nutrient value.

Unit-II Food Sanitation & Hygiene

i. Food contamination : Sources and transmission, water, air, sewage, soil and other agnets.
ii. Food Sanitation: Food Spoilage, Elementary idea about the Micro-organisms involved in spoilage, Principles of bacteriology of water for food sanitation.
iii. Hygienic handling of food: Preparation and handling: Temperature control and storage.

Unit-III Food Processing

i. Principles involved in Food deterioration' Microbial spoilage, Food enzymes, Insects, Temperature, Moisture, Oxygen, light etc.
ii. Methods of food preservation and processing, Principles of preservation, Preservation by temperature, by preservatives deep freezing, dehydration, fermentation, high osmotic pressure and by radiation.
iii. Milk and Milk Products: Composition, nutritive value, Milk Protein, effect of heat, acid and enzymes; Milk processing, Pasteurization, Milk products.
iv. Egg: Structure, Composition, nument value, quality of egg and its evaluation, effect of cooking, heating preservation of egg.
v. Fresh Foods: Meat: Classes of meat, composition nutrient value, aging, tenderization and curing of meat Fish: Composition, nutrient value, spoilage, preservation and spoilage.

Unit-IV Food preservation

i. Food Additivies: Need for food additive different categories of food additives-Antioxidants, Chelating agents, colouring agents, curing agents, Emulsions,

flavours and flavor enhancers, improvers, anti-caking and anti-foaming agents, Humectants, Sequestrants, leavening agnets, sweetening agents, pH control agents, stabilizers thickeness.

ii. Chemical preservatives used in the preparation of Jam, Jelly, Sauces, Chutneys and Pickles.

iii. Additives and food safety; Evaluation of safety, safety Vs. Hazards; Unintentional additives: Radio active fall-out agricultural contaminants.

PAPER-II

Unit-I Food Chemistry

i. Introduction to Food Chemistry; Moisture in foods: Hydrogen bonding, bound water, determination of Moisture.

ii. Pigments and Colours: Chlorophylls, Myoglobin and haemoglobin, anthocyanins, flavonoids, tannirs, betalins, quinines and xanthones, carotenoids, Synthetic colours.

iii. Flavours: The Sensation of flavor – Taste, Odour, Control of flavor and aroma in processed food: Measurement of flavours, flavor intensifier, Synthetic flavours.

Unit-II

i. Fats and Oils (Lipids): Occurrence in Foods and composition, Structure, Physical and Chemical properties, Rancidity, Reversion, Hydrogenation, effect of heat on fats and oils, Role of food lipids in flavours.

ii. Carbohydrates: Sources, classification: General properties Solubility, fermentation, acid hydrolysis, enzyme hydrolysis, effect of heat, sweetness, changes during cooking & Processing.

iii. Proteins: Sources, basic structure, Physical and Chemical properties: homogeneity, electrophoresis, sedimentation, Osmotic pressure, amphoterism, hydration, methods of denaturation and coagulation effect of heat or cooking on proteins.

iv. Vitamins and Minerals: Types of vitamins, sources, recommended intake and losses during cooking and storage of fat – soluble vitamins (Vit.-A, Vit.-D, Vit.-K) and water soluble vitamins (Thiamine, Riboflavin, Niacin, Folic acid, Biotin, Pantothenic acid, Vit.B -12, Vit.-C).

Minerals : Macronutrients (Calcium, Phosphorous, Sulphur, Magnesium, Sodium, Potassium & Chlorine) and Micronutrients (Iron, Zinc, Copper, Iodine, Chromium, Cobalt) Fortification and Restoration of minerals and Vitamins in food.

Unit-III Food Analysis

i. Food Sampling: Terminology, Statistical concept, Sampling errors, Preparation of food samples: Mechanical, enzymatic and chemical Methods, reliability of analysis.

ii. Proximate constituents and analysis: Moisture, Ether extract, Ash value, pH and acidity measurement, Solid content, Estimation of Moisture in food by overy drying, distillation or Kari Fischer Method: Estimation of total protein by Kjeldahl's Method.

iii. Estimation of Minerals: Phosphorous, Iron, Copper, Sulphur, Chloride.

Unit-IV Analysis of Food components

i. Some common additives- Sulphur dioxide, Sodium benzoate, Colours in foods.
ii. Sugars – By Volumetric and Polarimetric methods.
iii. Oils- Moisture, insoluble impurities, free fatty acids, refractive index, iodine value, saponification and unsaponip ficable matter.
iv. Milk – Fat, Total solids, Lactose, Proteins, Resazurin test, Preservatives in Milk.
v. Fruit Products: Analysis of JAM, fruit juices and Beverages, tomato sauce.

PAPER-III Practical pertaining to Paper I and II

PAPER-IV

Unit-I Micro-organisms associated with food and Toxicity

i. Micro-organisms : Bacteria, Molds, Yeast.
ii. Food as a substrate for Micro-organisms: pH, Moisture requirement: Water activity, Oxidation – reduction potential, nutrient – content, combined effects of factors effecting growth.
iii. Chemical changes caused by Micro-organism.
iv. Naturally occurring toxins in foods.
v. Toxicity of Chemical additives:Preservatives, antioxidants, colouring substances, flavours, sweeteners.
vi. Mycotoxins, carcinogens, Toxic metals.

Unit-II Contaminating and spoilage of foods

i. Cereals and cereal products.
ii. Sugars and sugar products
iii. Vegetables and fruits.
iv. Milk and Milk products.
v. Eggs and Poultry.

Unit-IV Foods in relation to disease

1

i. Bacterial: Botulism, Infant botulism, Salmonellosis, Gastroenterities, Shigellosis. Non-bacterial: Fungal illness, viral health hazards.
ii. Investigation of food – borne diseases outbreaks: Objectives of investigation, Personnel involved in investigation, materials and equipment required, field investigation, laboratory testing, interpretation and application of results, preventive measures.

Unit-V Production of cultures for food fermentations

i. General principles of culture maintenance and preparation – bacterial cultures, yeast culture and mold cultures.

ii. Foods and enzymes from micro-organisms : As food: Single cell protein (SCP) Fats, Amino acids, As Enzymes: Amylases, Invertase, Pectolytic enzymes, Proteolytic enzymes.

PAPER-V

Unit-I Food Quality

i. Sensory evaluation: Characteristic requirements for conducting sensory tests, Evaluation Card – Types of tests : Difference tests, Rating test, Sensory tests, Descriptive tests.
ii. Objective evaluation: Basic guidelines, Tests for objective evaluation – Chemical methods, Physico Chemical methods, Microscopic examination, Physical methods.
iii. Instruments used for texture evaluation.

Unit-II Food Adulteration

i. Various types of adulterants, Methods of detection.
ii. Principles of food packaging: Types of containers, food packaging materials and forms, package testing, safety of food packaging, environmental considerations, Govt. regulation of food and nutritional labeling.

Unit-III Food Canning Technology

i. Development of canning industry, heat sterilization of canned food, rigid metal container, glass container, and closures, flexible packaging for thermo processed foods.
ii. General canning procedures: Canning procedures for fruits, vegetables, meats & poultry.
iii. Factory affecting nutrient content of canned food.

Unit-IV Food Quality Control

i. Quality Control in Agricultural produce.
ii. Quality contrl in production and marketing of fruit products – Fruit Products Order.
iii. Food standard and certification for Quality control: Indian Standards Institution – Agmark standard & Codex Alimenatarius.
iv. Quality control of Food Products for export.
v. Role of Trade and industry in Food Quality Control.
vi. Effective implementation of Food laws and regulation – Food Adulteration Act., Fruit Products Order (FPO), Meat product order, Cold Storage Order, Other Acts and orders.
vii. Agencies responsible for quality control: International Agencies, State Agencies, Private Agencies, Processing Industries.

PAPER-VI : Practical pertaining to paper IV and V

B.Sc. ZOOLOGY (Minor)

There will be two theory papers of 50 marks (Semester 40 + Internal 10 marks) having 3 credits each and one practical paper of 50 marks having 3 credits in a semester.

Paper-I: Animal Diversity (Non Chordata)

- Unit I: Protozoa and Porifera
- Unit II: Coelenterates and Helminthes
- Unit III: Annelida and Arthropoda
- Unit IV: Mollusca and Echinodermata

Paper-II:

- Unit I: Cytology and Histology
- Unit II: Taxonomy and Developmental Biology
- Unit III: Genetics and Molecular Biology
- Unit IV: Ecology and Evolution

Paper-III: Practicals related to Paper-I and II

Paper-IV: Animal Diversity (Protochordata and Chordata)

- Unit I: Protochordata
- Unit II: Pisces
- Unit III: Amphibia and Reptiles
- Unit IV: Aves and Mammals

Paper-V:

- Unit I: Comparative Anatomy
- Unit II: Physiology and Biochemistry
- Unit III: Endocrinology and Immunology
- Unit IV: Economic Zoology

Paper-VI: Practicals related to Paper-IV and V

Outline of the Syllabus for Computer Application in UG Course for Universities of Odisha

Subject	Semester-I	Semester-II	Semester-III	Semester-IV	Semester-V	Semester-VI	(Credits)
Minor-I	Funda of IT P1 3—0—0	LOC 3—0—0 P2 PC Software 1—0--2 P3	C-Programming P4 3—0—0	DS P5 3—0—0	C&DS Prac P6 0—0—3	Project DS/Oracle/Word/excel sheet/power point 1—0—2	3X6= 18
Minor-II	Funda of IT P1 3—0—0	LOC P2 3—0—0	PC Software P3 1—0--2	C-Programming P4 3—0—0	DS 3—0—0 P5 C&DS Prac 0—0—3 P6		3X6= 18
Major	Funda of IT P1 3—0—0	C-Programming P4 3—0—0	Programming in C++ P7 3—0—0	DBMS P10 3—0—0	OS P13 3—0—0	Comp Network P16 3—0—0	3X18= 54 L—Lecture T—Tutorial P—Practical L--T—P 3—0—0 0—0—3 1—0—2
	LOC P2 3—0—0	DS P5 3—0—0	MFCS P8 3—0—0	Computer Organisation P11 3—0—0	Numerical method P14 3—0—0	Java Prog P17 3—0—0	
	PC Software Prac P3 1—0--2	C&DS Prac P6 0—0—3	C++ Prac P9 0—0—3	DBMS Prac P12 0—0—3	Numerical method Prac P15 0—0—3	Java Prac P18 0—0—3	
Credits	**3x6=18**	**3x7=21**	**3x7=21**	**3x7=21**	**3x7=21**	**3x4+8=20**	**122**

Modification or suggestion of the above subjects may be informed by e-mail jayarampradhan2011@gmail.com for finalisation.

Syllabus for Computer Application in UG Course for Universities of Odisha

Major

Semester-III

P7 Programming in C++

P8 MFCS(MATHEMATICAL FOUNDATINS OF COMPUTER SCIENCE)

P9 C++ Practical

Semester-IV

P10 DBMS

P11 Computer Organisation

P12 DBMS Practical (Data Base Management System)

Semester-V

P13 OS(Operating System)

P14 Numerical Method

P15 Numerical Method Practical

Semester-VI

P16 CN(Computer Network)

P17 Java Programming

P18 Java Practical

Major

Semester-III

P7. Programming in C++

Unit-I

Object-Oriented programming paradigm, Basic data types, variables, operators, functions, objects, classes, constructors, destructors, operator overloading, Inheritance, derived classes, multiple inheritance, abstract classes, member classes, pointers, virtual functions, polymorphism.

Unit-II

C++ Programming Language Introduction, Programming paradigm, support for Data Abstraction, support for Object Oriented programming, Declaration and constants. Expression and statement. Function and files, linkage, How to make a library, Functions, classes and objects, definition of class, class declaration: Data numbers. Member functions, private and public members. Default labels, Data Hiding and Encapsulation. Arrays within a class. Class function class declaration, scope resolution operator (: :), private and public member function. Nesting of member functions.

Unit-III

Defining class and objects in C++, constructors and Destructions, operator overloading type conversion, Inheritance, polymorphism, Virtual functions

Unit-IV

Templates, Function & class templates, Exception handling, Try, Throw & Catch constructs. File handling in C++

Books recommended

1. Object-Oriented programming with C-E. Balguruswamy (TMH)
2. Object-oriented programming in TURBOC-R.Lafore (Galgotia)
3. Object oriented programming with C++, S. Sahay, Oxford University Press.

P8. MFCS (MATHEMATICAL FOUNDATINS OF COMPUTER SCIENCE)

Unit-I:

Set, Relations and functions :

Definition of sets and sub sets, Intersection, Union and Complements, De Morgans law Cardinality, Relations- Equivalence relations etc Mappings one- one, onto etc.

Unit-II:

Logic operators like AND, OR etc, Statement notations, Connectives, Statement formula and truth tables, theory of inference for statement calculus. Relation and ordering, function and recursion.

Unit-III: Group and Subgroups:

Monoids, Semi groups, Group Table and axioms, permutation Groups, Subgroups, co-sets, normal subgroups and its applications, Lagrange Theorem.

Unit-IV: Determinant:

Properties of determinants, Determinants to transpose and inverse.

Solving of Linear equations, Solution of Matrices of the form AX=B, Row\ Columns, operations. Gaussian Elimination, Inversion of matrix.

Linear Products and Norms.

Length, angle, direction cosines, orthogonalisations.

Books;

1. Korthage,R.R ; Discrete Computational Structures.Academic press.1974,
2. Preparata ,F.R ,Yeh R.T : Introduction to Discrete Structures ,Addison- Wesley 1973.

P9. C++ Practical

1. Write a program which accept temperature in Farenheit and print it in centigrade.
2. Write a program which accept principle, rate and time from user and print the simple interest.
3. Write a program which accepts a character and display its ASCII value.
4. Write a program to swap the values of two variables.
5. Write a program to calculate the total expenses. Quantity and price per item are input by the user and discount of 10% is offered if the expense is more than 5000. solution
6. Write a program to determine whether the seller has made profit or incurred loss. Also determine how much profit he made or loss he incurred. Cost price and selling price of an item is input by the user. solution
7. If the ages of Ram, Sulabh and Ajay are input by the user, write a program to determine the youngest of the three. solution
8. Write a program to check whether a triangle is valid or not, when the three angles of the triangle are entered by the user. A triangle is valid if the sum of all the three angles is equal to 180 degrees.
9. Write a program using function which accept two integers as an argument and return its sum. Call this function from main( ) and print the results in main( ). solution
10. Write a function to calculate the factorial value of any integer as an argument. Call this function from main( ) and print the results in main( ). solution
11. Write a function that receives two numbers as an argument and display all prime numbers between these two numbers. Call this function from main( ). solution
12. Raising a number to a power p is the same as multiplying n by itself p times. Write a function called power that takes two arguments, a double value for n and an int value for p, and return the result as double value. Use default argument of 2 for p, so that if this argument is omitted the number will be squared. Write the main function that gets value from the user to test power function. solution
13. Write a function called zero_small() that has two integer arguments being passed by reference and sets the smaller of the two numbers to 0. Write the main program to access the function.
14. Write a C++ program to swap first and last element of an integer 1-d array. solution
15. Write a C++ program to reverse the element of an integer 1-D array. solution

Semester-IV

P10. DBMS (data base management system)

UNIT – I

Overview of DBMS concepts, Data abstraction, Architecture of DBMS, Data independence, Data models, Data base Languages, DBA, Data base users, Data base system structure, Data modeling using Entity-Relationship model, mapping constraints, weak entities, Extended E-R features : specialization, generalization, aggregation.

UNIT – II

Relational model : Structure, concepts of keys, Integrity Constraints, Relational Algebra : Select, Project , Joint, Division operations, Set theoretic operations : Union, Intersection, Set difference, Cartesian-product. Tuple relational calculus, domain relational calculus, Modifications on a DB, concept of views, view definition, updates through views.

UNIT-III

Relational DB design : DB Design considerations, concept of different forms of dependencies & normalization, normalization using functional dependencies : INF, 2NF, 3NF, BCNF, Normalization using multi-valued dependencies : 4NF, Join dependencies, 5NF.

UNIT –I V

Querying on a DB using SQL : Basic query structures. The select-where-from clauses, Rename operations, Tuple variables, Set operations, Aggregate functions, nested sub-queries, Derived relations, views, Delete, Insert & update operations, Data-Definition language, Indexes in SQL, Steps in query processing, cost estimation, selection operation, Join operations, Evaluation of expressions, Transformation of relational expressions, Query optimization : Cost-based optimization & heuristic-optimization.

TEXT BOOKS

1. An Introduction to Database systems - By C.J. Date (Narosa)
2. An Introduction to Database systems - By B.C. Desai (Galgotia)

Reference books :

1. Databse System concepts : A silberscsatz, H.F. Korth. & S. Sudarshan (MC Grow-Hill)
2. Fundamentals of Database Systems : R. Elmasri & S.B. Navathe, Addison Wesley longman.

P11. Computer Organisation

UNIT I

Basic Computer Organization

Fetching a word from memory, storing a word in memory, Register transfers, performing arithmetic and logic operations, Execution of a complete instruction, Hardwired control, CPU-Memory interaction, Multiple-bus organization.

UNIT - II

Arithmetic Logic Organization

Addition and subtraction in I's Complement and 2's complement form, Binary adder, Parallel adder, Carry Look ahead Adder, Multiplication, Booth's algorithm, Division, Floating point operations. (addition and subtraction).

UNIT – III

CPU Organization

Instructions and Instruction sequencing, Instruction formats (zero, one, and two address instructions), Addressing modes (Register, Absolute, Immediate, Indirect, Indexed, Auto-increment and Auto decrement), Basic input-output operations, stack and queues, subroutines.

UNIT - IV

Input - Output Organization

Addressing Input-output Devices, Interrupts, Handling multiple Devices, Vector interrupts, Simultaneous Requests, Direct Memory Access (DMA), Channels.

BOOKS

1. Hamacher : Computer Organization (McGraw-Hill Int.)
2. Mano, M.M. : Computer System Architecture 3/ed (PHI)

P12. DBMS Practical (Data Base Management System)

1) Create a student data base with relevant information. Write SQL statement to
   i) Display the number of students enrolled under each of the courses.
   ii) Find the student with career first class and the number of such students.
2) Create an employee data base. Write SQL statement to
   a) Display the number of employee working under each of the departments.
   b) Find the number of employees with more than 20 years of experience.

3) Create a data base to maintain information about books and borrowers of a library. Write procedures for issue and return of books.

4) Create a data base to maintain information about books and borrowers of a library. Write Queries: (i) to know about availability of a book
   (ii) List books issue to a borrower.

5) Create a data base to maintain information about passengers those who have booking in different flights. Write Queries to find
   (i) The passenger details given a passenger reservation code.
   (ii) Passenger those who have booked returned tickets in the same flight.

6) Create a data base to maintain information about customers and their account details. Write procedures to deposit money and fund transfer after proper verifications.

7) Create a data base to maintain information about customers and their account details. Write procedures to perform balance check and withdrawal after proper verifications.

8) Create a data base to maintain information train timing of different trains passing through a station. Write SQL statement to process queries like:
   a. train number display its arrival and departure times.
   b. Given a time period displays the trains passing through the station during that time.

9) Create a data base to store student performance in an entrance examination. Prepare a merit list of those candidates who qualified after scoring a minimum mark.

10) Given two separate files containing customer information merge the files after removing duplicates, if any.

11) Create a data base to maintain the call history of different mobile users indicating the caller and caller ID along with the time of call.

12) Create a data base to maintain information about customers in super market. Display the name of buyers (those who buy items more than 8000/ in a month)

13) Create a data base to maintain information about Doctor visiting a nursing home. Prepare weekly payment details based on the hours for which they have offered service during the week.
14) Create a data base to maintain marks secured by students in an entrance examination. Find the average mark and display the name of the students securing more than the average.

15) Create a data base to maintain information about customers of LPG gas dealer. Display a list of users those who used more than 12 Gas Cylinders in a year.

Semester-V

P13. OS (Operating System)

Unit-I:

Review of operating system concepts, batch processing, simple monitor, multiprogramming, multiprocessing, time sharing, real-time systems. Operating system services: the user view, the operating system view

File systems: Access methods, allocation methods, directory systems, file protection

Unit-II:

Memory Management concepts, swapping, paging and segmentation, Concepts of Virtual memory, overlays, demand paging, page replacement techniques, page replacement and allocation algorithms

Unit-III:

CPU scheduling: Scheduling concepts, Scheduling algorithms and their evaluation

Disk scheduling: first come First Serve scheduling, Shortest seek time first, sector queuing

Unit-IV:

Concepts of Deadlock, deadlock problems, deadlock characterization, deadlock prevention, deadlock avoidance, deadlock detection and recovery, Support for Concurrent process, Concurrency conditions, critical section, semaphores, inter process communication

Books:

1. Operating System Concepts: Slibeschatz, Galvin
2. Operating systems: A. S. Tanenbaum PHI

P14. Numerical Method

Unit-I:

Solution of Algebraic and Transcendental equations, Bisection method, False Position method, Newton-Raphsons method.

Unit-II:

Solution of simultaneous linear equations: Gauss-elimination method, Gauss-Jordan elimination method, Gauss-Seidel Iterative method, ill conditioned equations

Unit-III:

Interpolation: Polynomial interpolation, Lagrange interpolation, difference tables, error detection from difference table, Newton forward interpolation, Newton backward interpolation, Newton general interpolation, Integration by Trapezoidal rule, Simpson $1/3^{rd}$ rule differentiation

Unit-IV:

Solution of differential equations: Taylor's series method, Euler method, modified Euler method, Runga Kutta method

Books:

1. Introduction to Numerical Analysis: S. S. Sastry PHI
2. Computer based algorithm by E.V. Krishanamurty and S. K.Sen East wesly)
3. Computer Oriented Numerical Methods: V. Rajaraman

P15. Numerical Method Practical

Q1. Write computer program to find the root of an algebraic equation by

i) Bisection method
ii) False position method
iii) Newton Raphson method

Q2. Write computer program to find the root of an algebraic equation x^y= N and hence compute square root(N), cube root(N) for a given integer N by Newton Raphson method.

Q3. Write computer program to solve an algebraic equation by Gauss elimination method.

Q4. Write computer program to solve an algebraic equation by Gauss Jordan elimination method.

Q5. Write computer program to solve an algebraic equation by Gauss seidel iterative method.

Q6. In the above programs of question (3) (4) & (5) put ill condition equation as the input and test the output.

Q7. Write computer program for Lagrange interpolation.

Q8. Write computer program for integration using Trapezoidal rule.

Q9. Write computer program for integration using Simpson rule.

Q10. Write computer program for Runga Kutta method

Semester-V

P16. CN (Computer Network)

Unit-I:

Goals of Computer Network, application of network, network architecture, ISO reference model, introduction to public networks, ARPANET and SNA

Transmission media: Magnetic, Twisted pair, base band, coaxial cable, fiber optics, communication satellites

Unit-II:

Analog transmission: The telephone system, Modems, RS-232-C

Digital Transmission: Pulse code modulation (PCM), Transmission and Switching: Frequency division and time division multiplexing, circuit switching, packet switching

ISDN services, ISDN system architecture, the digital PBX, the ISDN interface

Terminal handling: Polling, Multiplexing versus concentration

Unit-III:

Designing issues in data link layer: framing, error control, flow control, link management

Protocols, elementary protocols, unrestricted simplex protocols, simplex stop-and-wait protocol for a noisy channel, one bit sliding window protocol with pipelining, protocol using selective repeat.

Unit-IV:

Virtual circuits and data grams, routing algorithms, congestion control algorithms

Network layer in public networks, ARPANET, Satellite networks, packet radio networks

Books:

1. Computer Networks: A. S. Tannebaum
2. Computer Networks: A. Ahuja

P17 Java Programming

Unit-I:

An overview of object oriented programming and Terminology : Abstraction variable and methods, encapsulation interfaces, message: object communicating with objects, modularity, classification, inheritance.

Unit-II:

Overview of JAVA Language, Java development environment, Language fundamental : how java differs from c: Programs structure and environment name space: packages, classes and members, Commands, no processor, Unicode and character escape, primitive data type, reference data type objects, array, strings, operators, statement, exceptions and exception handling .

Unit-III:

Classes and objects in Java: introduction to class and objects, objects creation, class variables class methods, object destruction, subclass and inheritance overriding methods, data hiding and encapsulation, abstract class and interface.

String and array: strings arrays and utility classes

Input/output: Streams standard system streams. IO streams, filtered stream.

Unit-IV:

Abstract windowing toolkit: AWT overview, graphics, fonts, colors, images, Java controls, layout components, new AWT features.

Applets Introduction to Applet designing basics, drawing graphics, handling events, reading applet parameters, images and sounds, JAR files, applet security restriction, signed applet-weaving Applet into web pages.

References

1. "A complete reference for Java" Herbert Schildt.
2. "Java in Nutshell" David Flanagan, O'Reilly
3. "Java programming " Balaguruswami

P18 Java Practical

1. Use the switch-case concept for a given string, return true if the string starts with "hi" and false otherwise.
2. Use the conditional control structure for given three int values, A B C, return the largest.
3. Use the conditional control structure for given 2 positive int values, return the larger value that is in the range 10..20 inclusive, or return 0 if neither is in that range.
4. Given a string, return a new string where the last 3 chars are now in upper case. If the string has less than 3 chars, uppercase whatever is there. Note that str.toUpperCase() returns the uppercase version of a string.
5. Given n of 1 or more, return the factorial of n, which is n * (n-1) * (n-2) ... 1. Compute the result recursively (without loops).
6. The fibonacci sequence is a famous bit of mathematics, and it happens to have a recursive definition. The first two values in the sequence are 0 and 1 (essentially 2 base cases). Each subsequent value is the sum of the previous two values, so the whole sequence is: 0, 1, 1, 2, 3, 5, 8, 13, 21 and so on. Define a recursive fibonacci(n) method that returns the nth fibonacci number, with n=0 representing the start of the sequence.
7. Given a non-negative int n, return the sum of its digits recursively (no loops). Note that mod (%) by 10 yields the rightmost digit (126 % 10 is 6), while divide (/) by 10 removes the rightmost digit (126 / 10 is 12).
8. Given a non-negative int n, return the count of the occurrences of 7 as a digit, so for example 717 yields 2. (no loops). Note that mod (%) by 10 yields the rightmost digit (126 % 10 is 6), while divide (/) by 10 removes the rightmost digit (126 / 10 is 12).
9. Write a program to find the number of and sum of all integers greater than 200 that are divisible by 7.
10. Given any number, write a program using *while* loop to reverse the digits of the number.
11. Write a program to determine the sum of the following harmonic series for a given value of n:
    1+1/2+1/3+ ----- +1/n The value of n should be given interactively through the keyboard.
12. Write a program that computes the area of a triangle. The sides of triangle should be given interactively through the keyboard.
13. Write a program to sort a set of given numbers using one dimensional array.
14. Write a program to add two 3 by 3 matrices using two dimensional arrays.
15. Write a java code to find the distance from Ranchi to major cities of India.
    Hint: Create an String array of major cities and integer array of distances. User gives the city name and the same is searched (use binary search) in the respective array and displays result.

Syllabus for Computer Application in UG Course for Universities of Odisha

Minor-I

Semester-I

P1 Fundamental of IT

Semester-II

P2 LOC (Logical organisation of Computer)

P3 PC Software (Personal Computer Software)

Semester-III

P4 C-Programming

Semester-IV

P5 DS (Data Structure)

Semester-V

P6 C&DS Practical

Minor-II

Semester-I

P1 Fundamental of IT

Semester-II

P2 LOC (Logical Organisation of Computer)

Semester-III

P3 PC Software (Personal Computer Software)

Semester-IV

P4 C Language

Semester-V

P5 DS (Data Structure)

Semester-VI

P6 C&DS Practical

Minor-I & Minor-II

P1 Fundamental of IT (FUNDAMENTAL OF INFORMATION TECHNOLOGY)

Unit – I

Functional block diagram of digital computer, Functions of Central unit and ALU in CPU. Concept of primary memory (RAM & ROM) and secondary memory- Magnetic Hard Disks, CD-ROM etc., Functions of I/O devices-Display unit-Keyboard, dot matrix printer, Line Printer, Laser Printer, Ink-Jet Printer.

Classification of Computers – Micro, Mini Computers and mainframes, Evolution of personnel Computers.

Unit – II

Algorithm Development:

Problem analysis and identification, Steps in program development, Outputs and Inputs, flow chart, decision table, pseudo codes and algorithms, algorithm to program coding, Testing and Debugging etc. high level language and programmer model of computer system.

Unit-III

Programming language classification, machine language, Assembly language, Third generation language, fourth generation Languages, Programming techniques, Top-down design, Bottom-up design, Modular design and structured programming.

Unit –IV

Boolean Algebra: Truth Table, AND, OR, NOT operators, De-Morgan's theorem.

Binary numbers, octal numbers, Hexadecimal numbers, decimal, octal, hexadecimal-conversion from one to another. Representation of decimal, octal, hexadecimal numbers, fractional numbers and signed numbers 1's compliment, 2's compliment forms, Binary Arithmetic-Addition, Subtraction, Multiplication, division.

Books:

1. B. Ram: Computer Fundamentals

Reference

2. T. C. Bartee: Digital Computer Fundamentals
3. Fundamentals of Computer by V. Rajaraman.
4. Computer for beginners by Jaggi & Jain.

P2 LOC (LOGICAL ORGANIZATION OF COMPUTER)

Unit - I : Data representation: Number System (Binary, Octal, Hexa decimal) Representation of integers, floating point numbers, ASCII, EBC DIC, Digital Logic: Boolean function, Truth Table, AND, OR, NOT, NOR, NAND, XOR, XNOR Gates, NAND gate as universal gate.

Unit – II : Arithmetic Circuit: Binary Adder (Half & Full adder), Half Subtraction, Full substractor, Subtraction through Adder circuit, Sequential Logic circuit: Flip Flops, R-S Flip Flop, J-K FF, Master Slave Flip - Flop, counters, Registrars, Machine Instruction Format, Addressing modes.

Unit-III: Fetching a word from memory, storing a word in memory, Register transfers, performing arithmetic and logic operations, Execution of a complete instruction, Hardwired control, CPU-Memory interaction, Multiple-bus organization.

Unit-III:

Instructions and Instruction sequencing, Instruction formats (zero, one, and two address instructions), Addressing modes (Register, Absolute, Immediate, Indirect, Indexed, Auto-increment and Auto decrement), Basic input-output operations

Unit-IV:

Instructions and Instruction sequencing, Instruction formats (zero, one, and two address instructions), Addressing modes (Register, Absolute, Immediate, Indirect, Indexed, Auto-increment and Auto decrement), Basic input-output operations

BOOKS:

1) Digital Logic & Computer Design by M. Mano.
2) T. C. Bartee: Digital Computer Fundamentals

P3 PC Software (Personal Computer Software)

- Introduction to Personal Computers
- Overview of Basic Operating System Commands
- Introduction to Word Processing
- Examples of some popular WP packages
- Uses and applications of word processors
- Creation, Editing, Formatting of Documents
- Global search and Replacement of text
- Spelling checker
- Creating a presentation
- Formatting Slides
- Slide transition, adding special effects in slides
- Inserting pictures, sound, chart etc in slides
- Spreadsheets
- Introduction to spreadsheet
- Examples of some popular spreadsheet packages
- Uses of spreadsheet packages
- Building spreadsheets using formulas, conditional calculations, built in function.
- Database Utilities : sorting, filtering, extracting etc.
- Graph-Plotting facilities
- Writing macros and spreadsheet menus to build a user-interface to the spreadsheet packages.

1.Manuals of the PC Software.

2. Held, G. : IBM PC & PC XT User's Reference Manual, 2nd Edn. B.P.B. Publications, 1987.
3. Coffron, J.W. : The IBM PC Connection, B.P.B. Publications, 1987.

P4 C-Programming

Unit-I

An overview of C Language, History of C Language, the structure of a C program, Data types, Variables and constants, Integer constants, character constants, Floating constants, Logical constants, string, constants, variables, Integer variables, Real variables, character variables, Floating variables, logical variables, string variables, declaration , Scope of variables, Local variables and Global Variables,

Unit-II

Signed, unsigned, Long and short, storage classes specifiers-extern, auto , static, register. Expressions, Operators and Assignment Statements Operators, Arithmetic Operator, Relational Operators, Logical Operators, Bitwise operator, The ? operator, The comma as an operator and the precedence of operators Expressions, Definition, Type conversion n expressions, type casting and Assignment statements, General form, Type conversion n assignments, variable initialisations.

Unit-III

Control statements If General forms, Nested ifs, The if-else-if ladder, The ? as an alternative to if, switch general form, Type conversion in assignments, variable initialisations, nested switch statements, for, while, do – while, break, continue, it ( ) function, go to and label declarations, console I/O, un-formated console I/O, Printf( ), sprint f(), scanf() Arrays, declaration, single dimensional arrays, Two dimensional arrays, and Multi dimensional arrays.

Unit-IV

General form, declaration and prototypes, Function arguments, The return statement, Returning values from a function, function call, call by value, call by reference, scope rules of functions, calling functions with arrays, and Recursion.

Pointers The & and * operators, pointer expressions, pointer assignments, pointer arithmetic, pointer comparison. The dynamic allocation functions malloc and alloc. Structures and Unions and User-defined variables. Structures. Baisc structures, Declaring a structure, Referencing structure elements. Array of structures, passing structures to functions.

Book:

1) Balguruswamy E: C programming

Reference Books

2) A.M. Tannenbaum and others: Data structure using C-PHI, 1992.

P5 DS (Data Structure)

Unit – I

Data Type-Data object- Abstract Data Type -Data structure.

Notion of an Algorithm-Complexity measures: Rate of growth. Basic time analysis of an algorithm. Order notion-detailed timing analysis-space complexity.

Unit – II

Arrays. Arrays and their representation-single and multidimensional arrays, Row major and column major ordering-Address calculation.

Unit – III

Linked Lists, Singly and Doubly Linked Lists-Insertion & Deletion operations on lists-representation of sparse matrices and polynomials using lists, circular lists, Stacks and Queues.

Stacks and Queues- Representation and manipulation-Uses of stacks and Queues-Recursion.

Unit – V

Trees – Binary-Representation of Trees – Tree Tree traversal algorithm (Inorder. Preorder & Postorder)

Book

1. S.Lipschutz : Introduction to Data structures, MC.Grow-Hill, ch. 1,2,3,4,5,6,7,

Reference Books

2. A.M. Tannenbaum and others: Data structure using C-PHI, 1992.
3. Robert L. Kruse : Data structures and programme Design – Prentice Hall of India, 1987.

P6 Practical on C & DS Programming (To do any five from each)

Write C programs for the following questions.

1. Input a set of numbers and find the smallest among them.
2. Find the roots of a quadratic equation.
3. Find the factorial of any number.
4. Read Product No. and Cost of a product. Compute the net price after deducting discount as follows:
   A) If cost < Rs. 500/- No discount
   B) If cost is equal or > than Rs 500/- but less than Rs 1000/- then allow 10 % discount
   C) If cost is equal or > than Rs 1000/- then allow 15 % discount
5. Find the sum of the digits of an input number.
6. Find Prime numbers between 2 to 1000.
7. Read two numbers and perform addition, subtraction, multiplication and division as indicated using Switch---Case statement.
8. Read a matrix and find the row-sum and column-sum separately.
9. Find the sum of two matrices after verifying the conditions for the operation.
10. Read N numbers into an array and then find the position of a given number in the array.
11. Arrange a given set of numbers in ascending order.
12. Find the sum of the following series using function.

    s=1 + 1/3! + 1/5! + ... upto n terms.

13. Declare a pointer array to store integers and find the sum of the array elements.
14. Read a string and find the length of the string without using any library function.
15. Declare a structure with the following student data: Roll, Name, Course, Marks in 5 subjects. Read data for 10 students and display the Roll number and name of the student securing the highest mark.

DS Programming

Write C programs to implement the following problems relating to data structures.

1. Create a Stack and insert 10 items into it and display the items of the Stack from top end of the Stack.

2. Create a Stack to store the names of the days in a week. For example, Sunday, Monday etc. and count the number of items in the Stack.

3. Create a Stack and write procedures to implement PUSH and POP operations on it.

4. Create a Queue data structure and write procedures to implement Insertion and Deletion operations on it.

5. Create a Queue to store the names of the months in a Year. For example, January, February, ... etc. and count the number of items in the Queue.

6. Write procedures to implement Insertion and Deletion operations on a Circular Queue.

7. Create a Singly linked list with 5 nodes containing the values 10, 20, 30, 40, and 50.

8. Insert 25 into the linked list such that the list remains in order with ascending values.

9. Create a Singly linked list with a sequence of input data. Write a procedure to delete the i-th node of the linked list.

10. Create a Doubly linked list to store a sequence of input values. Display the contents of the list by traversing from the Rear end.

Environmental Science (Major)

12 papers theory: 50x12=600 marks; 6 papers practical: 50x6=300 marks

18 papers x 3 credits each = 54 credits

[Marks Distribution: 20% Internal Assessment + 80% End Term Examination i.e. 10 marks per paper for Internal Assessment + 40 marks per paper for End Term]

Paper I Fundamentals of Environmental Science

UNIT I: Multidisciplinary Nature of Environmental Science: Introduction to Environmental Science, its Scope and its Multidisciplinary nature; Historical events in relation to growth of environmental science; Importance of Environmental Science and necessity of public awareness.

UNIT II: Origin of Life on Earth: Concepts on origin of our Universe (Big bang theory) and our solar system (Nebular condensation theory); Origin of earliest life forms: Millers experiment, Origin of early prokaryotes, Origin of early eukaryotes.

UNIT III: Evolution Life on Earth: Theories of biological evolution: Basic outlines of Lamarkism, Darwinism, Mutation theory and Hardy-Weinberg principle; Geological time scale; Mass extinctions; Brief account on evolution of Human.

UNIT IV: Human Society and Environment: Evolution of human society: Hunting, Gathering, Agricultural and Industrial Society; Human Population Explosion: Factors affecting population growth (Birth and death rate, migration, fertility age structure); Environmental impacts of population explosion; Control of population growth: family planning, birth control methods.

Paper II Abiotic Environment

UNIT I: Hydrosphere: Distribution of water in Hydrosphere; Hydrology cycle: Evapotranspiration, Condensation, Precipitation, infiltration, runoff; Unique properties of water; Ground water: Types of aquifers, Vertical distribution/zones of groundwater, Artesian wells; Surface Water: Lentic and Lotic aquatic systems.

UNIT II: Atmosphere: Composition of the atmosphere: variable and stable components; Vertical variations in atmosphere: atmospheric layers, pressure change, temperature change, change in composition; Earth-Sun relationships and seasonal variations (Solstices and equinoxes); Indian Monsoon; Low pressure-Depression and Cyclone

UNIT III: Geosphere: Structure of earth's interior; Plate tectonics and continental drift theory; Classification of rocks: igneous, metamorphic and sedimentary; Different land

forms created by the work of rivers, ground water, wind and glaciers; Preliminary idea on Earthquake, Tsunami, Volcanoes, and Landslides.

UNIT IV: Lithosphere: Weathering (physical, chemical and biological) of rocks and formation of soil; Components (Mineral and Organic) of soil and their importance; Soil profile or soil horizons; Soil classification, Soil types of India; Soil erosion and their control measures.

Paper III: Practical pertaining to Paper I and II

1. **Major Experiment:**
   i. Study of soil profile of a particular area.
   ii. Measurement of evapotranspiration using potted plant.
   iii. Analysis of soil texture (using differential sieve method).
   iv. Assessment of water deficit stress on potted plants.
2. **Minor Experiment:**
   i. Measurement of rainfall over a particular area.
   ii. Measurement of wind speed by using anemometer.
   iii. Survey of number of lotic and lentic aquatic systems in a particular locality.
   iv. Identification of soil type of nearby locality.
3. **Identification of rock samples**
   Igneous, Sedimentary and metamorphic rocks

Paper IV Ecology and Ecosystems

UNIT I: System Ecology: Scope and subdivisions of Ecology; System concept in Ecology; Classification of ecosystems; Concept of Biomes, major Biomes of the world; Component parts of an ecosystem: Biotic components (Producer, Consumer and Decomposers), Abiotic factors of an ecosystem (Water, Temperature and Light).

UNIT II: Functions of an Ecosystem: Biogeochemical cycling of C, N, P & S; Food Chain, Food Web & Trophic levels, Types of food chain; Ecological pyramids: Pyramid of number, biomass & energy; Energy flow in Ecosystems: Concept of Energy, Energy source in Ecosystem, Laws governing energy transformation, Lindeman's Trophic-Dynamic concept Energy flow models.

UNIT III: Ecological Productivity: Concept of Primary Production, Factors affecting primary production, methods for measuring primary production, Relationship between GPP, NPP and autotrophic respiration, primary productivity of different world sites; Secondary Production, Concept of secondary production and secondary productivity, Maintenance cost, production assimilation efficiency and secondary productivity, Relationship of secondary production to net primary production.

UNIT IV: Habitat Ecology: Types, characteristic features, structure and function of the following ecosystem a. Forest ecosystem b. Grassland ecosystem c. Desert ecosystem d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries, Mangrove)

Paper V Population and Community Ecology

UNIT I: Population Ecology: Concept of Population; Population attributes: Natality, Mortality, Growth Curves and Survivorship curve, life table, age, structure, population growth forms, Biotic potential, Concept of carrying capacity and environmental resistance; Life history strategies, r and k selection.

UNIT II: Population Fluctuation and Population Interaction: Extrinsic and intrinsic factors associated with population fluctuation; Population interactions: Competition, Prey-Predator relationship, parasitism, commencialism, Proto-cooperation and Symbiosis.

UNIT III: Community Ecology: Concept of habitat and niche; Community structure (analytic and synthetic); Qualitative feature of community (Composition, stratification, Physigonomy dispersion, socioability, vitality); Quantitative characteristics of community (Frequency, density, dominance and diversity, important value index); Keystone species; Ecotone and edge effect.

UNIT IV: Community Dynamics and Ecological Succession: Ecological succession, Causes and trends of succession; Succession process; Concept of climax, monoclimax and polyclimax theories; Examples of ecological succession (Hydrosere, Lithosere and Xerosere)

Paper VI: Practical pertaining to Paper IV and V

1. **Major Experiment:**
   - i. Determination of minimum size of a quadrate for study of a grassland study.
   - ii. Determination of frequency, diversity and dominance of different species in grassland ecosystem.
   - iii. Determination of Important Value Index some species in a grassland ecosystem.
   - iv. Measurement of productivity of the pond ecosystem by Winkler's Oxygen liberation method.
   - i. **Minor Experiment:**
   - ii. Identification of aquatic weeds of a pond ecosystem.
   - iii. Simulation of an aquatic ecosystem in the laboratory.
   - iv. Identification of trophy level of a food chain.
   - v. Identification of animal association mainly symbiosis, commencialism and Parasitism.

2. **Identification of supplied specimen**
3. Identification of zooplankton from pond water sample
   Identification of phytoplankton from pond water sample
   Identification of ecologically adapted plant species (hydrophytes, xerophytes and mesophytes)

Paper VII Natural Resource and their Management

UNIT I: Mineral Resources: Ores and Minerals, Metal ores, Non metal minerals, Radioactive minerals, Mining (types of mining and environmental concerns), Conservation of mineral resources (Reduce-Recycle and Reuse), Economic mineral deposits of Odisha and India.

UNIT II: Non-renewable Energy Resource: Concept of renewable and non-renewable energy resource; Fossil fuels (Coal and its types, Oil and Natural gas and their fractionation products), Environmental Impacts of Fossil Fuel use; Nuclear Energy: Source, fission and fusion reactions, safety measures of nuclear reactors; Concepts on Geothermal energy and their exploration.

UNIT III: Renewable Energy Resource: Hydroelectricity (Multipurpose river valley projects of India and Odisha, advantages and disadvantages of major dam projects); Solar energy (Devices based on solar energy: solar cookers, solar water heaters, photovoltaic cells; their advantages and drawbacks); Energy from biomass (Bio-fuel and Biogas generation); Concepts on Wind energy, Wave and tidal energy.

UNIT IV: Biodiversity: Definition of Biodiversity (genetic, species and ecosystem diversity); Biogeographical classification of India; Value of biodiversity (consumptive use, productive use, social, ethical, aesthetic and other values); India as a mega-diversity nation; Hot-spots of biodiversity, Threats to biodiversity, Endangered and endemic species of India, Conservation of biodiversity: In-situ and Ex-situ conservation.

Paper VIII Environmental Pollution

UNIT I: Water Pollution: Sources of pollution (for surface water, ground water and marine water); Effects of water pollution on aquatic organisms and human health; Biological magnification of pollutants, Eutrophication, Water borne diseases associated with water pollution; Basic concepts on BOD, COD; Basic concepts on waste water treatment processes (Primary, secondary and tertiary treatment processes)

UNIT II: Air Pollution: Sources and Classification of air pollutants: Primary air pollutants (CO, CO_2, NO_x, SO_x, hydrocarbons, Particulate matter) and Secondary air

pollutants (Smog, PAN, O_3, Formaldehyde); Cause-effect and mitigation of Green House effect & global warming, Ozone layer depletion and Acid rain.

UNIT III: Solid Wastes and Soil Pollution: Effects of intensified agro-ecosystems on soil health; Effects of chemical residues (pesticides, fertilizers, heavy metals) on soil; Soil pollution by industrial and urban wastes, Different methods of solid waste management (Composting, vermicomposting, Incineration, Pyrolysis, Sanitary land filling)

UNIT IV: Noise, Thermal Pollution and Radiation: Cause, Effects, Prevention and Control of Noise Pollution, Thermal Pollution and Radiation Pollution; Measurement of Noise level; Disposal of Radioactive Wastes.

Paper IX: Practical pertaining to Paper VII and VIII

1. **Major Experiment:**
   i. Measurement of dissolved oxygen content.
   ii. Estimation of Biological Oxygen Demand waste water sample.
   iii. Measurement of carbon dioxide evolution from soil sprayed with of pesticides.
   iv. Analysis of soil carbon or organic matter.
   v. Determination of PO_4, NO_3 of soil/water sample,
   vi. Measurement of SPM/RSPM using air sampler.
2. **Minor Experiment:**
   i. Measurement of pH of different soil samples (agricultural fields, barren lands petroleum contaminated site).
   ii. Measurement of pH of different water samples (sewage water, pond water and tap water)
   iii. Measurement of conductivity of different water samples.
   iv. Recording and interpretation of noise and noise Leq determination.
3. **Identification of supplied specimen**
   Identification of obnoxious weeds of a locality causing air pollution (*Parthenium* grass, China weed etc.)
   Identification of bioindicator species (Lichen, etc.)

Paper X Environmental Microbiology and Biotechnology

UNIT I: Environmental Microbiology: Cellular structure of Bacteria, Archaea and Eukaryotes; Microbial metabolic diversity (Photoautotrophs, Chemoautotrophs); Microbial adaptations to extreme environments (extreme pH and temperature), Biofilms; Application of microbes in wastewater treatment and solid waste management and Biofuels.

UNIT II: Environmental Biotechnology: Environmental biotechnology: Definition, Scopes and Issues; Basic resources for environmental biotechnology (Microorganisms, plants, animals and/or their produce); Recombinant DNA technology, genetically engineered organisms their environmental risk and importance.

UNIT III: Bioremediation: Concept of bioremediation, Types of bioremediation: *In-situ* and *Ex-situ* bioremediation; Factors influencing bioremediation; Microbial Bioremediation: Biosorption and Biodegradation; Phytoremediation: Phyto-transformation and phyto-stabilization; Bioremediation by animals: Vermitechnology

UNIT IV: Eco-friendly Technology for Industry and Agriculture: Cleaner Technology for: Pulp and Paper Industries (Bio-pulping, Bio-bleaching), Leather industry (Enzymatic degreasing of skins), Electroplating Industry (recovery of metals from effluent); Cleaner Technology for Agriculture: Development and utilization of Bio-fertilizers, Bio-pesticides.

Paper XI Environmental Toxicology and Public Health

UNIT I: Environmental Toxicology: Concept of Toxicology, toxicity, Tolerance limits, Acceptable daily intake, Dose, Effect & Response, Dose-response curve, Acute & chronic toxicity; Toxicity of pesticides (DDT, Malathion, carbofuran) and heavy metals (Mercury, Arsenic).

UNIT II: Environment and Public Health: Concept of health and disease, relationship of man-environment and health, relationship of nutrition and health; Concepts of infection, incubation period, symptom, syndrome, host, pathogen, parasite and pathogenicity; Epidemics and Pandemics; Epidemiological study of arsenicosis, fluorosis, Goiter, Dengue and Chikungunya.

UNIT III: Environmental Carcinogens: Basic concept of carcinogenesis: Types of cancer, properties of cancer cells, Stages and progression of cancer, role of cell cycle check points in carcinogenesis; Carcinogens: Definition, Types (physical, chemical, biological, genotoxic and epigenetic).

UNIT IV: Occupational Health: Occupational health: Definition; Potential health hazards factors in work environment (Physical, Chemical, Biological, Ergonomical, Psychological and Accidental); Cause, Symptoms and prevention of Occupational diseases like Silicosis, Asbestosis, Anthrax and AIDS.

Paper XII: Practical pertaining to Paper X and XI

1. **Major Experiment:**
   i. Determination of effect of heavy metal (mercury/arsenic) on total chlorophyll content of hydrophytic plants (*Hydrilla verticillata*)
   ii. Measurement of Oxygen uptake by Fish/Earthworm exposed to different stress.

iii. Measurement of carbon dioxide evolution from soil sprayed with of pesticides.
iv. Bacterial coliform analysis in waste water sample by MPN method.
v. Quantification of bacteria in waste water by serial dilution and Viable Plate Count Method
vi. Analysis of soil enzymes

2. **Minor Experiment:**
   i. Determination of effect of heavy metal (mercury/arsenic) on seed germination.
   ii. Preparation of microbial culture media.
   iii. Sterilization by autoclaving or UV or 70 % alcohol treatment
   iv. Categorization bacteria by Gram staining
3. **Identification of supplied specimen**
   Identification of some saprophytic fungi
   Identification of composting organisms

Paper XIII Environmental Legislations and Policies

UNIT I: Guiding Principles of Environmental Law: The Precautionary Principle, The Prevention Principle, The "Polluter-Pays" principle, The Integration principle, The Public Participation principle

UNIT II: International Legislations, Policies for Environmental Protection: Salient features of: Stockholm Conference (1972) and its declaration, World Commission on Environment and Development (1983) and Brundtland Report (1987), Rio Earth Summit (1992) and its declaration, Montreal Protocol - 1987, Basel Convention (1989), Kyoto Protocol- 1997, Ramsar Convention 1971

UNIT III: National Legislations, Policies for Pollution Management: Salient features of Wild life protection act 1972, Water Pollution (Prevention and Control) Act-1974, Forest conservation act 1980, Air Pollution (Prevention and Control) Act-1981, National Environmental Policy -2006, Central and State Pollution Control Boards: Constitution and power.

UNIT IV: Public Participation for Environmental Protection: Environmental movement and people's participation with special references to Gandhamardan, Chilika and Narmada Bachao Andolan, Chipko and Silent valley Movement; Women and Environmental Protection, Role of NGO in bringing environmental awareness and education in the society.

Paper XIV Environmental Impact Assessment and Sustainable Development

UNIT I: Environmental Impact Assessment (EIA): Concepts of carrying capacity and ecological footprints, Origin and development of the concept of EIA; Steps of EIA process: Evaluation of proposed actions, scoping and base line study, identification and prediction of impacts, mitigation measures, comparison of alternatives, review and decision making, public participation and compensatory actions.

UNIT II: Waste Minimization and Management: Elements of waste minimization strategy: Concept of four Rs (Refuse, Reduce, Reuse, Recycle); Life cycle assessment of consumer products (Paper products, Metal products, Plastic products); Elements of waste Management strategy: Segregation of wastes at source, Bio-medical and hazardous waste management.

UNIT III: Green Marketing and Business: Economics of Pollution control, Cost-benefit and cost effectiveness analysis, World Trade Organisation and Environment, Corporate Social Responsibility, Development of ISO 14000 series.

UNIT IV: Sustainable Development: Origin and growth of the concept of Sustainable development; Domains of sustainable development: Economics, Society and Environment, Economic growth vs. Environmental sustainability, Gross National Productivity and the quality of life, Tragedy of Commons, Environmental awareness and Education; Environmental Ethics.

Paper XV: Practical pertaining to Paper XIII and XIV

1. **Major Experiment:**
   i. Characterization and segregation of solid/biomedical waste.
   ii. Simulation of vermicompost/biogas unit.
   iii. Documentation of ambient air quality standards as specified by CPCB.
   iv. Documentation of potable water quality standards as specified by CPCB/WHO/EU/EPA
2. **Minor Experiment:**
   i. Identification of biodiesel feed stock plant of a locality.
   ii. Identification of secondary decomposers of soil sample.
   iii. Analysis of TDS and TSS of waste water sample.
3. **Identification of supplied specimen**
   Identification of invading species (*Lantana, Parthenium,* water hyacinth etc.)
   Identification of Biofertilizer (*Azolla*, Blue green algae)

Paper XVI: Analytical Tools and Techniques in Environmental Science

UNIT I: Environmental Statistics: Primary and secondary data; Measure of mean, mode, median, standard deviation and standard errors; Measure of skewness, theory of sampling of population, theory of testing hypothesis: 't'-Test and χ^2 Test; Correlation and regression analysis.

UNIT II: Environmental Chemistry: Stoichiometry; Chemical equilibria, Acid base reactions, solubility product; Laws of thermodynamics, Entropy, enthalpy; Periodic table and geochemical classification of elements; Radioactive and heavy isotopes and their use in paleo-dating.

UNIT III: Analytical Techniques: Principles and techniques of Titrimetry, Gravimetry, Colorimetry; Basic principles and applications of UV-Vis Spectrophotometer, Flame photometer and Gas-chromatograph for environmental sample analysis.

UNIT IV: Remote Sensing and GIS: Defining remote sensing & GIS, History and development; Platform and Sensors; Remote sensing satellites (Geostationary and polar orbiting satellites); Spectral characteristics of environmental components (vegetation, water, soil); Advantages and applications of remote sensing and GIS in environmental management.

Paper XVII: Environmental Hazards, Risk & Disaster Management

UNIT I: Disaster and Hazard Management: Disaster definition; Disaster Management Capability: Vulnerability and risk; Disaster preparedness: Community based training and education, Engineered structure /structural strengthening techniques; Disaster management cycle, Rescue and relief camps, Post disaster restoration.

UNIT II: Geological Hazards: Global distribution pattern, causes, consequences and mitigation of Earthquake, Tsunami, Volcanoes, Landslide; Forecasting of geological disasters (tsunami warning system); Earthquake zones of India, Richter scale.

UNIT III: Weather Disasters: Global distribution pattern, causes, consequences and management of Cyclone, Flood and Drought; Forecasting of weather disasters: Basic concepts on weather radar (Doppler radar) and weather satellites (INSAT 3D).

UNIT IV: Technological Disasters: Causes, consequences and mitigation of nuclear disasters, coal mine disasters, industrial disasters (due to fly ash and poisonous gases); Case studies: Bhopal gas tragedy (1984), Chernobyl nuclear disaster (1986).

Paper XVIII: Practical pertaining to Paper XVI and XVII

1. **Major Experiment:**
   i. Calculation of arithmetic mean of length of fish/leaf samples.
   ii. Calculation of standard deviation of weight of fish/leaf samples
   iii. Calculation of leaf area index of leaf samples
   iv. Verification of Beer Lambert's law using spectrophotometer.

2. **Minor Experiment:**
   i. Preparation of buffers of different pH.
   ii. Calculation of mode of a sample data.
   iii. Preparation of Disaster preparedness Fast Aid Kit
3. **Identification of supplied specimen**
   Identification of biomedical waste disposal bins
   Identification of biohazardous materials related to health care service.

Books Recommended:

1. Fundamentals of Ecology by Odum and Barrett, Thompson publ.
2. Fundamentals of Ecology by MC Dash, Tata Mc Graw Hill Edu Pvt Ltd
3. Fundamentals of Ecology by EP Odum, Natraj Publ.
4. Environmental Science by SC Santra, Central Publ.
5. Environmental Science by Cunningham and Cunningham
6. Ecology: Principles and Applications by J. L. Chapman, M. J. Reiss, Cambridge University Press
7. Concepts of Ecology by EJ Kormondy, PHI
8. Sustainable Development by Kumar das, Reference Publ.
9. Ecology, Chemistry and Management of Environmental Pollution by MC Dash, Mac Millan
10. Ecology and Environmental Science by SVS Rana, PHI pvt. ltd.
11. Ecology and Environment by P D Sharma, Rastogi publication
12. Fundamental concept in Environmental Studies by DD Mishra, S.Chand, New Delhi
13. A Textbook of Environmental Studies by DK Asthana & Meera Asthana, S.Chand, New Delhi
14. Natural Resources and Renewable Energy by MP Singh, Daya Publishing House
15. Environment Population and Resources by Sunit Gupta and Mukta Gupta, Anmol Publ. Pvt.Ltd.
16. Biodiversity by Kumar and Asija, Agrobios publ.
17. Biodiversity Assessment and Conservation by PC Trivedi, Agrobios publ.
18. Air Pollution by VP Kudesia, Pgagati Prakashan
19. Noise Pollution by VP Kudesia, Pgagati Prakashan

20. Introduction to Environmental Engineering and Science by Gilbert M. Masters, Pearson Education
21. Environmental Chemistry by AK Dey, New age International (P) Ltd
22. Environmental Protection and Laws by Jadhav and Bhosale, V.M.Himalaya publishing House.
23. Environmental Radiation and Thermal Pollution by GR Chhatwal *et al.* Anmol Publications
24. Environmental Noise Pollution and its Control GR Chhatwal *et al.* Anmol Publications
25. The Atmosphere: An Introduction to Meteorology by FK Lutgen and EJ. Tarbuk, Pearson publ.
26. Basics of Atmospheric Science, by A. Chandrasekar, PHI publ.
27. The Monsoons by Dr P. K. Das, National Book Trust, New Delhi, India.
28. Statistical methods by S.P. Gupta. S. Chand Publications
29. The nature and Properties of Soils by N C Brady and R R Weil, Pearson Education
30. Introductory Soil Science by DK Das, Kalyani Publishers
31. Environmental Geology by C W Montgomery, Mc. Graw Hill International
32. Text book of Physical Geology by G B Mohapatra, CBS Publ.
33. Remote Sensing by Meenakshi Kumar, NCERT
34. Environmental Toxicology by W.G. Lendis, Lewis Publ.
35. Environmental Biology and Toxicology by P.D. Sharma, Rastogi Pupl.
36. Brock Biology of Microorganisms, by MT. Madigan *et. al.* Prentice Hall publication.
37. Microbiology by Lansing M Prescott, John P.Harley and Donald A. Klein, Mc Graw Hill publication
38. Environmental Impact Assessment by PR Trivedi, APH Publishing Corporation
39. Sustainable Development by Kumar Das, Reference Publ.
40. Coping with Natural Hazards; Indian context by KS Valdiya, Orient Longman
41. Environmental Changes and Natural Disasters by Baber, New India Publishing agency
42. All you want to know about Disasters by BK Khanna, New India Publishing agency
43. Textbook of Environmental Biotechnology by PK Mohapatra, IK International
44. Environmental Biotechnology: Basic Concepts and Applications by I S Thakur, IK International

Environmental Science (Minor)

4 papers theory: 50x4=200 marks; 2 papers practical: 50x2=100 marks; 6 papers x 3 credits each = 18 credits

[Marks Distribution: 20% Internal Assessment + 80% End Term Examination i.e. 10 marks per paper for Internal Assessment + 40 marks per paper for End Term]

Paper I Fundamentals of Ecology & Environmental Science

UNIT I: Ecosystem Dynamics: Introduction to Environmental Science and its Scope; Definition of Ecology and Ecosystems; Structure of an Ecosystem: Abiotic and Biotic components; Function of an Ecosystem: food chain, food webs, ecological pyramids, energy flow, biogeochemical cycling of water, C, N, P & S; Concept of productivity: Primary and secondary production, gross and net production.

UNIT II: Population and Community Ecology: Concept of Population; Population attributes: Natality, Mortality, Biotic potential, Environmental resistance, growth Curves and Survivorship curve; Population interactions: Competition, Prey-Predator relationship, parasitism, commencialism, Symbiosis; Ecological succession: primary and secondary processes in successions, theories of successions, concept of climax community; Niche concept, key stone species, ecotone, edge effect; Species richness & diversity.

UNIT III: Basic Earth Science: Structure of earth's interior; Plate tectonics and continental drift theory; Classification of rocks: igneous, metamorphic and sedimentary; Different land forms created by the work of rivers, ground water, wind and glaciers; Preliminary idea on Earthquake, Tsunami, Volcanoes, and Landslides.

UNIT IV: Basic Atmospheric Science: Composition of the atmosphere: variable and stable components; Vertical variations in atmosphere: atmospheric layers, pressure change, temperature change, change in composition, Ionosphere); Earth-Sun relationships and seasonal variations (Solstices and equinoxes); Indian Monsoon; Low pressure-Depression and Cyclone

Paper II Natural Resources and their Management

UNIT I: Mineral Resources: Ores and Minerals, Metal ores, Non metal minerals, Radioactive minerals, Mining (types of mining and environmental concerns), Conservation of mineral resources (Reduce-Recycle and Reuse), Economic mineral deposits of Odisha and India.

UNIT II: Conventional Energy Resource: Concept of renewable and non-renewable energy resource; Fossil fuels (Coal and its types, Oil and Natural gas and their fractionation products), Environmental Impacts of Fossil Fuel use; Hydroelectricity (Multipurpose river valley projects of India and Odisha, advantages and disadvantages of major dam projects).

UNIT III: Non-conventional Energy Resource: Nuclear Energy: Source, fission and fusion reactions, safety measures of nuclear reactors; Solar energy (Devices based on solar energy: solar cookers, solar water heaters, photovoltaic cells; their advantages and drawbacks); Energy

from biomass (Bio-fuel and Biogas generation); Concepts on Wind energy, Geothermal energy, Wave and tidal energy.

UNIT IV: Biodiversity: Definition of Biodiversity (genetic, species and ecosystem diversity); Biogeographical classification of India; Value of biodiversity (consumptive use, productive use, social, ethical, aesthetic and other values); India as a mega-diversity nation; Hot-sports of biodiversity, Threats to biodiversity, Endangered and endemic species of India, Conservation of biodiversity: In-situ and Ex-situ conservation.

Paper III: Practical: Pertaining to Paper I and II

1. **Major Experiment:**
   - i. Simulation of an Ecosystem in the laboratory.
   - ii. Measurement of frequency and relative abundance of species on a grassland and forest by quadrate method.
   - iii. Measurement of the diversity index of a particular place
   - iv. Estimation of Phytoplankton and Zooplanktons abundance in fresh water
2. **Minor Experiment:**
   - i. Identification of autotrophs and heterotrophs (according to trophic level) of a grassland and pond ecosystem.
   - ii. Measurement of Rainfall over an area.
   - iii. Measurement of wind speed by using anemometer.
   - iv. Identification of organism association mainly symbiosis, commencialism and Parasitism
   - v. Identification of rock samples
3. **Identification of slides of phyto-and zooplankton**

Paper IV Environmental Pollution & Toxicology

UNIT I: Water Pollution: Sources of pollution (for surface water, ground water and marine water); Effects of water pollution on aquatic organisms and human health; Biological magnification of pollutants, Eutrophication, Water borne diseases associated with water pollution; Basic concepts on BOD, COD; Basic concepts on waste water treatment processes (Primary, secondary and tertiary treatment processes)

UNIT II: Air Pollution: Sources and Classification of air pollutants: Primary air pollutants (CO, CO_2, NO_x, SO_x, hydrocarbons, Particulate matter) and Secondary air pollutants (Smog, PAN, O_3, Formaldehyde); Cause-effect and mitigation of Green House effect & global warming, Ozone layer depletion and Acid rain.

UNIT III: Solid Wastes and Soil Pollution: Effects of intensified agro-ecosystems on soil health; Effects of chemical residues (pesticides, fertilizers, heavy metals) on soil; Soil pollution by industrial and urban wastes, Different methods of solid waste management (Composting, vermicomposting, Incineration, Pyrolysis, Sanitary land filling)

UNIT IV: Environmental Toxicology: Concept of Toxicology, toxicity, Tolerance limits, Acceptable daily intake, Dose, Effect & Response, Dose-response curve, Acute & chronic toxicity; Toxicity of pesticides (DDT, Malathion, carbofuran) and heavy metals (Mercury, Arsenic); Basic concept on environmental Carcinogens.

Paper V Sustainable Development and Environmental Policies

UNIT I: Sustainable Development: Economics and Environment: Economic growth, Gross National Productivity and the quality of life, Tragedy of Commons, Economics of Pollution control, Cost-benefit and cost effectiveness analysis, WTO and Environment, Corporate Social Responsibility, Environmental awareness and Education; Environmental Ethics.

UNIT II: International Legislations, Policies for Environmental Protection: Stockholm Conference (1972) and its declaration, WCED (1983) and Brundtland Report (1987), Rio Earth Summit-UNCED (1992) and its declaration, Montreal Protocol - 1987, Basel Convention (1989), Kyoto Protocol- 1997, Ramsar Convention 1971

UNIT III: National Legislations, Policies for Pollution Management: Salient features of Wild life protection act 1972, Water Pollution (Prevention and Control) Act-1974, Forest conservation act 1980, Air Pollution (Prevention and Control) Act-1981, National Environmental Policy -2006, Central and State Pollution Control Boards: Constitution and power.

UNIT IV: Public Participation for Environmental Protection: Environmental movement and people's participation with special references to Gandhamardan, Chilika and Narmada Bachao Andolan, Chipko and Silent valley Movement; Women and Environmental Protection, Role of NGO in bringing environmental awareness and education in the society.

Paper VI: Practical pertaining to Paper IV and V

1. **Major Experiment:**

i. Estimation of Biological Oxygen Demand of waste water.
ii. Measurement of dissolved oxygen content in water.
iii. Analysis of soil Carbon or Organic matter.
iv. Determination of effect of heavy metal (mercury/arsenic) on total chlorophyll content of hydrophytic plants (*Hydrilla verticillata*)
v. Measurement of Oxygen uptake by Fish/Earthworm exposed to different stress
vi. Measurement of carbon dioxide evolution from soil sprayed with of pesticides.

2. **Minor Experiment:**

i. Identification of phyto and zooplankton from oligotrophic and Eutrophic water bodies.
ii. Determination of effect of heavy metal (mercury/arsenic) on seed germination
iii. Measurement of pH of different soil samples (agricultural fields, barren lands petroleum contaminated site)
iv. Measurement of pH of different water samples (sewage water, pond water and tap water)

3. **Identification of supplied specimen**

Identification of obnoxious weeds of a locality causing air pollution (*Parthenium* grass, China weed etc.)

Identification of bioindicator species (Lichen, etc.)

Books Recommended:

1. Man and Environment by M C Dash and P C Mishra, McMillan
2. Environment and society by P C Mishra and M C Dash, McMillan
3. Environmental Pollution by Timmy Katyal and M. Satake, Anmol publications Pvt. Ltd. New Delhi.
4. Fundamentals of Ecology by EP Odum, Natraj Publ.
5. Environmental Science by Cunningham and Cunningham, Tata Mc Graw Hill Edu Pvt Ltd
6. Fundamental concept in Environmental Studies by DD Mishra, S.Chand, New Delhi
7. A Textbook of Environmental Studies by DK Asthana & Meera Asthana, S.Chand, New Delhi
8. Environmental Science by SC Santra, Central Publ.
9. Air Pollution by VP Kudesia, Pgagati Prakashan
10. WaterPollution by VP Kudesia, Pgagati Prakashan
11. Environmental Chemistry by AK Dey, New age International (P) Ltd
12. Environmental Protection and Laws by Jadhav and Bhosale, V.M.Himalaya publ. House
13. Biodiversity Assessment and Conservation by PC Trivedi, Agrobios publ.

Environmental Studies (General Core)

1 Paper theory: 50 marks, [Marks Distribution: 20% Internal Assessment + 80% End Term Examination i.e. 10 marks for Internal Assessment + 40 marks for End Term],m 3 Credits

UNIT I: Understanding our Environment: Man and Environment relationships, Components of Environment (Elementary idea on Hydrosphere, Lithosphere, Atmosphere, Biosphere), Structure of an Ecosystem (Biotic components: Producer, Consumer and Decomposer; Abiotic components: Light, Temperature, Soil, Water and Air); Function of an Ecosystem (Food Chain, Food Web, concept of Energy flow and Nutrient Cycling)

UNIT II: Natural Resources and their Management: Concept of Resources, Renewable and Non-renewable Resources, Mineral Resources of Odisha and India, Energy Resources (Fossil fuel: Coal and petroleum, hydroelectricity, solar energy, wind energy), Forest Resources, Biodiversity and its importance; Concept of Sustainable Development, Environmental movements in India (Chipko Movement, Narmada Bachao).

UNIT III: Environmental Pollution: Definition of Pollution; Causes, effects and Control measures of air, water, soil and noise pollution; Studies on historical environmental issues (London Smog, Minamata disease); Municipal solid waste: characterization and disposal; Current pollution issues around the world (Eutrophication of water bodies, Acid Rain, Green House Effect and Global Warming, Ozone layer depletion and its effects).

UNIT IV: Public Health and Sanitation: Human Population growth and Pressure on Environment, Epidemics, Transmission of communicable diseases (waterborne diseases, Air-borne Diseases, Vector-borne Diseases, HIV/AIDS); Food borne Diseases, Eradication of vector-borne diseases through chemical, biological and Environmental management methods, Role of NGOs and Public awareness to combat communicable disease.

Books Recommended:

1. Man and Environment by M C Dash and P C Mishra, McMillan
2. Environment and society by P C Mishra and M C Dash, McMillan
3. Environmental Pollution by Timmy Katyal and M. Satake, Anmol publ. Pvt. Ltd. New Delhi.
4. Fundamentals of Ecology by EP Odum, Natraj Publ.
5. Environmental Science by Cunningham and Cunningham, Tata Mc Graw Hill Edu Pvt Ltd
6. Fundamental concept in Environmental Studies by DD Mishra, S.Chand, New Delhi
7. A Textbook of Environmental Studies by DK Asthana & Meera Asthana, S.Chand, New Delhi
8. Environmental Science by SC Santra, Central Publ.

Information Technology (general core)

Credit: 3

Unit I *Data, Information and Computer Organization:-*

Introduction, Types of Data, Central Processing Unit, Working of a computer, Interconnection of CPU with Memory and I/O units, Memory(Primary/Secondary Memory, Read Only Memory, Random Access Memory, Compact Disc Read Only Memory(CDROM), Flash Memory

Unit II *Software:-*

System Software and Application Software, Operating System, role of operating system, Programming Languages, Database Management System, functions of DBMS in the management of data.

Unit III *Computer Networks and Internet Technology:-*

Introduction to Computer Networks, Local Area Networks(LAN), Wide Area Networks(WAN), Metropolitan Area Networks(MAN), Internet, use of internet, World Wide Web(WWW), Browsers, search engines.

Unit IV *Social Impacts of IT:-*

Societal applications of IT such as in business, healthcare, administration, entertainment, judiciary, engineering, agriculture, education etc., privacy and security issues in the use of IT, cyber crime, intellectual property right.

Text Book:

1. V.Rajaraman, Fundamentals of Computers, Prentice Hall of India, New Delhi.
2. P.K. Sinha and P. Sinha, Computer fundamentals, BPB Publication.

Reference Books:

1. Efraime Turban, R. Kelly Rainer, and Richard E. Potter, Introduction to Information Technology, Wiley.
2. Raj Kamal, Internet and Web Technology, Tata McGraw Hill Education.
3. R. Elmasri and S.B. Navathe, Fundamentals of Database system, Addison Wisley.

NATIONAL SERVICE SCHEME (N.S.S.)

(There shall be 3 credits course of 50 marks, out of which 40 marks will be of theory and 10 marks of internal evaluation based on assignment/ field study/ project work.)

UNIT-1: CONCEPTS AND PHILOSOPHY

History, Basic Concepts and Objectives of National Service Scheme, Aims of NSS Programmes, Administrative structure of NSS at National, State, University and College Levels, Advisory Committees, planning and Implementation of NSS programmes at State, University and College Levels, Regular and special camping activities.

UNIT-3: PERSONALITY DEVELOPMENT AND LEADERSHIP

Personality development: various aspects of personality development and factors influencing development of personality. Leadership: definition, principles, attributes and qualities of constructive leadership, Rapport building with community and role of leadership.

UNIT-2: VILLAGE/ SLUM ADOPTION

Aims and objectives of village adoption, Approaches and strategies in adopting a village, Survey of village/ slum for identification of problems and development of activities on the basis of survey, Introduction to various communities (Rural and Slum). Effective implementation of NSS programmes through peoples' participation (PP) modes involving NGOs/ GOs/ political and village leaders. Contributions of Odisha to NSS programmes.

UNIT-4: ALLIED ACTIVITIES

Awareness against: unemployment, illiteracy, poverty, terrorism, superstitions, deforestation, corruption and other social stigmas. Public awareness on: water and environment safety, sanitation, health, hygiene, Yoga, Self-defence and active citizenship. Know AIDS, RTI, National integration, Social Harmony. Disaster management, role of NSS during natural calamities such as flood, draught, cyclone, earth quake, rescue operation, first aid, home nursing. Women empowerment through Self Help Group, Youth Welfare.

REFERENCES:

1. NATIONAL SERVICE SCHEME MANUAL (REVISED), Government of India, Ministry of Youth Affairs & Sports, New Delhi, 2006.
2. Saiyidian, K.G, National Service Scheme – A Report, Ministry of Education, Govt. of India, 1961.
3. Know NSS , Edited By NSS ETI, OUAT, Bhubaneswar
4. A. S. Seetharamu, Philosophies of Education (2nd Edn), Ashish Publishing House, 1989
5. J. C. Aggarwal, S. P. Agrawal, Educational Planning in India: Reports of committees and commissions, five year plans, statistical tables, Concept Publishing Company,1992
6. G.R. Madan, Indian Social Problems (Vol-2): Social Disorganization and Reconstruction, Allied Publishers, 1967
7. P. D. Puranik, National integration through education, Pune Vidyarthi Griha Prakashan, 1978

PRINCIPLES & PRACTICES OF MANAGEMENT

UNIT-I

Management-Meaning, Definition, Feature, Functions, Types of Management ,Management as an Art and Profession. Manager-Types, skills, Qualities of a good manager.

UNIT-II

Planning-Meaning, Importance. Steps & Methods of Planning, Types of Plans. Decision Making: Meaning, Characteristics, Principles, Elements & Administrative problems in decision-making. Types of decisions, Characteristics of a good decision making.

UNIT-III

Controlling-Concept, Process, Techniques of control, Effective control system. Organization-Concept, Definition, Nature ,Importance & Principles.

UNIT-IV

Approaches of Management- Traditional & Modern Approaches to management, Trends in Management. Role of management in changing environment.

REFERENCES

- C.B. Gupta, Management Theory and Practice, Sultan Chand and Sons, New Delhi.
- T. Ramaswami, Principles of Management, Himalaya Publishing House, Mumbai.
- L.M. Prasad, Principles and Practices of Management, Sultan Chand and Sons, New Delhi.
- P.C. Tripathi, Principles of Management, Tata McGraw Hill, New Delhi.

ORGANIZATION BEHAVIOUR

UNIT-I

Organization Behaviour, Concept, Definition, Nature, Purpose, Scope & Development, OB Models & Models of man, Research in OB.

UNIT-II

Personality- Concept, Definition, Determinants, Theories of Personality, Personality and jobs, Personality & Organization, Perception-Concept, Perceptual Process, Perception & OB, Perception & Sensation.

UNIT-III

Learning & Behaviour Modification- Learning-Concept, Process, Theories of Learning & Organizational Behaviour, Behaviour Modifications, Attitude- Concept, Definition, Characteristics, Components, Attitude & Behaviour, Attitude Formation, Measurements of attitude, Attitude & Productivity, Cognitive Dissonance Theory, Values & Job Satisfaction.

UNIT-IV

Motivation- Concept, Nature, Motivation Process, Theories of Motivation, Conflict- Concept, Nature, Levels & Types, Transactional Analysis.

REFERENCES

- L.M Prasad, Organization Behaviour, Sultan Chand & Sons, New Delhi.
- K. Aswathappa, Organization Behaviour, Himalaya Publishing House, Mumbai.
- Udaya Pareek, Understanding Organization Behaviour, Oxford University Press, New Delhi.
- F. Luthans, Organization Behaviour, Tata McGraw Hill, New Delhi.

Elective:

Conservation and Management of Natural Resources

2 papers theory: 50x2=100 marks; 2 papers x 3 credits each = 6 credits

[20% marks internal assessment or 40 marks per paper + 10 marks Internal assessment]

Paper-I

Unit-I

Concept of resource: Classification of physical and chemical resources; Importance of natural resources in the human society; Impact of industrialization on natural resources; Fundamental concepts regarding inexhaustible resources: Immutable resources like solar energy, atomic energy, wind power, geothermal energy and tidal power; Mutable resources (atmosphere, water, soil); Non-maintainable resources like gems, metals, non metallic minerals like glass, sand, gypsum and metals.

Unit-II

Potential of physical and chemical resources, their conversion and efficiency of energy recovery pattern, suitability in the context of economic standard (developed and developing countries) and environmental conservation: Demographic quotient and economic standard.

Unit-III

Technologies available for conservation of natural resources: Solar pond technology, solar photovoltaic system, efficient solar cooker, cooking Chula and energy conservation, Wind mill, water harvesting technology, management of industrial byproducts like fly ash.

Unit-IV

Environmental law of conservation of natural resources, conventions and international treaties on conservation of natural resources, conservation education and value systems; Energy perspectives in rural and urban system.

PAPER-II

Unit-I

Concept of resource, classification of resources, classification of natural biological resources (fossil fuels, plants animals, microbes), Industrial revolution and modern age, fundamental principles of ecosystem and conservation of resources; Fundamental concepts regarding biological resources: Exhaustible resources like fossil; Maintainable biological resources like plants, animals and microbes; Mutable resources (transgenic organism and food, cultivars, cloning and human genome).

Unit-II

Potential of biological resources, their conversion and efficiency of energy recovery pattern, Biodiversity and resource conservation, intellectual property right, WTO and environmental standards (pollution and conservation); Demographic quotient.

Unit-III

Examples of biological resource conservation such as agriculture (sustainability in traditional and conventional method), Forestry (agroforestry, energy plantations), Aquaculture (intensive farming Vs. energy maximization), Wild animals, National parks and biosphere reserves in Orissa.

Unit-IV

Environmental aesthetics and ecological conservation, Problems of environmental pollution (air, water and soil) and its impact on biological resources, Ecological balance and biodiversity threatened and endangered species.

Elective:

Life Sciences

2 papers theory: 50x2=100 marks; 2 papers x 3 credits each = 6 credits

[20% marks internal assessment or 40 marks per paper + 10 marks Internal assessment]

PAPER-I

Unit-I

Life, its origin and evolution, Diversity of life, Plants, animal, Microorganisms (Pathogen, Parasite, Saprophytes, Chemotrophs, Symbniotics and commensals).

Unit-II

Cell as basic unit of life, structural organization of cell, Prokaryotes and Eukaryotes, cellular organelles (Nucleus, Mitochondria, Chloroplast, Endoplasmic reticulum, Golgi apparatus, Ribosomes), cell membrane, cell cycle and division.

Unit-III

Biophysical – Chemistry: Interaction in biological system: Intra and inter molecular forces, hydrophilic interaction; Water as universal solvent, properties of aqueous solution; Bio-molecules in cell: Carbohydrate, Lipid, protein, Nucleic acid (RNA & DNA) with their structure. ATP, the energy rich compound in the cell.

Unit-IV

DNA as genetic material, central Dogma & Reverse transcription, DNA replication, Transcription and Translation, Genetic code; Regulation of gene action.

PAPER-II

Unit-I Enzymes: Properties, classification, Mechanism of enzyme action and regulation, Enzyme Kinetics and inhibition, cofactors.

Unit-II Biological Processes: Photosynthesis, Respiration & Energy yielding mechanisms, Physiology of digestion and assimilation, Physiology of excretion, Basic concepts of transmission of impulse and hormonal integration.

Unit-III Basic concept of genetic engineering: Concept of gene, Recombinant DNA technology: Concept, application in the field of Agriculture, Medicine, Food and Industrial production.

Unit-IV Organism and Environment: Dynamics of environment, concept of Ecosystem, Population and Community, Energy flow and nutrient cycling, Food chain, Food web, population dynamics and regulation in nature, Ecosystem development and concept of climax in Ecological system, Biodiversity and its significance.

Elective:

Non-conventional Energy Resources

2 papers theory: 50x2=100 marks; 2 papers x 3 credits each = 6 credits

[20% marks internal assessment or 40 marks per paper + 10 marks Internal assessment]

PAPER-I

Unit-I

Use of fire by primitive Man; Harnessing water and wind Power, Discovery of wheel; Industrial revolution and use of fossil fuels; Faraday's discovery of electromagnetic induction and use of electrical energy; Natural energy sources in India, Non conventional energy Vs. conventional energy scenario at national and international level.

Unit-II

Definition of energy units, Joule, BTU, calorie, Kilowatt and Electron volt; Forms of energy; mechanical, thermal, electrical, sound, atomic (with example).

Unit-III

Conversion of energy from one from to another form; Laws of thermodynamics (1^{st} and 2^{nd} laws), Application of energy: Domestic, transport, Industry, defence, space science and agriculture.

Unit-IV

Calorific value of fuels like wood, charcoal biogas etc., proximate and ultimate analysis, Caking and cooking properties, Low and high temperature combustion.

Unit-V

PAPER-II

Unit-I

Energy from wind: Windmill, aeroturbine, Hydro energy: Hydroelectricity, Turbine, Tidal power, Hydraulic power.

Unit-II

Geothermal energy: Origin, heat exchange, Vapour cycle turbine, Solar energy, Solar cell and application, Preservation of solar energy, Energy generation in sun.

Unit-III

Nuclear Energy: Different stages of development, Nuclear fuels – uranium, thorium.

Unit-IV

Nuclear energy: Fission energy: Principles of fission, reactor design, reactors in India; Fission material reserve in India, Principle of thermonuclear reactions; Microwave for heating appliances.

Elective:

Psiciculture

2 papers theory: 50x2=100 marks; 2 papers x 3 credits each = 6 credits

[20% marks internal assessment or 40 marks per paper + 10 marks Internal assessment]

PAPER-I

Unit-I

History of Ichthyology in India; Classification of fishes with distinguishing characters and examples of the major sub-divisions; *Labeo rohita*: Systematic position; external features; digestive, circulatory and nervous systems; lateral line organs, air-bladder, webberian ossicies; Biochemical composition and Nutritional value of raw fish.

Unit-II

Physico-chemical characteristics of pond water affecting fish productions: turbidity, temperature, dissolved oxygen content, depth of water, acidity & alkalinity, dissolved nutrient, weed control, planktons etc.; Collection of spawn: Natural breeding grounds in Indian major carps, some important breeding grounds in the Ganges and the Bramhaputra river system; Collection of eggs, fish seed (tries & fingerlings) from breeding grounds; Wet and dry bundh breeding.

Unit-III

Hatchery and its management; Preparation and management of nursery and rearing ponds. Fertilization of ponds; Preparation and management of stocking ponds, supplementary feeding, carrying capacity; Induced breeding of Indian major carps. Agents used. Principle, technique and advantages of hypoplysation Response time.

Unit-IV

Predatory and weed fishes, common predatory and weed fresh water fishes, examples with systematic position; Common fresh water weeds & their control; Composite fish culture, composite culture of Indian and exotic fishes, Intensive fish culture, Fish-cum-duck culture, fish-cum-paddy culture.

PAPER-II

Unit-I

Fisheries of some important reservoirs of India, conservation and management of reservoir; Fish Pathology: Diseases caused by infection of fungi, bacteria, protozoa, worms and crustacean; Control of fish diseases; Larvicidal fishes and their importance.

Unit-II

Harvesting of fish: Craft and gears used in inland fresh, water fish culture; Fish preservation methods: Handling and Cleaning of fresh fish, chilling, freezing, salting, sun-drying and smoking methods of preservation for both inland and marine catches; Transport of fresh catch and its marketing. Transport of fish seeds/fry/fingerlings, Role of fish co-operative societies.

Unit-III

Fishery resources of Orissa; Fisher extension education; Prawn culture in India; Elementary idea of fisheries in Chilika lake.

Unit-IV

Aquaculture and pearl culture, Fisheries products of commercial value: Inland and marine; Aquatic pollution and its impact on fishes: types, sources and effects of pollution, preventive measures.

Elective:

Sustainable Agriculture Practices

2 papers theory: 50x2=100 marks; 2 papers x 3 credits each = 6 credits

[20% marks internal assessment or 40 marks per paper + 10 marks Internal assessment]

PAPER-I

Unit-I

Sustainable development, conditions for sustainability; Ecological conservation and economic development, green Vs Greed Revolution.

Unit-II

Ecological Paradigms and agricultural principles, understanding the integrative science (Ecology), Agricultural developments and consequences, Diversity and stability.

Unit-III

Traditional verses modern agriculture, Biodiversity and sustainability, Agriculture and its commercialization, WTO, Patent and Intellectual Property Rights (IPR), GAT, liberalization policy and sustainability.

Unit-IV

Indian scenario in agriculture and sustainability, Trends in production, Linkage to deforestation and climate change, Environment and health, Consumer consciousness.

PAPER-II

Unit-I

Indicaors of sustainable agricultural practices, soil quality, biological indicators, trend in productivity and product quality; Biofertilizer Vs. Chemical fertilizers.

Unit-II

Low External Input Sustainable Agriculture (LEISA) Salient features and networks concept of seed bank, water harvesting technology, professional knowledge transfers through generations; Bio intensive agriculture (BIA) M.K. Gandhian concepts of agriculture and conservation.

Unit-III

Examples of sustainable agriculture, shifting cultivation, one straw revo0lution, organic farming, Ximbu system model (Integration of energy in agriculture), Use of local resources and importance of biodiversity in sustainable agriculture.

Unit-IV

Policy and action plan: National agricultural policies and action plan, Introspection of agricultural developments and environmental impacts, Human consciousness and present developments.

Industrial Relations & Personnel Management

General Elective (100Marks: 6 Credits)

Paper- I: Human Resource Management-I (50 Marks: 3 Credits)

1. Meaning, Definition and Scope of Human Resource Management.
2. Objectives and Characteristics of Human Resource Management.
3. Functions of HRM: Managerial and Operative functions.
4. Organizational structure : meaning and types
5. Role and functions of Human Resource Manager

Paper-II: Human Resource Management- II (50 Marks: 3 Credits)

1. Recruitment: meaning, concept and process of recruitment.
2. Selection: meaning, process and limitation.
3. Selection: types of test and interview.
4. Placement and induction.
5. Training and Development

MATHEMATICS (GENERAL ELECTIVE) (FOR BOTH ARTS & SCIENCE STUDENTS)

COURSE STRUCTURE:

SEMESTER-III

PAPER-I 40+10 Marks **(3 Credits)**

CALCULUS

Unit-I 10 Marks

Limits, Continuity, differentiability, Derivation of functions, higher order derivatives,Partial derivatives.

Unit-II 10 Marks

Tangent and normal, Maxima and Minima,Indeterminant forms, integration and definite integrals.

Unit-III 10 Marks

Differential Equations (1^{st} order and 1^{st} Degree linear equations, Homogeneous Equations Linear equation with higher order.

Unit-IV 10 Marks

Problems relating to all the three units above (i.e. Unit-I to III). All the problems are compulsory under this unit.

Books Prescribed:

1. Differential Calculus- Shanti Narayan & P.K. Mittal, S.Chand & Co. Pvt. Ltd., Chapters 3,4,5,7(7.2),9(9.1 to 9.5),10.
2. Integral Calculus- Shanti Narayan & P.K. Mittal, S.Chand & Co. Pvt. Ltd.,Chapter 2,3.

Reference Books:

1. Differential Calculus- Das & Mukharji, U. N. Dhur & Sons Pvt. Ltd.,Calcutta.
2. Integral Calculus- Das & Mukharji, U. N. Dhur & Sons Pvt. Ltd.,Calcutta.

SEMESTER-IV

PAPER-I I 50 Marks **(3 Credits)**

STATISTICS AND PROBABILITY

Unit-I 10 Marks

Frequency distributions and measures of location.

Unit-II 10 marks

Measures of Dispersions, Skewness & Kurtosis, Moments of Frequency distribution.

Unit-III 10 Marks

Theory of Probability.

Unit-IV 10 Marks

Problems relating to all the three units above (i.e. Unit-I to III). All the problems are compulsory under this unit.

Prescribed Book.

1. Mathematical Statistics- J.N. Kapur, H.C. Saxena, S.Chand & Co. Pvt. Ltd.,Chapters 2,3,4.

Reference Books:

1. Statistical Methods-S.P.Gupta (Sultan Chand & Sons).
2. Business Statistics- Shenoy, Srivastava and Sharma (New Age International).

Population Studies (General Elective)

SEMESTER-WISE LIST OF PAPERS	
Semester - III	
PS-I	Fundamentals of Population Studies
Semester - IV	
PS-II	Components of Population Studies

PS-I: Fundamentals of Population Studies

I. Nature and Scope of Population Studies; Relationship between Population Studies and Other Disciplines; Trends of population growth in the world and India; Causes of population growth.

II. Theories of Population: Malthusian Theory; Views of Karl Marx; Optimum Population Theory; Theory of Demographic Transition.

III. Sources of Demographic Data: Population Census - Significant features and Uses; Registration of Vital events; Sample Survey: Advantages.

IV. Age-sex Structure and its Measures; Factors affecting overall sex ratio; Factors determining the age structure of population.

Suggested Readings:

Bhende, A. and T. Kanitkar (2010). *Principles of Population Studies*, Himalaya Publishing House, Mumbai.

Chandana, R. C. (2004). Geography of Population, Kalyani Publishers, New Delhi.

Raj, Hans (2005). Fundamentals of Demography. Surjeet Publications, Delhi.

PS-II: Components of Population Studies

I. Fertility: Concept and Factors Affecting Fertility; Measures of Fertility: Crude Birth Rate, General Fertility Rate, Age Specific Fertility Rate, Total Fertility Rate; Theories of Fertility: Leibenstein and Easterlin.

II. Mortality: Meaning and Factors Affecting Mortality, Measures of Mortality: Crude Death Rate, Age-specific Death Rate; Infant Mortality Rate; Factors Affecting Infant Mortality; Mortality Differentials; Levels and Trends of Mortality in India.

III. Concepts of Migration; Types of Migration; Determinants and Consequences of Internal Migration; Migration Theories and Models: Ravenstein's Laws of Migration and Everett Lee's Theory of Migration.

IV. Urbanisation: Definition of Urban and Related Concepts used in Indian Census; Components of Urban Population Growth; Determinants of Urbanization**;** Process of Urbanization: Kingsley Davis Model and Gibbs Stages; Major Urban Problems in India.

Suggested Readings:

Bhende, A. and T. Kanitkar (2010). *Principles of Population Studies*, Himalaya Publishing House, Mumbai.

Bose, Ashis, (2002), India's Urbanisation 1901-2001, Tata-McGraw Hill, Delhi.

Chandana, R. C. (2004). Geography of Population, Kalyani Publishers, New Delhi.

Jhingan, M.L.; Bhatt, B.K. and Desai, J.N. (2011). Demography. Vrinda Publications (P) Ltd, Delhi.

Pathak, K. B., and Ram, F. (2005). Techniques of Demographic Analysis, Himalaya, Mumbai.

Raj, Hans (2005). Fundamentals of Demography. Surjeet Publications, Delhi.

Siddharth, K. and Mukherjee, S. (2013). Cities, Urbanization and Urban System. Kisalaya Publications, New Delhi.

Srinivasan, K. (2006). *Basic Demographic Techniques and Applications*, Sage, New Delhi.

BACHELOR OF ARTS
Choice Based Credit System
Industrial Relations & Personnel Management
MAJOR (900 Marks: 54 Credits)

First Year: Semester - I

Paper- I : Principles of Management (50 Marks: 3 Credits)

1. Concept, Scope and Objectives of Management.
2. Management as an Art, Science and Profession.
3. Function of Management: Planning, Organising, Directing and Controlling.
4. Concept, Scope and function of Financial Management.
5. Concept, Scope and function of Marketing management.

Paper-II: Labour Welfare (50 Marks: 3 Credits)

1. Concept and Scope of labour Welfare.
2. Principles of Labour Welfare.
3. Philosophy of Labour welfare.
4. Development of Labour Welfare in India.
5. Labour Administration in Odisha.

Paper-III: Indian Labour Problem (50 Marks: 3 Credits)

1. Labour problem in India: Issues and Concerns.
2. Problem of Child Labour in India and role of the state to eliminate.
3. Problems of Agricultural labour in India; Issues and Concern.
4. Problems of Migrant workers and its remedies.
5. Unemployment: Meaning and Types of Unemployment in India.

First Year: Semester - II

Paper-IV: Industrial Relations-I (50 Marks: 3 Credits)

1. Concept and Scope of Industrial Relations, Approaches to Industrial Relations, Dunlop's System Model of Industrial Relations.
2. Labour-Management cooperation: Meaning and Scope and Objectives.
3. Collective Bargaining: Meaning, Prerequisites, process, levels of bargaining.
4. Participative forums: Works committee, Grievance settlement authority, Safety committee, Canteen committee, Quality Circle
5. International Labour Organisation (ILO): Structure function and its impact on Industrial Relation in India.

Paper- V: Human Resource Management-I (50 Marks: 3 Credits)

1. Meaning, Definition and Scope of Human Resource Management.
2. Objectives and Characteristics of Human Resource Management.
3. Functions of HRM: Managerial and Operative functions.
4. Organizational structure : meaning and types
5. Role and functions of Human Resource Manager

Paper- VI: Social Security (50 Marks: 3 Credits)

1. Social security in India: Concept, Objectives and Scope; Techniques of social security: social assistance, social insurance.
2. Principles of Social Security.
3. Development of Social Security in India.
4. Role of ILO in shaping social security provision in India.
5. Social security for unorganised Labour.

Second Year: Semester - III

Paper VII: Industrial Relation-II (50 Marks: 3 Credits)

1. Meaning, Causes and Consequences of Industrial Dispute.
2. Methods of Settlement of industrial Disputes: Conciliation, adjudication and arbitration.
3. Meaning, Objective, Types and Functions of Trade Union in India.
4. Problems of Trade Union: Multiplicity, Inter and Intra Union rivalry, Outside leadership.
5. Grievance Handling: Model grievance procedure, Disciplinary Action and Procedure.

Paper VIII: Human Resource Management-II (50 Marks: 3 Credits)

1. Recruitment: meaning, concept and process of recruitment.
2. Selection: meaning, process and limitation.
3. Selection: types of test and interview.
4. Placement and induction.
5. Training and Development

Paper-IX: Human Resource Development (50 Marks: 3 Credits)

1. Concept and Philosophy of Human Resource Development (HRD).
2. HRD Mechanisms: Performance appraisal, Career planning and development, Job rotation.
3. Training & Development: Concept, Types and Evaluation of Training.
4. Methods of Training: Case Study, Role Play, Management Games, Managerial Grid.
5. HRD Practices in Indian organisations.

Second Year: Semester - IV

Paper-X: Labour Legislation-I (50 Marks: 3 Credits)

1. Meaning and Objectives of Labour Legislation. Factors influencing the growth the growth of Labour legislation in India.
2. Principles and categories of Labour legislation.
3. The Factories Act, 1948.
4. The Mines Act, 1952.
5. The Orissa Shops and Commercial Establishment Act, 1956.

Paper-XI: Labour Economics (50 Marks: 3 Credits)

1. Definition, Nature and Scope of Labour Economics.
2. Labour Market: Concept, Characteristics and Classification.
3. New Economic Policy, 1991 and its impact on Labour.
4. Meaning and concept of wage, types of wages: Minimum Wages, Fair Wage, Living Wage, Real Wage and Nominal Wage.
5. Wage Policy and Fixation in India.

Paper-XII: Organisational Behaviour-I (50 Marks: 3 Credits)

1. Organizational Behavior: Concept and Scope.
2. Approaches to Organisational Behavior.
3. Components of OB system: objectives and resources, formal organizational system, Industrial system and Social system.
4. Group Dynamics: Informal Groups and Organisation
5. Communication: Meaning, process and types of communication

Third Year: Semester – V

Paper-XIII: Labour Legislation-II (50 Marks: 3 Credits)

1. Trade Union Act, 1926.
2. The Industrial Disputes Act, 1947.
3. The Industrial Employment (Standing Orders) Act, 1946.
4. The Contract Labour (Regulation and Abolition) Act, 1970

Paper-XIV: Labour Legislation-III (50 Marks: 3 Credits)

1. The Payment of Wages Act, 1936.
2. The Minimum Wages Act, 1948.
3. The Employees' Compensation Act, 1923.
4. The Employees State Insurance Act, 1948.

Paper-XV: Organisational Behaviour-II (50 Marks: 3 Credits)

1. Formal Organisation System, Organization Structuring process: bureaucratic, project and matrix structure.
2. Motivation: Concept and theories of motivation- Maslow, Herzberg and Vroom.
3. Morale: Definition and factors affecting morale.
4. Meaning and Concept of perception, personality, attitude and values.

Third Year: Semester – VI

Paper-XVI: Computer Application in HRM (50 Marks: 3 Credits)

1. Fundamentals of Computer, Block diagram of a computer system, computer language and translators. Input and Output devices.
2. Operating Systems: Types of operating systems, basic services of operating systems.
3. Computer Network: Types of Network, LAN, WAN, MAN, Internet and FTP.
4. Management Information System: meaning, System Development Life Cycle.
5. Enterprises Resource Planning and HRM.

Paper-XVI: Field Work Report and Viva Voce (100 Marks: 6 Credits)

Industrial Relations & Personnel Management

MINOR - I (400Marks: 26 Credits)

First Year: Semester - I

Paper-I: Industrial Relations-I (50 Marks: 3 Credits)

1. Concept and Scope of Industrial Relations, Approaches to Industrial Relations, Dunlop's System Model of Industrial Relations.
2. Labour-Management cooperation: Meaning and Scope and Objectives.
3. Collective Bargaining: Meaning, Prerequisites, process, levels of bargaining.
4. Participative forums: Works committee, Grievance settlement authority, Safety committee, Canteen committee, Quality Circle
5. International Labour Organisation (ILO): Structure function and its impact on Industrial Relation in India.

First Year: Semester - II

Paper II: Industrial Relation-II (50 Marks: 3 Credits)

1. Meaning, Causes and Consequences of Industrial Dispute.
2. Methods of Settlement of industrial Disputes: Conciliation, adjudication and arbitration.
3. Meaning, Objective, Types and Functions of Trade Union in India.
4. Problems of Trade Union: Multiplicity, Inter and Intra Union rivalry, Outside leadership.
5. Grievance Handling: Model grievance procedure, Disciplinary Action and Procedure.

Second Year: Semester - III

Paper-III: Labour Welfare - I (50 Marks: 3 Credits)

1. Concept and Scope of labour Welfare.
2. Principles of Labour Welfare.
3. Philosophy of Labour welfare.
4. Development of Labour Welfare in India.
5. Labour Administration in Odisha.

Second Year: Semester - IV

Paper-IV: Labour Welfare - II (50 Marks: 3 Credits)

1. Agencies of labour Welfare: Government, Employers, Trade Unions and Voluntary Organisations
2. Statutory Labour Welfare measures: Canteen, Creche
3. Non-Statutory Welfare measures: Housing, Education, Cooperatives
4. Industrial Safety: Causes, consequences and prevention of industrial accidents
5. Industrial Hygiene: Occupational Health Hazards and Occupational diseases

Third Year: Semester - V

Paper- V: Human Resource Management-I (50 Marks: 3 Credits)

1. Meaning, Definition and Scope of Human Resource Management.
2. Objectives and Characteristics of Human Resource Management.
3. Functions of HRM: Managerial and Operative functions.
4. Organizational structure : meaning and types
5. Role and functions of Human Resource Manager

Paper-VI: Human Resource Management- II (50 Marks: 3 Credits)

1. Recruitment: meaning, concept and process of recruitment.
2. Selection: meaning, process and limitation.
3. Selection: types of test and interview.
4. Placement and induction.
5. Training and Development

Third Year: Semester - VI

Paper- VII: Project Work and Viva Voce (100 Marks: 8 Credits)

Choice Based Credit System
Bachelor of Arts

Industrial Relations & Personnel Management

General Core - Common to all candidates 300 Marks (18 credits)

General Elective - Human Resource Management-I (50 marks) 100 Marks (6 credits)
Human Resource Management-II (50 marks)

Minor -I Industrial Relations & Personnel Management 400 Marks (18 +8 credits)

Year	Semester	Paper Title	Marks	Credits
1st Year	Semester-I	Industrial Relations-I	50	3
	Semester-II	Industrial Relations-II	50	3
2nd Year	Semester-III	Labour Welfare-I	50	3
	Semester-IV	Labour Welfare-II	50	3
3rd Year	Semester-V	Human Resource Management-I	50	3
	Semester-V	Human Resource Management-II	50	3
	Semester-VI	Project Work & Viva voce	100	8

Minor -II - Any other subjects as per the List 300 Marks (18 credits)

Major - Industrial Relations & Personnel Management 900 Marks (54 credits)

Year	Semester	Paper	Minor Elective	Marks
1st Year	**Semester-I**	Paper-I	Principles of Management	50(3 credits)
		Paper-II	Labour Welfare	50(3 credits)
		Paper-III	Indian Labour Problem	50(3 credits)
	Semester-II	Paper-IV	Industrial Relations-I	50(3 credits)
		Paper-V	Human Resource Management-I	50(3 credits)
		Paper-VI	Social Security	50(3 credits)
2nd Year	**Semester-III**	Paper-VII	Industrial Relation-II	50(3 credits)
		Paper-VIII	Human Resource Management-II	50(3 credits)
		Paper-IX	Human Resource Development	50(3 credits)
	Semester-IV	Paper-X	Labour Legislation-I	50(3 credits)
		Paper-XI	Labour Economics	50(3 credits)
		Paper-XII	Organisational Behabiour-I	50(3 credits)
3rd Year	**Semester-V**	Paper-XIII	Labour Legislation-II	50(3 credits)
		Paper-XIV	Labour Legislation-III	50(3 credits)
		Paper-XV	Organisational Behavior-II	50(3 credits)
	Semester-VI	Paper-XVI	Computer Application in HRM	50(3 credits)
		Paper-XVII	Field Work Report & Viva voce	75+25(Viva) (6 credits)

MATHEMATICS (GENERAL ELECTIVE) (FOR BOTH ARTS & SCIENCE STUDENTS)

COURSE STRUCTURE:

THIRD SEMESTER

Paper-I	CALCULUS	40+10 Marks **(3 Credits)**

FOURTH SEMESTER

Paper-II	STATISTICS AND PROBABILITY	40+10 Marks **(3 Credits)**

MATHEMATICS (MINOR) (FOR BOTH ARTS & SCIENCE STUDENTS)

COURSE STRUCTURE:

FIRST SEMESTER

Paper-I	CALCULUS	40+10 Marks **(3 Credits)**

SECOND SEMESTER

Paper-II	ANALYSIS	40+10 Marks **(3 Credits)**

THIRD SEMESTER

Paper-III	ORDINARY DIFFERENTIAL EQUATIONS	40+10 Marks **(3 Credits)**

FOURTH SEMESTER

Paper-IV	ABSTRACT ALGEBRA AND THEORY OF EQUATIONS	40+10 Marks **(3 Credits)**

FIFTH SEMESTER

Paper-V	NUMERICAL ANALYSIS	40+10 Marks **(3 Credits)**
Paper-VI	LINEAR ALGEBRA	40+10 Marks **(3 Credits)**

MATHEMATICS (MAJOR) (FOR BOTH ARTS & SCIENCE STUDENTS)
(WITH PRACTICAL COMPONENT)

COURSE STRUCTURE:

	FIRST SEMESTER	
Paper-I	CALCULUS	40+10 Marks **(3 Credits)**
Paper-II	LINEAR PROGRAMMING	40+10 Marks **(3 Credits)**
Paper-III	COMPUTER PROGRAMMING IN C	40+10 Marks **(3 Credits)**
	SECOND SEMESTER	
Paper-IV	ANALYSIS-I	40+10 Marks **(3 Credits)**
Paper-V	PROBABILITY	40+10 Marks (**3 Credits**)
Paper-VI	PRACTICAL: Windows/DOS/UNIX/MS-Office Programming in C	40+10 Marks **(3 Credits)**
	THIRD SEMESTER	
Paper-VII	ORDINARY DIFFERENTIAL EQUATIONS	40+10 Marks **(3 Credits)**
Paper-VIII	DIFFERENTIAL GEOMETRY	40+10 Marks **(3 Credits)**
Paper-IX	ADVANCED CALCULUS	40+10 Marks **(3 Credits)**
	FOURTH SEMESTER	
Paper-X	ABSTRACT ALGEBRA & THEORY OF EQUATIONS	40+10 Marks **(3 Credits)**
Paper-XI	ANALYSIS-II	40+10 Marks **(3 Credits)**
Paper-X II	PRACTICAL: Windows/DOS/UNIX/MS-Office Programming in C	40+10 Marks (3 Credits)
	FIFTH SEMESTER	
Paper-XIII	NUMERICAL ANALYSIS	40+10 Marks **(3 Credits)**
Paper-XIV	LINEAR ALGEBRA	40+10 Marks **(3 Credits)**

Paper-XV	MATHEMATICAL MODELLING	40+10 Marks **(3 Credits)**

SIXTH SEMESTER

Paper-XVI	ANALYSIS-III	40+10 Marks **(3 Credits)**
Paper-XVII	DISCRETE MATHEMATICS/MECHANICS	40+10 Marks **(3 Credits)**
Paper-XVIII	ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS OR NUMBER THEORY	40+10 Marks **(3 Credits)**

MATHEMATICS (MAJOR) (FOR BOTH ARTS & SCIENCE STUDENTS)
(WITH PRACTICAL COMPONENT)

COURSE STRUCTURE:

SEMESTER-I

PAPER-I 40+10 Marks **(3 Credits)**

CALCULUS

Unit-I 10 Marks

Asymptotes, Curvature, Tracing of Curves (Cartenary, Cycloid, Folium of Descartes, Astroid, Limacon, Cissoids and loops).

Unit-II 10 Marks

Rectification, Quadrature, Volumes and Surface areas of solid of revolution .

Unit-III 10 Marks

Sphere, Cone, Cylinder, Central Conicoids.

Unit-IV 10 Marks

Problems relating to Unit- I to Unit-III (All problems under this unit are compulsory).

Books Prescribed :

1. A Text Book of Calculus Part-II – Shantinarayan, S. Chand and Co., Chapter 8 (Art 24, 25, 26).
2. A Text Book of Calculus Part-III– Shantinarayan, S. Chand and Co., Chapter 1 (Art 1,2),3,4(Art 10, 11,12 only).
3. Analytical Solid Geometry- Shanti Narayan, P.K. Mittal, S. Chand & Co.

Reference Books:

1. Text Book of Differential Calculus-Gorakh Prasad, Pothisala Pvt. Ltd, Allahabad.
2. Text Book of Integral Calculus-Gorakh Prasad, Pothisala Pvt. Ltd, Allahabad.
3. Differential Calculus- Das & Mukharjee, U.N. Dhur & Sons Pvt. Ltd., Calcutta.
4. Integral Calculus- Das & Mukharjee, U.N. Dhur & Sons Pvt. Ltd., Calcutta.
5. Text Book of Analytical Solid Geometry of Three Dimensions- P.K. Jain and Khalil Ahmad, Wiley Eastern Ltd. (New Age International Ltd.) New Delhi.

PAPER-II 40+10 Marks **(3 Credits)**

LINEAR PROGRAMMING

Unit-I 10 Marks

Mathematical formulation, Graphical Solution, Simplex Method.

Unit-II 10 Marks

Duality in Linear Programming, Post-optimal Analysis.

Unit-III 10 Marks

Transportation Problem and Assignment Problem.

Unit-IV 10 Marks

Problems relating to Unit- I to Unit-III (All problems under this unit are compulsory).

Book Prescribed:

1. Operations Research : Kantiswarup, P. K. Gupta and Manmohan, Sultan Chand and Sons, Chapter 2,3,4,5 (except 5.8), 6,10,11 (11.1 to 11.4)

Books for Reference:

1. Operation Research- P.K. Gupta & D.S. Hira, S. Chand & Co. Pvt. Ltd.
2. Linear Programming Methods and Applications- G.I. Gauss, McGraw Hill – International Book Company.
3. Linear Programming Methods and Applications- G.V. Shenoy (New Age International Ltd. ,New Delhi).

PAPER-III 40+10 Marks **(3 Credits)**

COMPUTER PROGRAMMING IN C

Unit-I 10 Marks

Getting Started : What is C, Getting Started with C, C\instructions, The first C Programme, Control instruction in C, Decision Control Structure, Decision !, The if statement, The if-else statement, use of logical operators, A word of Caution, The conditional operations.

Unit-II 10 Marks

The Loop Control Statement: Loop, The break statement, The Continue statement, The do While Loop, The Case Control Structure : Decision using Switch, the go to statement. Functions: What is function, passing value between functions, Scope Rule of functions, Advanced features of functions.

Unit-III 10 Marks

Data Types Revised : Integers, Long and Short, integers- Signed and unsigned, Chars-Signed and unsigned, Floats and Doubles, Storage Class in C, C pre-processor : Features of C preprocessoe, Macro Expansion, File Inclusion, Conditional Compilation, Arrays : what an arrays, more on arrays, pointers and Arrays, More their and Dimension, Array of pointers.

Unit-IV 10 Marks

Problems relating to Unit- I to Unit-III (All problems under this unit are compulsory).

Book Prescribed :

1. Let us C (third Editions) : Yashvant Kanetkar, BPB Publication, Chapter 1,2,3,4,5,6,7,8.

Reference Book:

1. Programming in ANSI C – E. Bala Guruswamy.

SEMESTER-II

PAPER-IV 40+10 Marks **(3 Credits)**

ANALYSIS-I

Unit-I 10 Marks

Ordered field of Real numbers, l.u.b. and g.l.b, Completeness of of R (Not through Dedkindcuts), Complex numbers, Inequalities, Metric properties of R, Limit points, ClosedSets, Open Sets, Bolzano-Weirstrass theorem.

Unit-II 10 Marks

Convergence of real sequence and Series, Monotonic sequences, Cauchy criteria ofConvergence, Limit Superior, Limit inferior, Tests of converence of series of positive terms, Comparision tests, Ratio test, Root test, Absolute Converegence, Alternating series test.

Unit-III 10 Marks

Limit and Continuity of functions, properties of continuous functions, discontinuities, uniform continuity, Differentiability of real functions, Higher derivatives, Mean Value Theorems, Taylor's theorm with reminder, Taylor's series.

Unit-IV 10 Marks

Problems relating to Unit- I to Unit-III (All problems under this unit are compulsory).

Book Prescribed :

1. Mathematical Analysis- S. C. Mallik and S. Arora, New Age International Publications, Chapter 1(excluding 4.3 and 4.4),2,3,5,6.

Reference Books:

1. Elements of Real Analysis-Shanti Narayan & M.D. Raisinghania, S. Chand & Co.
2. Fundamentals of Mathematical Analysis- G. Das and S. Pattanaik (TMH).
3. Principles of Mathematical Analysis- W. Rudin (TMH).

PAPER-V 40+10 Marks (**3 Credits**)

PROBABILITY

Unit-I 10 Marks

Classical definition of probability, Impirical definition of probability, Axiomatic approach of probability theory, Finite sample spaces, Conditional probability, Independent events.

Unit-II 10 Marks

Concepts of random variable, Distribution functions, Moments of random variable, Binomial, Poission, Uniform and normal distribution.

Unit-III 10 Marks

Joint distribution functions and density functions, Conditional densities of Continuous random variables, Conditional expectation and Variance.

Unit-IV 10 Marks

Problems relating to Unit- I to Unit-III (All problems under this unit are compulsory).

Books Prescribed :

1. Probability of Random Processes- Srinivasan and K.M. Mehta (II edition) Chapter 3,4 (excluding absolute moment),5 (excluding 5.4).

Reference Book:

1. Modern Probability Theory- B. R. Bhatt (New Age International).

PAPER-VI 40+10 Marks **(3 Credits)**

PRACTICAL: Windows/DOS/UNIX/MS-Office

Programming in C

A student is required to perform two experiments in two hours duration. A student has to perform at least 70% of the number of experiments prescribed for practical.

Experiment	30 Marks
Record	10 Marks
Viva	10 Marks

A student shall be required to maintain a record , certified by the teacher and produce them at the time of examination.

The following practical should be done in addition to working with operating systems like UNIX and WINDOWS and prepare documents, tabulation using MS Office.

1. Program to find sum of digits of a given number.
2. Program to find ascending order of some numbers.
3. Program to generate Fibonacci sequences.
4. Program to compute factorial of a number.
5. Program to test whether a number is prime or not
6. Program to find roots of a quadratic equation.
7. Program to find G.C.D and L.C.M of two numbers.
8. Program to find all the factors of a number.
9. Program to check whether a number is palindrome.
10. Program to generate PASCAL's Triangle
11. Program to find slope and midpoint of a line passing through two given points.
12. Program to find the product of two complex numbers.

SEMESTER-III

PAPER-VII 40+10 Marks **(3 Credits)**

ORDINARY DIFFERENTIAL EQUATIONS

Unit-I 10 Marks

Ordinary Differential Equations of 1^{st} order and 1^{st} degree (Variables Separable, homogeneous, exact, linear), Equations of 1^{st} order and higher degree.

Unit-II 10 Marks

Second Order linear equation with constant coefficients, Second order Equation with variables Coefficients, variation of parameters.

Unit-III 10 Marks

Laplace transforms and it's application to solutions of Ordinary differential equations.

Unit-IV 10 Marks

Problems relating to Unit- I to Unit-III (All problems under this unit are compulsory).

Book Prescribed :

1. A Course on Ordinary and Partial differential equation, J. Sinha Roy and S. Padhy (Kalyani Publication), Chapter 2(2.1 to 2.7),3,4 , 5, 9 (9.1,9.2,9.5,9.10,9.11,9.13).

Books Reference:

1. Introductory Course of Differential Equation- D.A. Murray, Longman.
2. Differential Equation and their Application- Matrin Braun, Spinger International.
3. Differential Equations- G. F. Simmons.

PAPER-VIII 40+10 Marks **(3 Credits)**

DIFFERENTIAL GEOMETRY

Unit-I 10 Marks

Introduction, Curves with Torsion.

Unit-II 10 Marks

Envelopes, developable surfaces, Curvillinear Co-ordnates on Surface.

Unit-III 10 Marks

Fundamental Magnitudes, Curves on Space.

Unit-IV 10 Marks

Problems relating to Unit- I to Unit-III (All problems under this unit are compulsory).

Book Prescribed :

1. Differential Geometry- C. E. Weatherburn (ELBS), Chapter : 1 (1,2,3,4,7,8,10),2 (13,14,16,17),3,4(29,30,31,35,37,38).

Books Reference:

1. Elementary differential Geometry-Presseler, Springer Indian Student edition.
2. Elements of Differential Geometry-P.K. Satapathy.

PAPER-IX 40+10 Marks **(3 Credits)**

ADVANCED CALCULUS

Unit-I 10 Marks

Functions of Several Variables : Explicit and Implicit Functions, Continuity, Partial derivatives, differentiability, Partial derivatives of higher orders, differentials of higher order, Functions of functions, Change of variables.

Unit-II 10 Marks

Taylor's theorem for two variables, Maxima and Minima of a function of two and three variables, Functions of several variables, Implicit Functions: Definitions, Jacobians, Lagranges Multipliers.

Unit-III 10 Marks

Vector differentiation, Gradient, divergence and Curl of vector function, Line integral and Volume integral, Statement of Gauss, Stoke's and Green's theorem (statements without proof).

Unit-IV 10 Marks

Problems relating to Unit- I to Unit-III (All problems under this unit are compulsory).

Books Prescribed :

1. Mathematical Analysis- S. C. Mallik and S. Arora , (New Age International), Chapters 15, 16.
2. Topics of Calculus- R. K. Panda and P.K. Satapathy, Chapters 6,7.

Reference Books:

1. Mathematics for Degree students-Dr. P.K. Mittal, S. Chand & Co. Pvt. Ltd.
2. Vector Analysis- P.Duraipandian, Kayalal Pachaiyappa, S. Chand & Co. Pvt. Ltd.

SEMESTER-IV

PAPER-X 40+10 Marks **(3 Credits)**

ABSTRACT ALGEBRA AND THEORY OF EQUATIONS

Unit-I 10 Marks

Group Theory: Definition and examples, Subgroups. Counting Principles, Normal Subgroups, Quotient groups, Homomorphism.

Unit-II 10 Marks

Ring Theory : Definition and examples, Some special Classes of rings, Homomorphism, Ideals and quotient rings.

Unit-III 10 Marks

Theory of Equations : Preliminaries, properties of equations, Descrate's rules of Sign, Relation between Roots and Co-efficients, Symmetric function of Rules, Algebraic Solution of Cubics, Nature of roots of a Cubic, Solution of Cubic by Carden's method , Solution of Biquadratic.

Unit-IV 10 Marks

Problems relating to Unit- I to Unit-III (All problems under this unit are compulsory).

Books Prescribed :

1. Topics in Algebra- I.N. herstein (Vikash Publishing), Chapter 2 (2.1 to 2.7), 3 (3.1 to 3.5).
2. Theory of Algebra- Chandrika Prasad (Pothisala), Chapter 11 (11.1 to 11.4), 12 (12.1 to 12.3, 12.6).

Books Reference :

1. A first Course in abstract Algebra-J.B. Fraleigh, Wesley Publ. Company.
2. Contemporary Abstract Algebra-J.Galian , Narosa Publishing House.
3. Higher Algebra- S. Barnad and J. M. Child, MacMillan .

PAPER-X I 40+10 Marks **(3 Credits)**

ANALYSIS-II

Unit-I 10 Marks

The Riemann Integral : Definition and Existence of the integral, Refinement of partitions, Darboux's Theorem, Conditions of Integrability, Integrability of the sum and Difference of Integrable functions, The Integral as a limit of a sums (Riemann Sums), Some Integrable functions, Integration and Differentiations (The primitive).The Riemann Integral Continued : The fundamental Theorem of Calculus, Mean Value Theorem of Integral calculus, Integration by parts, Change of variable in an Integral, Second Mean Value Theorem.

Unit-II 10 Marks

Improper Integrals : Integration of Unbounded functions with finite limits of Integration,Comparision Tests for Convergence at a of $\int_a^b f dx$, Infinite range of Integration, Integrand as a product of functions (Convergence at ∞).

Unit-III 10 Marks

Fourier Series : Trigonometric Series, Fourier Series, periodic functions, Piecewise monotonic functions, Some Theorem on Fourier Series for even and odd function, Half range series, Interval, Other than $[-\pi, \pi]$.

Unit-IV 10 Marks

Problems relating to Unit- I to Unit-III (All problems under this unit are compulsory).

Books Prescribed:

1. Mathematical Analysis- S.C. Mallick and S. Arora, New Age International Ltd., New Delhi, Chapters 9,11,14.

Books for Reference:

1. Elements of Real Analysis- Shanti Narayan, Dr. M.D. Raisinghania, S. Chand & Co. Pvt. Ltd.
2. Fundamental of Mathematical Analysis- G.Das & S. Pattnaik (TMH).

PAPER-X II 40+10 Marks **(3 Credits)**

PRACTICAL: Windows/DOS/UNIX/MS-Office

Programming in C

A student is required to perform one experiment of two hours duration. A student has to perform at least 70% of the number of experiments prescribed for practical.

Experiment	30 Marks
Record	10 Marks
Viva	10 Marks

A student shall be required to maintain a record , certified by the teacher and produce them at the time of examination.

The following practical should be done in addition to working with operating systems like UNIX and WINDOWS and prepare documents, tabulation using MS Office.

1. Progam to find addition of two matrices.
2. Progam to find multiplication of two matrices.

3. Progam to find Matrix Inverse.
4. Progam to find sum of the diagonal elements of a square matrix.
5. Formation of C program for searching of primes less than or equal to 'A'.
6. Write a programme to evaluate the area under the curve *y=f(x), x=*$a\ and\ x = b$ and X-axis using trapezoidal rules.
7. Write a programme to evaluate the integral $\int f(x)dx$ using Simpson's rule.
8. Write a programme and draw the flow chart to evaluate the following function for values $x = 1\ to\ 3$ in increaments of 0.1 for $f(x) = 2x^2 + 3x + 4$ for *x=2*

$$= 0\ for\ x = 2$$

$$= -2x^2 + 3x + 3\ for\ x > 2$$

9. Write a programme and draw the flow chart to find the Armstrong Number between 1 to 100.
10. Write a programme and draw the flow chart to find the sum of n odd/even natural numbers.
11. Write a programme to evaluate the series

$$\frac{1}{1-x} = 1 + x + x^2 + x^3 + \cdots for - 1 < x < 1\ to\ (0.01)\%$$ accuracy.

12. Write a programme to determine the value of "e" by the use of Maclaurins' series.

SEMESTER-V

PAPER-X III 40+10 Marks **(3 Credits)**

NUMERICAL ANALYSIS

Unit-I 10 Marks

Errors, Root finding by Bisection Method, Root finding by Iteration Methods based on first Degree equations, Secant Method, Regular-Falsi Method, Newton-Raphson Method (Without rates of Convergence and Order of Convergence).Numerical Solution of System of linear equations: Direct methods, Cramer's rule,(Gauss Elimination methods, Gauss-Jordan Elimination Method). Interpolation : Lagrange and Newton interpolations, Finite difference operators,Interpolating polynomials using finite differences.

Unit-II 10 Marks

Differentiation : Method based on Interpolation (Linear and quadratic interpolation with non-uniform and uniform nodal points without error analysis), Methods based on finite differences (Without error analysis). Integration: Methods based on Interpolation (Trapezoidal rule with error term, Simpson's rule with error term, Composite integration methods.

Unit-III 10 Marks

Numerical Solution of Ordinary differential equations : Euler Method, Backward Euler Method, Runga-Kutta method (Second Order, Fourth Order Method) (All these methods without Convergence and error analysis).

Unit-IV 10 Marks

Problems relating to Unit- I to Unit-III (All problems under this unit are compulsory).

Book Prescribed :

1. Numerical Methods for Scientific and Engineering Computation – M. K. Jain, S.R.K. Iyengar, R.K. Jain, New Age International Ltd., New Delhi, Chapter 1 (1.1,1.3), 2 (2.2,2.3), 3 (3.2), 4 (4.2,4.3,4.4), 5 (5.2,5.7,5.9),6 (6.3,6.4).

Books Reference:

1. Introductory Numerical Analysis- R. N. Jena & N. Dutta, Sridhar Prakashani.
2. A Course Numerical Analysis- B. P. Acharya & N. Das (Kalyani Publication).

PAPER-X IV 40+10 Marks **(3 Credits)**

LINEAR ALGEBRA

Unit-I 10 Marks

Vector Space, Subspaces, Span of a set, Linear dependence and independence, dimension and basis.

Unit-II 10 Marks

Linear transformations : Definition, examples, Range and Kernel of a map, rank and nullity, The space L(U,V), Composition of Linear maps, Linear map associated with matrix, matrix Operations, rank and nullity of matrix, transpose of a matrix.

Unit-III 10 marks

Elementary row operations, System of linear equations, matrix inversion, determinants, minors and rank of a matrix, product of determinants, application to linear equations, eigen values and eigen vectors.

Unit-IV 10 Marks

Problems relating to Unit- I to Unit-III (All problems under this unit are compulsory).

Book Prescribed :

1. An Introduction to Linear Algebra- V. Krishnamurty, V.P. Mainra, J.L. Arora -Affiliated East-West Press Pvt. Ltd.,New-Delhi Chapters 3,4 (4.1 to 4.7), 5, 6 (6.5 to 6.8).

Books for Reference:

1. Linear Algebra, a geometric Approach- S Kumaresan, Prentice Hall of India.
2. Linear Algebra – Rao and Bhimasankarn, Hindustan Publishing House.

PAPER-X V 40+10 Marks **(3 Credits)**

MATHEMATICAL MODELLING

Unit-I 10 Marks

Simple Situations Requiring Mathematical Modeling, The Technique of mathematical modelling, Mathematical Modeling through differential equations, Linear growth and Decay Models, Non-L inear growth and decay models, Compartment models, Mathematical Modeling of geometrical problems through ordinary differential equations of first order.

Unit-II 10 Marks

Mathematical modelling in population dynamics, Mathematical modelling of epidermics through systems of ordinary differential equations of first order, compartment models through systems of ordinary differential equations of first order, Mathematical models on Medicine, arms Race, Battles and International Trade in terms of systems of ordinary differential equations, Mathematical modelling of Planetary motions, Mathematical modelling of circular Motion and Motion of satellites, Mathematical modelling through linear differential equations of second order.

Unit-III 10 Marks

Situation giving rise to partial differential equations models, Mass-balance equations : First method of getting PDE models, Momentum-balance equations; The Second method of obtaining partial differential equation models, Probability generating function, fourth method of obtaining partial differential equation models, Model for Traffic flow a Highway, Situations that can be modelled through graphs, Mathematical models in terms of directed graphs, Optimization principles and techniques, Mathematical modelling through calculus of variations.

Unit-IV 10 Marks

Problems relating to Unit- I to Unit-III (All problems under this unit are compulsory).

Books Prescribed:

1. Mathematical Modelling- J. N. Kapoor (New Age International), Chapter:1,(1.1 and 1.2), 2(2.1 to 2.4),3 (3.1 to 3.5), 4(4.1 to 4.3),6(6.1 to 6.6), 7(7.1 and 7.2),9 (9.1 and 9.2).

SEMESTER-VI

PAPER-X VI 40+10 Marks **(3 Credits)**

ANALYSIS-III

Unit-I 10 Marks

Integration on R^2.

Unit-II 10 Marks

Integration on R^3.

Unit-III 10 Marks

Metric Spaces: Definitions and examples, Open and Closed Sets, Convergence and Completeness, Continuity and Uniform Continuity, Compactnessn Connectedness.

Unit-IV 10 Marks

Problems relating to Unit- I to Unit-III (All problems under this unit are compulsory).

Book Prescribed:

1. Mathematical Analysis- S.C. Mallik and S. Arora, (New Age International), Chapters: 17 and 18.

Books for Reference:

1. Elements of Real Analysis- Shanti Narayan, Dr. M.D. Raisinghania, S. Chand & Co. Pvt. Ltd.
2. Fundamental of Mathematical Analysis- G.Das & S. Pattnaik (TMH).

PAPER-X VII 40+10 Marks **(3 Credits)**

DISCRETE MATHEMATICS

Unit-I 10 Marks

Mathematical Logic: Properties and Logical Operators, Construction of Truth tables, Tautologies and Contradictions, Equivalence and Implication,NAND and NOR, Functionally Complete Sets, Two State Devices and Statement Logic, Normal Forms.

Unit-II 10 Marks

Lattices and Boolean Algebra: Partially Ordered Sets, Hasse Diagram of Partially order sets, Lattices, Boolean Algebra, Karnaugh Map, Representation of Logical functions.

Unit-III 10 Marks

Graph Theory: Basic Concepts, Operations on Graphs, Isomorphism, Connected Graphs, Distance in a Graph, Cut-Vertices and Cut-edges, Connectedness in Directed Graph, Incidence and Adajacency Matrices, Eulerian and Hamiltonian Graphs, Euler Circuits, Eulerian Diagraphs,Trees, Applications of trees, Trees and Sorting, Spanning Trees, Optimal Spanning Graphs, Depth-First Search and Breadth- First Search.

Unit-IV 10 Marks

Problems relating to Unit- I to Unit-III (All problems under this unit are compulsory).

Books Prescribed:

1. Fundamental Approach to Discrete Mathematics- D.P. Acharya and Sree Kumar (New Age International).

Reference Book:

1. A Text book of Discrete Mathematics- Dr. Swapan Kumar Sarkar, S. Chand & Co. Pvt. Ltd.

OR

MECHANICS

Unit-I 10 Marks

Method of plane statics, application in plane statics.

Unit-II 10 Marks

Plane Kinematics, methods of plane dynamics, application in plane dynamics.

Unit-III 10 Marks

Motion of particle and motion of rigid body.

Unit-IV 10 Marks

Problems relating to Unit- I to Unit-III (All problems under this unit are compulsory).

Book Recommended :

1. Mechanics-J.L. Synge and Griffith, Mc Graw Hill, Chapters : 2, 3 (excluding 3.3, Cables with smooth and rough curves & 3.5), 4, 5 (excluding 5.3), 6 (6.1 & 6.2), 7)7.1,7.2,7.3,7.5).

PAPER-XVIII 40+10 Marks **(3 Credits)**

ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS

Unit-I 10 Marks

Series Solutions and Special functions.

Unit-II 10marks

Ordinary differential Equations in more than two variables, partial differential equations of first order.

Unit-III 10 Marks

Partial differential Equations of the Second and higher Order.

Unit-IV 10 Marks

Problems relating to Unit- I to Unit-III (All problems under this unit are compulsory).

Books Prescribed :

1. A Course on Ordinary and Partial differential equation- J. Sinha Roy and S. Padhy (Kalyani Publishers), Chapters 7,11 (11.11 to 11.4),12 (12.1 to 12.6) 13 (13.1 to 13.5, 13.7).

Reference Book:

1. Advanced Differential Equations- M.D. Raisinghania, S. Chand & Co. Ltd.

OR

NUMBER THEORY

Unit-I 10 Marks

Divisibility, Primes, Congruency, solution of congruency, Congruency of degree 1, the function $\phi(n)$, Number Theory from Algebric view point, multiplicative groups.

Unit-II 10 Marks

Quadratic reciprocity : Quadratic residues, Jacobi symbols.

Unit-III 10 Marks

Some Diophantine Equations **ax+by=c**, positive solutions, other linear equations $x^4 + y^4 = z^2$

Sums of Four and Five squares Waring's Problem, Sum of fourth power.

Unit-IV 10 Marks

Problems relating to Unit- I to Unit-III (All problems under this unit are compulsory).

Books Prescribed :

1. An Introduction to Theory of Numbers- Ivan Niven and H.S. Zuckerman, Wiley Eastern Pvt. Ltd., Chapters : 1 (1.1-1.3), 2 (2.1-2.4,2.10,2.11),3 (3.1,3.3),4(4.1-4.4), 5(5.1-5.9).

Project work must be done on major subjects- 100 Marks ;6 Credits [Project 75 + Comprehensive viva-voce 25]

MATHEMATICS (MINOR) (FOR BOTH ARTS & SCIENCE STUDENTS)

COURSE STRUCTURE:

SEMESTER-I

PAPER-I 40+10 Marks **(3 Credits)**

CALCULUS

Unit-I 10 Marks

Asymptotes, Curvature, Tracing of Curves (Cartenary, Cycloid, Folium of Descartes, Astroid, Limacon, Cissoids and loops).

Unit-II 10 Marks

Rectification, Quadrature, Volumes and Surface areas of solid of revolution .

Unit-III 10 Marks

Sphere, Cone, Cylinder, Central Conicoids.

Unit-IV 10 Marks

Problems relating to Unit- I to Unit-III (All problems under this unit are compulsory).

Books Prescribed :

1. A Text Book of Calculus Part-II – Shantinarayan, S. Chand and Co., Chapter 8 (Art 24, 25, 26).
2. A Text Book of Calculus Part-III– Shantinarayan, S. Chand and Co., Chapter 1 (Art 1,2),3,4(Art 10, 11,12 only).
3. Analytical Solid Geometry- Shanti Narayan, P.K. Mittal, S. Chand & Co.

Reference Books:

1. Text Book of Differential Calculus-Gorakh Prasad, Pothisala Pvt. Ltd, Allahabad.
2. Text Book of Integral Calculus-Gorakh Prasad, Pothisala Pvt. Ltd, Allahabad.
3. Differential Calculus- Das & Mukharjee, U.N. Dhur & Sons Pvt. Ltd., Calcutta.
4. Integral Calculus- Das & Mukharjee, U.N. Dhur & Sons Pvt. Ltd., Calcutta.
5. Text Book of Analytical Solid Geometry of Three Dimensions- P.K. Jain and Khalil Ahmad, Wiley Eastern Ltd. (New Age International Ltd.) New Delhi.

SEMESTER-II

PAPER-II 40+10 Marks **(3 Credits)**

ANALYSIS

Unit-I 10 Marks

Ordered field of Real numbers, l.u.b. and g.l.b, Completeness of of R (Not through Dedkindcuts), Complex numbers, Inequalities, Metric properties of R, Limit points, ClosedSets, Open Sets, Bolzano-Weirstrass theorem.

Unit-II 10 Marks

Convergence of real sequence and Series, Monotonic sequences, Cauchy criteria ofConvergence, Limit Superior, Limit inferior, Tests of converence of series of positive terms, Comparision tests, Ratio test, Root test, Absolute Converegence, Alternating series test.

Unit-III 10 Marks

Limit and Continuity of functions, properties of continuous functions, discontinuities, uniform continuity, Differentiability of real functions, Higher derivatives, Mean Value Theorems, Taylor's theorm with reminder, Taylor's series.

Unit-IV 10 Marks

Problems relating to Unit- I to Unit-III (All problems under this unit are compulsory).

Books Prescribed :

1. Mathematical Analysis- S. C. Mallik and S. Arora, New Age International Publications, Chapter 1(excluding 4.3 and 4.4),2,3,5,6.

Reference Books:

1. Elements of Real Analysis-Shanti Narayan & M.D. Raisinghania, S. Chand & Co.
2. Fundamentals of Mathematical Analysis- G. Das and S. Pattanaik (TMH).
3. Principles of Mathematical Analysis- W. Rudin (TMH).

SEMESTER-III

PAPER-III 40+10 Marks **(3 Credits)**

ORDINARY DIFFERENTIAL EQUATIONS

Unit-I 10 Marks

Ordinary Differential Equations of 1^{st} order and 1^{st} degree (Variables Separable, homogeneous, exact, linear), Equations of 1^{st} order and higher degree.

Unit-II 10 Marks

Second Order linear equation with constant coefficients, Second order Equation with variables Coefficients, variation of parameters.

Unit-III 10 Marks

Laplace transforms and it's application to solutions of Ordinary differential equations.

Unit-IV 10 Marks

Problems relating to Unit- I to Unit-III (All problems under this unit are compulsory).

Books Prescribed :

1. A Course on Ordinary and Partial differential equation, J. Sinha Roy and S. Padhy (Kalyani Publication), Chapter 2(2.1 to 2.7),3,4 , 5, 9 (9.1,9.2,9.5,9.10,9.11,9.13).

SEMESTER-IV

PAPER-IV 40+10 Marks **(3 Credits)**

ABSTRACT ALGEBRA AND THEORY OF EQUATIONS

Unit-I 10 Marks

Group Theory: Definition and examples, Subgroups. Counting Principles, Normal Subgroups, Quotient groups, Homomorphism.

Unit-II 10 Marks

Ring Theory : Definition and examples, Some special Classes of rings, Homomorphism, Ideals and quotient rings.

Unit-III 10 Marks

Theory of Equations : Preliminaries, properties of equations, Descrate's rules of Sign, Relation between Roots and Co-efficients, Symmetric function of Rules, Algebraic Solution of Cubics, Nature of roots of a Cubic, Solution of Cubic by Carden's method , Solution of Biquadratic.

Unit-IV 10 Marks

Problems relating to Unit- I to Unit-III (All problems under this unit are compulsory).

Books Prescribed :

1. Topics in Algebra- I.N. herstein (Vikash Publishing), Chapter 2 (2.1 to 2.7), 3 (3.1 to 3.5).

2. Theory of Algebra- Chandrika Prasad (Pothisala), Chapter 11 (11.1 to 11.4), 12 (12.1 to 12.3, 12.6).

SEMESTER-V

PAPER-V 40+10 Marks **(3 Credits)**

NUMERICAL ANALYSIS

Unit-I 10 Marks

Errors, Root finding by Bisection Method, Root finding by Iteration Methods based on first Degree equations, Secant Method, Regular-Falsi Method, Newton-Raphson Method (Without rates of Convergence and Order of Convergence).Numerical Solution of System of linear equations: Direct methods, Cramer's rule,(Gauss Elimination methods, Gauss-Jordan Elimination Method). Interpolation : Lagrange and Newton interpolations, Finite difference operators,Interpolating polynomials using finite differences.

Unit-II 10 Marks

Differentiation : Method based on Interpolation (Linear and quadratic interpolation with non-uniform and uniform nodal points without error analysis), Methods based on finite differences (Without error analysis). Integration: Methods based on Interpolation (Trapezoidal rule with error term, Simpson's rule with error term, Composite integration methods.

Unit-III 10 Marks

Numerical Solution of Ordinary differential equations : Euler Method, Backward Euler Method, Runga-Kutta method (Second Order, Fourth Order Method) (All these methods without Convergence and error analysis).

Unit-IV 10 Marks

Problems relating to Unit- I to Unit-III (All problems under this unit are compulsory).

Book Prescribed :

1. Numerical Methods for Scientific and Engineering Computation – M. K. Jain, S.R.K. Iyengar, R.K. Jain, New Age International Ltd., New Delhi, Chapter 1 (1.1,1.3), 2 (2.2,2.3), 3 (3.2), 4 (4.2,4.3,4.4), 5 (5.2,5.7,5.9),6 (6.3,6.4).

Book Reference:

PAPER-VI 40+10 Marks **(3 Credits)**

LINEAR ALGEBRA

Unit-I 10 Marks

Vector Space, Subspaces, Span of a set, Linear dependence and independence, dimension and basis.

Unit-II 10 Marks

Linear transformations : Definition, examples, Range and Kernel of a map, rank and nullity, The space L(U,V), Composition of Linear maps, Linear map associated with matrix, matrix Operations, rank and nullity of matrix, transpose of a matrix.

Unit-III 10 marks

Elementary row operations, System of linear equations, matrix inversion, determinants, minors and rank of a matrix, product of determinants, application to linear equations, eigen values and eigen vectors.

Unit-IV 10 Marks

Problems relating to Unit- I to Unit-III (All problems under this unit are compulsory).

Books Prescribed :

1. An Introduction to Linear Algebra- V. Krishnamurty, V.P. Mainra, J.L. Arora -Affiliated East-West Press Pvt. Ltd.,New-Delhi Chapters 3,4 (4.1 to 4.7), 5, 6 (6.5 to 6.8).

Books for Reference:

1. Linear Algebra, a geometric Approach- S Kumaresan, Prentice Hall of India.
2. Linear Algebra – Rao and Bhimasankarn, Hindustan Publishing House.

B. A (Minor)

Political Science Syllabus

SEMESTER - I

Paper –I: POLITICAL THEORY (I)

Unit-I: Nature, Scope and significance of Political Theory

UNIT: II – Concept and origin of the State

UNIT:III – Concept of Sovereignty

UNIT: IV: Concept of Liberty, Equality and Justice

SEMESTER - II

Paper – II: INDIAN GOVERNMENT AND POLITICS

Unit – I: Making of Indian Constitution

Unit- II: Fundamental Rights and DPSP

Unit – III: The Union Executive

Unit- IV: Union Judiciary and Central Election Commission

SEMESTER – III

Paper – III: Major Constitutions and Governments

Unit – I: The Government of the United Kingdom

Unit –II: The Government of United States

Unit – III: People's Republic of China

Unit – IV: The Government of Switzerland

SEMESTER – VI

Paper – VI: Indian Politics: Issues and Debates

Unit – I: Major perspectives on Indian politics: Liberal, Marxist, Subaltern and Feminist

Unit – II: The Politics of Identity: Caste, Tribe, Class and Gender and social justice

Unit – III: Regionalism and Secessionism and linguism, Demand for separate states, salience of regional parties at national and state level

Unit –IV: Secularism and Communalism

SEMESTER – V

Paper – V: Modern Political Thinkers of Odisha

Unit –I: Vir Surendra Sai and Fakir Mohan Senapati

Unit –II: Krishna Chnadra Gajapati and Rama devi

Unit –III: Ramchandra Bhanj Deo and Harekrushna Mahatab

Unit- IV: Madhu Sudan Das and Gopabandhu Das

SEMESTER – VI

Paper – VI: Indian Political Thinkers

Unit – I: Manu and Kautilya

Unit – II: Swami Vivekananda and Aurobindo Ghosh

Unit – III: Manevendra Nath Roy and Mohan Das Karamchand Gandhi

Unit – IV: Jawaharlal Nehru and Baba Saheb Bhim Rao Ambedkar

B. A (Major)

Political Science Syllabus

SEMESTER - I

Paper –I: POLITICAL THEORY (I)

Unit-I: Nature, Scope and significance of Political Theory

UNIT: II – Concept and origin of the State

UNIT:III – Concept of Sovereignty

UNIT: IV: Concept of Liberty, Equality and Justice

Paper – II: WESTERN POLITICAL THOUGHT (I)

Unit –I

Plato

Aristotle

Unit –II

Nichole Machiavelli

Thomas Hobbes

Unit-III

John Locke

Jean Jacque Rousseau

Unit-IV

Jeremy Bentham

John Stuart Mill

Paper – III: INDIAN GOVERNMENT AND POLITICS

Unit – I: Making of Indian Constitution

Unit- II: Fundamental Rights and DPSP

Unit – III: The Union Executive

Unit- IV: Union Judiciary and Central Election Commission

SEMESTER – II

Paper – IV: Political Ideology

Unit – I: Liberalism and Socialism

Unit – II: Fascism and Communism

Unit – III: Nationalism and Internationalism

Unit – IV: Feminism and Environmentalism

Paper – V: Indian Political Thinkers

Unit – I: Manu and Kautilya

Unit – II: Swami Vivekananda and Aurobindo Ghosh

Unit – III: Manevendra Nath Roy and Mohan Das Karamchand Gandhi

Unit – IV: Jawaharlal Nehru and Baba Saheb Bhim Rao Ambedkar

Paper – VI: Theoretical Aspects of International Relations

Unit –I: Nature, Scope and theories of International Relations

Unit – II: Concepts: Power, Ideology and National Interest

Unit – III: Structural Aspects: Balance of Power, Collective Security and Diplomacy

Unit – IV: Contemporary Issues: Relevance of Non-Alignment, Globalisation, International Terrorism and Human Security

SEMESTER – III

Paper – VII: Public Administration

Unit – I: Meaning, Scope, Significance and Evolution of Public Administration

Unit – II: Administrative Theories: Ideal Type, Bureaucratic, Scientific Management theory, Human Relations Theory and Rational Decision Making.

Unit – III: Development Administration: Meaning, Nature and Approaches

Unit – IV: Recent Trends: New Public Administration, Good Governance and Feminist Perspective

Paper – VIII: Major Constitutions and Governments

Unit – I: The Government of the United Kingdom

Unit –II: The Government of United States

Unit – III: People's Republic of China

Unit – IV: The Government of Switzerland

Paper – XI: Indian Politics: Issues and Debates

Unit – I: Major perspectives on Indian politics: Liberal, Marxist, Subaltern and Feminist

Unit – II: The Politics of Identity: Caste, Tribe, Class and Gender and social justice

Unit – III: Regionalism and Secessionism and linguism, Demand for separate states, salience of regional parties at national and state level

Unit –IV: Secularism and Communalism

SEMESTER – IV

Paper – X: Western Political Thinkers (II)

Unit – I: G. W. Hegel and Karl Marx

Unit –II: V. I. Lenin and Mao-Tse-Tung

Unit - III: John Rawls and Robert Nozick

Unit – IV: Antonio Gramsci and Hannah Arendt

Paper – XI: Global Politics

Unit – I: Understanding Global Politics and its various perspectives

Unit – II: Globalisation and its various dimensions

Unit: III: Contemporary Issues: Ecology, Migration, Nuclear Proliferation and International Terrorism

Unit –IV: Crisis of Human Development; Human Security and Governance

Paper – XII: Political Sociology

Unit – I: Political Sociology: Emergence, Nature and Scope of Study

Unit: II: Elite Theory, Political Culture and Political Socialisation

Unit – III: Political Participation and Bureaucracy

Unit – IV: Political Development

SEMESTER – V

Paper – XIV: Development Process and Social Movements

Unit – I: Development process since independence

Unit – II: Industrial Development Strategy and its Impact on the Social Structure

Unit – III: Agrarian Development strategy and its impact on Social Structure

Unit – IV: Social Movements: Tribal, Dalit, Women, Maoists and Civil Rights Movements

Paper – XV: India's Foreign Policy

Unit –I: Approaches to the study of India's foreign Policy

Unit - II: Foreign Policy: An Overview

Unit - III: Recent Trends in India's Foreign Policy

Unit - IV: India and the New World Order: Challenges

Paper – XVI: Contemporary Political Economy

Unit - I: Approaches to Political Economy

Unit – II: Capitalist Transformation

Unit - III: Issues in Development

Unit – IV: Globalization and Development Dilemmas

SEMESTER – VI

Paper – XVI: State Politics in Indian Politics with Special Reference to Odisha

Unit-I: Development of study of State Politics in India

Unit-II: State Politics: Framework for Analysis: Systemic, Post-Modernist and Social Capital

Unit –III: Nature of Indian Diversities and Nationalist Response

Unit-IV: State Politics in Odisha

Paper – XVII: Comparative Government and Politics

Unit –I: Understanding Comparative Politics

Unit –II: Historical Context of Modern Government

Unit-III: Colonialism and Decolonisation: Meaning

Unit- IV: A Comparative study of constitutional development SSARC countries

Paper – XVIII: Modern Political Thinkers of Odisha

Unit –I: Vir Surendra Sai and Fakir Mohan Senapati

Unit –II: Krishna Chnadra Gajapati and Rama devi

Unit –III: Ramchandra Bhanj Deo and Harekrushna Mahatab

Unit- IV: Madhu Sudan Das and Gopabandhu Das

Syllabus for Bachelor of Arts Examination
Population Studies (Major)

SEMESTER-WISE LIST OF PAPERS	
Course	***Title***
Semester-I	
PS-I	Fundamentals of Population Studies
PS-II	Human Ecology and Environment
PS-III	Practical -I
Semester-II	
PS-IV	Statistical Methods in Demography
PS-V	Gender Issues
PS-VI	Practical - II
Semester - III	
PS-VII	Fertility Studies
PS-VIII	Development Studies
PS-IX	Practical - III
Semester - IV	
PS-X	Mortality Studies
PS-XI	Nutrition & Public Health
PS-XII	Practical - IV
Semester - V	
PS-XIII	Migration Studies
PS-XIV	Population Policy
PS-XV	Practical - V
Semester - VI	
PS-XVI	Urban Studies
PS-XVII	Regional Demography
PS-XVIII	Practical - VI

PS-I: Fundamentals of Population Studies

I. Nature and Scope of Population Studies; Relationship between Population Studies and Other Disciplines; Trends of population growth in the world and India; Causes of population growth.

II. Theories of Population: Malthusian Theory; Views of Karl Marx; Optimum Population Theory; Theory of Demographic Transition.

III. Sources of Demographic Data: Population Census - Significant features and Uses; Registration of Vital events; Sample Survey: Advantages.

IV. Age-sex Structure and its Measures; Factors affecting overall sex ratio; Factors determining the age structure of population.

Suggested Readings:

Bhende, A. and T. Kanitkar (2010). *Principles of Population Studies*, Himalaya Publishing House, Mumbai.
Chandana, R. C. (2004). Geography of Population, Kalyani Publishers, New Delhi.
Jhingan, M.L.; Bhatt, B.K. and Desai, J.N. (2011). Demography. Vrinda Publications (P) Ltd, Delhi.
Raj, Hans (2005). Fundamentals of Demography. Surjeet Publications, Delhi.

PS-II: Human Ecology and Environment

I. Concept of Human Ecology and Ecosystem; Structure and Components of Ecosystem; Concept of Energy Flow in Ecosystem; Food Chain, Food Web and Ecological Pyramids.

II. Biodiversity – Definition, Classification, Value and Conservation; Natural Resources and Sources of Energy Resources- Renewable and Non-renewable resources; Conservation of Natural Resources.

III. Environment: Definition; Pollution: Definition, Causes, Effects and Control of Air, Water, Noise and Solid Waste Pollutions.

IV. Global Environmental Problems: Climate Change, Global Warming, Ozone Depletion and Acid Rain; Management of Natural Disasters; Environmental Movements in India: Chipko Movement.

Suggested Readings:

Dash, M.C. Mishra P.C.,(2001), Man and Environment, Macmillan India, New Delhi.
Rana, S.V.S., (2004), Environmental Studies, Rastogi Publications, Meerut.
Sharma, P.D., (2000), Ecology and Environment, Rastogi Publications, Meerut.
Bharucha, Erach (2005). Textbook of Environmental Studies. Universities Press, Hyderabad.

PS-III: Practical –I

1. Trend Analysis of World Population
2. Trend Analysis of India's Population
3. Age – sex Pyramid
4. Dependency Ratio Analysis

PS-IV: Statistical Methods in Demography

I. Statistics: Definition and Uses; Frequency distribution; Data Series; Steps of Construction of Table; Graphical Presentation of Data: Histogram, Bar Diagram, Ogive and Pie Chart.

II. Rates, Ratios, Proportions and Percentages; Measures of Central Tendency: Mean, Median and Mode; Measures of Dispersion: Range, and Standard Deviation.

III. Measures of Skewness and Kurtosis; Measures of Location: Quartile, Decile and Percentile; Moving average; Correlation Analysis: Definition, Types, Degree of Correlation, Pearson and Spearman Coefficients.

IV. Linear Regression Analysis: Meaning, Lines and Equation; Population Projection: Meaning, Types, Limitations and Advantages; Methods of Population Projection: Arithmetic and Exponential Methods.

Suggested Readings:

Croxton, F., Cowden, D. and Clein, S.(2005). Applied General Statistics, Prentice-Hall, New Delhi.
Gupta, S.C. (2008). Fundamentals of Statistics, Himalaya Publishing House, Mumbai.
Jhingan, M.L.; Bhatt, B.K. and Desai, J.N. (2011). Demography. Vrinda Publications (P) Ltd, Delhi.
Nagar, K.N. (2001). Fundamentals of Statistics. Minakshi Publications, Meerut.

PS-V: Gender Studies

I. Gender Studies: Meaning, Scope and Evolution; Difference between Gender & Sex; Social Construction of Gender; Basic Concepts in Gender Studies: Feminism, Masculinity, Femininity.

II. Women and Social Institutions: Marriage – Definition, Characteristics, Functions and Forms; Family - Meaning, Features, Functions, and Types – Patriarchal and Matriarchal.

III. Status of Women: Concept, Determining Factors, and Indicators; Empowerment of Women – Concept, Need and Facilitating Factors; Divorce: Meaning, Causes and Consequences.

IV. Status of Women in Independent India; Problems of Women in Modern India: Violence, Discrimination, Education, Employment, Dowry; Rights and Protection Given to Women by Constitution of India; Future Prospects of Status of Indian Women.

Suggested Readings:

Agnihotri Gupta, Jyotsna (2000). New Reproductive Technologies, Women's. Health and Autonomy: Freedom or Dependency? New Delhi: Sage. Publications.
Bhasin, Kamala, (2000), Understanding Gender, Kali Primaries, New Delhi.
Rao, C.N.S. (2008). Sociology - Principles of Sociology with an Introduction to Social Thought. S Chand and Company Ltd., New Delhi.
Rao, C.N.S. (2008). Sociology of Indian Society. S Chand and Company Ltd., New Delhi.
Rashmi Agarwal, & Rao, B.V.L, (2004), Gender Issues. A Road Map to Empowerment, Shipra Publications, Delhi.

PS-VI: Practical –II

1.Histogram, Pie Chart and Ogive
2.Arithmetic Mean and Standard Deviation
3.Coefficient of Correlation – Pearson and Rank Correlation
4.Arithmetic & Exponential Growth Models

PS-VII: Fertility Studies

I. Nuptiality: Concept and Measures – Crude and General Marriage Rate; Fertility: Reproductive Span and Theoretical Maximum Fertility, Data Source, Factors Affecting Fertility –Biological, Economic and Socio-Cultural Factors;

II. Methods of Family Planning – Male and Female Methods; Determinants of Natural Fertility: Davis & Blake Intermediate Variable Framework, Bongaart's Proximate Determinant Model; Causes responsible for Higher Fertility in Developing Countries.

III. Theories of Fertility: Social Capillarity Theory, Theory of Diffusion and Cultural Lag, Theories of Leibenstein, Becker, Easterlin, UN Threshold Hypothesis.

IV. Measures of Fertility: Crude Birth Rate, General Fertility Rate, Age Specific Fertility Rate, Total Fertility Rate; Sex Age Adjusted Birth Rate, Child Women Ratio and Children Ever Born.

Suggested Readings:

Bhende, A. and T. Kanitkar (2010). *Principles of Population Studies*, Himalaya Publishing House, Mumbai.

Jhingan, M.L.; Bhatt, B.K. and Desai, J.N. (2011). Demography. Vrinda Publications (P) Ltd, Delhi.

Pathak, K.B. & Ram F. (2005). *Techniques of Demographic Analysis*; Himalaya Publ. House, Mumbai.

Raj, Hans (2005). Fundamentals of Demography. Surjeet Publications, Delhi.

PS-VIII: Development Studies

I. Concepts of Change, Growth and Development; Population-Development: Concept and Importance; Effects of Population Growth on Economic Development: Promoting and Retarding Factors; Effects of Population Growth on Indian Economy.

II. Measures of Development: PQLI and HDI; Theories of Development: Rostow's Stages of Economic Growth; Lewis' Theory of Unlimited Supplies of Labour; Leibenstein's Critical Minimum Efforts Thesis; Concepts of Sustainability and Sustainable Development.

III. Rural Development: Concepts; Basic Elements and Need; Measures of Level of Rural Development; Concepts and Measures of Rural Poverty; Determinants of Rural Development; Role of Agricultural and Non-agricultural Sector in Rural Development.

IV. Rural Development Policies: Need and Goals; Rural Development Policies in India; Panchayati Raj Institutions (PRIs), Cooperatives, and Voluntary Agencies/Non-governmental Organisations in Rural Development; Corporations and Rural Development.

Suggested Readings:

Chandana, R. C. (2004). Geography of Population, Kalyani Publishers, New Delhi.

Jhingan, M.L.; Bhatt, B.K. and Desai, J.N. (2011). Demography. Vrinda Publications (P) Ltd, Delhi.

Raj, Hans (2005). Fundamentals of Demography. Surjeet Publications, Delhi.

Singh, Katar (2009). Rural Development: Principles, Policies and Management Third Edition. Sage Publications, New Delhi.

PS-IX: Practical –III

1. Crude and General Marriage Rate
2. Crude and General Birth Rates
3. Age Specific and Total Fertility Rates
4. Sex Age Adjusted Birth Rate and Child Women Ratio

PS-X: Mortality Studies

I. Health: Definition and Determinants; Morbidity: Meaning and Measurement - Incidence and Prevalence Rates, Prevention and Intervention of Diseases; Communicable and Non-Communicable Diseases.

II. Mortality: Meaning and Uses of Mortality Data; Factors Affecting Mortality, Reasons for High Mortality in the Past; Causes of Mortality Decline in Developed Countries; International Classification of Causes of Death.

III. Measures of Mortality: Crude Death Rate, Age-specific Death Rate, Cause-specific Death Rate, Sex-specific Death Rate; Infant Mortality: Definition, Infant Mortality Rate and its Adjustment;

IV. Factors Affecting Infant Mortality; Major Causes of Maternal Deaths in India; Mortality Differentials; Levels and Trends of Mortality in India; Life Table: Concept, Assumptions and Columns, Concept of Life Expectancy.

Suggested Readings:

Bhende, A. and T. Kanitkar (2010). *Principles of Population Studies,* Himalaya Publishing House, Mumbai.

Jhingan, M.L.; Bhatt, B.K. and Desai, J.N. (2011). Demography. Vrinda Publications (P) Ltd, Delhi.

Pathak, K.B. & Ram F. (2005). *Techniques of Demographic Analysis*; Himalaya Publ. House, Mumbai.

Raj, Hans (2005). Fundamentals of Demography. Surjeet Publications, Delhi.

Park, J. E. & K. Park (2005). *Text Book of Preventive and Social Medicine*, Banarasidas Bhanot Publishers, Jabalpur.

Srinivasan, K. (2006). *Basic Demographic Techniques and Applications*, Sage, New Delhi.

PS-XI: Nutrition and Public Health

I. Concept of Nutrition; Classification of Food; Nutritional Constituents of Human body; Nutritional Requirement and Balanced Diet; Nutritional Problems in Public Health.

II. Assessment of Nutritional Status; Social Aspects of Nutrition; Community Nutrition Programmes: Prophylaxis against Nutritional Anaemia, ICDS Programme and Mid Day Meal Programme.

III. Health Care of the community: Concept, Levels, Elements and Principles of Health Care; Health Care Delivery System; Resources for Community Health – Health Manpower, Money & Material and Time.

IV. Health Care System; Primary Health Care in India: Village, Sub-Centre, PHC, CHC and District Levels; Health Insurance; Voluntary Health Organization in India.

Suggested Readings:

Gopalan, C. (1987) Nutrition: Problems and Programmes in SE Asia, SEARO Reg. Hith Pap. No. 15, WHO, New Delhi.

Park, K. (2002) Preventive and Social Medicine, Banarsidas Bhanot Publishers, Jabalpur.

Swaminathan, M. (1983) Human Nutrition and Diet, The Bangalore Printing and Publishing Co. Ltd., Bangalore.

PS-XII: Practical -IV

1. Incidence and Prevalence Rates
2. Crude and Age-specific Death Rates
3. Infant Mortality Rate and its Adjustment
4. Trend Analysis of Mortality

PS-XIII: Migration Studies

I. Concepts of Migration; Sources of Migration Data; Types of Migration: Rural-Rural, Rural - Urban, Urban-Urban, Urban-Rural Migrations; Determinants and Consequences of Internal Migration.

II. Estimation of Migration from Place of Birth, Duration of Residence, and Place of Last Residence Data; Indirect Measures of Net Internal Migration: Vital Statistics Method, and National Growth Rate Method.

III. International Migration: Sources of Data; Categories of International Migration: Labour Migration, Brain Drain, Refugee Migration and Illegal Migration; Socio-economic Effects of International Migration.

IV. Migration Theories and Models: Ravenstein's Laws of Migration, Everett Lee's Theory of Migration, Todaro's Model of Rural-Urban Migration.

Suggested Readings:

Bhende, A. and T. Kanitkar (2010). *Principles of Population Studies,* Himalaya Publishing House, Mumbai.

Chandana, R. C. (2004). Geography of Population, Kalyani Publishers, New Delhi.

Pathak, K. B., and Ram, F. (2005). Techniques of Demographic Analysis, Himalaya, Mumbai.

PS-XIV: Population Policy

I. Population Policy: Concept and Need; Fertility Influencing Policies - Pro-Natalist and Anti-Natalist; Mortality and Migration Influencing Policies; Population Policies of More and Less Developed Countries.

II. Fertility Influencing Policy in Pre -Independent India, Family Planning Programme; Family Planning in Independent India; Mortality Influencing Policies in India: Health for All

III. Evolution of Population Policies in India; National Population Policy 2000: Objectives, Strategic Themes, Structure, Funding, Promotional and Motivational Measures for Adoption of Small Family Norms.

IV. National Health Mission: Janani-Shishu Suraksha Yojna, Rashtriya Kishor Swasthya Karyakram and Rashtriya Bal Swasthya Karyakram; Odisha State Youth Policy 2013: Objectives, Guiding Values and Principles, Special Focus Groups, Thrust Areas, Policy Directions.

Suggested Readings:

Bhende, A. and T. Kanitkar (2010). *Principles of Population Studies,* Himalaya Publishing

Chaubey, P.K. (2001). Population Policy for India: Perspective, Issues and Challenges. Kanishka Publishing House, New Delhi.

Govt. of India (2014). www.nrhm.gov.in

Govt. of Odisha (2014). www.nrhmorissa.gov.in

Govt. of Odisha (2013). www.dsysodisha.gov.in/pdf/osyp_2013.pdf

PS-XV: Practical-V

1. Estimation of Migration from Place of Birth Data
2. Estimation of Migration from Duration of Residence Data
3. Vital Statistics Method
4. National Growth Rate Method

PS-XVI : Urban Studies

I. Urbanisation: Importance of Study and Sources of Data; Definition of Urban and Related Concepts used in Indian Census; Components of Urban Population Growth; Determinants of Urbanization.

II. Level and Tempo of Urbanization; Types of Cities and their Classification; City Population Distribution; Rank Size Rule & Primacy Index; Lorenz Curve and Gini Concentration Ratio.

III. Process of Urbanization: Kingsley Davis Model and Gibbs Stages; Models of Metropolitan Growth: Burgess Concentric Zone Model, Hoyt's Sector Model, Haris and Ullman's Multiple Nuclei Model.

IV. Trends of Urbanisation in Developing & Developed Countries; Major Urban Problems in India: Land Use, Housing, Slums, Water Supply, Sanitation, and Environmental Problems.

Suggested Readings:

Bose, Ashis, (2002), India's Urbanisation 1901-2001, Tata-McGraw Hill, Delhi.
Chandana, R. C., (2004), Geography of Population, Kalyani Publishers, Delhi.
Davis, Kingsley, (1971), The Urbanization of Human Population in Scientific American Books on "CITIES", New York.
Siddharth, K. and Mukherjee, S. (2013). Cities, Urbanization and Urban System. Kisalaya Publications, New Delhi.

PS-XVII: Regional Demography

I. Factors Affecting Distribution of Population; World Population Distribution and Density Pattern; Sex ratio: Determinants of Primary, Secondary and Tertiary Sex Ratio, World Pattern of Sex Ratio.

II. Determinants of Age Composition and World Pattern of Age Distribution; World Pattern of Crude birth rate, Total Fertility Rate, Crude death rate and Infant mortality rate.

III. Demography of India: Age-sex structure, Sex ratio, Density of population, Literacy rate, Work force, Crude birth rate, Crude death rate and Infant mortality rate.

IV. Demography of Orissa: Trends of population growth, Sex ratio, Density of population, Literacy rate; Distribution of tribes, Growth of Tribal population; Major Problems of Tribals.

Suggested Readings:

Bose, Ashis (2001) Population of India: 2001 Census Results and Methodology, B. R. Publishing Corporation, Delhi
Chandana, R. C., (2004), Geography of Population, Kalyani Publishers, Delhi.
SCSTRTI (2004) Tribes of Orissa, Orissa Government Press, Cuttack, Orissa
Sinha, B. N. (2001) Geography of Orissa, National Book Trust, India

PS-XVIII: Practical –VI

1. Level of Urbanization
2. Tempo of Urbanization
3. Rank Size Rule & Primacy Index
4. Lorenz Curve and Gini Concentration Ratio

Syllabus for Bachelor of Arts Examination
Population Studies (Minor)

PS-I: Fundamentals of Population Studies

I. Nature and Scope of Population Studies; Relationship between Population Studies and Other Disciplines; Trends of population growth in the world and India; Causes of population growth.

II. Theories of Population: Malthusian Theory; Views of Karl Marx; Optimum Population Theory; Theory of Demographic Transition.

III. Sources of Demographic Data: Population Census - Significant features and Uses; Registration of Vital events; Sample Survey: Advantages.

IV. Age-sex Structure and its Measures; Factors affecting overall sex ratio; Factors determining the age structure of population.

Suggested Readings:

Bhende, A. and T. Kanitkar (2010). *Principles of Population Studies*, Himalaya Publishing House, Mumbai.

Chandana, R. C. (2004). Geography of Population, Kalyani Publishers, New Delhi.

Jhingan, M.L.; Bhatt, B.K. and Desai, J.N. (2011). Demography. Vrinda Publications (P) Ltd, Delhi.

Raj, Hans (2005). Fundamentals of Demography. Surjeet Publications, Delhi.

PS-II: Fertility Studies

I. Nuptiality: Concept and Measures – Crude and General Marriage Rate; Fertility: Reproductive Span and Theoretical Maximum Fertility, Data Source, Factors Affecting Fertility –Biological, Economic and Socio-Cultural Factors;

II. Methods of Family Planning – Male and Female Methods; Determinants of Natural Fertility: Davis & Blake Intermediate Variable Framework, Bongaart's Proximate Determinant Model; Causes responsible for Higher Fertility in Developing Countries.

III. Theories of Fertility: Social Capillarity Theory, Theory of Diffusion and Cultural Lag, Theories of Leibenstein, Becker, Easterlin, UN Threshold Hypothesis.

IV. Measures of Fertility: Crude Birth Rate, General Fertility Rate, Age Specific Fertility Rate, Total Fertility Rate; Sex Age Adjusted Birth Rate, Child Women Ratio and Children Ever Born.

Suggested Readings:

Bhende, A. and T. Kanitkar (2010). *Principles of Population Studies*, Himalaya Publishing House, Mumbai.

Jhingan, M.L.; Bhatt, B.K. and Desai, J.N. (2011). Demography. Vrinda Publications (P) Ltd, Delhi.

Pathak, K.B. & Ram F. (2005). *Techniques of Demographic Analysis*; Himalaya Publ. House, Mumbai.

Raj, Hans (2005). Fundamentals of Demography. Surjeet Publications, Delhi.

PS-III: Mortality Studies

I. Health: Definition and Determinants; Morbidity: Meaning and Measurement - Incidence and Prevalence Rates, Prevention and Intervention of Diseases; Communicable and Non-Communicable Diseases.

II. Mortality: Meaning and Uses of Mortality Data; Factors Affecting Mortality, Reasons for High Mortality in the Past; Causes of Mortality Decline in Developed Countries; International Classification of Causes of Death.

III. Measures of Mortality: Crude Death Rate, Age-specific Death Rate, Cause-specific Death Rate, Sex-specific Death Rate; Infant Mortality: Definition, Infant Mortality Rate and its Adjustment;

IV. Factors Affecting Infant Mortality; Major Causes of Maternal Deaths in India; Mortality Differentials; Levels and Trends of Mortality in India; Life Table: Concept, Assumptions and Columns, Concept of Life Expectancy.

Suggested Readings:

Bhende, A. and T. Kanitkar (2010). *Principles of Population Studies,* Himalaya Publishing House, Mumbai.

Jhingan, M.L.; Bhatt, B.K. and Desai, J.N. (2011). Demography. Vrinda Publications (P) Ltd, Delhi.

Pathak, K.B. & Ram F. (2005). *Techniques of Demographic Analysis*; Himalaya Publ. House, Mumbai.

Raj, Hans (2005). Fundamentals of Demography. Surjeet Publications, Delhi.

Park, J. E. & K. Park (2005). *Text Book of Preventive and Social Medicine*, Banarasidas Bhanot Publishers, Jabalpur.

Srinivasan, K. (2006). *Basic Demographic Techniques and Applications*, Sage, New Delhi.

PS-IV: Migration Studies

I. Concepts of Migration; Sources of Migration Data; Types of Migration: Rural-Rural, Rural - Urban, Urban-Urban, Urban-Rural Migrations; Determinants and Consequences of Internal Migration.

II. Estimation of Migration from Place of Birth, Duration of Residence, and Place of Last Residence Data; Indirect Measures of Net Internal Migration: Vital Statistics Method, and National Growth Rate Method.

III. International Migration: Sources of Data; Categories of International Migration: Labour Migration, Brain Drain, Refugee Migration and Illegal Migration; Socio-economic Effects of International Migration.

IV. Migration Theories and Models: Ravenstein's Laws of Migration, Everett Lee's Theory of Migration, Todaro's Model of Rural-Urban Migration.

Suggested Readings:

Bhende, A. and T. Kanitkar (2010). *Principles of Population Studies,* Himalaya Publishing House, Mumbai.
Chandana, R. C. (2004). Geography of Population, Kalyani Publishers, New Delhi.
Pathak, K. B., and Ram, F. (2005). Techniques of Demographic Analysis, Himalaya, Mumbai.

PS-V: Urban Studies

I. Urbanisation: Importance of Study and Sources of Data; Definition of Urban and Related Concepts used in Indian Census; Components of Urban Population Growth; Determinants of Urbanization.

II. Level and Tempo of Urbanization; Types of Cities and their Classification; City Population Distribution; Rank Size Rule & Primacy Index; Lorenz Curve and Gini Concentration Ratio.

III. Process of Urbanization: Kingsley Davis Model and Gibbs Stages; Models of Metropolitan Growth: Burgess Concentric Zone Model, Hoyt's Sector Model, Haris and Ullman's Multiple Nuclei Model.

IV. Trends of Urbanisation in Developing & Developed Countries; Major Urban Problems in India: Land Use, Housing, Slums, Water Supply, Sanitation, and Environmental Problems.

Suggested Readings:

Bose, Ashis, (2002), India's Urbanisation 1901-2001, Tata-McGraw Hill, Delhi.
Chandana, R. C., (2004), Geography of Population, Kalyani Publishers, Delhi.
Davis, Kingsley, (1971), The Urbanization of Human Population in Scientific American Books on "CITIES", New York.
Siddharth, K. and Mukherjee, S. (2013). Cities, Urbanization and Urban System. Kisalaya Publications, New Delhi.

PS-VI: Practical

1. Age – Sex Pyramid
2. Age Specific and Total Fertility Rates
3. Crude and Age-specific Death Rates
4. National Growth Rate Method
5. Level and Tempo of Urbanization
6. Lorenz Curve and Gini Concentration Ratio

Coordinating Chairman of the BOS for the subjects and related General electives/Vocational/ Choice based courses as below for Science, Arts and Commerce streams:

(The Chairman of BOS of the subject assigned to the University below need to finalize the syllabus in collaboration with the Chairman of BOS of other Universities of the state as discussed and resolved in the meeting on 17th January 2014).

Deadline to submit the syllabus (outline, detail and book recommended) to the Vice-Chancellor of the respective University is 31st January 2015.

These will be submitted to Govt. of Odisha, Higher Education and placed in the website of HE for comments and suggestions by experts in the respective field from colleges by 15th February 2015. The suggestions to be communicated to the Chairman of the Concerned BOS for incorporation, if agreed upon by Chairmans of the BOS, and place in the next meeting to be held in Berhampur tentatively in the 3rd or 4th week of February 2015.

Subject wise groups of the Chairperson of BOS & the Coordinator of each group to submit the soft copy of the Syllabus to the respective Vice-Chancellor of the Coordinators:

Science and Arts stream:

I. Mathematics (Major or Minor): Berhampur University
   Prof. Niyati Mishra, BU; niyatimath@yahoo.com
   Dr. Sabita Sahu, SU; sabitamath@yahoo.com
II. BCA (Major and Minor): Berhampur University
   Prof. P.K. Padhy, BU; profpadhy@hotmail.com; profpadhy@gmail.com
   Prof. P.K. Mohanty, UU; pkmohanty_bbsr@yahoo.com
   Prof. D.P. Mishra, FMU; profdpmisrabl@gmail.com
III. Geography (Major and Minor): Utkal University
   Prof. K.M. Sethi, UU
IV. Anthropology (Major and Minor): Utkal University
   Prof. S. Acharya, UU;sacharya.uu@gmail.com
   Dr. Ratnawali, SU; sinha_ratnawali@yahoo.com
V. Statistics (Major and Minor): Utkal/Sambalpur University
   Prof. P.K. Tripathy, UU
VI. Archaeology and Museology (Minor & General Elective); Utkal University
   Prof. K.K. Basa, UU
VII. Computer science (Major or Minor): Sambalpur University
   Dr. C.S. Panda, SU
   Dr. J. Pradhan, BU; jayarampradhan2011@gmail.com
   Prof. S. Pradhan, UU
VIII. Physical Education (Major and Minor): F.M. University
   (To be assigned by CDC/IQAC, FMU)

Science stream:

IX. Physics (Major or Minor): Utkal University
Prof. Swapna Moharana, UU
Dr. M.K. Adhikary, FMU; mcadhikary@gmail.com
Prof. T.R. Routray, SU; trr1@rediffmail.com

X. Geology (Major or Minor): Utkal University
(To be assigned by CDC/IQAC, FMU)

XI. Computer Application (Major or Minor): Berhampur University
Dr. C.S. Panda, SU
Dr. J. Pradhan, BU
Prof. S. Pradhan, UU
Dr. S.N. Deuri, FMU; satchi_d@yahoo.co.in

XII. Electronics (Major and Minor): Berhampur University
(To be assigned by CDC/IQAC, BU)

XIII. Chemistry (Major or Minor): Ravenshaw University
Prof. N. Das, RU; dasnn64@rediffmail.com

XIV. Industrial chemistry (Minor): Ravenshaw University
Prof. N. Das, RU; Dasnn64@rediffmail.com

XV. Botany (Major or Minor) : F. M. University
Prof. S.P. Adhikary, FMU; vcfmuniversity@gmail.com
Prof. P.K. Chand, UU; pkchanduubot@rediffmail.com
Dr. Binita Nayak, SU;binita.bga@gmail.com

XVI. Zoology (Major or Minor): F.M University
Dr. B.P. Dash, FMU ;bisnubsbtfmu@gmail.com
Prof.P.K. Mohanty, UU; prafulla.mohanty3@gmail.com
Dr. H.P. Mohapatra, SU; mohapatraharaprasad@gmail.com
Biotechnology (Minor): F.M. University
Prof. S.P. Adhikary, FMU
Dr. J. Dandpat, UU

XVII. Environmental science (Major and Minor): F.M. University
Dr. Surjyendu Dey, FMU
Prof. Sanjat K. Sahu, SU

VIII. Information Technology (Minor): F.M. University
Dr. C.S. Panda, SU
Dr. J. Pradhan, BU
Dr. S.N. Deuri, FMU (To coordinate)

IX. Microbiology (Major and Minor): F.M. University
Prof. S.P. Adhikary, FMU
Prof. P.K. Chand, UU

X. Industrial Fish and Fisheries (Minor): F.M. UniversitY
Prof. P.K. Mohanty, UU
Prof. S.P. Adhikary, FMU (To coordinate)

XI. Food Science and Quality control (Minor): F.M. University
Prof. S.P. Adhikary, FMU
Dr. Binita Nayak, SU

XII. Sericulture (Minor):F.M. University
Prof. P.K. Mohanty, UU
Prof. S.P. Adhikary, FMU (To coordinate)

Arts stream:

XIII. History (Major or Minor): Utkal Universty
Prof. A.K. Patnaik, UU
Prof. P.K. Behera, SU; pkbehera@rediffmail.com

XIV. Economics (Major or Minor): Utkal University
Prof. Padmaja Mishra, UU; padmajamisra_2000@yahoo.com
Prof. S.S. Rath, SU rath; rathsudhansusekhar@gmail.com
Dr.Sunil K. Padhi, FMU

XV. Sociology (Major or Minor): Utkal University
(To be assigned by CDC/IQAC, UU)
Dr. Tanaya Mohanty, FMU

XVI. Geography (Major or Minor): Utkal University
Prof. K.M. Sethi, UU; kabirmohan2006@yahoo.com
Dr. Nihar R. Rout, FMU;niharfmu@gmail.com

XVII. Psychology (Major or Minor): Utkal University
Dr. Nomita Mohanty, UU; drnomitamohanty@yahoo.co.in

XVIII. Public administration (Major or Minor): Utkal University
(To be assigned by CDC/IQAC, UU)

XIX. Odia (Major or Minor): Utkal University
Prof. U.N. Sahoo, UU
Prof. Samar Muduli, SU; samarmuduli@gmail.com

XX. Law & Jurisprudence (Minor): Utkal University
(To be assigned by CDC/IQAC, UU)

XXI. Library and Information science(Major or Minor): Sambalpur University
Dr. B. Moharana, SU
Dr. Puspanjali Jena, UU;pjutkal1987@yahoo.co.in

XXII. English (Major or Minor): Sambalpur University
Prof. Kalidas Mishra, SU; kalidasmisra@yahoo.com; hodeng@suniv.ac.in

XXIII. Social work (Major and Minor): Sambalpur University
(To be assigned by CDC/IQAC, SU)

XXIV. Philosophy (Major or Minor): Sambalpur University
(To be assigned by CDC/IQAC, UU)

XXV. Home science (Major or Minor): Berhampur University
Prof. Aparajita Choudhury, BU; aparajitabpur@gmail.com

XXVI. IR&PM (Major and Minor): Berhampur University
Prof. P.K. Padhy, BU

XXVII. BBA (Major and Minor): Berhampur University
Prof. P.K. Padhy, BU
Prof. D.P. Mishra, FMU

XXVIII. Telugu (Major and Minor): Berhampur University
Dr. Narayan Rao, BU

XXIX. Education (Major or Minor): Ravenshaw University
Prof. G.C. Nanda, RU; gcnanda2005@yahoo.co.in

XXX. Political science(Major or Minor): F.M. Universty
Prof. S.S. Acarya, FMU
Prof. B. Satapathy, UU
Dr. S.P. Dash, SU

XXXI. Sanskrit (Major or Minor): North Orissa University
Prof. P.K. Mishra, NOU
Dr. Bhaskar P. Mishra, SU; bhaskarprasad.mishra@gmail.com
XXXII. Alternate Sanskrit (Minor): North Orissa University
Prof. P.K. Mishra, NOU
XXXIII. Santali (Major and Minor): North Orissa University
Dr. Damayanti Beshra, NOU
Dr. Naku Hamdoy, SU
XXXIV. Hindi (Major or Minor): Ravenshaw University
Prof. S. Mishra, RU; Smarapriyamishra57@gmail.com
XXXV. Population studies (Major and Minor): F.M. University
Dr. Nihar R. Rout, FMU
XXXVI. Bengali (Major and Minor): (To be assigned by CDC/IQAC, FMU)
XXXVII. Urdu (Major and Minor): F.M. University
Mr. Abdul K. Khan, FMU; abdekhalique@gmail.com

Commerce stream:

Minor I, Minor II, Major, General elective(s) as per the outline of the syllabus pattern to be prepared by Prof. Ranjan Bal (Utkal University) and Prof. Bhagaban Das; drbhagabandas@gmail.com (F.M. University) in collaboration with experts from other Universities of Odisha.

General Core:

MIL (Odia/Sanskrit/Hindi/Santali/ Urdu/Telugu/Bengali): The Chairman BOS of the respective University assigned to prepare Major and Minor course syllabus.
Alternate English: Sambalpur University
Prof. Kalidas Mishra, SU
Communicative English: Sambalpur University
Prof. Kalidas Mishra, SU
Indian Society and Culture: Utkal University
(To be assigned by CDC/IQAC, FMU)
National Service scheme: F.M. University
Dr. Minati Mishra, FMU; minatiminu@yahoo.com
Dr. Priyabrata Gochhayat, SU; pgochhayat@gmail.com
Environmental Studies: F.M. University
Dr. Surjyendu Dey, FMU
Dr. Sanjat Sahu, SU
Information Technology; Soft skill (50:50%): F.M. University/Utkal University
Dr. C.S. Panda, SU
Dr. J. Pradhan, BU
Dr. S.N. Deuri, FMU
Prof. R. Bal, UU (To coordinate); ranjan_bal@yahoo.com

Proceedings of the workshop on "Common Syllabus and Regulation for UG courses in Universities of Odisha" held at F.M. University, Balasore on 17th January 2015.

The Vice-Chancellors of 6 Universities of Odisha (Prof. A. Das, UU; Prof. D. Behera, BU; Prof. P.K. Misha, NOU; Prof. C. R. Tripathy, SU, Prof. P. C. Sarangi, RU and Prof. S.P. Adhikary,FMU) along with the respective Chairman, P.G. Council; Controller of Examination and Chairman of BOS of different subjects, and also Dr. Ajay K Nayak, Jt. Secretary, HE , Dr. Mihir K. Das, Director Performance Tracking Cell, HE, and Dr. R. Begum, Director of Vocational courses of Govt. of Odisha participated the day-long workshop.

The Vice-Chancellors and Officers of the state Govt. presented their views on the draft course and Syllabus pattern for Science, Arts and Commerce streams comprising 6 General core papers, One General elective paper, Two minor courses (Earlier terminology-Pass), one major course (earlier terminology-Honours), distributed in 6 semesters, one project work compulsory for all streams in the 6th semester, optional choice based courses and vocational courses for additional credits over and above 122 credit for the entire course was formulated and finalized.

The Controller of Examinations of all the Universities discussed and brought out a draft regulation which will be finalized in a separate sitting by them on a convenient date at Utkal University by the end of January 2015.

For preparation of the detail courses of the respective subjects the Chairman BOS of each subject from different Universities discussed and they were allotted to prepare the detail draft syllabus of each subject and submit to the respective VCs by 31st January 2015 for submission to the Govt. HE for placing in the website inviting comments from the experts in the subjects from the colleges of the state. The suggestions will be incorporated and the final syllabus of each subject along with the regulation and examination details will be placed in the next such workshop scheduled to be held at Berhampur University by February 2015.

Basing on the outcome of the workshop, the new syllabus in semester pattern with grade point as well as mark and also credit with subjects incorporating choice based courses can be finalized and implemented in the state by the Government form the next academic session.

(S.P. Adhikary)
VC, F.M. University

List of Participants

Sl. no	**Name**	**Designation**	**Address**
1.	Prof. Ashok K. Das	Vice-Chancellor vc@utkaluniversity.ac.in	Utkal University
2.	Prof. Deepak K. Behera	Vice-Chancellor vcbuorissa@gmail.com	Berhampur University
3.	Prof. Siba P. Adhikary	Vice-Chancellor vcfmuniversity@gmail.com	Fakir Mohan University
4.	Prof. Prafulla K. Mishra	Vice-Chancellor	North Orissa University
5.	Prof.Chitta R. Tripathy	Vice-Chancellor vc@ suniv.ac.in	Sambalpur University
6.	Prof.Prakash C. Sarangi	Vice-Chancellor	Ravenshaw University
7.	Dr. Ajay Kumar Nayak	Joint Secretary, HE Ajaynayak0001@gmail.com	Dept. Higher Education, Government of Odisha
8.	Dr. Mihir Kumar Das	State Perform Tacking Cell, mihir_gmc @rediffmail.com	Dept. Higher Education, Government of Odisha
9.	Dr. Rosnara Begum	Director, Vocational Edu.	Government of Odisha
10	Prof. Jagannath Lenka	PGC	North Orissa University
11	Prof. Gitanjali Dash	PGC	Fakir Mohan University
12	Prof. P.K. Padhy	PGC	Berhampur University
13	Prof. P.K. Mohapatra	CCD (Chairman of Deans)	Ravenshaw University
14	Prof. Ranjan K. Bal	Chairman, IQAC	Utkal University
15	Prof. Debi P. Mishra	Chairman, IQAC	Fakir Mohan University
16	Dr. Arun Kumar Panda	COE	Berhampur University
17	Dr. S.K. Swain	COE	Sambalpur Universty
18	Dr. Jayaprakash Das	COE	Ravenshaw University
19	Dr. Sushant K. Das	COE	Utkal University
20	Mr. Debabrata Ash	COE	Fakir Mohan University
21	Dr. Sunada Pradhan	Dy. COE	Fakir Mohan University
22	Dr. P.K. Dalai	SWO	Berhampur University

23	Dr.Bhaskar P. Mishra	BOS, Sanskrit	Sambalpur Universty
24	Prof. S.S. Rath	BOS, Economics	Sambalpur University
25	Prof. T.R. Routray	BOS, Physics	Sambalpur University
26	Prof.. Samar Muduli	BOS, Odia	Sambalpur Universty
27	Dr. Priyabrata Gochayat	BOS, NSS	Sambalpur University
28	Dr. Naku Hamdoy	BOS, Santali	Sambalpur University
29	Dr. B. Moharana	BOS,Library, Inf. Sci	Sambalpur University
30	Dr. P.K. Behera	BOS, History	Sambalpur University
31	Dr. Sabita Sahu	BOS, Mathematics	Sambalpur Universty
32	Dr. Binita Nayak	BOS, Life Sciences	Sambalpur University
33	Dr. Ratnawali	BOS, Anthropology	Sambalpur University
34	Prof. Kalidas Mishra	BOS, English	Sambalpur Universty
35	Dr. C.S. Panda	BOS, Computer Sci.	Sambalpur University
36	Dr. S.P Dash	BOS, Political Sci.	Sambalpur University
37	Dr. Hara P. Mohapatra	BOS, Zoology	Sambalpur University
38	Dr. S. Narayan Rao	BOS, Telugu	Berhampur University
39	Prof.AprajitaChoudhury	BOS, Home Science	Berhampur University
40	Prof. Niyati Mishra	BOS, Mathematics	Berhampur University
41	Prof. Jayaram Pradhan	BOS, Computer Science	Berhampur Universty
42	Prof. S. Mishra	BOS, Hindi	Ravenshaw University
43	Prof. N. Das	BOS, Chemistry	Ravenshaw University
44	Prof. G.C. Nanda	BOS, Education	Ravenshaw University
45	Prof. B. Satapathy	BOS, Pol. Science	Utkal University
46	Prof. P.K. Mohanty	BOS, Zoology	Utkal University
47.	Prof. K.K. Basa	BOS, Anthropology	Utkal University
48	Prof. U.N. Sahoo	BOS, Odia	Utkal University
49	Prof. Kabir M. Sethi	BOS, Geography	Utkal University
50	Prof. Swapna Moharana	BOS, Physics	Utkal University
51	Dr. J. Dandpat	BOS, Biotechnology	Utkal University
52	Prof. P.K. Chand	BOS, Botany	Utkal University
53	Prof. Padmaja Mishra	BOS, Economics	Utkal University
54	Dr.Namita Mohanty	BOS, Psychology	Utkal University
55	Prof. S. Acharya	BOS,Anthropology	Utkal University
56	Prof. Puspanjali Jena	BOS, Lib & Inf. Sci.	Utkal University
57	Prof. P.K. Mohanty	BOS, MBA	Utkal University
58	Prof. P.K. Tripathy	BOS, Statistics	Utkal University
59	Dr. Minati Mishra	BOS, NSS	Fakir Mohan University
60	Dr. B.B. Mohapatra	BOS, NSS	Fakir Mohan University
61	Dr. S.K. Agrwalla	DO & BOS, Physics	Fakir Mohan University
62	Dr.Munesh K. Adhikary	Registrar & BOS Physics	Fakir Mohan University
63	Prof. S.S. Acharya	BOS, Pol. Science	Fakir Mohan University
64	Dr. Tanaya Mohanty	BOS, Sociology	Fakir Mohan University
65	Dr.Satchidananda Deuri	BOS, Information and Communi. Technology	Fakir Mohan University
66	Prof. Bhagaban Das	BOS, Commerce	Fakir Mohan University

67	Dr. Sunil K. Padhi	BOS, Economics	Fakir Mohan University
68	Dr. Surjyendu K. Dey	BOS, Env. Science	Fakir Mohan University
69.	Dr. Baskar Behera	BOS, Biosciences	Fakir Mohan University
70	Dr. Bishnu P. Dash	BOS, Bio sciences	Fakir Mohan University
71	Dr. Nihar R. Rout	BOS, Population Studies	Fakir Mohan University
72.	Prof. S.S. Patnaik	BOS, Information and Communi. Technology	Fakir Mohan University
73	Mr. Abdul K. Khan	BOS, Urdu	Fakir Mohan University
74	Dr. S. Nayak	Principal, F.M. Autonomous College	Fakir Mohan University
75	Mr. P.K. Swain	Principal, Bhadrak Autonomous College	Fakir Mohan University
76	Smt. J. Pal	Principal, KKS (Gov) Womens College	Fakir Mohan University
77	Dr. Uma Kanta Das	BOS, Pol Science	Fakir Mohan University
78	Dr. Damayanti Beshra	BOS, Santali	M.P.C. (Auto) College, North Orissa University
79	Mr. Deepak K. Mishra	PA to VC	Fakir Mohan University
80	Mr. Madam M. Behera	Asst., Examination	Fakir Mohan University
81	Dr. Arjun Kar	Asst., Examination	Fakir Mohan University
82.	Mr. Jagdish C. Masanta	Asst., Examination	Fakir Mohan University
83	Mr. Sukanta K. Diwedy	Asst., Examination	Fakir Mohan University
84	Mr. Amaresh K. Barik	Asst., Examination	Fakir Mohan University
85	Mr. Sanjeeb K. Nayak	Asst., Examination	Fakir Mohan University
86	Mr. Karunakar Behera	Asst., Examination	Fakir Mohan University
87	Smt. Suchismita Behera	Asst., Examination	Fakir Mohan University
88	Smt.Sagarika Choudhury	Asst., Examination	Fakir Mohan University

---

Coordinating Chairman of the BOS for the subjects and related General electives/Vocational/ Choice based courses as below for Science, Arts and Commerce streams:

(The Chairman of BOS of the subject assigned to the University below need to finalize the syllabus in collaboration with the Chairman of BOS of other Universities of the state as discussed and resolved in the meeting on 17th January 2014).

Deadline to submit the syllabus (outline, detail and book recommended) to the Vice-Chancellor of the respective University is 31st January 2015.

These will be submitted to Govt. of Odisha, Higher Education and placed in the website of HE for comments and suggestions by experts in the respective field from colleges by 15th February 2015. The suggestions to be communicated to the Chairman of the Concerned BOS for incorporation, if agreed upon by Chairmans of the BOS, and place in the next meeting to be held in Berhampur tentatively in the 3rd or 4th week of February 2015.

The assignments to prepare the syllabus to the BOS of different subjects:

Science and Arts (Both streams):

1. Mathematics (Major or Minor): Berhampur University
2. Geography (Major and Minor): Utkal University
3. Anthropology (Major and Minor): Utkal University
4. Statistics (Major and Minor): Sambalpur University
5. Computer science (Major or Minor): Sambalpur University
6. BCA (Major and Minor): Berhampur University
7. Physical Education (Major and Minor): F.M. University

Science stream:

1. Botany (Major or Minor) : F. M. University
2. Zoology (Major or Minor): F.M University
3. Chemistry (Major or Minor): Ravenshaw University
4. Physics (Major or Minor): Utkal University
5. Geology (Major or Minor): Utkal University
6. Computer Application (Major or Minor): Berhampur University
7. Biotechnology (Minor): F.M. University
8. Electronics (Major and Minor): Berhampur University
9. Environmental science (Major and Minor): F.M. University
10. Information Technology (Minor): F.M. University
11. Industrial chemistry (Minor): Ravenshaw University
12. Microbiology (Major and Minor): F.M. University
13. Industrial Fish and Fisheries (Minor): F.M. Universty
14. Food Science and Quality control (Minor): F.M. University
15. Sericulture (Minor):F.M. University

Arts stream

16. Political science(Major or Minor): F.M. Universty
17. History (Major or Minor): Utkal Universty
18. Economics (Major or Minor): Utkal University
19. Sociology (Major or Minor): Utkal University
20. Social work (Major and Minor): Sambalpur University
21. Philosophy (Major or Minor): Sambalpur University
22. Geography (Major or Minor): Utkal University

23. Psychology (Major or Minor): Utkal University
24. Home science/Family &Community Science (?)(Major or Minor): Berhampur University
25. Education (Major or Minor): Ravenshaw University
26. Population studies (Major and Minor): F.M. University
27. Library and Information science(Major or Minor): Sambalpur University
28. Public administration (Major or Minor): Utkal University
29. Odia (Major or Minor): Utkal University
30. English m(Major or Minor): Sambalpur University
31. Sanskrit (Major or Minor): North Orissa University
32. Alternate Sanskrit (Minor): North Orissa University
33. Hindi (Major or Minor): Ravenshaw University
34. Santali (Major and Minor): North Orissa University
35. Telugu (Major and Minor): Berhampur University
36. Bengali (Major and Minor): F.M. University
37. Urdu (Major and Minor): F.M. University
38. Law & Jurisprudence (Minor): Utkal University
39. IR&PM (Major and Minor): Berhampur University
40. BBA (Major and Minor): Berhampur University

Commerce stream:

Minor I, Minor II, Major, General elective(s) as per the outline of the syllabus pattern to be prepared by Prof. Ranja Bal (Utkal University) and Prof. Bhagaban Das (F.M. University) in collaboration with experts from other Universities of Odisha.

General Core:

1. MIL (Odia/Sanskrit/Hindi/Santali/ Urdu/Telugu/Bengali): The Chairman BOS of the respective University assigned to prepare Major and Minor course syllabus.

Alternate English: Sambalpur University
2. Communicative English: Sambalpur University
3. Indian Society and Culture: Utkal University
4. National Service scheme: F.M. University
5. Environmental Studies: F.M. University
6. Information Technology; Soft skill (50:50%): F.M. University/Utkal University

NB: Please add and inform if I have left any subject in the list above

Prof. S.P. Adhikary
VC, F.M. University
Email:vcfmuniversty@gmail.com

Outline of the syllabus for **Science** in UG course for Universities of Odisha

Subject	**Semester-I**	**Semester-II**	**Semester-III**	**Semester-IV**	**Semester-V**	**Semester-VI**	**Marks (Credits)**
General Core	Communicative English (Mark50; 3 Credits)	MIL/Alternative English (Mark50; 3Credits)	Indian Society &Culture (Mark50; 3 Credits)	NSS (Mark50; 3 Credits)	Environmental Studies (Marks50;3credits)	Information Tech & Soft skills (Marks 50,3 credits)	300 marks (18 credits)
General Elective*	**Vocational/Choice based subjects for accruing additional one credits @10 hour**		Paper-I (Mark50; 3 Credits)	Paper-II (Mark50; 3 Credits)	**Vocational/Choice based subjects for accruing additional one credit @10 hours**		100 marks (6 credits)
Minor-I	Paper-I (Mark50; 3 Credits)	Paper-II (Mark50; 3 Credits)	Paper-IV (Mark50; 3 Credits)	Paper-V (Mark50; 3 Credits)	Paper-VI **Practical** (Mark50; 3 Credits)	Project work [100 marks; 8 credits] (project 75+ Comprehensive viva-voce 25)	Project: 100 marks; 8 credits
		Paper-III **Practical** (Mark50; 3 Credits)					Minor I &II: 600 marks (36 credits)
Minor-II	Paper-I (Mark50; 3 Credits)	Paper-II (Mark50; 3 Credits)	Paper-III **Practical** (Mark50; 3 Credits)	Paper-IV (Mark50; 3 Credits)	Paper-V (Mark50; 3 Credits)		
					Paper-VI **Practical** (Mark50; 3 Credits)		
Major	Paper-I (Mark50; 3 Credits)	Paper-IV (Mark50; 3 Credits)	Paper-VII (Mark50; 3 Credits)	Paper-X (Mark50; 3 Credits)	Paper-XIII (Mark50; 3 Credits)	Paper-XVI (Mark50; 3 Credits)	Major: 900 marks (54 credits)
	Paper-II (Mark50; 3 Credits)	Paper-V (Mark50; 3 Credits)	Paper-VIII (Mark50; 3 Credits)	Paper-XI (Mark50; 3 Credits)	Paper-XIV (Mark50; 3 Credits)	Paper-XVII (Mark50; 3 Credits)	
	Paper-III **Practical** (Mark50; 3 Credits)	Paper-VI **Practical** (Mark50; 3 Credits)	Paper-IX **Practical** (Mark50; 3 Credits)	Paper-XII **Practical** (Mark50; 3 Credits)	Paper-XV **Practical** (Mark50; 3 Credits)	Paper-XVIII **Practical** (Mark50; 3 Credits)	
Marks (Credits)	50x6=300 marks (3x6 = 18 credits)	50x7=350 marks (3x7= 21 credits)	50x7=350 marks (3x7 = 21 credits)	50x7=350 marks (3x7 = 21 credits)	50x7=350 marks (3x7 = 21credits)	50x4+100=300 marks (3x4+8=20 credits)	**2000 Marks (122credits)** **

**Additional can be accrued for maximum of four choice based subjects with 3 credits each = up to additional 12 Credits
Or **[122+12= 134 Credits maximum];** For Mathematics there will be no practical paper/class, and instead it will be a theory -cum- tutorial class.

***General elective:** One subject with two papers to be chosen from the following: Biotechnology, Life Sciences, Sustainable agriculture practices, Pisciculture, Non-conventional energy resources, Conservation and Management of natural resources, Statistics, Material science, Geography, Remote sensing, Disaster management, Physics, Chemistry, Computer Application, Mathematics, Industrial chemistry, Polymer science, Solid state devices, Psychology, Anthropology, Physical Education , Instrumentation, , Seed Technology, Textile science, Industrial Fish and Fisheries, Sericulture, Food Science and Quality control, Biofertilizers, Vermicomposting, Soil health management. (Other subjects including vocational

courses can also be added as per relevance; Syllabus of the subject to be developed, subject-wise and college-wise with approval of the University as per the expertise and facility available and approved by the concerned Board of Studies of the University).

Major and Minor I & II: One core subject and two allied subjects of Physical science or Biological science to be chosen from the following:

1. Botany (Major or Minor)
2. Zoology (Major or Minor)
3. Chemistry (Major or Minor)
4. Physics (Major or Minor)
5. Mathematics (Major or Minor)
6. Geology (Major or Minor)
7. Computer Application (Major or Minor)
8. Biotechnology (Minor)
9. Electronics (Minor)
10. Statistics (Minor)
11. Environmental science (Minor)
12. Information Technology (Minor)
13. Industrial chemistry (Minor)
14. Microbiology (Minor)
15. Geography (Minor)
16. Anthropology (Minor)
17. Industrial Fish and Fisheries (Minor)
18. Food Science and Quality control (Minor)
19. Sericulture (Minor)

To choose one of the following combinations with one Major and two Minor subjects:

(A) **Botany (Major),** Minor: any two from (Chemistry/Industrial chemistry, Zoology, Computer Application/ Information Technology, Geography, Anthropology, Sericulture, Industrial Fish and Fisheries, Food science and Quality control)

(B) **Zoology (Major),** Minor: any two from (Chemistry/Industrial chemistry, Botany, Computer Application/ Information Technology, Geography, Anthropology, Sericulture, Industrial Fish and Fisheries, Food science and Quality control)

(C) **Chemistry (Major),** Minor: any two from (Physics/ Electronics, Mathematics/ Statistics, Geology, Environmental science, Biotechnology, Microbiology, Computer Application/ Information Technology, Geography)

(D) **Physics (Major),** Minor: any two from (Chemistry/Industrial chemistry , Mathematics/ Statistics, Geology, Environmental science, Biotechnology, Microbiology, Computer Application/ Information Technology, Geography)

(E) **Mathematics (Major),** Minor: any two from (Chemistry/Industrial chemistry , Physics/ Electronics , Geology, Environmental science, Biotechnology, Microbiology, Computer Application/ Information Technology, Geography

Outline of the syllabus for **Arts** in UG course for Universities of Odisha

Subject	**Semester-I**	**Semester-II**	**Semester-III**	**Semester-IV**	**Semester-V**	**Semester-VI**	**Marks (Credits)**
General Core	Communicative English (Mark50; 3 Credits)	MIL/Alternative English (Mark50; 3Credits)	Indian Society &Culture (Mark50; 3 Credits)	NSS (Mark50; 3 Credits)	Environmental Studies (Marks50;3credits)	Information Tech & Soft skills (Marks 50,3 credits)	300 marks (18 credits)
General Elective*	**Choice based subjects for accruing additional credits @10 hours per Credit**		Paper-I (Mark50; 3 Credits)	Paper-II (Mark50; 3 Credits)	**Choice based subjects for accruing additional credits @10 hours per Credit**		100 marks (6 credits)
Minor-I	Paper-I (Mark50; 3 Credits)	Paper-II (Mark50; 3 Credits)	Paper-IV (Mark50; 3 Credits)	Paper-V (Mark50; 3 Credits)	Paper-VI Practical (Mark50; 3 Credits)	Project work [100 marks; 8 credits] (project 75 + Comprehensive viva-voce 25)	Project: 100 marks; 8 credits
		Paper-III Practical (Mark50; 3 Credits)					Minor I &II: 600 marks (36 credits)
Minor-II	Paper-I (Mark50; 3 Credits)	Paper-II (Mark50; 3 Credits)	Paper-III (Mark50; 3 Credits)	Paper-IV (Mark50; 3 Credits)	Paper-V (Mark50; 3 Credits)		
					Paper-VI Practical (Mark50; 3 Credits)		
Major	Paper-I (Mark50; 3 Credits)	Paper-IV (Mark50; 3 Credits)	Paper-VII (Mark50; 3 Credits)	Paper-X (Mark50; 3 Credits)	Paper-XIII (Mark50; 3 Credits)	Paper-XVI (Mark50; 3 Credits)	Major: 900 marks (54 credits)
	Paper-II (Mark50; 3 Credits)	Paper-V (Mark50; 3 Credits)	Paper-VIII (Mark50; 3 Credits)	Paper-XI (Mark50; 3 Credits)	Paper-XIV (Mark50; 3 Credits)	Paper-XVII (Mark50; 3 Credits)	
	Paper-III (Mark50; 3 Credits)	Paper-VI (Mark50; 3 Credits)	Paper-IX (Mark50; 3 Credits)	Paper-XII (Mark50; 3 Credits)	Paper-XV (Mark50; 3 Credits)	Paper-XVIIIP (Mark50; 3 Credits)	
Marks (Credits)	50x6=300 marks (3x6 = 18 credits)	50x7=350 marks (3x7= 21 credits)	50x7=350 marks (3x7 = 21 credits)	50x7=350 marks (3x7 = 21 credits)	50x7=350 marks (3x7 = 21credits)	50x4+100=300 marks (3x4+8=20 credits)	**2000 Marks (122credits)** **

**Additional can be accrued for maximum of four choice based subjects with 3 credits each = up to additional 12 Credits
Or **[122+12= 134 Credits maximum]**

***General elective:** One subject with two papers to be chosen from the following: Odia, English, Sanskrit, Hindi, Communicative/Functional English, Mathematics, Indian Polity, Indian Economy, Indian Geography, Landmarks in Indian History,, Home Science, Philosophy, Anthropology, Statistics, Sociology, Education, Psychology, Physical Education, Computer application, Archaeology and museology, Functional English, Functional Sanskrit, Library and information science, IR & PM, Science And Technology. (Other subjects including vocational courses can also be

added as per relevance; Syllabus of the subject to be developed, subject-wise and college-wise with approval of the University as per the expertise and facility available and approved by the concerned Board of Studies of the University).

Major and Minor I & II: One core subject and two allied subjects to be chosen from the following:

1. Political science(Major or Minor)
2. History (Major or Minor)
3. Economics (Major or Minor)
4. Sociology (Major or Minor)
5. Philosophy (Major or Minor)
6. Geography (Major or Minor)
7. Psychology (Major or Minor)
8. Statistics (Major or Minor)
9. Anthropology (Major or Minor)
10. Mathematics (Major or Minor)
11. Computer science (Major or Minor)
12. Home science(Major or Minor)
13. Education (Major or Minor)
14. Library and Information science(Major or Minor)
15. Public administration (Major or Minor)
16. Odia (Major or Minor)
17. English m(Major or Minor)
18. Sanskrit (Major or Minor)
19. Hindi (Major or Minor)
20. Santali (Minor)
21. Telugu (Minor)
22. Bengali (Minor)
23. Urdu (Minor)
24. Law & Jurisprudence (Minor)
25. IR&PM (Minor)

To choose one of the combinations with one Major and two Minor subjects: (To be prepared ……..)

Outline of the syllabus for **Commerce** in UG course for Universities of Odisha

Subject	**Semester-I**	**Semester-II**	**Semester-III**	**Semester-IV**	**Semester-V**	**Semester-VI**	**Marks (Credits)**
General Core	Communicative English (Mark50; 3 Credits)	MIL/Alternative English (Mark50; 3Credits)	Indian Society &Culture (Mark50; 3 Credits)	NSS (Mark50; 3 Credits)	Environmental Studies (Marks50;3credits)	Information Tech & Soft skills (Marks 50,3 credits)	300 marks (18 credits)
General Elective*	**Choice based subjects for accruing additional credits @10 hours per Credit**		Paper-I (Mark50; 3 Credits)	Paper-II (Mark50; 3 Credits)	**Choice based subjects for accruing additional credits @10 hours per Credit**		100 marks (6 credits)
Minor-I	Paper-I (Mark50; 3 Credits)	Paper-II (Mark50; 3 Credits)	Paper-IV (Mark50; 3 Credits)	Paper-V (Mark50; 3 Credits)	Paper-VI Practical (Mark50; 3 Credits)	Project work [100 marks; 8 credits] (project 75+ Comprehensive viva-voce 25)	Project: 100 marks; 8 credits
		Paper-III Practical (Mark50; 3 Credits)					Minor I &II: 600 marks (36 credits)
Minor-II	Paper-I (Mark50; 3 Credits)	Paper-II (Mark50; 3 Credits)	Paper-III (Mark50; 3 Credits)	Paper-IV (Mark50; 3 Credits)	Paper-V (Mark50; 3 Credits)		
					Paper-VI Practical (Mark50; 3 Credits)		
Major	Paper-I (Mark50; 3 Credits)	Paper-IV (Mark50; 3 Credits)	Paper-VII (Mark50; 3 Credits)	Paper-X (Mark50; 3 Credits)	Paper-XIII (Mark50; 3 Credits)	Paper-XVI (Mark50; 3 Credits)	Major: 900 marks (54 credits)
	Paper-II (Mark50; 3 Credits)	Paper-V (Mark50; 3 Credits)	Paper-VIII (Mark50; 3 Credits)	Paper-XI (Mark50; 3 Credits)	Paper-XIV (Mark50; 3 Credits)	Paper-XVII (Mark50; 3 Credits)	
	Paper-III Practical (Mark50; 3 Credits)	Paper-VI Practical (Mark50; 3 Credits)	Paper-IXPractical (Mark50; 3 Credits)	Paper-XIIPractical (Mark50; 3 Credits)	Paper-XVPractical (Mark50; 3 Credits)	Paper-XVIIIPractical (Mark50; 3 Credits)	
Marks (Credits)	50x6=300 marks (3x6 = 18 credits)	50x7=350 marks (3x7= 21 credits)	50x7=350 marks (3x7 = 21 credits)	50x7=350 marks (3x7 = 21 credits)	50x7=350 marks (3x7 = 21credits)	50x4+100=300 marks (3x4+8=20 credits)	**2000 Marks (122credits)** **

**Additional can be accrued for maximum of four choice based subjects with 3 credits each = up to additional 12 Credits
Or **[122+12= 134 Credits maximum]**

***General elective:** One subject with two papers and choice based subjects for additional credit: ..... **To be developed by Commerce faculty**
Minor I & II and Major: Comprising Core subject and Allied subjects ..... **To be developed by Commerce faculty**

BERHAMPUR UNIVERSITY

Bhanja Bihar, Berhampur- 760 007

UNDER GRADUATE COURSES-SEMISTER SYSTEM

CHOICE BASED CREDIT SYSTEM SYLLABUS STRUCTUE

T E L U G U

2015-16

Carriculam Designed

BY

Dr Singupuram Narayana Rao

GENERAL CORE **Full marks-40**

SECOND SEMISTER **Credits -3**

M.I.L TELUGU BA/BSc/BCom

Unit-I POETRY:

1.Ganga santanula katha – Nannaya

2.Hamsee chakravaka samvadamu – Peddana

3.Musafarulu – Jashuwa

Unit-II PROSE:

1.Galivana – Palagummi Padmaraju

2.Akali - Kolakaluri Enoc

3.Gurajada Kavitwam-vimarsa vivechana –Dr Singupuram Narayanarao

Unit –III Non-Detail

Sri Krishnachandra gajapati

Unit - IV GRAMMER

Samskrita sandhulu: Savarnadeergha ,Guna ,Anunasika,Yanadesa.

Telugu sandhulu: Akara, ikara,Ukara,yadagama,Gasadadavadesa,
Trika,Dwiruktatakara,Tugagama,Rugagama,

Samasamulu: Tatpurusha,Karmadharaya,Dwandva,Dwigu,Bahuvreehi

Books Recommended :

Sahitya Lahari – By Dr Singupuram Narayanarao
Sri Krishna Chandra Gajapati – Harshasri P.Prasadarao
Vyakarana parijatamu – Dr Singupuram Narayanarao

***

MINOR ELECTIVE **Full marks-40**
First Semister **Credits-3**
PAPER-I
Poetry, Prose, Prosedy & Poetics

Unit –I Classical Poetry:
1.Prahlada charitramu - Potana
2.Satyabhama santwanamu - Nandi timmana
3.Sita parityagamu –Kankanti paparaju

Unit –II Modern Poetry
1.Arta geetamu – Tilak
2.Mahandrodyamamu – Dasarathi
3.Lakuma tyagamu – C.Narayana Reddi

Unit –III Prose
1.Swabhasha – Panuganti Lakshminarasimha Rao
2.Rayalanati Rasikata – Rallapalli Anantakrishna Sarma
3.Srisri Sahityam-samajika chaitanyam – Dr Singupuram Narayana Rao

Unit –IV Grammer
Chandassu : Champakamala, Utpalamala, Sardhulam, Mattebham, Tetageeti, Ataveladi, Kandamu, Seesamu.

Alankaramulu : Sabdalankaramulu – Vrutyanuprasam,

Chekanuprasamu, Latanuprasamu, Yamakamu,
Ardhalankaramulu – Upama, Rupaka, Utpreksha,
Ardhantaranyasa, Atisayokti, Swabhavokti

Books Recommended:

Sahitee vallari – By Dr Singupuram Narayana Rao
Vyakarana parijatamu – By Dr SNarayana Rao

***

MINOR ELECTIVE **Full marks-40**
Second Semister **Credits - 3**
PAPER –II
History of Telugu Literature

Unit –I

1.Vaknmayamu –Saraswatamu –Sahityamu
2.Kavitrayamu-Nannaya,Tikkana,Yerrana

Unit – II

1.Sreenadha yugamu –Sreenadhudu, Potana
2.Prabandha yuga lakshanalu – Peddana,Rayalu,Molla

Unit –III

1.Dakshinandhra yuga vaisistyam-Nayakarajula vaknmaya seva
2.Raghunadha nayakuni krutula sameeksha

Unit –IV

1.Adhunika kavitwam –Gurajada,Rayaprolu,Sri Sri
2.Navala –Kandukuri,Unnava,Viswanadha

Books Recommended:

Andhra sahitya charitra –Pingali Lakshmikantam
Telugu sahitya sameeksha –Dr G.Nagayya
Samagrandhra sahityam –Arudra
Telugu sahtya charitra sangraham –Dr Singupuram Narayana Rao

****

MINOR ELECTIVE **Full marks - 40**
Third Semister **Credits -3**
PAPER –III
Poetry, Prose & Novel

Unit –I Classical Poetry:

1.Sakuntalo pakhyanam – Nannaya
2.Draupadi parivedanamu – Tikkana
3.Sreekrishnuni Balakreedalu – Yerrana

Unit –II Modern poetry:

1.Desabhakti – Gurajada
2.Prabodhamu – Rayaprolu
3.Gabbilamu – Jashuwa

Unit –III Prose:

1.Bahukala darsanamu – Devulapalli Krishna sastri
2.Manucharitramu – Divakarla Venkatavadhani
3.Trunakankana kavya saundaryam – Dr Singupuram Narayana Rao

Unit –IV Novel:

Ekaveera

Books Recommended:

Sahitya prabha – Dr Singupuram Narayana Rao
Ekaveera – Viswanadha Satyannarayana

****

MINOR ELECTIVE **Full marks -40**
Fourth Semister **Credits -3**
PAPER - IV
History of Telugu language,Grammer & Dialects

Unit –I

1.Telugu Bhasha charitra –Sangraha swarupam
2.Dravida bhashalu,tadvyavahartalu-vari prantalu

Unit –II

1.Dravida Bhashalalo Telugunakugala sthanam
2.Andhramu,Telugu,Tenugu padala puttuka-vyapti

Unit –III Grammer:

Sangnya parichedamu

Unit –IV

1.Mandalikalu-Nirvachanam-Utpathi-Swarupam
2.Telugu Mandalikalu – Bhedalu

Books Recommended:

Telugu Bhasha Charitra – By P.S.Subramanyam
Andhra Bhashacharitra – By Spurtisri
Balavyakaranam-ghantapada vyakhya – By Vantaram Ramakrishnarao

***

MINOR ELECTIVE **Full marks -40**
Fifth Semister **Credits -3**
PAPER –V
Prose,Poetry & Drama

Unit –I Classical Poetry:
1.Vamanavataramu - Potana
2.Salivahana vijayam – Koravi Goparaju
3.Greeshmartuvu –Raghunata nayakudu

Unit –II Modern poetry :
1.Makoddee telladoratanam – Garimella satyannarayana
2.Meghadutamu – Puttaparti Narayanacharyulu
3.Koyila – Rayaprolu subbarao

Unit –III Prose:
1.Dharmasamvadamu – Pingali katuri
2.Vemana hasyamu – Rallapalli anantakrishna sarma
3.Kundurti vimarsanadrukpadham –Dr Singupuram Narayana Rao

Unit –IV Drama:
Varavikrayam

Books Recommended:

Sahity Chandrika – Dr Singupuram Narayana Rao
Varavikrayamu – Kallakuri Narayana Rao

***

MINOR ELECTIVE **Full marks -40**
Sixth Semister **Credits -3**
PAPER –VI
Literary criticism

Unit –I

1.Vimarsa-Nirvachanam-Swarupa swabhavalu
2.Vimarsa prayojanalu-Vimarsa bhedalu

Unit –II

1.Uttamavimarsakuni lakshnalu
2.Kavi-vimarsakula sambandham

Unit –III

1.Kavya Nirvachanamu–Prachya paschatya drukpadhalu
2.Kavyabhedalu-kavyahetuvulu-kavyaprayojanamulu

Unit –IV

1.Sahitya Nirvachanamu-kalalu-vidyalu
2.Adhunika sahitya prakriyalu –Navala-Kadhanika-Ekankika

Books Recommended:

Sahitya Darsanamu- By KVR Narasimham
Sahitya silpa sameeksha- By Pingali laxmikantam
Abhinava sahitya darsanam- By Prof Konka yadagiri
Sahitya vimarsa sangraham-By Dr S.Narayana Rrao

***

MAJOR ELECTIVE **Full marks-40**
First Semister **Credits - 3**
PAPER –I
History of Telugu Language

Unit –I
1.Hindvarya dravida bhashalu-paraspara prabhavam,
2.Dravida bhasha lakshanalu-Andhramu,Telugu, Tenugu

Unit –II
1.Telugu lipiparinamam-ardhaparinamam-dwaniparinamam
2.Telugu bhasha- dwanula utpathi,Dwanula marpu-hetuvulu

Unit –III
1.Muladravida varnalu telugulo parinaminchina teeru
2.Telugu bhashalo anya desyalu-adanapradanalu

Unit –IV
1.Telugu padanirmanam-namavachakam-lingam-vachanam
2.Telugu vibhakti vidhanam-Sankhya vachakalu

Books Recommended:

Andhra bhasha vikasam- By Prof Gantijogi somayaji
Telugu bhasha charitra – By Prof Bhadriraju krishnamurty
Dravida bhashalu – By Prof P.S.Subramanyam
Telugu bhasha charitra sangrahamu –By Dr S. Narayana Rao

***

MAJOR ELECTIVE **Full marks-40**
First Semister **Credits-3**
PAPER –II
History of Telugu Literature

Unit –I
1. **Vaknmaya, Saraswata, Sahitya sabdarthalu.**
2. **Sahitya Charitra -swarupa swabhavalu.**
3. **Praknnannaya yugamu-sahitya vikasamu**

Unit –II
1. **Nannaya Bharatandhreekarana vidhanamu.**
2. **Tikkana kavitareetulu-atmeeyata**
3. **Yerrana krutula sameeksha**

Unit –III
1. **Sreenadhuni naishadandreekarana vidhanamu**
2. **Potana Bhagavatarachana vaisistyam**
3. **Annamayya vemanala samajika samskarana drukpadham**

Unit –IV
1. **Rayalayugamu- prabandha lakshanalu**
2. **Dakshinandhra yugamu-yakshagana prakriyalu**
3. **Raghunadha nayakuni krutula sameeksha**

Books Recommended:

Andhra sahitya charitra- By Pingali Laxmikantam
Telugu sahitya sameeksha- By Prof G.Nagayya
Samagrandhra sahitya – By Arudr
Telugu sahitya charitra sangraham – By Dr S.Narayana Rao

****

MAJOR ELECTIVE **Full marks -40**
First Semister **Credits - 3**
PAPER –III
Kavya Natakamulu

Unit –I
Dharmavyadhopakhyanam (27 to 70)

Unit –II
Dharmavyadhopakhyanam (71 to 112)

Unit –III
Amrutam kurisina ratri

Unit –IV
Brahmma vivaham

Books Prescribed:

Sahitya sindhuvu – By Dr.Singupuram Narayana Rao
Andhra Mahabharatam ,panchamaswasam– By Yerrana
Amrutam kurisinaratri – By Balagangadhara tilak
Brahmma vivaham – By Kandukuri veeresalingam

***

MAJOR ELECTIVE **Full marks - 40**
Second Semister **Credits - 3**
PAPER – IV
Ancient Literary criticism

Unit – I
1.vimarsa- Nirvachanam-avasyakata-prayojanam
2.uttama vimarsakuni lakshanalu – badhyatalu

Unit –II
1.Kavyam,kavitwam-prachya,paschatya nirvachanalu
2.Kavya bhedalu,kavyahetuvulu-vividha abiprayalu

Unit – III
1.Rasa sidhantam- vibhinna alankarikula matam
2.Dwani- Nirvachanam,bhedalu,dwanyabhava vadalu

Unit – IV
1.Pracheena sahitya prakriyalu-Itihasam,puranam,kavyam
2.Prachya paschatya natakotpathi vadalu –Nataka lakshanalu

Books Recommended:

Sahitya darsanam – By KVR Narasimham
Sahitya silpa sameeksha – By Pingali laksmikantam
Sahitya bhava lahari – By SV Jogarao
Telugulo sahitya vimarsa – By Patibanda madhavasarma

` ***

MAJOR ELECTIVE **Full marks - 40**
Second Semister **Credits - 3**
PAPER – V
Folk Literature

Unit – I
1.Janapada vignanam - swarupaswabhavalu,vargeekarana
2.Janapada vignana krushikulu - Paschatyulu,Andhrulu

Unit – II
1.Janapada sahityam– Swarupaswabhavalu,Vargeekarana
2.Janapada vagnmayamu – lakshanalu,Vargeekarana

Unit – III
1.Adima geetam – puttuka, vikasam
2.Janapada geyam – nirvachanam, lakshanalu

Unit – IV
1.Janapada geyalu – Bhasha chendo vishesalu
2.Sameta – Nirvachanam,puttuka,lakshanalu,vargeekarana

Books Recommended:

Janpada Vignanadhyayanam– By G.S.Mohan
Andhrula janapadavignanam – By R.V.S.Sundaram
Telugu janapada geyasahityam – By B.Ramaraju

****

MAJOR ELECTIVE **Full marks - 40**
Second Semister **Credits - 3**
PAPER – VI
Grammer,Prosody & Poetics

Unit – I
Balavyakaranam – Sandhi parichedam

Unit - II
Balavyakaranam – Tatsama parichedamu

Unit – III
Appakaveeyam – Yati,prasalu

Unit – IV
Alankaramulu : Upama,Rupaka,Apahnava,Utpreksha,Deepaka,
Sahokti,Samasokti,Vyajastuti,Kavyalinga

Books Recommended:

Ramaneeyamu – By Duvvuri venkataramana sastri
Balavyakaranam (ghantapada vyakhya) – By Vantaram Ramakrishnarao
Appakaveeyam(truteeyaswasam- Yati,Prasalu) - By Appakavi

***

MAJOR ELECTIVE **Full marks - 40**
Third Semister **Credits - 3**
PAPER –VII
Modern Literary Criticism

Unit – I
1.Samajam-sahityam-sahitya vimarsa- paraspara sambandam
2.Rachayita-samajika spruha-Samajika samasyalu-parishkara badhyata

Unit – II
1.Adhunika sahitya vimarsa lakshanalu- paddhatulu
2.Samskarana-kalpanika-hetuwada-abhyudaya sahitya vimarsa

Unit – III
1.Digambara-viplava-dalita-streewada sahitya vimarsa
2.Kadhanika-Natakam-Vyasam-haiku- Naneela vimarsa

Unit – IV
1.Adhunika sahitya vimarsakarulu- Kattamanchi,kandukuri,SriSri
2.Atyadhunika sahitya vimarsakarulu – Rachamalla Rama Chandra reddy, Sudarsanam,Kathi padmarao,katyayani vidmahe

Books Recommended:

Sahitya darsanam- By KVR Narasimham
Sahityam maulika bhavanalu – By Papineni sivasankar
Adhunikandhra kavitwam- BY C.Narayana Reddy
Adhunika telugu sahitya vimarsa- By Kovela Suprasannacharya
Adhunika sahitya vimarsa sutram – By Kolakaluri Enoc
Vimarsa maulika lakshanalu – By Mudigonda veerabhadrayya

***

MAJOR ELECTIVE **Full marks - 40**
Third Semister **Creditas - 3**
PAPER – VIII
Streevada Sahityam

Unit – I
1.Streevada nirvachanam-lakshanalu-nepadyam
2.Bharatadesamulo streewada udyamalu-puttupurvotharalu

Unit – II
1.Streewadam -vividha dhoranulu
2.Telugulo streewada sahityam-parinamavikasam

Unit – III
Streewada kavitwam –Neelimeghalu(sankalanam)

Unit – IV
1.Streewada navala – Sahaja –Volga
2.Streewada kadhalu – Illalakagane – P.Satyavati

Books Recommended;

Maku godalulevu(streewada siddhanta parichayamu) – By Asmita
Sarihaddulu leni sandhyalu – By Asmita
Streewada vivadalu – By S.V.Satyanarayana
Manaku telyani mana charitra – By Asmita

****

MAJOR ELECTIVE **Full marks- 40**
Third Semister **Credits -3**
PAPER – IX
Kavya Natakamulu

Unit – I
Manjuvani rayabharam (58 to 95)

Unit – II
Manjuvani rayabharam(96 to 133)

Unit – III
Gudiselu kalipotunnai

Unit – IV
Seeta jyosyam

Books Recommended:

Vasucharitra (4th Canto) – By Ramarajabhushanudu
Gudiselu kalipotunnai – By Boyi Bheemanna
Seeta jyosyam – Narla venkateswararao

***

MAJOR ELECTIVE **Full marks - 40**
Fourth Semister **Credits - 3**
PAPER – X
Prabandha Sahityam

Unit – I
1.Prabandha sahityam – Avirbhava vikasalu
2.Prabandhayugam – Sanghika,charitrika,samskritika nepadyam

Unit – II
1.Astadiggaja kavulu – Vyavasta puttuka,sampradayam
2.Manucharitra ,Parijatapaharanam- sameeksha

Unit – III
1. Amuktamalyada,Rajasekhara charitra - sameeksha
2.Vasucharitra,kalapurnodayamu - sameeksha

Unit – IV
1.Kshetra mahatmya prabandhalu - puttuka,perugudala
2.Dvyardhi prabandhalu – puttuka, perugudala

Books Recommended:

Prabandhamu-Avatarana vikasamu – By KVR Narasimham
Telugu sahitya sameeksha(2nd part) –By Dr G.Nagayya
Parijatapaharana saundaryam –By Vakklanka laxmipatirao
Manucharitra – Vemparala suryanarayana sastri vyakhya
Amaktamalyadasaundaryam –By Tummapudi koteswar Rao
Prabandhamulalo prakruti varnanalu –By Antati Narasimham

****

HETUVADA SAHITYAM **Full marks - 40**
Fourth Semister **Credits - 3**
PAPER –XI
Hetuwada sahityam

Unit – I
1.Hetuwada nirvachanam-Lakshanalu-Udyamam
2.Hetuwadam- Nastika,Manava,Samyawadalato Sambandham

Unit – II
1.Hetuwada sahityam – Anglabhasha prabhavam
2.Pramukha hetuwada rachayitalu- Sahityam

Unit – III
1.Hetuwada kavitwam –Satakalu
2.Telugu kavitwam – Hetuwada prasamsa

Unit – IV
1.Vyasa prakriya – Hetuwadam
2.Hetuwadam – Parisodhana vyasam

Books Prescribed :

Andhrapradeshlo hetuwada udyamam – By Ravipudi venkatadri
Nastikawadam-hetuwadam – Manavawadam –By Ranganayakamma
Andhradesamlo hetuwada manavawada udyamalu – By Avula manjulata

***

MAJOR ELECTIVE **Full marks - 40**
Fourth Semister **Credits - 3**
PAPER - XII
Vemana

Unit – I
1.Kathalu,padyala adharamga vemana jeevitam
2.Vemana desakalalu –bhinnabhiprayalu

Unit – II
1.vemana padya makutam –vividha abhiprayalu
2.Vemana padya chandassu –Ataveladi pratyekata

Unit –III
1.Vemana kavitwam –hasyam,neetulu
2.Vemana kavita saundaryam –bhasha,saili,alankaralu

Unit –IV
1.Vemana drukpadham –kulam,matam,ardhika,stree,racharikam
2.Vemana vaisistyam –telugu sahityamlo vemana sthanam

Books Recommended:

Prajakavi vemana – By N. Gopi
Vemana –By Rallapalli ananta Krishna sarma
Vemana vaisistyam-stree drukpadham –By M.jayadev
Vemana vaisistyam –By Narla venkateswar rao
Viswadhabhirama vinura vema –By Tripuraneni Venkteswar rao
Vemana jeevitam –sahityam –By S.M.Subhani
Vemana kavita saundaryam –By Ponnaganti hanumanta reddy

****

MAJOR ELECTIVE **Full marks - 40**
Fifth Semister **Credita - 3**
PAPER – XIII
Navyandhra Kavitwam

Unit – I
1.Navyandhra kavitvodyama hetuvulu –lakshanalu-yugakarta
2.Sanghasamskaranodyama kavitwam-lakshanalu-dhoranulu

Unit – II
1.Bhavakavitwa nirvachanam – Vividha sakhalu
2,Abhyudayakavitwa swarupaswabhavalu – dhoranulu

Unit – III
1.Vachanakavitwa nirvachanam-lakshanalu-vikasam
2.Digambara kavitwa lakshanalu –Sameeksha

Unit – IV
1.Viplava,dalita kavitwa lakshanalu-dhoranulu-swarupaswabhavalu
2.Streewadakavitwa swarupaswabhavam-bhinna drukpadhalu

Booka Recommended:

Adhunikandhra kavitwam –By C.Narayanareddy
Telugulo kavitaviplavala swarupam –By Velcheru narayana rao
Streewada vivadalu –By S.V.Satyanarayana
Telugulo kavitodyamalu –By Avula manjulata

****

MAJOR ELECTIVE **Full marks - 40**
Fifth Semister **Credits - 3**
PAPER – XIV
Gurajada

Unit – I
1.Gurajada jeevitam - Adhunika sahitya margadarsi Gurajada
2.Mutyalasaralu – vastu, bhava,bhasha,chando navyatalu

Unit – II
1.Kanyasulkam- itivrutha nirvahana,Gireesam patra pradhanyata
2.Kanyasulkam – Streepatralu,sanghasamskaranalu,bhasha navyata

Unit – III
1.Kondubhatteeam,Bilhaneeyam – Sameeksha
2.Gurajada kathalu – Kathakathanam,patrachitrana,abhyudaya bhavalu

Unit – IV
1.Gurajada vyavaharika bhashodyamam,asammati patram- pariseelana
2.Gurajada vyasalu-vimarsanadrukpadham, Gurajada-Yugakarta

Books Recommended:

Adhunikandhra kavitwam –By C.Narayana reddy
Telugulo kavitaviplavala swarupam –By Velcheru narayana rao
Mahodayam –By K.Ramanareddy
Kanyasulkam-natakakala –By Sardesayi tirumalarao
Gurajada- toli telugu kotha kadhalu –By R.Chandrasekhar reddy
Kanyasulkam-nurella samalochanam –By Visalandhra

***

MAJOR ELECTIVE **Full marks - 40**
Fifth Semister **Credits - 3**
PAPER – XV
Kavya Natakamulu

Unit – I
Udankopakhyanam (94 to 120)

Unit – II
Pravruni vruttantamu (49 to 79)

Unit – III
Piradausi

Unit – IV
Varavikrayam

Books Prescribed:

Mahabharatam,adiparvam,prathamaswasam –By Nannaya bhattu

Manucharitra,prathamaswasam –By Allasani peddana
Piradausi –By Gurram Jashuwa
Varavikrayam –By Kallakuri narayana Rao

***

MAJOR ELECTIVE **Full marks - 40**
Sixth Semister **Credits - 3**
PAPER – XVI
Navyandhra Vachana Sahityam

Unit – I
1.Navala- swarupa swabhavalu –prapancha bhashalalo navala
2.Telgu navala-Nirvachanalu- lakshanalu-toli telugu navala

Unit – II
1.Telugu navala vargeekarana – Vikasa dasalu
2.Sanghika navalalu –Manovaignyanika navalalu

Unit-III
1.Kadhanika –Nirvachanam-lakshanalu
2.Kadhanika-Arambha vikasalu-vargeekarana

Unit – IV
1.Telugu natakam-lakshanalu-arambha vikasalu-vargeekarana
2Natika-nirvachanam-lakshanalu-arambha vikasalu

Books Recommended:

Telugu navala vikasam – By Dr Modali Nagabhushana sarma
Telugu navala sahitya vikasam –Pullabhatla venkateswarlu
Kadhanika swarupa swabhavalu – Dr Poranki dakshinamurty
Telugu sanghika natakam- Dr PV Ramana
Telugu ekankika vikasam – Dr Vanam Madhusudhan

****

MAJOR ELECTIVE **Full marks - 40**
Sixth Semister **Credits - 3**
PAPER – XVII
Journalisam & Translation

Unit – I
1.Samachara sankalana sthalam-SIbbandi vidhulu
2.Vartapatrika swarupam-siddhantalu-bhasha

Unit – II
1.Sampadakuni vidhulu-badhyatalu-sampadakatwam-sampadakeeyam
2.Feature-nirvachanam-lakshanalu-rakalu,Sheershikalu –rakalu

Unit – III
1.National journalism,Yellow journalism,jateeya varta samstalu
2.Praja sambandhalu-pradhanyata,Praja sambandhallo media patra

Unit – IV
1.Anuvadam-nirvachanam-mulabhasha-lakshya bhasha
2.Anuvada paddhatulu-svechanuvadam-yadhamatrukanuvadam

Books Recommended:

Anuvada samasyalu – By Rachamallu Ramachandrareddy
Telugu journalism-charitra –By Rapolu Anandabhaskar
Telugu journalism-avagahana-acharana –By Budaraju Radhakrishna

***

MAJOR ELECTIVE **Full marks - 40**
Sixth Semister **Credits - 3**
PAPER – XVIII
Tulanatmaka Sahityam

Unit – I
1.Tulanatmaka sahityam-Nirvachanam-siddhantalu-vibhagalu
2.Vibhinna sahitya drukpadhalu-jateeya sahityam-viswa sahityam

Unit – II
1.Anuvadam –Nirvachanam –anuvadakuni lakshanalu
2.Tulanatmaka sahityamulo anuvadala pramukhyata-avasyakata

Unit – III
1.Telugu-oriya sahityalu – Avirbhava vikasalu-sahitya udyamalu
2.telugu oriya janapada prakriyalu –avirbhava vikasalu

Unit – IV
1.Telugu-oriya sangikacharalu-vastu samskriti-pandagalu,nomulu,alankaralu
2.Telugu-oriya samskriti-sampradayalu-parasparaprabhavam

Books Recommended;

Comparative literature in india – By budhadev bose
Tulanatmaka sahityam- By S.jayaprakash
Problems of translation- By H Laxmi
Odiya sahitya itihas- By Dr Mayadhar nansing
Odiya sahitya charitra – Puripanda appalaswami
Telugu-Odiya sahityamu –samskriti-Sampradayalu- By Dr S.Narayanarao

***

SYLLABUS FOR UNDER GRADUATE (UG) COURSE IN CHEMISTRY (MINOR)

UNDER CHOICE BASED CREDIT SYSTEM

(Effective for the students seeking admission in Colleges/Universities of Odisha in the academic session 2015-16 and onwards)

Minor Course Structure

Total Marks - 300 (Total Credit – 18)

(Examination: Internal – 20%, External – 80%)

SEMESTER	Paper No.	Paper Code	Theory/Practical/ Project	Credit	Marks	Total Hours
I	I	CH-101E	Theory	3	50	
II	II	CH-201E	Theory	3	50	
	III	CH-202E	Practical	3	50	
III	IV	CH-301E	Theory	3	50	
IV	V	CH-401E	Theory	3	50	
V	VI	CH-501E	Practical	3	50	

Course Structure

- All theory papers will have 3 periods per week including 1 period for assignments, discussion, presentations, etc.
- There shall be 6 practical classes per week in the semester having practical.

SEMESTER-I

Paper-I

CH-101E **Marks– 10+40 (3 Credit)**
Time – 2 Hrs.

Unit-I:

Gaseous state

Postulates of kinetic theory of gases, derivation of kinetic gas equation and deduction of gas laws. Deviation of real gases from ideal behavior, van der Waals equation of state, critical phenomenon, PV isotherm of real gases, relationship between critical constants and van der Waals constants. Molecular velocities and their relation. Elementary idea of Maxwell's distribution of molecular velocity.

Chemical kinetics

Chemical kinetics and its scope, rate of a reaction, factors influencing the rate, determination of rate, kinetics of zero order, 1^{st} order, 2^{nd} order ($2A \rightarrow$ products and $A+B \rightarrow$ products), half- life period and mean life. Determination of order, effect of temperature on rate-The Arrhenius equation, concept of activation energy and its determination. Simple collision theory.

Unit-II

Atomic Structure

Limitations of Bohr's theory, wave-particle duality, de-Broglie equation, Uncertainty principle, Schrödinger wave equation (mention only), significance of ψ and ψ^2, probability and distribution curve, Pauli exclusion principle, Hunds rule, Auf-bau principle, quantum Numbers and their significance, electronic configuration and stability.

Periodic properties

Atomic and ionic radii, ionisation energy, electron affinity, electro negativity (and their factors), trends of these properties in the periodic table and their applications in predicting and explaining chemical behaviour.

s-block elements:

Comparative study of compounds of I-A and II-A. Diagonal relationship. Salient features of hydrides, solvation and complexation tendencies.

Noble gases: Chemistry of xenon fluorides and oxides, uses of noble gases

Unit-II

Structure and reactivity of organic molecules

Review on types of bonding in organic compounds, electron distribution in organic molecules: inductive effect, electromeric effect, resonance, hyperconjugation and steric effect. Influence of these effects on acidity, basicity and dipole moment.

Types of organic reactions and mechanism

Fundamental idea on curved arrow notation, drawing electron movement with half and double headed arrows. Homolytic and heterolytic cleavage, electrophiles, nucleophiles, types of organic reactions, reactive intermediates: Formation, structure and stability of carbocation, carbanion and free radical. SN_1, SN_2, E_1, E_2, AND and ADE reactions.

Aliphatic hydrocarbons:

Alkane: Wurtz, Kolbe's and Corey-House reactions with mechanism. *Cycloalkanes:* Nomenclature, methods of formation, chemical reactions, Baeyer's strain theory and its limitation. *Alkenes:* Preparation-Elimination of alcohols and alkyl halides Saytzeff and Hoffmann elimination. Markonikoff and Anti-Markonikoffs rule with mechanism. *Alkynes*: Difference from alkenes, acidity and substitutions reaction.

SEMESTER-II

Paper-II

CH-201E **Marks– 10+40 (3 Credit)**
Time – 2 Hrs.

UNIT-I:

Thermodynamics -I

Thermodynamic terms, heat and work, Internal energy and Enthalpy—their relation. State function and Path function, First law and its mathematical form. Heat capacity-C_p and C_v, their relation. Calculation of work done in reversible expansion of an ideal gas. Adiabatic process-different relations. Calculation of dU and dH for the expansion of an ideal gases under isothermal and adiabatic condition for reversible process.

Thermochemistry: Standard state, Enthalpy of reactions, Hess's law and its applications, heat of reaction at constant pressure and constant volume, Enthalpy of neutralisation, bond dissociation energy & calculation from thermodynamic data.

Thermodynamics - II

Spontaneous and Non-spontaneous process, statement of second law, Carnot's Cycle, calculation of efficiency, concept of entropy, entropy change of ideal gases, entropy as a function of V and T and P and T. Entropy as a criteria of spontaneity and equilibrium, work function and free energy Gibbs–Helmholtz equation. Free energy change as the criteria of spontaneity and equilibrium.

Unit-II

Chemical bonding

Ionic bond: lattice energy and its evaluation by Born-Haber's cycle, solvation energy and solubility of ionic solids, polarizing power and polarisability of ions, Fajan's rule. .

Covalent bond: Valence bond theory and its limitations, directional characteristics of covalent bond, hybridization (sp, sp^2, sp^3, dsp^3, d^2sp^3) and shapes of simple inorganic molecules. VSEPR Theory and its application in predicting shapes of simple inorganic molecules and ions ($BeCl_2$, H_2O, NH_3, SF_4, PCl_5, ClF_3, XeF_2, ICl_3^-). Resonance and resonance energy, Polarity of covalent bonds.

MO theory: LCAO principle, molecular energy level diagram of H_2, H_2^+, H_2^-, N_2, O_2, O_2^+, Weak interactions: Hydrogen bond and van der Waals forces.

Non-aqueous solvents

Physical properties of a solvent, types of solvents and their general characteristics, reactions in non-aqueous solvents with reference to liquid NH_3 and liquid SO_2.

Unit-III

Stereochemistry

Geometrical isomerism: Definition and condition, E-Z notation, geometrical isomerism of oximes and alicyclic compounds.

Optical isomerism: Definition, condition elements of symmetry, chirality, enantiomerism, diastereoisomerism, racemic mixture, inversion, retention, and racemisation, relative and absolute configuration, sequence rules, D/L and R/S system of configuration.

Conformational isomerism: Definition, difference between configuration and conformation, Newman, Fischer and Saw-horse projection. Conformational analysis of ethane, n-butane and cyclohexane, axial and equatorial bonds, chair and boat conformation.

Arenesandaromaticity: Aromaticity and Huckel's rule. Structure of benzene, stability of benzene ring, aromatic electrophilic substitution reaction – general mechanism. Nitration, halogenetion, sulfonation and Friedel Craft reaction- its limitations, Directive influence of

groups, activating and de-activating groups, Methods of formation and reactions of side chain hydrocarbons.

Paper-III (Practical)

CH-202E **Marks– 10+40 (3 Credit)**
Time – 6 Hrs.

Unit-I: **Qualitative analysis** **20 Marks**

Qualitative analysis of mixture of Inorganic substances containing four radicals with interfering radicals like (CO_3^{2-}/SO_3^{2-}), (NO_3^-/NO_2^-), (NO_3^-/Br^-), (Cl^-/Br^-/I^-)(No insoluble in the mixture).

Unit-II: **Volumetric analysis** **10 Marks**

i. Standardisation of $KMnO_4$ by oxalic acid/sodium oxalate
ii. Estmation of Ca^{2+} by $KmnO_4$ (direct method).
iii. Standardisation of sodium thiosulphate by $K_2Cr_2O_7$
iv. Volumetric estimation of Fe^{2+}/Fe^{3+} with $K_2Cr_2O_7$/$KmnO_4$solution.
v. Volumetric estimation of copper iodometrically.
vi. Crystallisation of organic compounds (Acetanilide/bezoic acid/phthalic acid from water; naphthalene from alcohol)

VIVA VOCE 5 Marks
RECORD 5 Marks

(Mark distribution out of 40 for external evaluation)

SEMESTER-III

Paper-IV

CH-301E **Marks– 10+40 (3 Credit)**
Time – 2 Hrs.

UNIT I

Dilute solution and colligative properties

Ideal and non-ideal solution, Raoult's law and relative lowering of vapour pressure, elevation of boiling point, depression in freezing point, osmotic pressure and its laws, determination of molecular mass by these methods, abnormal molecular mass- the vant Hoff factor.

Chemical equilibria:

Different types of equilibrium constants: K_c, $K_p$andK_x and their relationship, thermodynamic derivation of law of mass action. Le-chatilier's principle and its application on physical and chemical equilibria.

Ionic equilibria: Concept of acid and base-Arrhenius, BronstedLwory, Lewis and Lux-flood system, common ion effect, buffer solution-Henderson equation, salt hydrolysis with expressions of pH.

Phase equilibria: Definition of phase, component and degree of freedom with example, water system andsulphur system

UNIT II

p-block elements

Hydrides, oxides, oxy-acids and halides of Gr.13-17. Hydrides of Boron:Diborane (Preparation and structure), Borazine, Fullerenes, carbides, silicates and Inter-halogen compounds. Fluorocarbons.

d-block elements

General characteristics of d-block elements, Chemistry of 1st row transition elements with special reference to ionic radii, ionization potential, electronic configuration, variable valency, magnetic property and complex formation.

Chemistry of Ni, Cr and V (Occurrence, extraction and properties).

Lanthanides and actinides

Electronic configuration, oxidation states and ionic radii. Lanthanide contraction, complex formation. Occurrence and isolation. General features and chemistry of actinides, chemistry of separation of Np, Pu and Am from Uranium.

Unit-III

Alkyl and aryl halides

*Alkyl halides:*Monohalogen compounds, nucleophilic substitution (SN_1 and SN_2) reactions. polyhalogen compounds - Chloroform and carbon tetrachloride. *Aryl halides:* Methods of formation, nuclear and side chain reactions, addition-elimination and elimination-addition nucleophilic aromatic substitution reactions, Synthesis and uses of DDT and BHC.

Alcohols and phenols:

*Alcohols:*Distinction between 1°, 2°, 3° alcohols. Dihydric alcohols-Glycols-Preparation and reactions of ethylene glycol, Pinacol-Pinacolone rearrangement. Oxidative cleavage by $Pb(OAc)_4$ and HIO_4.*Phenols:*Preparation and properties of phenols, comparative acid strengths of alcohols and phenols, resonance stabilization of phenoxide ion. Electrophilic substitution reactions-Halogenation, nitration, Reimer-Tiemann reaction.

Aldehydes and ketones (Aliphatic and Aromatic)

Synthesis of aldehydes and ketones with special reference to synthesisaldehydes from acid chlorides and ketones from carboxylic acid & nitriles. Mechanism of nucleophilic addition to

carbonyl group with reference to benzoin, aldol and Knoevenagel condensations. Cannizzaro reaction, Clemmension and Wolf Krishnerreduction.

SEMESTER-IV

Paper-V (Practical)

CH-401E **Marks– 10+40 (3 Credit)**
Time – 6 Hrs.

UNIT-1: Systematic identification of unknown organic compound with CHO and CHN Systemsand confirmation by M.P/ B.P (No derivative) 20 Marks

UNIT-II: 10 Marks

i. Determination of specific reaction rate of acid hydrolysis of methyl acetate/ethyl acetate atroom temperature.
ii. Determination of acetic acid in commercial vinegar using NaOH.
iii. Determination of alkali content in antacid tablets by using HCl.
iv. Estimation of vitamin C in (containing sufficient amount of vitamin C)/citrous fruits (by 2,6 – dichlorophenol / indophenols indicator)
v. Estimation of Hardness of water by EDTA.
vi. Preparation of Iodoform and Aspirin.

VIVA VOCE 5 Marks
RECORD 5 Marks

(Mark distribution out of 40 for external evaluation)

SEMESTER-V

Paper-VI

CH-601 **Marks– 10+40 (3 Credit)**
Time – 2 Hrs.

UNIT-I

Electrochemistry-I

Conductance, specific conductance, equivalent conductance and molar conductance, measurement of conductance, variation of conductance with dilution, migration of ions andKohlrausch's law, Arrhenius theory of electrolytic dissociation and its limitations, Ostwald's dilution law, Theory of strong electrolyte-Debye Huckel Theory (qualitative approach). Transport number (general idea). Applications of conductance measurement-degree of dissociation of acids, solubility product of sparingly soluble salts andconductometric titration.

Electrochemistry - II

Types of reversible electrodes, electrode reactions, Nernst equation, Galvanic cell and derivation of cell EMF, single electrode potential, reference electrode (general idea), electrochemical series and its applications. Applications of EMF measurement-dissociation constant of weak monobasic acid, solubility product of sparingly soluble salts, determination of pH by hydrogen electrode.

Unit-II

Coordination compounds

Werner's theory and its experimental verification, effective atomic number concepts, chelates, nomenclature of coordination compounds, stereoisomerism (coordination no. 4 and 6 only) VBT of transition metal complexes with co-ordination number 4 and 6.

Nuclear chemistry

Artificial radioactivity. Artificial transmutation of elements, mass defect, binding energy, nuclear reactions induced by ${}_0n^1$, ${}_1H^1$,${}_1H^2$ and ${}_2H^1$, fission and fusion, liquid drop model, applications of radioactive isotopes.

Hard/Soft Acids and Bases

Classification of acid and bases as hard and soft, Pearson's HSAB concept, acid-base strength and hardness and softness, symbiosis, theoretical basis of hardness and softness.

UNIT III

Carboxylic acids and acid derivatives (aliphatic and aromatic)

Acidity of carboxylic acids,effect of substituents on acid strength,preparation and reactions of carboxylic acids.HVZ reaction, reduction of carboxylic acid,mechanism of decarboxylation.Relative reactivity of acid derivatives, Acyl nucleophilic substitution, important reactions of acid derivatives-acid chlorides, esters, amides, acid anhydrides. Mechanism of ester hydrolysis

Organic compounds of nitrogen (aliphatic and aromatic)

Nitro compounds: Preparation of nitro alkanes and nitro arenes. Mechanism of nucleophilic substitution in nitro arenes, reduction product of nitro benzene in different medium. Picric acid and TNT. ***Amines:*** Separation of amine mixtures, structural features affecting basicity of amines,Preparation and reactions of amines, electrophilic substitution in aromatic amines.***Diazonium salts:*** Preparation and synthetic applications of diazonium salts, diazo-coupling

Organometallic compounds: Grignard's reagent:-Preparation and synthetic applications.

Books recommended

1. R. Puri, L.R. Sharma and K.C. Kalia, *Principles of Inorganic Chemistry*, 31st Edition, MilestonePublishers and Distributors, New Delhi, 2013.
2. R.L. Madan, Chemistry for Degree students Part-I,II and III), S.Chand & Company Pvt. Ltd., 2011.
3. H.J. Arnikar, *Essentials of Nuclear Chemistry*, 4th Edition, New Age International (P) Ltd., NewDelhi, 1995 (Reprint 2005).
4. J.D. Lee, *Concise Inorganic Chemistry*, 5th Edition, Oxford University Press, New Delhi, 2008.
5. B.R. Puri, L.R. Sharma and M.S. Pathania, *Principles of Physical Chemistry*, 46th Edition, VishalPublishing Company, New Delhi, 2013.
6. I.L. Finar, *Organic Chemistry Vol. I & II,* 5th Edition, Pearson Education, New Delhi, 2013.
7. K.S. Tewari, N.K. Vishnoi and S.N. Mehrotra, *A Textbook of Organic Chemistry*, 2nd Edition,Vikas Publishing House (P) Ltd., New Delhi, 2004.
8. A. Bahl and B.S. Bahl, *Advanced Organic Chemistry*, 1st Multicolour Edition, S. Chand & Company, New Delhi, 2010.
9. D.F. Shriver and P. Atkins, *Inorganic Chemistry*, 5th Edition, Oxford University Press, NewYork, 2010.
10. Organic Chemistry: R.T. Momson and R.N. Boyd, 6th Edition, Prentice Hall Pearson Education.
11. V.R. Gowarikar, *Polymer Chemistry*, New Age International (P) Ltd., New Delhi, 2010.
12. J.E. Huheey, E.A. Keitler and R.L. Keitler, *Inorganic Chemistry – Principles of Structure and Reactivity,* 4th Edition, Pearson Education, New Delhi, 2013.
13. P.S. Kalsi, *Organic Reactions, Stereochemistry and Mechanism*, 4th Edition, New Age International Publishers, New Delhi, 2006.
14. H.J. Arnikar, *Essentials of Nuclear Chemistry*, 4th Edition, New Age International (P) Ltd., New Delhi, 1995 (Reprint 2005).

Practical books:

1. R.C. Das and B. Behra, *Experiments in Physical Chemistry*, Tata McGraw Hill, New Delhi, 1983.
2. V.K. Ahluwalia, Sunita Dhingra, "Comprehensive Practical Organic Chemistry – Qualitative Analysis"**:** University Press (India) Private Limited, Hyderabad, 1st Indian Edition, 2010.
3. Systematic qualitative organic analysis: H. Middleton, Orient Longman.
4. A hand book of organic analysis: H. T. Clarke revised by B. Haymes, Arnold publishers
5. J. Mendham, R.C. Denney, J. D. Barnes and M. Thomas, *Vogel's Textbook of Quantitative ChemicalAnalysis*, 6th Edition, Pearson Education, Noida, 2013.
6. G. Svehla, *Vogel's Qualitative Inorganic Analysis*, Pearson Education Ltd. 7th Edition, 2009.
7. I. Vogel, "Elementary Practical Organic Chemistry Part-II, Qualitative Organic Analysis"**:** CBS Publishers & Distributers, New Delhi, 2nd Edition, 2004.
8. I. Vogel, "Elementary Practical Organic Chemistry Part III Quantitative Organic Analysis"**:** CBS Publishers & Distributers, New Delhi, 2nd Edition, 2004.
9. Hand book of Organic qualitative analysis by H. T. Clarke.
10. Practical Organic Chemistry**:** F. G. Mann and B. C. Saunders. Low – priced Text Book. ELBS, Longman.

(The list is tentative. More books can be added or books may be deleted)

EVALUATION SCHEME
FOR
Minor (Chemistry)

The evaluation scheme for each course contains two parts: *viz.,* internal (20% of each theory and practical paper) and external (80% of each theory and practical) evaluation.

THEORY PAPERS

1. INTERNAL EVALUATION

- **Components of Internal Evaluation**

Sl. No.	Component	Marks
1.	Attendance	2.5
2.	Assignment/Viva	1.5
2.	Test papers (I and II)	6
		10

- **Percentage of Attendance and Eligible Marks**

% of attendance	Marks
Above 90%	2.5
>80-90%	2
>70-80%	1.5
>60-70%	1
>50-60	0.5
Below 50%	0

- **Pattern of Test Papers**

There shall be internal evaluation for 20 marks for each theory paper and mark obtained is to be converted as per conversion given below. Questions to be asked from the units covered with equal weightage.

Duration	Pattern of question	Number of question	Number of questions to be answered	Marks
1 hour	One word/line	2	2	2
	Short	4	4	8
	Paragraph/Essay	4	2	10
Total Marks				20

*Marks to be converted as follows: 80% and above = 6, 70 to below 80% = 6, 60 to below 70% = 4, 50 to below 60% =3, 40 to below 50% = 2, 30 to below 40% = 1, below 30% = 0.

2. EXTERNAL EVALUATION

External evaluation carries 80% marks. University examinations will be conducted at the end of each semester.

- **Pattern of Test Papers**

Duration	Pattern of question	Number of question	Number of questions to be answered	Marks
1 hour	One word/line	4	4	4
	Short	6	3	12
	Paragraph/Essay	6	3	24
Total Marks				40

PRACTICAL PAPERS

1. INTERNAL EVALUATION

- **Components of Internal Evaluation**

Sl. No.	Component	Marks
1.	Attendance in lab	2.5
2.	Assignment/Viva	1.5
3.	Practical Record: Required number of experiments and neatness	2.0
4.	Model tests (I and II)	4
	Total	10.0

- **Percentage of Attendance and Eligible Marks**

% of attendance	Marks
Above 90%	2.5
>80-90%	2
>70-80%	1.5
>60-70%	1
>50-60	0.5
Below 50%	0

2. EXTERNAL EVALUATION

External evaluation carries 80% marks. University examinations will be conducted at the end of each semester.

- **Pattern of Question Papers**

Duration	Pattern of question	Marks
6 hour	Experiments (2 Nos.)	30
	Record	05
	Viva voce	05
		40

SYLLABUS FOR UNDER GRADUATE (UG) COURSE IN INDUSTRIAL CHEMISTRY (MINOR)

UNDER CHOICE BASED CREDIT SYSTEM

(Effective for the students seeking admission in Colleges/Universities of Odisha in the academic session 2015-16 and onwards)

Minor Course Structure
Industrial Chemistry
Total Marks - 300 (Total Credit – 18)
(Examination: Internal – 20%, External – 80%)

SEMESTER	Paper No.	Paper Code	Theory/Practical/ Project	Credit	Marks	Total Hours
I	I	CH-101E	Theory	3	50	
II	II	CH-201E	Theory	3	50	
	III	CH-202E	Practical	3	50	
III	IV	CH-301E	Theory	3	50	
IV	V	CH-401E	Theory	3	50	
V	VI	CH-501E	Practical	3	50	

Course Structure

All theory papers will have 3 periods per week including 1 period for assignments, discussion, presentations, etc.

There shall be 6 practical classes per week in the semester having practicals.

SEMESTER-I

Paper-I

CH-101E **Marks– 10+40 (3 Credit)**
Time – 2 Hrs.

Unit-I

(a) Introduction

Requirements of an industry, Location, Water, Industrial water treatment, Safety measures, Pilot plants, ISO certification, Environmental management systems.

(b) Fuel Chemistry

Introduction, Classification of fuels and their calorific value (Gross and net). Theoretical Calculation of Calorific Value of a Fuel, Solid fuels.

Coal: Uses of coal (fuel and non-fuel) in various industries, Composition and its classification, carbonization of coal. Composition and uses of various fractions, Coal gasification (Hydro and Catalytic gasification), Coal liquefaction.

Unit-II

Petroleum and Petrochemical Industry: Composition of crude petroleum, Refining and different types of petroleum products and their applications. Fractional Distillation (Principle and process), Cracking (Thermal and catalytic cracking), Petrol, Knocking, Octane number, Anti-knocking compounds. Diesel oil, Cetane number, Flash point. Reforming Petroleum and non-petroleum fuels (LPG, CNG, LNG, bio-gas, fuels derived from biomass), fuel from waste, synthetic fuels (gaseous and liquids), clean fuels (hydrogen fuel).

Petrochemicals: Vinyl acetate, Propylene oxide, Isoprene, Butadiene, Toluene and its derivatives Xylene.

Unit-III

Battery industries

Primary and secondary batteries, battery components and their role, Characteristics of Battery. Working of following batteries: Pb acid, Li-Battery, Solid state electrolyte battery. Fuel Cells, Solar cell and polymer cell.

Explosive and propellants

Classification of Explosives, Primary Explosive, High explosives, Low explosives, Secondary High Explosive.

Initiators or Detonators: Lead azide; Non-initiating high explosives, TNT, Dynamite, cyclonite (RDX).

SEMESTER-II

Paper-II

CH-101E **Marks– 10+40 (3 Credit)**

Time – 2 Hrs.

Unit-I

Silicate Industries

(a) 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, fluorosilicate, coloured glass, photosensitive glass.

(b) Ceramics: Important clays and feldspar, ceramic, their types and manufacture. High technology ceramics and their applications, super conducting and semi conducting oxides, fullerenes carbon nanotubes and carbon fiber.

(c) Cements: Classification of cement, ingredients and their role, Manufacture of cement and the setting process, quick setting cements.

Unit-II

(a) Fertilizers:

Fertilizers: Different types of fertilizers. Manufacture of the following fertilizers: Urea, Ammonium nitrate, Calcium ammonium nitrate, Ammonium phosphates; Polyphosphate, Super phosphate, Compound and mixed fertilizers Potassium Chloride, Potassium sulphate.

(b) Pesticides

General introduction to pesticides (natural and synthetic), benefits and adverse effects, changing concepts of pesticides, structure activity relationship, synthesis and technical manufacture and uses of representative pesticides in the following classes: Organochlorines (DDT, Gammexene,); Organophosphates (Malathion, Parathion); Carbamates (Carbofuran and carbaryl); Quinones (Chloranil), Anilides (Alachlor and Butachlor).

Unit-III

(a) Metallurgical industries and alloys

Metallurgical industries: Important ores and their occurrence in Orissa. Extraction of Aluminium and Iron. Manufacture of Steel (removal of silicon decarbonization, demanganization, desulphurization dephosphorisation) and surface treatment (argon treatment, heat treatment, nitriding, carburizing). Composition and properties of different types of steels. Classification of alloys, Ferrous and Non-Ferrous alloys, Specific properties of elements in alloys. Study of composition of Brass, Y-alloy, electron metal, ferrochrome, ferrovanadium, ferrosilicon.

(b) Corrosion and its control:

Introduction: Economic aspects of corrosion, Dry or Chemical Corrosion, Wet or electrochemical corrosion, Mechanism of Electrochemical Corrosion. Factors Influencing Corrosion, Corrosion Control: Using pure metal and metal alloys, cathodic protection, coating, inhibitors.

Paper-III (Practical)

CH-202E **Marks– 10+40 (3 Credit)**
Time – 6 Hrs.

Unit-I **15 Marks**

Analysis of components in ores, alloys and complex materials

i. Estimation of total iron in an iron ore.
ii. Determination of composition of dolomite (by complexometric titration).
iii. Analysis of (Cu, Ni); (Cu, Zn) in alloy or synthetic samples.
iv. Analysis of cement.

Unit-II **15 Marks**

Analysis of water

Volumetric

i. Measurement of chloride, sulphate and salinity of water samples by simple titration method. ($AgNO_3$ and potassium chromate)
ii. Estimation of total alkalinity of water samples (CO_3, HCO_3) using double titration method.
iii. Determination of total permanent and temporary hardness of water using EDTA.
iv. Determination of acetic acid in commercial vinegar using NaOH.

Instrumental

i. Estimation of hexavalent chromium present in the given water sample
ii. Estimation of phenol present in the given water sample
iii. Estimation of copper present in the given water sample.
iv. Determination of Sodium/potassium by flame photometry

Viva Voce **5 Marks**
Record **5 Marks**

SEMESTER-III
Paper-IV

CH-301E **Marks– 10+40 (3 Credit)**
Time – 2 Hrs.

Unit-I

Drugs and Pharmaceuticals

Drug discovery, design and development; Basic Retrosynthetic approach. Synthesis of the representative drugs of the following classes: analgesics agents, antipyretic agents, anti-inflammatory agents (Aspirin, paracetamol, lbuprofen); antibiotics (Chloramphenicol); antibacterial and antifungal agents (Sulphonamides; Sulphanethoxazol, Sulphacetamide, Trimethoprim); antiviral agents (Acyclovir), Central Nervous System agents (Phenobarbital, Diazepam), Cardiovascular (Glyceryl trinitrate), antilaprosy (Dapsone), HIV AIDS related drugs (AZT- Zidovudine).

Unit-II

Cosmetics and Perfumes

A general study including preparation and uses of the following: Hair dye, hair spray, Shampoo, cleansing creams (cold creams, vanishing creams and bleach creams), sun screen preparations, UV absorbers, skin bleaching agents, face powder, lipsticks, talcum powder, nail enamel, creams (cold, vanishing and shaving creams), antiperspirants and artificial flavours. Harmful effects cosmetics.

Essential oils and their importance in cosmetic industries with reference to Eugenol, Geraniol, sandalwood oil, eucalyptus, rose oil, ®-phenyl ethyl alcohol, Jasmone, Civetone, Muscone.

Unit-III

(a) Oils and Fats

Classification of oils, fat splitting, distillation of completely miscible and nonmiscible oils, hydrogenation of oils, rancidity, saponification value, iodine number, acid value, Soap and Synthetic Detergent, preparation of soap and detergent, cleaning action, different types of soap and their composition, surfactants (LAS, ABS, LABS), detergent binders and builders. .

(b) Food Chemistry

Common food adulterants in various food materials and their identification: Milk, vegetable oils, tea, coffee powder, rice and chilly powder. Methods of preservation: Drying, pasteurization, refrigeration, vacuum packing, use of salt and pickling. Food additives: Food preservatives, artificial sweeteners and antioxidants (definition and examples, structures not required).

SEMESTER-IV

Paper-V

CH-401E **Marks– 10+40 (3 Credit)**

Time – 2 Hrs.

Unit-I

Polymers

Organic Polymers: Preparation, Properties, Classification, Structure property relationship (Thermoplastic and Thermosetting). Industrial manufacture of the monomers and the following polymers: Polystyrene, Polyacrylonitrile, Polymethacrylate, Polymethylmethacrylate, Polyethene, Polybutadiene, Polyvinylidene, Polycarbonates, Polyesters, Polyurethanes, Nylon (6, 6:6, 6:10), Phenolic polyesters, Polyamides, Polysulphones. Rubbers (synthetic and natural) and their processing, Elastomers, Cellulosics, Natural and Synthetic fibers, fiber processing, anti-wrinkle and flame retardant. Comparison of natural and synthetic polymers, relation between molecular structure and properties. Polymer Processing: Moulding, compounding, blending. Polymer designing: packaging, certification and process evaluation.

Unit-II

Dyes, paint and pigment

Dyes: General introduction and classification with special reference to textile and edible dyes and fabric brighteners. Industrial preparation and uses of methyl orange, malachite green, indigo, bismark brown, alizarin.

Paints: Primary constituents, Binders and solvents, Requirements of a good paint, Oil based paints, latex paints, luminescent paints, fire retardant paints and heat resistant paints. Varnishes: Spirit varnishes and oleo resinous varnishes, Raw materials, Enamels and lacquers (brief study).

Pigments: Definition, White lead, lithopone, ultramarine, red lead, guignet's green and chrome yellow (composition and uses).

Unit-III

Textile Industry: Production of viscose fibre from cellulose, Properties and uses of nylon and polyester fibres, Introduction to dyeing, Chromophore, auxochrome and chromogen, Primary and secondary colours, Chromatic and achromatic colours, Dyeing of nylon with acid dyes.

Paper and Pulp: Introduction, Manufacture of pulp, Sulphate or Kraft pulp, Soda pulp, Sulphite pulp, Rag pulp, Beating, refining, filling, sizing and coloring - manufacture of paper.

Adhesives: Introduction, Classification of adhesives, Adhesive Action, Development of Adhesive Strength. Chemical Factors influencing Adhesive Action, Bonding Processes by Adhesives, Advantages and limitations.

SEMESTER-V

Paper-III (Practical)

CH-202E **Marks– 10+40 (3 Credit)**

Time – 6 Hrs.

Unit-I **15 Marks**

Quantitative analysis

i. Determination of saponification value of oil
ii. Determination of percentage of available chlorine in bleaching powder.
iii. Determination of acetic acid in commercial vinegar using NaOH.
iv. Determination of alkali content in antacid tablet using HCl.
v. Estimation of calcium in chalk - Permanganometry.
vi. Estimation of calcium in calcium ammonium nitrate fertilizer.
vii. Estimation of phosphoric acid in superphosphate fertilizer.
viii. Determination of viscosity of oils by Ostwald viscometer

Unit-II **15 Marks**

Organic/Polymer synthesis:

i. Preparation of Malachite Green and Methyl Orange.
ii. Preparation of nylon 6,6 and Polystyrene.
iii. Preparation of carboxylic acid by alkaline hydrolysis of ester/amide and by oxidation of alcohol/aldehydes/hydrocarbons.

Viva Voce **5 Marks**

Record **5 Marks**

Recommended books

1. B.K. Sharma, *Industrial chemistry*, 11th Edition, Goel publishing House, Meerut, 2000.
2. Marshal Sittig and M. Gopala Rao, *Outlines of Chemical Technology for the 21st Century*, 3rd Edition, East-West Press Pvt. Ltd., New Delhi, 2010.
4. C.E. Drydens and M. Gopala Rao, *Outlines of Chemical Technology*, East-West Publishers, New Delhi, 1997.
5. K.H. Davis and F.S. Berner, *Handbook of Industrial Chemistry*, *Vols. 1 and 2*, CBS, New Delhi, 2005.
6. B.K.B. Rao, *Modern Petroleum Refining Processes*, 4th Edition, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi, 2002.
7. R.A. Meyers, *Handbook of Petroleum Refining Processes,* 3rd Edition, McGraw-Hill, Noida, 2004.
8. G. Thomas, *Fundamentals of Medicinal Chemistry,* John Wiley & Sons Ltd., London, 2003.
9. D.J. Abraham, *Burger's Medicinal Chemistry and Drug Discovery, Vol. 1-6*, Wiley-Interscience, Hoboken, NJ, 2003.
10. Sara J. Kadolph and Anna L. Langford, *Textiles*, 10th Edition, Pearson/Prentice-Hall, New Delhi, 2007.
11. A.A. Vidya, *Production of Synthetic Fibers*, Prentice-Hall of India, New-Delhi, 1988.
12. Gurdeep R. Chatwal, *Synthetic Drugs*, Himalaya Publishing House, Bombay, 1995.
13. O. P. Vermani, A. K. Narula: *Industrial Chemistry,* Galgotia Publications Pvt. Ltd., New Delhi.
13. S. C. Bhatia: *Chemical Process Industries,* Vol. I & II, CBS Publishers, New Delhi.
14. E. Stocchi: *Industrial Chemistry*, Vol-I, , Ellis Horwood Ltd. UK.
15. *2.* R. M. Felder, R. W. Rousseau: *Elementary Principles of Chemical Processes*, Wiley Publishers, New Delhi.
16. J. A. Kent: Riegel's *Handbook of Industrial Chemistry*, CBS Publishers, New Delhi.

EVALUATION SCHEME
FOR
Minor (Industrial Chemistry)

The evaluation scheme for each course contains two parts: *viz.,* internal (20% of each theory and practical paper) and external (80% of each theory and practical) evaluation.

THEORY PAPERS

1. INTERNAL EVALUATION

- **Components of Internal Evaluation**

Sl. No.	Component	Marks
1.	Attendance	2.5
2.	Assignment/Viva	1.5
2.	Test papers (I and II)	6
		10

- **Percentage of Attendance and Eligible Marks**

% of attendance	Marks
Above 90%	2.5
>80-90%	2
>70-80%	1.5
>60-70%	1
>50-60	0.5
Below 50%	0

- **Pattern of Test Papers**

There shall be internal evaluation for 20 marks for each theory paper and mark obtained is to be converted as per conversion given below. Questions to be asked from the units covered with equal weightage.

Duration	Pattern of question	Number of question	Number of questions to be answered	Marks
1 hour	One word/line	2	2	2
	Short	4	4	8
	Paragraph/Essay	4	2	10
			Total Marks	20

*Marks to be converted as follows: 80% and above = 6, 70 to below 80% = 6, 60 to below 70% = 4, 50 to below 60% =3, 40 to below 50% = 2, 30 to below 40% = 1, below 30% = 0.

2. EXTERNAL EVALUATION

External evaluation carries 80% marks. University examinations will be conducted at the end of each semester.

- **Pattern of Test Papers**

Duration	Pattern of question	Number of question	Number of questions to be answered	Marks
1 hour	One word/line	4	4	4
	Short	6	3	12
	Paragraph/Essay	6	3	24
			Total Marks	40

PRACTICAL PAPERS

1. INTERNAL EVALUATION

- **Components of Internal Evaluation**

Sl. No.	Component	Marks
1.	Attendance in lab	2.5
2.	Assignment/Viva	1.5
3.	Practical Record: Required number of experiments and neatness	2.0
4.	Model tests (I and II)	4
	Total	10.0

- **Percentage of Attendance and Eligible Marks**

% of attendance	Marks
Above 90%	2.5
>80-90%	2
>70-80%	1.5
>60-70%	1
>50-60	0.5
Below 50%	0

2. EXTERNAL EVALUATION

External evaluation carries 80% marks. University examinations will be conducted at the end of each semester.

- **Pattern of Question Papers**

Duration	Pattern of question	Marks
6 hour	Experiments (2 Nos.)	30
	Record	05
	Viva voce	05
		40

COURSES OF STUDIES

FOR

+ 3 DEGREE COURSE (ARTS)

MAJOR CORE COMPULSORY WITH MAJOR CORE ELECTIVE AND AND MINOR ELECTIVE

IN

SANSKRIT

(Under Choice-based Credit System)

From the sessions 2015 onwards

UTKAL UNIVERSITY

BHUBANESWAR – 751004

ODISHA

Proceedings of the Subject- Expert Committee

The Expert committee constituted by the Utkal University to formulate the Courses of Studies for 3 years B.A. Hons. Degree examination in Sanskrit comprising the following members met twice, i.e. 15.09.2012 and 13.10.2012 to deliberate and finally have drafted the Syllabus. The member's are-

1. Prof. G.K. Dash, P.G. Department of Sanskrit, Utkal University
2. Prof. Radhamadhab Dash, Head of the Department of Sanskrit, Utkal University
3. Prof. Prativa Manjari Rath, P.G. Department of Sanskrit, Utkal University
4. Dr. Haramohan Mishra, Head of the Department of Sanskrit, Shailabala Women's College, Cuttack
5. Dr. Girija Shankar Mahapatra, Head of the Department of Sanskrit, talcher College, Talcher
6. Dr. Braja Sundar Mishra, Head of the Department of Sanskrit, Sadhu Gaureshwar College, Magalpur, Jajpur (Co-opted expert)

(G.K. Dash) (R.M. Dash) (P.M. Rath) (H.M Mishra) (G.S. Mahapatra)

(B.S. Mishra)

As per the letter of the Vice-Chancellor, UU Letter No.V.C/151(27)/2014 Dated : 23rd December, 2014 , The Head of the Dept. Of Sanskrit Prof.P.M.Rath and Sri Niranjan Sabar, Lecturer in Sanskrit UU, went through the courses of studies for UG as prepared previously and modified as per the structure discussed in the Principal Conference held on 22.12.2014. The modified draft of the COURSES OF STUDIES FOR + 3 DEGREE COURSE (ARTS) (MAJOR CORE COMPULSORY WITH MAJOR CORE ELECTIVE AND MINOR ELECTIVE IN SANSKRIT) under Choice-based Credit System From the sessions 2015 onwards for submission to Sri Ranjan Kumar Bal , Director, I Q A C, Utkal University on 5th January 2015.

(N.Sabar) (P.M. Rath)

COURSES OF STUDIES

ABBREVIATIONS

Major Core Compulsory – MCC

Major Elective- Mj E

Minor Elective – Mn E

The **Salient features** of the **Course Curriculum** are the following:

- **Major Core Compulsory (MCC) in Sanskrit :-**
  This syllabus provides for implementation of Choice based Credit courses under Semester Pattern. In this pattern, in the **Major Core Compulsory in Sanskrit,** there shall be 19 papers in total extending in Six Semesters. , Out of these 19 Papers first eighteen papers are of 50 Marks each having 3 credits and the
  last 19th Paper has 100 Marks having 8 credits.Thus total 62 credits and in total 1000 marks.
- **Minor Elective (Mn E) in Sanskrit** – In **Minor Elective in Sanskrit (Mn E**)there shall be 6 Papers carrying 300 marks in total , each paper having 50 marks and 3 credits .Thus there will be total 18 credits. The distribution of courses and Credits is as the following: -

1st Semester- (A) 2 Major Core Compulsory Papers – 2x3= 6 credits- (MCC1-2)

(B) 1 Minor Elective Paper-3 Credits (Mn E-1)

2nd Semester- (A) 3 Major Core Compulsory Papers- 3×3= 9 credits (MCC3-5)

(B) 1 Minor Elective Paper- 3 credits (Mn E-2)

3rd Semester- (A) 3 Major Core Compulsory Papers- 3×3= 9 credits (MCC6-8)

(B) 1 Minor Elective Paper- 3 credits (Mn E-3)

4th Semester – (A) 3 Major Core Compulsory Papers- 3×3=9 credits (MCC9-11)

(B) 1Minor Elective Paper-3-credits (Mn E-4)

5th Semester- (A) 5 Major Core Compulsory Papers– 5x3= 15 credits-(MCC12- 16)

(B) 1Minor Elective Paper-3-credits (Mn E-5)

6th Semester - (A)3 Major Core Compulsory Papers– out of which

First two papers 2x3= 6 credits-(MCC17-18) and

Last one paper of 100 Marks 1 x8=8 credits (MCC-19)

(B) 1Minor Elective Paper-3-credits (Mn E-6)

Major First six papers shall also be the papers for Minor Electives to be chosen in different Semesters as per the above schedule.

Papers 8th (3rd Semester), 11th (4th Semester), 16th (5th Semester) and 18th (6th Semester have two options each, out of which one alternative is to be offered by the students as Major Elective Papers .

Out of 50 marks of each paper 10 Marks are meant for mid-term test and 40 marks for Semester--End test.

In paper 19th (Project) – 75 Marks will be for project and 25 Marks will be for Viva.

GENERAL OUTLINE OF THE COURSES OF STUDIES

FIRST SEMESTER

Sl. No.	Course Code	Course Name	Marks	Credit	Lecture
1	MCC-1.1	Drama (**Nataka**)-1	10+40	3	
2	MCC-1.2	Fairy Tales and Fables (**Katha**)	10+40	3	

SECOND SEMESTER

3	MCC-2.3	Lyric Poetry (**Gitikavya**)	10+40	3	
4	MCC-2.4	Drama & Dramaturgy -2	10+40	3	

		(**Nataka and Natyatattva**			
5	MCC-2.5	History of Sanskrit Literature-1 (**Samskrta-Sahityetihasa**)	10+40	3	

THIRD SEMESTER

6	MCC-3.6	General Outlines of History of Vedic literature (**Vaidika-sahityetihasa**)	10+40	3	
7	MCC-3.7	Vedic Hymns (**Vaidika Suktas**)	10+40	3	
8	Mj.E-3.8•	Poetry (**Kavya**) and Prose (**Gadyakavya)** (**Gr.A**) **OR** Poetry (**Kavya** and fables (**Katha**) (**Gr.B**)	10+40	3	

FOURTH SEMESTER

9	MCC-4.9	Grammar both Non-Vedic-1 and Vedic (**Laukika** and **Vaidika Vyakarana** from Paninian System)	10+40	3	
10	MCC-4.10	Grammar Non-Vedic-2 (**Laukika** from Paninian System)	10+40	3	
11	Mj.E-4.11•	Inscription (**Abhilekha**) and Srimad-bhagavadgita-12th Chap (**Gr. A**) **OR** Poetics (**Kavya-shastra**)(**Gr.B**)	10+40	3	

FIFTH SEMESTER

12	MCC-5.12	Prose Literary text (**Gadyakavya**) and History of Sanskrit Literature- 2 (**Samskrta-sahityetihasa**)	10+40	3	
13	MCC-5.13	Figures of Speech and Prosody (**Alamkara** and **Chandas**)	10+40	3	
14	MCC-5.14	Technical Literature (**Arthashastra** and	10+40	3	

		Dharmashastra)			
15	MCC-5.15	Drama and History of Samskrit Drama (**Nataka** and **Samskrta-natyetihasa**)	10+40	3	
16	Mj.E-5.16•	Technical Literature (**Ayurveda** and **Vrksayurveda**) (**Gr.-A**) **OR** **Vastushastra** and **Jyotissastra**) (**Gr.- B**)	10+40	3	

SIXTH SEMESTER

17	MCC - 6.17	Essay in Sanskrit (**Samkrta-nibandha-lekhana**) and Translation (**Anuvada**) from English/Odia to Sanskrit	10+40	3	
18	Mj.E-6.18•	(i) Translation from Sanskrit to Odia/English (**Odia/ Āngala Bhasanuvada**), (ii) Comprehension (**Bhavatmako-uttaram**) and Expansion of Idea (**Bhava-prasaranam) (Gr. A)** **OR** (i) Sanskrit Précis writing (**Bhava-samksepikaranam**) and (ii)Applied Sanskrit (**Vyavaharika-Samskrutam**) (**Gr.B**)	10+40	3	
19	MCC-6.19	DISSERTATION/ PROJECT REPORT 0F 20 PAGES AND 4000 WORDS(Sodha/Pra-kalpaliknanam	75+VIVA-25= 100	8	

		OR TWO SEMINAR PRESENTATIONS (Śodhaprabandhadvayasya Upasthāpanam **OR** TRANSLATION FROM (Āngala/Utkalatah Samkṛtānuvādah ODIA/ENGLISH TO SANSKRIT (ABOUT 20 PAGES) OF A PROSE/STORY/POETRY TEXT OF ANY REPUTED AUTHOR

1st Semester

MCC-1.1 (Drama Nataka-1) Paper-1

Drama: *Abhijñānaśākuntalam* Acts I-IV 40 marks Credit-3

Unit-I Long question -1 10 marks

Unit-II Short questions-2 4×2=8 marks

Unit-III Explanation of 1 verse 7 marks

Unit-IV Translation (from Sanskrit to Odia/English) 5 marks

Unit-V Grammar from the text relating to Karaka-vibhakti 10 marks

Sandhi, *Samasa*, *Prakrti-pratyaya* such as 2 *Sandhis*-1×2=2

2 *Karaka-vibhaktis*- 1×2= 2,

2 Samasas-2×2= 4

3 *Prakrti-pratyayas*- 1×2= 2

Books for reference:

1. *Abhijnanashakuntalam* (Ed.) M. R. Kale or R. M. Bose or G. N. Mahapatra or R. Mahapatra Or H. K. Satapathy

MCC-1.2 (Fairy Tales and Fables- Katha) Paper-2

***Hitopadeśa Mitralābha* (Up to *Gṛdhra-vidala Katha*) 20 marks Credit- 3**

***Daśakumāracharita* (*Purva-pithikā, Prathama Ucchvāsa*) 20 marks**

Units I-III *Hitopadeśa*	Long question -1	10 marks
	Explanation of -1 verse	6 marks
	Translation of 1 verse/passage	4 marks
Units IV-V *Daśakumāracharita*	Long question-1	10 marks
	Short questions- 2 5×2=	10 marks

Books for reference:

1. *Dashakumaracharita,* (Ed.) M.R. Kale, Motilal Banarsidass, New Delhi
2. *Hitopadeśa*, Chowkhamba publication*, (Ed*) N. P. Dash & N. S. Mishra, Kalyani Publishers,New Delhi
3. *Dashakumaracharita*, Chowkhamba Publication, Varanasi

2nd Semester

MCC-2.3 (Lyric Poetry Gitikavya) Paper-3

***Meghadūtam* (*Pūrvamegha*) 40 marks Credit -3**

Units I-II	Long questions-2	10×2=	20 marks
Unit III	Short questions- 2	4×2=	8 marks
Unit IV	Explanation – 1		7 marks
Unit V	Translation-1		5 marks

Books for reference:

1. *Meghadūtam* (Ed.) S.R. Ray, Sanskrit Pustak Bhandar, 38 Cornwallis St., Calcutta
2. *Meghadutam* (Ed.) M.R. Kale, Motilal Banarsidass, Delhi
3. *Meghadūtam* (Ed.) Radhamohan Mahapatra, Books and Books, Vinodvihari, Cuttack,1984
4. *Meghadūtam* (Ed.) B.S. Mishra, Vidyapuri, Cuttack, 1999
5. *Meghadūtam* (Ed.) G. K. Dash & S. K. Dash, A. K. Mishra Agencies, Cuttack.

MCC-2.4 (Drama & Dramaturgy -2 Nataka and Natyatattva) Paper-4

40 marks Credit -3

***Abhijnanashakuntalam* (Acts V-VII) 20 marks**

Units I-II *Abhijnanashakuntalanm* Long question-1 10 marks

Short Questions-2 5×2= 10 marks

***Dramaturgy* 20 marks**

Units III-V Dramaturgy Short questions-4 5×4=20 marks

Units III *Nandi*, *Prastavana*, *Purvaranga/* Short note-1 5 marks

Unit-IV *Panca-arthaprakrti, Pancasandhi*, *Panca-arthopaksepaka*

Short notes-2 5×2=10 marks

Unit-V *Nataka*, *Prakarana and Viskambhaka* Short note-1 5 marks

Books for reference:

1. *Abhijnanashakuntalam* (Ed.) M.R. Kale or R.M. Bose or G.N. Mahapatra or R. Mahapatra
2. *Sahityadarpaṇa* Chap-VI (Ed.) P.V. Kane/N. Mahapatra/Odiya Translation by Narayan Mahapatra, Orissa Sahitya Acdemy/ Hindi Com. *Vimala/* Sans. Com. *Laksmi*
3. *Sahityadarpana evam Chanda, (Ed) B.S.Mishra, Satyanarayan Book store, Cuttack.*

MCC-2.5 (History of Sanskrit Literature-1 Samskrta-Sahityetihasa)
Paper-5 History of Sanskrit Literature 40 marks Credit-3

Units I- III **History of *Ramayana*, *Mahabharata* and General Outlines of *Puranas* 20 marks**

Long question- 1 10 marks

Short questions- 2 5×2= 10 marks

Unit IV ***Mahakavyas* of Kālidāsa, Ashvaghosa, Bhāravi, Māgha, Sriharsa and Bhatti 10 Marks**

Long question-1 = 10 marks

Unit-V ***Gadyakāvyas* of Dandin, Subandhu, and Bānabhatta** **10 marks**

Short question-2 5×2 = 10 marks

Books for reference:

1. *Samskrta Sahitya ka Itihasa*, Baladev Upadhyaya, Choukhama, Suravarati Prakashan, Varanasi
2. *Samskrta Sahitya ka Itihasa*, Hansraj Agrawal, Munsilal Manoharlal,Delhi
3. *Samskrta Sahityara Itihasa*, G.N. Mahapatra, Nalanda Publishers, Cuttack
4. *Samskrta Sahity Itihasa*, H.K. Satapathy, Kitab Mahal,Cuttack
5. *A short History of Sanskrit Literature : H.R.Agarwal,* Munsilal Manoharlal, Delhi

3rd Semester

MCC- 3.6 General Outlines of History of Vedic literature (Vaidika-sahityetihas)Paper 6

General Outlines of History of Vedic Literature **40 marks Credit-3**

Units I-II *Samhita* and *Brahmana* **20 marks**

Long question-1 10 marks

Short question-2 5×2= 10 marks

Units III-V *Aranyaka*, *Upanisad* and *Vedangas* **20 marks**

Long question-1 10 marks

Short questions-2 5×2= 10 marks

Books for reference:

1. *Vaidika Sahitya aur Samskrti*, Baladev Upadhyaya, Chowkhamba Vidyabhavan, Varanasi
2. *Vaidikavanmayasyetihasa*, Jagadish Chandra Mishra
3. *History of Indian Literature* Vol.I, M. Winternitz, Motilal Banarsidass, New Delhi
4. *Vaidika Sahitya ki Ruparekha, Vacaspati Gaurella, Choukhamba, Varanasi*
5. *Vaidika Sahitya O Saskruti, Abhinna chandra Dash, Cuttack.*
6. *Veda Prabesika, Jagabandhu Padhi, Cuttack students store, Cuttack*

- Note : Problem : Vedic grammar is to be taught in 4th semester so, in 3rd semester the question cannot be asked.

  Solution : Specify the seers of concerned sūktas and short Notes on one of them can be given as question.

MCC -3.7 (Vedic Hymns -Vaidika Suktas) Paper-7

Vedic *Suktas* from different *Samhitas* such as: 40 marks Credit-3

Agni (RV- I.1), Indra (RV- II.12), Savitr (RV- I.35), Usas (RV- I.48)

Purusa-sukta (YV XXXI.1.16), Shiva-samkalpa (YV- XXX.1.6),
Samjnana (RV X.191), Vak (RV X.125),
visnu (RV

Unit I	Long question-1		10 marks
Unit II	Translation from the text- 2 mantras	4×2 =	8 marks
Units III &IV	Explanation of the mantras covering all the above Suktas - 3 mantra	6×3 =	18 marks
Unit V	Vedic Seers (Vaidikaṛṣayaḥ)	4 * 1=	4 marks

Books for reference:

1. *New Vedic Selection* Part-I , (Ed.) Telang and Chaubey, Bharatiya Vidya Prakashan, New Delhi
2. *Veda o Vaidika Prakarana*, (Ed.) Niranjana Pati, Kalyani Publishers, New Delhi

Mj.E -3.8 Poetry (Kavya) and Prose (Gadyakavya) (Gr.A) OR

Poetry (Kavya and fables (Katha) (Gr.B)

Paper-8 **40 marks Crdit-3**

Group -A

***Śiśupālabadham* (1st canto) - 20 marks**

***Dashakumaracaritam* (*Pūrvapithikā Ucchvāsa-II*) - 20 marks**

Unit- I	Long question-1 (from *Shishupalbadham*)-	10 marks
Unit-II	Explanation-1 (from *Shishupalbadham*)-	6 marks
Unit-III	Translation-1 (from *Shishupalbadham*) -	4 marks
Unit-IV	Long question-1 (*Dashakumaracaritam*) -	10 marks
Unit-V	Short questions-2 (*Dashakumaracaritam*) - 5×2=	10 marks

Group –B

Kiratarjuniyam (1st Canto)- 20

Pañcatantram (*Apariksitakarakam*)-20

Unit- I	Long question-1 (from *Kiratarjuniyam*)		10 marks
Unit-II	Explanation-1 (from *Kiratarjuniyam*)		6 marks
Unit-III	Translation-1 (from *Kiratarjuniyam*)		4 marks
Unit-IV	Long question-1 (*Pancatantram*) -		10 marks
Unit-V	Short questions-2 (*Pancatantram*) -	5×2=	10 marks

Books for reference:

1. *Shishupalabadham* (Ed.) S.R. Ray/ Vallabhatika, Bharatiya Vidya Prakashan, Delhi
2. *Dashakumaracharitam* (Ed.) M.R. Kale/ G.N. Mahapatra
3. *Kiratarjuniyam* (Cantos I-III) (Ed.) M.R. Kale, Motilal Banarsidass Publishers Pvt. Ltd., Delhi
4. *Pancatantram* (Ed.) (Ed.) M.R. Kale, Motilal Banarsidass, New Delhi
5. *Kiratajuniyam, (canto-I), Kiratajuniyam evam Chandamunansa,Kalyani Publishers, Cuttack*

4th Semester

MCC- 4.9 Grammar both Non-Vedic-1 and Vedic (Laukika and Vaidika Vyakarana from Paninian System) Paper-9

***Siddhanta-kaumudi* (*Samjna*, *Paribhasa* and *Vaidika Prakaranas*) 40 marks Crdit-3**

Units I-II (*Samjna-prakarana* Sutras 1-15 & 16-33) Explanation of 1 sutra from each

Unit- 5×2= 10 marks

Unit-III (*Paribhasa-prakarana*) Explanation of 2 sutras- 5×2= 10 marks

Units IV-V (*Vaidika-prakarana*) Explanation of 4 sutras- 5×4= 20 marks

The following Sutras are to be taught in the units IV and V:

Chandasi pare'pi, Vyavahitasca, *Chaturthyarthe bahulam chandasi*, *Bahulam chandasi*, *Chandasi lun-lan-litah*, *Linarthe let*, *Sibbahulam leti*, *Itasca lopah parasmaipadesu*, *Sa uttamasya*, *Leto'datau*, *Ata ai*, *Vaito'nyatra*, *Vyatyayo bahulam*, *Hr-grahor bhaschandasi*, *Chandasy ubhayatha*, *Tumarthe se-sen-ase-asen-kse-kasen-adhyai-adhyain-kadhyai-kadhyain-shadhyai-shadhyain-tavai-taven-tavenah*, *Va chandasi*, *Shesh chandasi bahulam*, *Prakrtya'ntapadam avyapare*, *Nipatasya ca*, *supam suluk purva-savarnac che-ya-da-yaj-alah*, *Idanto masi*, *Ajjaserasuk*, *Dirghadati samanapade*

Books for reference:

1. *Siddhanta-kaumudi* with *Balamanorama* and *Tattvabodhini*, (Ed.) Giridhara Sharma Chaturveda, Motilal banarsidass
2. *Siddhanta-kaumudi* with *Mitabhasini* Com., (Ed.) S.R. Ray, Sanskrit Pustak Bhandar, 38 Cornwallis St., Calcutta
3. *Siddhanta-kaumudi* with Eng Tr. (Ed.), S.C. Basu, Motilal Banarsidass, New Delhi
4. *Sidhanta Kaumudi (samjñā and Paribhasa) Ed. Pramod ranjan Ray,SanskritDepartment,S.B.Womens College,Cuttack*
5. Siddhanta Kaumudi , Ed. G.K.Dash & K.Dash, A.K.Mishra agencies,cuttack
6. *Siddhanta-kaumudi* (*Samjna* and *Paribhasa* and *Karaka Prakarana*) (Ed.) Pramod Ranjan Ray, Sanskrit Seminar, Sailabala Women's College, Cuttack
7. *Veda o Vaidika-prakarana,* (Ed.) Niranjan Pati, Vidyapuri, Cuttack, 1994

MCC 4.10 Grammar Non-Vedic-2 (Laukika from Paninian System) Paper-10
***Siddhanta-kaumudi* (*Karaka-Vibhakti-prakaranam*)**

40 marks Credit-3

Unit I- *Prathama* and *Dvitiya vibhakti* – 2 sutras to be explained- 4×2= 8 marks

Unit II- *Trtiya* and *Chaturthi Vibhakti* – 2 sutras to be explained- 4×2= 8 marks

Unit III- *Pancami Vibhakti* – 2 sutras to be explained- 4×2= 8 marks

Unit IV- *Shashthi Vibhakti* – 2 sutras to be explained- 4×2= 8 marks

Unit V- *Saptami Vibhakti* – 2 sutras to be explained- 4×2= 8 marks

Books for reference:

1. *Siddhanta-kaumudi* with *Balamanorama* and *Tattvabodhini*, (Ed.) Giridhara Sharma Chaturveda, Motilal Banarsidass
2. *Siddhanta-kaumudi* with *Mitabhasini* Com., (Ed.) S.R. Ray, Sanskrit Pustak Bhandar, 38 Cornwallis St., Calcutta
3. *Siddhanta-kaumudi* with Eng Tr. (Ed.), S.C. Basu, Motilal Banarsidass, New Delhi
4. *Siddhanta-kaumudi* (*Samjna*, *Paribhasa* and *Karaka Prakarana*) (Ed.) G.K. Dash and Kadambini Dash, A. K. Mishra Agencies, Cuttack
5. *Siddhanta-kaumudi* (*Samjna*, *Paribhasa* and *Karaka Prakarana*) (Ed.) Minati Mishra, Vidyapuri, Cuttack

Mj E 4.11 Inscription (Abhilekha) and Srimad-bhagavadgita-12th Chap (Gr. A) OR Poetics (Kavya-shastra)(Gr.B) Paper-11

40 marks Crdit-3

Group-A

***Abhilekha* (Girnar Inscription of Rudradaman and Mandasore Inscription of Yashovarman)- 20 marks**

***Shrimad-bhagavad-gita* (Ch-12 *Bhaktiyoga*)- 20 marks**

Unit I Long question-1 (from Inscriptions) 10 marks

Unit II Explanation-1 (from Inscriptions) 6 marks

Unit III Short notes-2 (from inscriptions) 2×2= 4 marks

Unit IV Long question-1 (from *Gita*)	10 marks
Unit V Explanation-1 (from *Gita*)	6 marks
Short question-1 (from *Gita*)	4 marks

Group-B

***Sahityadarpana* (1st Chapter)-20 marks**

***Shrimad-bhagavad-gita* (15th Chapter- *Purosottamayoga*)- 20 marks**

Unit I Long question-1 (*Sahityadarpana*)	10 marks
Unit II Short questions-2(*Sahityadarpana*)	10 marks
Unit III Long question-1(*Gītā*)	10 marks
Unit IV Explanation of verse-1 (*Gītā*)	6 marks
Unit V Short question- 1 (*Gītā*)	4 marks

Books for reference:

1. *Selected Sanskrit Inscriptions* (Ed.) D.B. Pusalkar, Classical Publishers, New Delhi
2. *Abhilekhamala* (Ed.) Sarojini Bhuyan, Cuttack
3. *Abhilekhamala* (Ed.) Sujata Dash
4. *Shrimad-bhagavad-gita* (Ed.) S. Radhakrishnan
5. *Shrimad-bhagavad-gita* (Ed.) Gambhirananda, Ramakrishna Mission
6. *Shrimad-bhagavad-gita*, Gita Press, Gorakhpur
7. *Sahityadarpana* (Ed.) Saligram Shastri
8. *Sahityadarpana* with Vimala Com, Chaukhumba,Varanasi
9. *Sahityadarpana* (Ed.) Odia Translation of Narayana Mahapatra, Odisha Sahitya Academy, Bhubaneswar
10. *Sahitya Darpana evam chanda, B.S. Mishra,Satyanarayan Book store,Cuttack*
11. *Sahitya Darpana evam chanda, Niranjan Pati, Vidyapuri, Cuttack*

5th Semester

MCC- 5.12 Prose Literary text (Gadyakavya) and History of Sanskrit Literature- 2 (Samskrta-sahityetihasa) Paper-12
Kadambari* (*Shukanasopadesha)* and History of *Laukika
Sanskrit Literature **40 marks Credit-3**

Units I- III *Shukanasopadesha* **20 marks**

Long question-1 10 marks

Explanation-1 6 marks

Translation of a sentence - 2 4×1= 4 marks

Units IV-V History of *Laukika* Sanskrit Literature **20 marks**

(*Khandakavya*, *Champu*, *Katha-sahitya*, i.e. *Panchatantra*, *Hitopadesha* *Simhasana-dvatrimshika*, *Vetala-panchavimshati*)

Short questions- 4 5×4= 20 marks

Books for reference:

1. *Shukanasopadesha* (Ed.) Ramakanta Jha, Choukhamba Vidya Bhawn, Varanasi
2. *Kadambari* (*Purvardham*) with the Sanskrit and Hindi Comm. of Bhanuchandra Siddhagani, Motilal Banarsidass, New Delhi, 1983 Rpt.
3. Sukanasopadesaḥ (Ed) Nirmal Sundar Mishra, Kalyani Publishers, Cuttack
4. *Samskrta Sahitya ka Itihasa*, Baladev Upadhyaya
5. *Samskrta Sahitya ka Itihasa*, Hansraj Agrawal, MunsiRam Manoharlal,delhi
6. *Samskrta Sahityara Itihasa*, G.N. Mahapatra, Nalanda, Cuttack
7. *Samskrta Sahitya Itihasa*, H.K. Satapathy, Vidyapuri, Cuttack

MCC- 5.13 Figures of Speech and Prosody (Alamkara and Chandas)Paper-13 *Alamkaras* (Figures of Speech) from *Sahityadarpana* Chap-X, and *Shrutabodha* (Prosody) **40 marks Credit-3**

Units I-III *Alamkaras* such as *Anuprasa*, *Yamaka*, *Shlesa*, *Upama*, *Rupaka*, *Utpreksa*, *Bhrantiman*, *Nidarshana*, *Arthantaranyasa*, *Aprastuta-prashamsa*, *Apahnuti*, *Vyatireka*, *Vibhavana*, *Vishesokti*, *Samasokti*, *Svabhavokti*, *Vyajastuti*, *Kavyalinga*, *Samkara*, *Samsrsti*

Definition and Examples of 4 *Alamkaras*- 5×4= 20 marks

Units IV-V *Arya*, *Anustubh*, *Indravajra*, *Upendravajra*, *Upajati*, *Vamshastha*, *Vasantatilaka*, *Mandakranta*, *Malini*, *Shikharini*, *Śardula-vikridita*, *Sragdhara* – Definition and Examples 4 *Chandas*- 5×4= 20 marks

Books for reference:

1. *Sahityadarpana* (Ed.) P.V. Kane/N. Mahapatra/Odia Translation by Narayan Mahapatra, Orissa Sahitya Acdemy/ Hindi Com. *Vimala/* Sans. Com. *Laksmi*
2. *Shrutabodha*, Hari Prasad Sharma, Nirnaya Sagar Press
3. *Kiratajauiyam O Chanda- (Ed) Niranjan Pati , Vidyapuri, Cuttack*
4. Sahityadarsana evam O chanda-(Ed) Braja Sundar Mishra, Satyanarayan Books, Cuttack

MCC- 5.14 Technical Literature (Arthashastra and Dharmashastra)Paper-14 *Arthashastra, Adhikarana* I.1-4 and *Manusmrti* Chap-II Verses 1-52

40 marks Credit-3

Unit I-III *Arthashastra* from the beginning up to *Vinayadhikarana Adhikarana* I.1-4

Short notes 4 5×4= 20 marks

Unit IV-V *Manusmrti* Chap.II, verses 1-52

Short notes 4 5×4=20 marks

Books for reference: Books for reference:

1. *Kautilya Arthashastra,* R. P. Kangle, tr. 3 vols., Motilal Banarsidass, New Delhi ,1997
2. *The Arthashastra*. L.N. Rangarajan (Ed., Rearranger & Translator), 1992, Penguin Classics, India
3. *The Arthashastra.* (Ed.) N.P. Unni, Bharatiya Vidya Prakashan, New Delhi
4. *Arthashastra* (Odia Tr.) (Translator) Anantarma Kar, Odisha Sahitya Academy, Bhubaneswar
5. *Manu's Code of Law: A Critical Edition and Translation of the Mānava-Dharmaśāstra.*(Ed. Olivelle, Patrick) Oxford: Oxford University Press, 2005
6. *Manusmrti,* (Ed.) Braja Kishor Swain, Sadgrantha Niketan,Puri
7. *Marusmriti (chapter-II) , Ed.* Braja Sundar Mishra,Vidyapuri ,Cuttack

MCC- 5.15 (Drama and History of Samskrit Drama Nataka and Samskrta-natyetihasa) Paper-15

***Pratimā-nātakam* of Bhasa and History of Sanskrit Drama**

40 marks Credit- 3

Unit I-III *Pratimā-nātakam*		**20 marks**
	Long question-1	10 marks
	Explanation-1	6 marks
	Translation of a verse	4 marks
Unit IV-V History of Sanskrit Drama		**20 marks**
	(Bhāsa, Kalidāsa, Aśvaghosa, Śriharṣa, Śudraka, Viśākhādatta, Bhavabhuti, Bhattanārāyana)	
	Long question-1	10 marks
	Short notes- 2	10 marks

Books for reference:

1. *Pratimā-nātaka.* (Ed.) Shridharananda Shastri, Motilal Banarsidass, New Delhi
2. *Pratimā-nātaka.* (Ed.) Braja Sundar Mishra,Vidyapuri ,Cuttack
3. *Sanskrit Drama.* A.B. Keith
4. *Samskrta-sahitya ka Itihasa*, Baladev Upadhyaya, Chowkhamba Publication
5. *Samskrta Sahitya Itihasa*. Harekrushna Satapathy, Vidyapuri, Cuttack

Mj.E - 5.16 (Technical Literature Ayurveda and Vrksayurveda) (Gr.-A) OR Vastushastra and Jyotisa) (Gr.- B) Paper-16

40 marks Credit-3

Group-A

***Charaka-samhitā* (*Sutra-sthāna- dirghajivitiyadhyaya* Verses 1-103) 20 marks**

***Vrksayurveda* of *Brhatsamhita* (*Adhyaya*-55)**	**20 marks**
Unit I-III *Charakasamhitā* Short notes-4	5×4= 20
Unit IV-V *Vṛkṣāyurveda* Short notes-4	5×4=20

Books for reference:

1. The *Charaka Samhitā*, (Tr.) A.C. Kaviratna and P. Sharma, 5 Vols., Indian Medical Science Series, Sri Satguru Publications, a division of Indian Books Centre, Delhi 81
2. *Caraka-Samhitā*: Agniveśa's Treatise Refined and annotated by Caraka and Redacted by Drdhabala (text with English translation), Sharma, P. V. , Chaukhambha Orientalia, 1981--1994.
3. Agniveśa's *Caraka Samhitā* (Text with English Translation & Critical Exposition Based on Cakrapāṇi Datta's Āyurveda Dīpikā), R.K. Sharma & Bhagwan Dash, Chowkhamba Sanskrit Series Office, 1976--2002. Another good English translation of the whole text, with paraphrases of the commentary of Cakrapānidatta.
4. *Brihatsamhita* of Varahamihira, N. Chidambaram Iyer, Divine Books
5. Vrksayurveda (Ed.) Narayan Prasad Dash,Vidyapuri, Cuttack

Group-B

***(I) Vasturatnakara (Chapter- I)* (*Bhu-parigraha-prakarana*)- 20 marks**
***(II) Yajnavalkyasmṛti* (*Vyavaharadhyaya (1- 65 verses)*)- 20 marks**
Or Jyotihsararatnavali (Chapter- I)

***Problem* :** (i) Vāstu cannot be understood without general knowledge in Jyotisa
(ii) Dharmasāstra is associated with Arthasāstra ; hence, why the repetition?

Solution : Include Jyotisha with vāstu. The Oḍia version of the referred book is available in market.

Unit I-III	*Vāsturatnakara-Ch-I*	Short notes-4	5×4= 20
Unit IV –V	*Yājñavalkyasmṛti* *(Vyavahārādhyaya(1-65 verses), up to the end of Ṛṇadānaprakaraṇa)*		
	OR		
	Jyotiḥsāraratnāvali	Short notes-4	5×4=20

Books for reference:

1. *Vasturatnakar* (Ed.) Vindhyeshwari Prasad Dwivedi, Chowkhamba Krishnadas Academy, Varanasi
2. *Jyotihsararatnavali, Pandita Baikoli Mahapatra, Berhampur, Ganjam.*
3. *Yajnavalkyasmrti (Vyavahārādhyaya)*

6th Semester

MCC- 6. 17 (Essay in Sanskrit Samkrta-nibandha-lekhana) and Translation (Anuvada) from English/Odia to Sanskrit Paper-17

Essay in Sanskrit and Translation from Eng/Odia to Sanskrit

40 marks **Credit-3**

Unit I-III	Essay in Sanskrit	20 marks
Unit IV-V	Translation of English Passage/ Odia Passage to Sanskrit	20 marks

Books for reference:

1. *Nibandhamala*. A.T. Sharma
2. *Samskrta-nibandha-shatakam.* Kapila Dev Dvivedi
3. *Brhat Anuvada Shiksa*. Chakradhara hansa Nautiyal
4. *Samskrta-nibandhadarshah*, Ramamurti Sharma, Sahitya Niketan, Kanpur, 1979
5. *Vyakaranadarpana, Text Book bureau, Pustaka Bhavan, Bhubaneswar*

Mj E- 6. 18 i)Translation from Sanskrit to Odia/English (Odia-English Bhasanuvada), (ii) Comprehension (Bhavatmaka-uttara) and Expansion of Idea (Bhava-prasarana) (Gr.A) OR

(i) Sanskrit Précis writing (Bhava-samksepikarana) and
(ii) Applied Sanskrit (Vyavaharika- Samskruta) (Gr.B) Paper-18

40 marks **Crdit-3**

Group-A

Unit I-III	**Translation from Sanskrit to Odia/English- to Sanskrit**	**20 marks**
Unit IV	**Comprehension-**	**10 marks**
Unit V	**Expansion of Idea-**	**10 marks**

Group-B

Unit I-II *Bhava-samksepikaranam* (Précis writing) in Sanskrit- 20 marks

Unit IV-V *Vyavaharika-samskrtam* (Sanskrit for daily use)- 20 marks

Formation of Sentences-	5 marks
Correction of Sentences-	5 marks
Contextual Passage writing-	10 marks

Books for reference:

1. *Vyakarana darpana*, Text Book Bureaue, Odisha, Bhubaneswar
2. *Brhat AnuvadaCandrika*, Chakradhar Hansa Nautial
3. *Sahaja Samskrta Siksa*, G.N. Mahapatra
4. *Samskrta Shiksana Sarani*, Acharya Ram Shastri, Acharya Ram Shastri jnanapitha, Samskrta Nagar, Rohini, Delhi
5. *Vyavahara-sahasri*, Lokabhasa Prachara Samiti, Bhubaneswar
6. *Vyavaharika-samskrtam*, Narendra, Sanskrit Centre, Sri Aurobindo Ashram, Puducherry

MCC 6.19 DISSERTATION/ PROJECT REPORT 0F 20 PAGES AND 4000 WORDS OR TWO SEMINAR Paper-19

Project (About 4000 words)/ 2 Seminar Presentations/

Translation from Odia/English to Sanskrit and Viva voce

100 marks Credits-8

Unit I Project Report/Dissertation (about 4000 words) **Or** Two Seminar Presentations **Or** Translation

From Odia/ English to Sanskrit (about 20 pages of a prose/ story/ poetry text of any reputed author)

Unit I -Project Report-	75 marks
Unit II Viva-voce	25 marks

*****

SYLLABUS FOR UNDER GRADUATE (UG) COURSE IN CHEMISTRY (MAJOR)

UNDER CHOICE BASED CREDIT SYSTEM

(Effective for the students seeking admission in Colleges/Universities of Odisha in the academic session 2015-16 and onwards)

Major Course Structure

Total Marks - 1000 (Total Credit – 1000)

(Assessment/Examination: Internal – 20%, External – 80%)*

SEMESTER	Paper No.	Paper Code	Theory/Practical/ Project	Credit	Marks	Total Hours
I	I	CH-101	Theory	3	50	
	II	CH-102	Theory	3	50	
	III	CH-103	Practical	3	50	
II	IV	CH-201	Theory	3	50	
	V	CH-202	Theory	3	50	
	VI	CH-203	Practical	3	50	
III	VII	CH-301	Theory	3	50	
	VIII	CH-302	Theory	3	50	
	IX	CH-303	Practical	3	50	
IV	X	CH-401	Theory	3	50	
	XI	CH-402	Theory	3	50	
	XII	CH-403	Practical	3	50	
V	XIII	CH-501	Theory	3	50	
	XIV	CH-502	Theory	3	50	
	XV	CH-503	Practical	3	50	
VI	XVI	CH-601	Theory	3	50	
	XVII	CH-602	Theory	3	50	
	XVIII	CH-603	Practical	3	50	
	XIX	CH-604	Project	8	100	

*** There will be no internal assessment for Project**

Minor Course Structure

Total Marks - 300 (Total Credit – 18)

(Examination: Internal – 20%, External – 80%)

SEMESTER	Paper No.	Paper Code	Theory/Practical/ Project	Credit	Marks	Total Hours
I	I	CH-101E	Theory	3	50	
II	II	CH-201E	Theory	3	50	
	III	CH-202E	Practical	3	50	
III	IV	CH-301E	Theory	3	50	
IV	V	CH-401E	Theory	3	50	
V	VI	CH-501E	Practical	3	50	

Major Course Structure

Total Marks - 1000 (Total Credit – 1000)

(Assessment/Examination: Internal – 20%, External – 80%)*

SEMESTER-I

Paper - I

CH-101 **Marks– 10+40 (3 Credit)**

Time – 02 Hrs.

Unit-I

Gaseous State: Postulates of kinetic theory and derivation of kinetic gas equations.Deviation from ideal behaviour, van der Walls equation of state, Critical phenomena, PV isotherms of real gases, continuity of states, the isotherms of van der Waal's equation, relationship between critical constants and van der Waal's constants, the law of corresponding states, reduced equation of state. Liquefaction of gases.Molecular (root mean square, average and most probable) velocities. Qualitativediscussion of Maxwell distribution of molecular velocities, collision number, meanfree path and collision diameter.

Liquid State: Intermolecular forces, structure and properties of liquids (a qualitative description), structural differences with other states, gases, surface tension and its determination by capillary rise method. Liquid crystals: Classification & structure of nematic, smectic and cholesteric phases. Liquid crystal displays and thermography.

Unit-II

Atomic Structure: de-Broglie's equation, Heisenberguncertainty principle, Schrodinger wave equation and physical significance of Ψ & Ψ^2, condition for acceptable wave functions, normalisation and orthogonality, quantum numbers, radial and angular wave functions, probability distribution curves, shapes ofs, p, d, f-orbitals and their characteristics. Aufbau and Pauli's exclusion principles, Hund's multiplicity rule, Electronic configuration of elements, effective nuclear charge.

Periodic properties: Atomic and ionic radii, ionization potential, electron affinity,electronegativity, methods of their determination. Trends in periodic table and application inpredicting and explaining the chemical behaviour.

Chemistry s-block elements: Comparative study and diagonal relationship, salient features of hydrides, solvation, complexation tendencies, introduction to alkyls and aryls.

Unit-III

Distribution of electrons in organic molecules: Inductive effect, conditions of resonance, hyperconjugation, steric and field effects. Influence of these factors on acidity, basicity and dipole moment of organic molecules.

Types and mechanism of organic reactions: Curved arrow notation, drawing of electron movements with arrows, half and double headed arrows, homo- and heterolytic bond breaking.

electrophiles, nucleophiles, Reactive intermediates: carbocations, carbanions, free radicals, carbenes, arynes and nitrenes (formation, structureand stability). Substitution, addition and elimination reactions; energy profile diagrams-transition states (general considerations).

Types of organic reactions: S_N1, S_N2, E_1, E_2, ADN, ADE with examples; kinetic, mechanism, energy profile and stereochemistry of S_N1 and S_N2 reactions, Effect of solvent on reaction mechanism,Methods of determination of reaction mechanism, Neighbouring Group participation.

Paper-II

CH-102 **Marks– 10+40 (3 Credit)**
Time – 2 Hrs.

Unit-I

Thermodynamics-I:

Definition of thermodynamic terms: system and surroundings, macroscopic properties (extensive and intensive), kinds of processes. State and path functions and their differentials.Concept of heat andwork.

First law of thermodynamics: Internal energy,sign convention for heat and work, nature of work, path dependence of work and heat. Enthalpy,heat capacity, heat capacities (C_v, C_p) at constant volume and constant pressure and their relationship, Joule's law, Joule-Thomson effect and inversion temperature, Calculation of w, q, ΔU and ΔH for expansion of ideal gas under isothermal and adiabatic conditions for reversible process, Kirchhoff s equation.

Thermochemistry: Standard enthalpy of formation. Hess's law of constant heat summationand its application, Heat of reaction at constant pressure and constant volume,Enthalpy ofneutralization. Bond dissociation energy and its calculation from thermochemical data,temperature dependence of enthalpy, Kirchhoff's equation.

Unit-II

Chemical Bonding:

Electrovalent bond: ionic structure, radius ratio effect and coordinationnumber, lattice defects, semiconductors, lattice energy, Born-Haber cycle, solvation energy,polarization power and polarizability (Fajan's rule).

Covalent bond: Valance bond theory, Heitler-London treatment of hydrogen molecule (mathematical treatment excluded),limitations of VB theory, concepts of resonance and resonance energy.

Concept of hybridisation (sp, sp^2, sp^3, dsp^2, d^2sp^3, dsp^3) and shapes of simple inorganic molecules and ions. VSEPR Theory and geometry of molecules (NH_3, H_2O, SF_4, PCl_5, ClF_3, ICl_2^-).Multicentre bond in electron deficientmolecules, percentage of ionic character from dipole moment and electronegativity difference.

MO theory: LCAO principle, molecular energy level diagram of H_2, H_2^+, H_2^-, He_2, N_2, O_2, O_2^+, O_2, CO, NO.

Other types of bond: van der Waals forces, Hydrogen- bond, Metallic bond.

Unit-III

Alkanes and Cycloalkanes:

IUPAC nomenclature of branched, unbranched alkanes and alkyl groups. Classification of carbon atoms in alkanes. Isomerism in alkanes. Sources and methods of synthesis of alkanes (Wurtz reaction, Kolbe reaction, Corey-House reaction and decarboxylation reactions). Physical properties and chemical reactions of alkanes. Mechanism of free radical halogenations of alkanes: orientation, reactivity and selectivity.

Cycloalkanes: nomenclature, methods of preparation, chemical reactions, Baeyer's strain theory and its limitations. Ring strain in small rings (cyclopropane and cyclobutane). Theory of strainless rings. The case of cyclopropane ring: banana bonds.

Alkyl halides: Methods of preparation, chemical reactions. Mechanisms of nucleophilic substitution reactions of alkyl halides, S_N1 and $S_N2$reactions with energy profile diagrams, Polyhalogen compounds: chloroform, carbon tetrachloride.

Paper-III

CH-103 **Marks– 10+40 (3 Credit)**
Time – 6 Hrs.

Unit –I **20 Marks**

Qualitative Inorganic mixture analysis

Qualitative analysis of mixture of inorganic substances containing six radicals with one or more interfering radicals like (CO_3^{2-}/SO_3^{2-}), (NO_3^-/NO_2^-), (NO_3^-/Br^-), (NO_3^-/I^-), (Cl^-/Br^-/I^-), (PO_4^{3-}/AsO_4^{3-}).

Unit-II **10 Marks**

a. Preparation of simple inorganic compounds:

i. Ferrous ammonium sulphate
ii. Tetrammine copper(II) sulphate
iii. Copper(I) thiourea complex
iv. To add few more

b. Standardisation of secondary standard solution

i. Preparation of standard solution of oxalic acid/Sodium oxalate and standardization of NaOH solution/ $KMnO_4$ solution
ii. Preparation of standard $K_2Cr_2O_7$ solution and standardisation of sodium thiosulphate solution

VIVA VOCE	5 Marks
Record	5 Marks

***Note*:** Experiments may be added/deleted subject to availability of time and facilities.

SEMESTER-II

Paper-IV

CH-201 **Marks– 10+40 (3 Credit)**
Time – 2 Hrs.

Unit –I

Solid State: Space lattice, unit cell and its dimensions, crystal systems. Laws of crystallography: (i) Law of constancy of interfacial angles (ii) Law of rational indices (iii) Law of symmetry. Symmetry elements in crystals, Lattice planes and Miller indices.

X-ray diffraction in crystals,Derivation of Bragg equation, determination of crystal structure of NaCl, KCl and CsCI (Laue's method and Powder method). Band theory of solids-metal, semiconductor and insulators.

Surface and Colloids chemistry:

Types of adsorption, Adsorption isotherms: Langmuir, Freundlich and Gibbs's, BET equation (no derivation) and its application to surface area measurement.

Colloids: Definition and classification; Solid in liquid (sols) – properties (kinetic, optical and electrical), stability of colloids, protective action, Hardy-Schulz law, gold number. Liquid in liquids (emulsion) – types of emulsion, preparation, and emulsifier. Liquid in solids (gels), preparation and properties, inhibition, general applications of colloids.

Unit-II

Chemistry of p-block elements: Comparative study and diagonal relationship of groups 13-17, hydrides, oxides, oxyacids, halides of groups 13-17.

Hydrides of Boron: Preparation, properties and structure of diborane & higher boranes, borazine. Fullerenes, carbides, silicates & Inter-halogen compounds. Fluorocarbons, borohydrides & polyhalides

Noble gases: Chemistry of xenon compounds (fluoride and oxides), uses of noble gases.

Non-aqueous solvents: Physical properties of a solvent for functioning as an effective reaction medium. Types of solvents and their general characteristics. Reactions in liquid ammonia and liquid sulphur dioxide with reference to acid-base reactions, solvolysis and precipitation reactions.

Unit-III

Stereochemistry: Concept and types of isomerism.

(a) Optical isomerism: elements of symmetry, molecular chirality, enantiomers, stereogenic centre, optical activity, properties of enantiomers, chiral and achiral molecules, with twostereogenic centres, diastereoisomers, threo and erythrodiastereomers, meso compounds, resolution of enantiomers, inversion, retention and racemisation, D/L, R/S and E/Z nomenclatures.

(b) Geometrical isomerism: Determination of configuration of geometrical isomers, E-Z systemof nomenclature, geometrical isomerism of oximes and alicyclic compounds.

(c) Conformational isomerism: Definition, difference between configuration and conformation, Conformation analysis of ethane, n-butane, cyclohexane, axial and equatorial bonds,Conformation of mono and di-substituted (1:2, 1:3, 1:4) cyclohexane;Newman, Fischer and Saw-horse projection, Sawhorse formula,Newman projection, Flying wedge formula.

Paper-V

CH-202 **Marks– 10+40 (3 Credit)**
Time – 2 Hrs.

Unit-I

Thermodynamics-II

Limitations of first law , spontaneous processes and second law of thermodynamics, Carnot cycle and itsefficiency, Carnot theorem, thermodynamic scale of temperature, efficiency of heat engines,concept of entropy. Entropy as a state function, entropy as a function of (i) V & T (ii) P & T, entropy changes in a physical processes, Clausius inequality, entropy as acriterion of spontaneity and equilibrium, entropy change in ideal gases, entropy change in mixture of gases.

Third law of thermodynamics: Nernst heat theorem, statement of third law, concept of residual entropy,evaluation of absolute entropy from heat capacity data, applications of third Law.

Free energy and its concept, Gibbsfunction (G) Helmholtz function (A) as criteria for thermodynamic equilibrium andspontaneity, their advantage over entropy change, variation of G and A with P,V and T.Gibbs-Helmholtz equation and its applications.

Unit-II

Chemistry of transition elements: General characteristic of d-blockelements.

Chemistry of first row transition elements with reference to electronic configuration, atomic and ionic radii, electron affinity, electronegativity, ionisation potential, oxidation states, variable valencies, colour and magnetic properties, complex formation, coordination number and geometry.

Metallurgy of Ni, V, Cr and Mn and chemistry of their important compounds.

Redox potentials: Standard electrode potentials, redox potentials and formal potentials, redox potential to explore the feasibility of reactions and calculations of values of equilibrium constants, Redox potential as a function of pH, Frost, Latimer and Pourbaix diagrams of redox potential, principle involved in extraction of metals.

Unit-III

Alkenes and Cycloalkenes, Dienes and Alkynes:

*Alkenes:*Methods of formation, mechanisms of dehydration of alcohols and dehydrohalogenation of alkyl halides, regioselectivity in alcohol dehydration. Saytzeff rule, Hofmann elimination, physicalproperties and relative stabilities of alkenes. Chemical reactions of alkenes – mechanismsinvolved in hydrogenation, electrophilic and free radical additions, Markownikoff's rule, hydroboration- oxidation, oxymercuration, demercuration and oxidation with $KMnO_4$.Polymerization of alkenes.

Cycloalkenes: Methods of formation, conformation and chemical reactions of cycloalkenes.

Dienes: Nomenclature and classification, isolated, conjugated and cumulated dienes; structure of allenes and butadiene, methods of formation, polymerization. Chemical reactions - 1,2 and 1,4 additions,Diels-Alder reaction.

*Alkyne:*Methods of formation, chemical reactions of alkynes, acidity of terminal alkynes. Mechanism of electrophilic andnucleophilic addition reactions, hydroboration - oxidation, metal ammonia reduction, oxidationand polymerization.

Paper-VI

CH-203 **Marks– 10+40 (3 Credit)**
Time – 6 Hrs.

Unit –I **15 Marks**

Volumetric Analysis:

Neutralization Titrations

i. Determination of composition of HCl and CH_3COOH mixture using two different indicators
ii. Determination of Na_2CO_3 and $NaHCO_3$ in given mixture

Redox Titrations

i. Estimation of Fe^{2+} in $FeSO_4.7H_2O$/Mohr's salt using $KMnO_4$/$K_2Cr_2O_7$ solution
ii. Estimation of ferric iron (after reduction with stannous chloride) using internal indicator
iii. Estimation of hydrogen peroxide using $KMnO_4$ solution.
iv. Estimation of Ca^{2+} (direct method) using $KMnO_4$ solution.

Iodometry

i. Estimation of copper by sodium thiosulphate

Complexometric Titrations

ii. Estimation of Mg(II) by EDTA solution
iii. Estimation of Ca(II) by EDTA solution
iv. Estimation of Zn(II) by EDTA solution

Unit-II **15 Marks**

Gravimetric Analysis

i. Estimation of barium as $BaSO_4$.
ii. Estimation of copper as CuSCN
iii. Estimation of Lead as lead chromate
iv. Estimation of Barium as barium chromate
v. Estimation of nickel as nickel dimethlglyoxime
vi. Estimation of aluminium as Al_2O_3
vii. Estimation of Zn as Zn NH_4PO_4

VIVA VOCE	5 Marks
RECORD	5 Marks

***Note*:** Experiments may be added/deleted subject to availability of time and facilities.

SEMESTER-III

Paper-VII

CH-301 **Marks– 10+40 (3 Credit)**
Time – 2 Hrs.

Unit-I

Chemical Equilibria: Different types of equilibrium constants: K_c, K_p and K_x and their relationship, thermodynamic derivation of law of mass action. Le Chatilier's principle and its application to physical and chemical equilibria. van't Hoff equation and its integration.Equilibrium constant and free energy change. Reaction isotherm and reaction isochore, Clapeyron equation and Clausius-Clapeyron equation, applications.

Ionic Equilibria: Dissociation of acids and bases, common ion effect, buffer solutions, Henderson equation, hydrolysis of salt and hydrolysis constant, indicators and theory of acid-base indicators

Phase Equilibria: Phase, component and degree of freedom, Gibb's phase rule and its derivation, phase equilibria ofone component (H_2O, CO_2 and SO_2) systems, two component systems (phenol-water, lead-silver, tin-magnesium). Distribution law its application to solvent extraction.

Unit-II

Coordination compounds: Werner's coordination theory and its experimental verification, classification of ligands, coordination numbers and stereochemistry, chelates, IUPAC nomenclature for coordination compounds, isomerism in coordination compounds.

Metal-Ligand bonding in transition metal complexes: Valance bond theory (VBT) and its limitation. Crystal field theory, Crystal field splitting d-orbitalin octahedral, tetrahedral and square planarfields. Factors affecting crystal field parameters.

Magnetic Properties of Transition metal Complexes: Types of magnetic behaviour, methods of determining magnetic susceptibility, spin only Formula LS-coupling, relation of μ_s and μ_{eff} values, orbital contribution to magnetic moment data for 3d metal-complexes.

Unit-III

Benzene and its derivatives:

Benzene: Structure (Kekule structure) and stability, carbon-carbon bond lengths, resonance structure, MO picture. Aromaticity, Huckel rule, aromatic ions. The aryl group. Aromatic nucleus and side chain.

Aromatic electrophilic substitution: general pattern of the mechanism, role of σ and πcomplexes. Mechanism of nitration, halogenation, sulphonation, mercuration and Friedel-Crafts(alkylation and acylation) reactions.

Energy profile diagrams, activating and deactivating substituents, orientation and ortho/para ratio. Side chain reactions of benzene derivatives. Birch reduction.

Methods of formation andchemical reactions of alkyl benzenes, alkynyl benzenes and biphenyl.

Aryl Halides: Methods of formation, nuclear and side chain reactions. Addition-eliminationand elimination-addition mechanisms of nucleophilic aromatic substitution reactions. Relative reactivities of alkyl halides vs allyl, vinyl and aryl halides. Synthesis and uses of DDTand BHC.

Paper-VIII

CH-302 **Marks– 10+40 (3 Credit)**
Time – 2 Hrs.

Unit-I

Electrochemistry-I: Specific, equivalent & molar conductance; Measurement of equivalentconductance, variation of equivalent and specific conductance with dilution. Migration of ions and Kohlrausch Law. Strong and weak electrolytes, Arrhenius theory of electrolytic dissociation and its limitations, Ostwalddilution law, its use and limitations. Debye-Huckel-Onsager equation for strong electrolytes (elementary treatment only).Transport number and its determination by Hittorf method and moving boundary method.

Applications of conductance measurement for determination of degree of dissociation weak electrolytes, dissociation constant (K_a) of weak acids,solubility product of sparingly soluble salts, ionic product of water, hydrolysis constant of salts.

Conductometric titrations: acid -base, precipitation and replacement reactions.

Unit-II

Chemistry of second and third row transition elements:

General characteristics, comparative treatment with their 3d analogues in respect to ionic radii, oxidation states, magnetic behaviour and stereochemistry.

Chemistry of Lanthanides and Actinides:

Lanthanides: Electronic Structure, oxidation states, ionic radii and lanthanide contraction, complex formation, occurrence & isolation, lanthanidecompounds.

Actinides: General features & Chemistry of actinides, separation of Np, Pm, Am from U,similarities between later actinides & later lanthanides

Hard/Soft Acids and Bases

Classification of acid and bases as hard and soft, Pearson's HSAB concept, acid-base strength and hardness and softness, symbiosis, theoretical basis of hardness and softness, Electronegativity in hardness and softness.

Unit-III

Alcohols: Dihydric alcohols: Nomenclature and methods of formation, chemical reactions ofvicinal glycols, oxidative cleavage by $Pb(OAc)_4$ and HIO_4. Pinacol-Pinacolone rearrangement.

Trihydric alcohols: Nomenclature, methods of formation and chemical reaction of glycerol.

Phenols: Nomenclature, structure and bonding of phenols. Preparation, physical and chemicalproperties of phenols. Comparative acid strengths of alcohols and phenols, resonance stabilization of phenoxide ion. Mechanism of Claisen rearrangement, Fires rearrangement, Gattermann synthesis, Houben-Hoesch reaction, Lederer-Manasse reaction, Reimer-Tiemann reaction and Kolbe reaction.

Ethers and Epoxides: Nomenclature, methods of formation, physical and chemical properties of ethers, Zeisels's method of estimation of methoxy group. Synthesis of epoxides, acid and basecatalysed ring opening of epoxides. Reactions of Grignard and Organolithium reagents with epoxides.

Paper-IX

CH-303 **Marks– 10+40 (3 Credit)**
Time – 6 Hrs.

Unit I:

Organic Qualitative Analysis **20** Marks

Identification of organic compounds through the detection of extra elements (nitrogen, sulphur and halogens). Functional group analysis (carboxylic, phenolic, carbonyl, alcoholic, carbohydrates, amides, amines and nitro). Determination of melting point/boiling point and preparation of suitable derivatives.

Unit-II **10 Marks**

a. Crystallisation of organic compounds

i. Acetanilide/benzoic acid/phthalic acid from water
ii. Naphthalene from alcohol

b. Preparation of simple organic compounds (one step synthesis)

i. Iodoform from ethanol/acetone
ii. Aspirin.
iii. m-dinitrobenzene
iv. Acetanilide
v. Tribromophenol
vi. Sulphanilic acid
vii. Benzoic acid from toluene
viii. p-nitroacetanilide, p-bromoacetanilide, picric acid, methyl orange, methyl red, and ethyl benzoate.

Viva Voce 5 Marks
Record 5 Marks

***Note*:** Experiments may be added/deleted subject to availability of time and facilities.

SEMESTER-IV

Paper-X

CH-401 **Marks– 10+40 (3 Credit)**
Time – 2 Hrs.

Unit I

Theory of dilute Solution and Colligative properties:

Ideal and non-ideal solutions, methodsof expressing concentrations of solutions, activity and activity coefficient.Dilute solutions and colligative properties, Roult's law, relative lowering of vapour pressure,molecular mass determination, Osmosis; laws of osmotic pressure and its measurement.Determination of molecular mass from osmotic pressure, Elevation of boiling point,Thermodynamic derivation of relation between molecular mass and colligative properties,Abnormal molar mass, degree of dissociation and association of solutes.

Nuclear Chemistry and radioactivity:

Nuclear stability, nuclear binding energy, mass defect and packing fraction,nuclear forces, meson field theory, artificial radio activity, different types of nuclearreactions,Bethe notation, fission and fusion, nuclear energy, nuclear fuels.Radioactive isotopes and their applications.

Unit-II

Electronic Spectra of Transition metal complexes: Type of electronic transition. Selectionrules of d-d transitions, Spectroscopic ground states, Orgel energy level diagrams for transitionmetal complexes (d^1- d^9 states). Discussion of the electronic spectrum of$[Ti(H_2O)_6]^{3+}$complexion.

Thermodynamic and kinetic aspect of metal complexes: Thermodynamic and kinetic stability, Stepwise and overall formation constants and their relationship; factors affecting thermodynamic and kinetic stability, Substitution reactions of square planar complexes,Trans effect.

Metal π –Complex: Metal carbonyls, EAN rule. Preparation and structure of mono-nuclear carbonyls of Cr, Fe and Ni. Isolobal concept; Preparation and structure binuclear carbonyls like $Co_2(CO)_8$, $Mn_2(CO)_{10}$, $Fe_2(CO)_{12}$.

Unit-III

Aldehydes and Ketones:

Nomenclature & structure of compounds with carbonyl group. Synthesisof aldehydes & ketones with particular reference to the synthesis of aldehydes from acidchlorides, synthesis of aldehydes & ketones using 1,3-dithines, synthesis of ketones from nitrile& from carboxylic acids. Physical properties. Mechanism of nucleophilic additions to carbonylgroup with particular emphasis to benzeoin, aldol, Perkin & knoevenagel condensations. Condensation with ammonia & its derivatives. Wittig & Mannich Reaction. Use of acetal as protecting group. Oxidation of aldehydes, Baeyer-Villiger oxidation of ketones, Caninizzaro reaction. Meerwein-Ponndorf-Verley, Clemmensen, Wolff-Kishner and $LiAlH_4$ reduction. Halogenation of enolizable ketones. An introduction to alpha, beta-unsaturated aldehydes &ketones.

Paper-XI

CH-402 **Marks– 10+40 (3 Credit)**
Time – 2 Hrs.

Unit-I

Electrochemistry II: Types of reversible electrodes, electrode reactions, Nernst equation, derivation of cellEMF and single electrode potential, standard hydrogen electrode, reference electrode, standardelectrode potential, sign conventions, electrochemical series and its significance, electrolytic andgalvanic cells, reversible and irreversible cells, conventional representation of electrochemicalcells, EMF of cells and its measurement, computation of cell EMF (G, H and K), hydrogenconcentration cell with and without transport, liquid junction potential. Application ofconcentration cells, determination of valency of ions, solubility product, activity coefficient, potentiometric titration, Determination of pH and pK_a, Determination of pH using hydrogen, quinhydrone and glass electrodes. Determination of transport number, heat of reaction, solubilityof sparingly soluble salt by EMF method.

Unit-II

Organometallic Chemistry:

Definition, nomenclature and classification of organometallic compounds. Preparation, properties, bonding & applications of metal alkyls & aryls of Li, Mg, Al, Sn &Ti.
Brief account of metal-ethylenic complexes & homogeneous hydrogenation.

Bio-inorganic Chemistry:

Essential and trace elements in biological processes, metalloporphyrins with special reference to haemoglobin, and myoglobin. Biological role of alkali and alkaline earth metal ions with reference to Ca^{2+}, Na^{+} and K^{+}. Nitrogen fixation. Toxicity of Cd, Pb and Hg.

Unit-III

Carboxylic acids and their derivatives: Carboxylic acid: Nomenclature, Structure & bonding,Physical Properties, acidity of carboxylic acids, Effects of substituents on acid strength.
Preparation of carboxylic acid. Reactions of carboxylic acids. Hell-Volhard-Zelinsky reaction.
Synthesis of acid chlorides, anhydrides, ester & amides. Reduction of carboxylic acids.
Mechanism of decarboxylation. Methods of formation & chemical reaction of unsaturated monocarboxylic acids, (arylic, crotonic and oleic acid)
Dicarboxylic acid: Method of formation of saturated dicarboxylic acid (oxalic, malonic, succinic, glutaric and adipic acid), Action of heat on dicarboxylic acid.
Carboxylic acid derivatives**:** Structure and nomenclature of acid chlorides, esters, amides(urea)and acid anhydride. Relative stability of acyl derivatives. Preparation of carboxylic acid derivatives, Physical properties, interconvertion of acid derivatives by nucleophilic acyl substitution. Chemical reactions. Mechanism of esterification and hydrolysis of ester (acidic andbasic).

Paper-IX

CH-403 **Marks– 10+40 (3 Credit)**
Time – 6 Hrs.

Unit-I **15 Marks**

Volumetric Quantitative Analysis

i. Determination of saponification value of oil/ester
ii. Determination of equivalent mass of an organic acid by volumetric (neutralization) and gravimetric analyses.
iii. Determination of equivalent mass of organic acids by volumetric analysis.
iv. Estimation of Vitamin C in multivitamin tablet/citrous fruits
v. Determination of acetic acid content in commercial vinegar using NaOH.
vi. Estimation of citric acid in lemon or orange.

Unit-II **15 Marks**

Quantitative estimation of simple organic compounds

i. Estimation of phenol and aniline by bromide-bromate method
ii. Estimation glucose/acetone

To add some experiment in both category

VIVA VOCE	5 Marks
RECORD	5 Marks

***Note*:** Experiments may be added/deleted subject to availability of time and facilities.

SEMESTER-V

Paper-XIII

CH-501 **Marks– 10+40 (3 Credit)**
Time – 2 Hrs.

Unit-I

Chemical Kinetics and catalysis:

Concepts of rate, order and molecularity of a reaction, factors affecting the rate of reaction (concentration, temperature, pressure, solvent, light, catalyst), determination of order of a reaction (differential and isolation method, method of integration and half-life period), differential and integrated forms of rate equation upto second order only, half and mean life period, steady-state approximation.

Theories of chemical kinetics: Temperature dependence of rate constant, Arrhenius equation, energy of activation. Simple collision theory, Lindemann theory of unimolecular reaction, transition state theory (thermodynamic treatment).

Reactions in solution and salt effect.Homogeneous, acid-base and enzyme catalysis with examples.

Unit-II

Photochemistry

Interaction of radiation with matter, difference between thermal and photochemical processes, laws of photochemistry, Grothus-Draper Law, Lambert-Beer's Law, Stark-Einstein Law of photochemical equivalence, quantum yield. Frank-Condon principle, decay of the existed states by radiative and non-radiative paths, Jablonski diagrams, Luminescence phenomena: fluorescence, phosphorescence, chemiluminescene and bioluminescence. Photosensitized reactions, photodimerisation, actinometry, quenching of fluorescence and Stern-Volmer equation.

Unit III

Elementary Quantum Mechanics

Black body radiation, Planck's radiation law, photoelectric effects, de Broglie equation, Heisenberg Uncertainty principle, Sinusoidal wave equation. Hermitian and Hamiltonian operator, Schrodinger's wave equation and its importance, physical interpretation of wave function, postulates of quantum mechanics, quantum mechanical treatment of particle in one and three dimensional box, degeneracy. Quantum numbers and their importance, hydrogen like wave functions, radial wave functions, angular wave functions.

Molecular orbital theory, basic ideas, criteria for forming MO from AO, construction of MO's byLCAO, H_2+ ion, calculation of energy levels from wave function, physical picture of bondingand anti-bonding wave functions, concept of σ, σ^*,π, π^* orbitals and their characteristics.

Paper-XIV

CH-502 **Marks– 10+40 (3 Credit)**
Time – 2 Hrs.

Unit-I

Organic compounds of nitrogen:

Nitroalkanes and niroarenes: Preparation and chemical reactions of nitroalkanes and nitroarenes, mechanism of nucleophilic substitution in nitroarenes and their reductions in acid. Picric acid and TNT.

Amines: Primary, secondary and tertiary amines. Separation of mixture of three types of amines (Hinsberg's method) and their distinction (Hinsberg's and Hoffman's methods). Structural features affecting basicity of amines, amine salts as phase transfer catalysts. Preparation of alkyl and aryl amines (from alkyl halides, nitro compounds, nitriles, isonitriles and amides), Gabriel-Phthalimide and Hoffmann bromide synthesis. Reactions of amines, electrophilic aromatic substitution in aryl amines, reactions of amines with nitrous acid.

Diazonium salts: Preparation and synthetic applications of aryl diazonium salts (benzene diazonium chloride), diazocoupling.

Unit-II

Carbohydrates: Classification and nomenclature, Monosaccharides, mechanism of osazone formation, Inter-conversion of glucose and fructose, chain lengthening and chain shortening ofaldoses and ketoses, configuration of monosaccharides, Erythro and threodiastereomers, formation of glycosides,ethers and esters. Determination of ring size of monosaccharides, Cyclic structure of D(+) glucose, Mechanism of mutarotation. Structure of ribose and deoxyribose. General idea on disaccharides (Maltose, sucrose and lactose) and polysaccharides (starch andcellulose).

Fats oils and Detergents: Natural fats, edible and industrial oils of vegetable origin, commonfatty acids, glycerides, hydrogenation of unsaturated oils, saponification value, iodine value andacid value .Soaps, synthetic detergents, alkyl and aryl sulphonates, cleansing

Unit-III

Amino acids, Peptides and Proteins: Classification, structure and stereochemistry ofaminoacids. Acid-base behaviour, isoelectric point and electrophoresis.

Preparation and nomenclature of peptides and proteins, classification, end group analysis,selective hydrolysis of peptides, classical peptide synthesis, solid phase peptide synthesis,structure of peptides and proteins, protein denaturation/renaturation,

Nucleic acids: Introduction, constituents of nucleic acids, Ribonucleieosides and ribonucleotides, Double helical structure of DNA.

Synthetic dyes: Colour and constitution (electronic concept), Classification of dyes. Chemistry and synthesis of methyl orange, Congo red, malachite green, crystal violet phenolphthalein, fluorescein, alizarin and indigo.

Paper-XV

CH-503 **Marks– 10+40 (3 Credit)**
Time – 6 Hrs.

Unit-I **20 Marks**

a. Chemical kinetics:

i. Determination of specific reaction rate of acid (H_2SO_4 and HCl) catalysed hydrolysis of methyl acetate/ethyl acetate at room temperature.
ii. Determination of rate of decomposition of hydrogen peroxide.
iii. Order of reaction of I_2/Acetone/H^+

b. Distribution law:

` Determination of distribution coefficient of:

i. Iodine between water and CCl_4
ii. Benzoic acid between benzene/toluene and water
iii. Acetic acid between CCl_4/$CHCl_3$ and water.

c. Adsorption :

To study the adsorption of acetic acid/oxalic acid on activated charcoal and verify Freundlich adsorption isotherm

d. Conductometry

i. Determination of concentration of HCl conductometrically using standard NaOH solution.
ii. Determination of concentration of acetic acid conductometrically using standard NaOH solution.
iii. Determination of dissociation constant (K_a) of acetic acid by conductivity measurements.
iv. Determination of the solubility and solubility product of a sparingly soluble electrolyte by conductometry.

e. Potentiometry

i. Determination of dissociation constant of weak monobasic acid (acetic acid) by potentiometric titration with strong base (NaOH).
ii. To titrate potentiometrically of the given ferrous ammonium sulphate solution using $KMnO_4$/$K_2Cr_2O_7$ as titrant and calculation of redox potential of Fe^{++}/Fe^{+++} system on hydrogen scale.

f. Study of the effect of temperature on miscibility of two partially miscible liquids: Phenol water system.

Unit-II **10 Marks**

a. Colourimetry

i. Verification of Beer-Lambert law using aqueous solution of $KMnO_4$/$K_2Cr_2O_7$ and determination of concentration of unknown solution.
ii. Verification of Beer-Lambert law using aqueous solution of $CuSO_4$/$NiCl_2$ and determination of concentration of unknown solution.

b. Potentiometry

Determination of pH of given acid solution and determination of H^+ ion concentration

.

VIVA VOCE	10 Marks
RECORD	05 Marks

***Note*:** Experiments may be added/deleted subject to availability of time and facilities.

SEMESTER-VI

Paper-XVI

CH-601 **Marks– 10+40 (3 Credit)**
Time – 2 Hrs.

Unit-I

Macromolecular Chemistry

Concept of monomer and polymer, Degree of polymerization,
Kinetics of addition, condensation, ionic and co-polymerization, concept of molecular mass,determination of molecular mass by viscometry. Industrial polymers: Polyolefines, Polystyrene, Polyvinyl chloride, Phenol-formaldehyde resin, urea-formaldehyde resin, epoxy resin,polyurethanes, Natural and synthetic rubbers, polyesters, polyamides, biodegradable polymer, Silicones and phosphazenes as examples of inorganic polymers.

Unit-II

Heterocyclic Compounds

Introduction, Molecular orbital picture and aromatic characteristics of pyrrole, furan, thiophene and pyridine. Methods of synthesis and chemical reactions withparticular emphasis on mechanism of electrophilic and nucleophillic substitution, comparison of basicity ofpyridine, piperidine and pyrole.
Introduction to condensed five and six membered heterocycles,preparation and reactions of indole, quinoline and isoquinoline with special reference to Fischer indole synthesis, Skraup synthesis and Bischler-Napieralski reaction, mechanism of electrophilicsubstitution reactions of indole, quinoline and isoquinoline.
Organo Sulphur Compounds: Nomenclature, structural features, methods of formation and chemical reactions of thiols, thioethers, sulphonic acids, sulphonamides and sulphaguanidine

Unit-III

Organic Synthesis: Acidity of α-hydrogens, alkylation of diethylmalonate, ethylacetoacetateand 1,3-dithianes, synthesis of ethylacetoacetate, claisen condensation, keto-enol tautomerism, alkylation and acylation of enamines.
Uses of following reagents in organic synthesis: OsO_4, HIO_4, NBS, diborane, Na/NH_3 (l),$LiAlH_4$ and $NaBH_4$.
Name reactions: Principle, mechanism and applications of Diel's-Alder, Mannich and Reformatsky reaction, fries and Beckmann rearrangement and Michael condensation.

Green Chemistry

Introduction, Environmental concern on chemical industry and need of greenchemistry, Origin of green chemistry. Twelve principles of green chemistry with explanations, Green organic synthesis, synthesis of ibuprofen. Microwave and ultrasound assisted green synthesis: Aldol condensation, Diels-Alder reaction andWilliamson's synthesis.

Paper-XVII

CH-602 **Marks– 10+40 (3 Credit)**
Time – 2 Hrs.

Unit-I

Ultraviolet (UV) absorption spectroscopy: Absorption laws: Beer-Lambert Law. Molarabsoptivity. Types of electronictransitions: $\sigma \rightarrow \sigma^*$, $n \rightarrow \sigma^*$, $\pi \rightarrow \pi^*$. Effect of conjugation, concept of chromophores and auxochromes. Bathochromic, hypsochromic, hyperchromic and hypochromic shifts, UV spectraof conjugated dienes and enones.

Infrared (IR) Spectroscopy: Molecular vibrations,Hooke's law, Basic principles and instrumentation of IR spectroscopy, intensity and position of IR band, finger point region, characteristics absorption of various functional groupsand interpretation of I.R. spectra of simple organic compounds (hydrocarbons, alcohols, amines, aldehydes, ketones, acids and aromatic ring) .

Unit-II

Nuclear Magnetic Resonance (NMR) Spectroscopy: Proton magnetic resonance (PMR),nuclear shielding and deshielding, chemical shift and molecular structure, spin-spin coupling, coupling constants, area of signals, interpretation of spectra of simple organic molecules suchasethyl alcohol, ethyl bromide, acetaldehyde, 1,3-dichloropropane, 1,1,2-tribromoethane, ethylacetate, toluene and acetophenone.

Mass Spectroscopy: Basic principle of mass spectroscopy. Determination of molecular formula.Parent and metastable peaks, mass spectra of some organic molecules (hydrocarbon, alcohol andamines only).

Applications of UV, IR, NMR or UV, IR, NMR and Mass spectroscopic data for the structure elucidation of simpleorganic molecules.

Unit-III

Separation techniques

Principle of adsorption and partition chromatography.

Colum chromatography: Principle, adsorbents used, preparation of column, adsorption, elution, recovery of substances, Applications.

Thin layer chromatography: Principle, choice of adsorbent and solvent, preparation of chromatogram, R_f value, applications.

Paper chromatography: Solvents used, principle, R_f value, factors influencing R_f value, applications, separation of amino acid mixture, radial paper chromatography.

Paper electrophoresis: Principle and applications

Ion exchange chromatography: Principle, resins, action of resins, experimental techniques, applications, separation of metal ions, separation of chloride and Bromide ions, removal of interfering radicals.

Basic idea of gas-liquid chromatography and HPLC.

Paper-XVIII

CH-603 **Marks– 10+40 (3 Credit)**
Time – 6 Hrs.

Unit-I **20 Marks**

Industrial Analysis

i. Estimation of MnO_2 in pyrolusite using sodium oxalate.
ii. Estimation of total iron in an iron ore
iii. Estimation of Cu content in brass
iv. Determination of saponification value of oil
v. Estimation of iodine in iodized salts

Analysis of water parameters

i. Estimation of total hardness of water by EDTA.
ii. Estimation of sulphate by turbidity method

Analysis of binary mixture of metal ions

i. Separation and estimation of Mg(II)/Fe(II) mixture.
ii. Separation and estimation of Mg(II)/Zn(II) mixture

Separation and identification Organic compounds.

i. Separation and identification of sugars present in the given mixture of glucose, fructose and sucrose by paper chromatography and determination of R_f values.
ii. Separation and identification of green leaf pigments (Spanish leaf may be used) by paper chromatography and determination of R_f values.
iii. Separation and identification of amino acids present in the given mixture of alanine, aspartic acid and leucine by thin layer chromatography and determination of R_f values.
iv. Separation and identification of mixture of phenylalaninie, and glycine by thin layer chromatography and determination of R_f values.

Unit-II **10 Marks**

i. Determination of pH of a given solution using glass electrode.
ii. Determination of alkali content in antacid tablets using HCl
iii. Determination of percentage of available chlorine in bleaching powder.

To add more experiments

Paper-XIX

CH-604 **Marks – 100 (8 Credit)**

Project on Chemistry/Chemical sciences by way of experiment or field study.

PROJECT WORK	75 Marks
COMPRESHENSIVE VIVA	25 Marks

Books recommended (Theory)

1. R. Puri, L.R. Sharma and K.C. Kalia, *Principles of Inorganic Chemistry*, 31st Edition, MilestonePublishers and Distributors, New Delhi, 2013.
2. H.J. Arnikar, *Essentials of Nuclear Chemistry*, 4th Edition, New Age International (P) Ltd., NewDelhi, 1995 (Reprint 2005).
3. J.D. Lee, *Concise Inorganic Chemistry*, 5th Edition, Oxford University Press, New Delhi, 2008.
4. B.R. Puri, L.R. Sharma and M.S. Pathania, *Principles of Physical Chemistry*, 46th Edition, VishalPublishing Company, New Delhi, 2013.
5. I.L. Finar, *Organic Chemistry Vol. I & II,* 5th Edition, Pearson Education, New Delhi, 2013.
6. K.S. Tewari, N.K. Vishnoi and S.N. Mehrotra, *A Textbook of Organic Chemistry*, 2nd Edition,Vikas Publishing House (P) Ltd., New Delhi, 2004.
7. A. Bahl and B.S. Bahl, *Advanced Organic Chemistry*, 1st Multicolour Edition, S. Chand & Company, New Delhi, 2010.
8. D.F. Shriver and P. Atkins, *Inorganic Chemistry*, 5th Edition, Oxford University Press, NewYork, 2010.
9. Organic Chemistry: R.T. Momson and R.N. Boyd, 6th Edition, Prentice Hall Pearson Education.
10. V.R. Gowarikar, *Polymer Chemistry*, New Age International (P) Ltd., New Delhi, 2010.
11. J.E. Huheey, E.A. Keitler and R.L. Keitler, *Inorganic Chemistry – Principles of Structure and Reactivity,* 4th Edition, Pearson Education, New Delhi, 2013.
12. P.S. Kalsi, *Organic Reactions, Stereochemistry and Mechanism*, 4th Edition, New Age International Publishers, New Delhi, 2006.
13. F.A. Cotton and G. Wilkinson, *Advanced Inorganic Chemistry*, 6th Edition, Wiley India Pvt. Ltd., New Delhi, 2009 (Reprint).

Books Recommended (Practical)

1. R.C. Das and B. Behra, *Experiments in Physical Chemistry*, Tata McGraw Hill, New Delhi, 1983.
2. V.K. Ahluwalia, SunitaDhingra, "Comprehensive Practical Organic Chemistry – Qualitative Analysis"**:** University Press (India) Private Limited, Hyderabad, 1st Indian Edition, 2010.
3. Systematic qualitative organic analysis: H. Middleton, Orient Longman.
4. A hand book of organic analysis: H. T. Clarke revised by B. Haymes, Arnold publishers
5. J. Mendham, R.C. Denney, J. D. Barnes and M. Thomas, *Vogel's Textbook of Quantitative ChemicalAnalysis*, 6th Edition, Pearson Education, Noida, 2013.
6. G. Svehla, *Vogel's Qualitative Inorganic Analysis*, Pearson Education Ltd. 7th Edition, 2009.
7. I. Vogel, "Elementary Practical Organic Chemistry Part-II, Qualitative Organic Analysis"**:** CBS Publishers & Distributers, New Delhi, 2nd Edition, 2004.
8. Hand book of Organic qualitative analysis by H. T. Clarke.
9. Practical Organic Chemistry**:** F. G. Mann and B. C. Saunders. Low – priced Text Book. ELBS, Longman.
10. Experimental organic chemistry: Vol-1 and Vol-II, P. R. Singh, D. S. Gupta and K. S.Bajpai, Tata Mc-Graw Hill.
11. Laboratory manual in organic chemistry: R. K. Bansal, Wiley Eastern Ltd.

(To add more books)

EVALUATION SCHEME
FOR
Major (Chemistry)

The evaluation scheme for each course contains two parts: *viz.,* internal (20% of each theory and practical paper) and external (80% of each theory and practical) evaluation.

I. THEORY PAPERS

INTERNAL EVALUATION

- **Components of Internal Evaluation**

Sl. No.	Component	Marks
1.	Attendance	2.5
2.	Assignment/Viva	1.5
2.	Test papers (I and II)	6
	Total Marks	10

- **Percentage of Attendance and Eligible Marks**

% of attendance	Marks
Above 90%	2.5
>80-90%	2
>70-80%	1.5
>60-70%	1
>50-60	0.5
Below 50%	0

- **Pattern of Test Papers**

There shall be internal evaluation for 20 marks for each theory paper and mark obtained is to be converted as per conversion given below. Questions to be asked from the units covered with equal weightage.

Duration	Pattern of question	Number of question	Number of questions to be answered	Marks
1 hour	One word/line	2	2	2
	Short	4	4	8
	Paragraph/Essay	4	2	10
			Total Marks	20

*Marks to be converted as follows: 80% and above = 6, 70 to below 80% = 6, 60 to below 70% = 4, 50 to below 60% =3, 40 to below 50% = 2, 30 to below 40% = 1, below 30% = 0.

EXTERNAL EVALUATION

External evaluation carries 80% marks. University examinations will be conducted at the end of each semester.

- **Pattern of Test Papers**

Duration	Pattern of question	Number of question	Number of questions to be answered	Marks
1 hour	One word/line	4	4	4
	Short	6	3	12
	Paragraph/Essay	6	3	24
			Total Marks	40

II. PRACTICAL PAPERS

INTERNAL EVALUATION

- **Components of Internal Evaluation**

Sl. No.	Component	Marks
1.	Attendance in lab	2.5
2.	Assignment/Viva	1.5
3.	Practical Record: Required number of experiments and neatness	2.0
4.	Test papers (I and II)	4
	Total	10.0

- **Percentage of Attendance and Eligible Marks**

% of attendance	Marks
Above 90%	2.5
>80-90%	2
>70-80%	1.5
>60-70%	1
>50-60	0.5
Below 50%	0

EXTERNAL EVALUATION

External evaluation carries 80% marks. University examinations will be conducted at the end of each semester.

- **Pattern of Question Papers**

Duration	Pattern of question	Marks
6 hour	Experiments	30
	Record	05
	Viva voce	05
	Total	40

III. PROJECT ON MAJOR

Project evaluation will be conducted at the end of sixth semester by external examiner. There will be no internal evaluation

Sl. No.	Criteria/component	Marks
1.	Content and relevance of the project	20
2.	Project report	40
3.	Project presentation	20
4.	Viva Voce	20
	Total Marks	**100**

Guidelines of project work

1. Students shall undertake the project work related to Chemistry/Chemical Sciences only.
2. The UG level project work is a group activity, maximum number of students being limited to four. However, each student shall prepare and submit the project report separately.
3. Head of the department must provide the service of a teacher for supervising the project work of each group. A teacher can guide more than one group, if necessary.
4. The students must complete the project in the 6^{th} semester and submit the same before the theory examination for evaluation.
5. Project work can be experimental or field study.
6. No two groups in the same institution are permitted to do project work on the same problem. Also the project must not be a repetition of the work done by students of previous batches.
7. Each group must submit a copy of the project report to keep in the department.
8. The project report must be either spiral bound or paper back.
9. The project report shall be divided as, Chapter I: Introduction, Chapter II: Review of literature, Chapter III: Scope of the research problem, Chapter IV: Materials and methods, Chapter V: Results and discussion, Chapter VI: Conclusion and suggestions, if any, and Chapter VII: Bibliography.