

# SYLLABUS

**B.Sc. III Year**



**JAI NARAIN VYAS UNIVERSITY  
JODHPUR**

## BOTANY 2016

### Theory

Course	Nomenclature	Number of Papers	Number of Periods per week	Maximum marks	Minimum marks
Paper I	Ecology and Environmental Biology	1	2	50	54
Paper II	Plant Physiology and Biochemistry	1	2	50	
Paper III	Plant Biotechnology and Molecular Biology	1	2	50	
PRACTICAL COURSE			6	75	27

Duration of examination of each theory papers

3 hours

Duration of examination of practicals

5 hours

### PAPER I: ECOLOGY AND ENVIRONMENTAL BIOLOGY

**Unit I:** Plants and Environment: Atmosphere (gaseous composition), water (properties of water cycle), light (global radiation, photosynthetically active radiation), temperature, soil (development, soil profiles, physico-chemical properties) and biota.

Morphological, anatomical and physiological responses of plants to water (hydrophytes and xerophytes) temperature (thermoperiodicity and vernalization), light (photoperiodism, heliophytes and sciophytes) and salinity

**Unit II:** Population ecology: Concept and characters, growth curves, biotic potential, ecotypes and ecads. Seed: The significance, suspended animation; ecological adaptation and dispersal strategies

Community ecology and Succession: Community characteristics, frequency, density, cover, life forms and biological spectrum. Succession: concept, classification and examples (hydrosere & xerosere)

**Unit III:** Ecosystems and Productivity: Ecosystem — Structure, abiotic & biotic components, food chain, food web, ecological pyramids, energy flow, biogeochemical cycles of carbon, nitrogen, phosphorus and Sulphur.

Productivity: Primary productivity, its measurements and factors affecting primary productivity

**Unit IV:** Environmental Biology of Indian Desert: Climate, vegetation types, adaptive strategies of desert plants. Desertification: meanings, causes, critical issues & driving forces. Agroforestry and its impact on desert agriculture. Desert biodiversity, Geomorphology, natural resources exploitation and their impact on desert environment

**Unit V:** Pollution Ecology: Definitions, classification, air, water and land pollution. Concepts of Industrial Ecology in pollution management. Global warming : Concepts and Current status.

Phytogeography: Vegetation types of India — Forest and Grasslands. Biogeographical regions of India, Remote sensing: The basics and applications in ecological studies

### Suggested Laboratory Exercises

1. To determine minimum number of quadrats required for reliable estimation of biomass in herbaceous vegetation
2. To study the frequency of herbaceous species and to compare the frequency distribution with Raunkaier's Standard frequency diagram
3. To estimate Importance Value Index for herbaceous vegetation on the basis of relative frequency, relative density and relative biomass in protected and Gochar land
4. To measure the vegetation cover of grassland through point frame
  5. To measure the above ground plant biomass in a natural field
6. To determine diversity indices (richness Simpson, Shannon-Weaver) in natural fields
  7. To estimate bulk density and porosity of soil samples
8. To determine moisture contents, water holding capacity and texture of soil samples
9. To estimate qualitatively nitrate, phosphate and potassium in soil samples
  10. To study the vegetation structure through profile diagram
  11. To estimate transparency and pH of different water bodies
12. To measure dissolved oxygen content in polluted and unpolluted water samples
13. To estimate salinity, hardness, carbonates and bicarbonate in different water samples
14. To determine the percent leaf area injury of different leaf samples collected around polluted site
15. To estimate dust holding capacity of the leaves of different plant species
16. Plant adaptive modifications: Specimens/Slides:
  - i) Succulents: *Opuntia*, *Euphorbia*
  - ii) Salt secretion: *Atriplex*, *Chloris*
  - iii) Salt accumulation: *Suaeda*, *Salsola*, *Zygophyllum*
- iv) Xerophytes: *Calligonum*, *Capparis*, *Leptadenia*, *Parkinsonia*
  - v) Hydrophytes: *Eichhornia*, *Nymphaea*, *Hydrilla*

### Suggested Readings

Dash, M.C. Fundamental of Ecology, Tata McGraw Hill Publishing Co. Ltd., New Delhi, 1996  
Kormondy, E.J. Concepts of Ecology, Prentice – Hall of India Pvt., New Delhi, 1996

Kumar, H.D. General Ecology, Vikash Publishing House Pvt. New Delhi, 1995  
Mukherjee, B. Environmental Biology, Tata McGraw Hill Publishing Co. Ltd., New Delhi, 1997  
Odum, E.P. Basic Ecology, Saunders, Philadelphia, 1983  
Sen, D.N. Environment and Plant Life in Indian Desert, Geobios International, Jodhpur, 1982  
Sharma, P.D. Ecology and Environment, Rastogi Publications, Meerut 2002

## PAPER II: PLANT PHYSIOLOGY AND BIOCHEMISTRY

- Unit I:** Plant-water relations: Importance of water to plant life; physical properties of water; diffusion and osmosis; absorption, transport of water and transpiration; physiology of stomata  
Mineral nutrition: Essential macro- and micro-elements and their role, mineral uptake; deficiency and toxicity symptoms  
Transport of organic substances: Mechanism of phloem transport; source-sink relationship; factors affecting translocation
- Unit II:** Photosynthesis: Significance; historical aspects; photosynthetic pigments; action spectra and enhancement effects; concept of two photosystems; Z-scheme; photophosphorylation; Calvin cycle; C<sub>4</sub> pathway; CAM plants; photorespiration. Rubisco and its regulation.
- Unit III:** Respiration: Aerobic and anaerobic respiration; Krebs's cycle; electron transport mechanism (chemi – osmotic theory); redox potential; oxidative phosphorylation pentose phosphate pathway  
Basics of enzymology: Discovery and nomenclature; characteristics of enzymes; concept of holoenzyme, apoenzyme, coenzyme and cofactors; regulation of enzyme activity; mechanism of action, Protein structures
- Unit IV:** Nitrogen and lipid metabolism: Biological Nitrogen fixation and metabolism. Importance of nitrate reductase and its regulation; ammonium assimilation. Structure and function of lipids; fatty acid biosynthesis;  $\beta$ -oxidation; saturated and unsaturated fatty acids; storage and mobilization of fatty acids
- Unit V:** Growth and development: Definitions; phases of growth and development. Seed dormancy, seed germination. Photoperiodism, physiology of flowering; florigen concept. biological clocks vernalization. physiology of senescence, fruit ripening. Plant Hormones-auxins, gibberellins, cytokinins, abscisic acid and ethylene, history of their discovery, Physiological role and mode of action. Photomorphogenesis; phytochromes and cryptochromes.

### Suggested Laboratory Exercises

1. To study the permeability of plasma membrane using different concentrations of organic solvents
2. To study the effect of temperature on permeability of plasma membrane
3. To prepare the standard curve of protein and determine the protein content in unknown samples
4. To study the enzyme activity of catalase and peroxidase as influenced by pH and temperature
5. Comparison of the rate of respiration of various plant parts
6. Separation of chloroplast pigments by solvent method
7. Determining the osmotic potential of *vacuolar sap* by plasmolytic method
8. Determining the water potential of *any tuber*

9. Separation of amino acids in a mixture by paper chromatography and their identification by comparison with standards
10. Bioassay of auxin, cytokinin, GA, ABA and ethylene using appropriate plant material
11. To study the regulation of stomatal movement using growth regulators, KCI and anti-transpirants

### **Suggested Readings**

- Dennis, D.T., Turpin, D.H., Lefebvre, D.D. and Layzell (eds.). Plant Metabolism (2nd ed.), Longman, Essex, England, 1997
- Galston, A.W. Life processes in Plants, Scientific American Library, Springer-Verlag, New York, USA, 1989
- Hopkins, W.G. Introduction to plant physiology, John Wiley & Sons, Inc., New York, USA, 1995
- Lea, P.J. and Leegood, R.C. Plant Biochemistry and Molecular Biology, John Wiley & Sons, Chichester, England, 1999
- Mohr, H. and Schopfer, P. Plant Physiology, Springer-Verlag, Berlin, Germany, 1995
- Salisbury, F.B. and Ross, C.W. Plant Physiology (4th ed.), Wadsworth Publishing Co., California, USA, 1992
- Srivastava, H.S. Plant Physiology, Rastogi Publication, Meerut, 2001
- Taiz, L. and Zeiger, E. Plant Physiology (2nd ed.), Sinauer Associates, Inc. Publishers, Massachusetts, USA, 1998

### **Suggested Readings**

(for Laboratory Exercises)

- Amar Singh. Practical Plant Physiology, Kalyani Publishers, New Delhi, 1977
- Moore, T.C. Research Experiences in Plant Physiology: A Laboratory Manual, Springer-Verlag, Berlin, 1974
- Nifa, A.J. and Ballou, D.P. Fundamental Laboratory Approaches for Biochemistry and Biotechnology, Fitzrierald Science Press, Inc., Maryland, USA, 1998
- Robalts and Tucker, G.A. (Eds.) Plant Hormone Protocols, Humana Press, New Jersey, USA, 2000
- Scot, R.P.W. Techniques and Practice of Chromatography Marcel Dekker, Inc., New York, 1995
- Wilson, K. and Goulding, K.H. A Biologists Guide to principles and techniques of Practical Biochemistry, Ed-ward Arnold, London, 1986

**Unit I:** Cell theory and concept of totipotency and pluripotency. Introduction,

History and application: plant tissue culture and biotechnology.

Genes, genomics, and proteomics: general introduction. Basic tools and techniques of molecular biology: History of genetic manipulation, restriction enzymes, ligases, electrophoresis (Agarose and PAGE) and PCR. General introduction and applications of DNA finger printing, bioinformatics and NanoBiotechnology.

**Unit II:** Bacterial and viral genome organization (with special reference to

plasmids and phage). Genetic recombination in bacteria. Vectors for gene cloning: p-BR322, p-UC18, Cosmids, Phagemids, BAC, PAC, YAC and HAC; c-DNA libraries. Detection and screening of recombinant DNA.

**Unit III:** General techniques of micropropagation. Fundamental and molecular aspects of organogenesis-somatic embryogenesis and androgenesis. Genetic basis of somaclonal variations and its applications. Protoplast isolation, fusion and somatic hybridization. Cryopreservation of germplasm.

Various types of bioreactors. Industrial production of secondary metabolites with special reference to *Ephedra* alkaloids, shikonin, diosgenin and *Vinca* alkaloids. Strategies used to optimize secondary metabolite production.

**Unit IV:** Genetic engineering of plants. *Agrobacterium* as a natural genetic engineer: molecular organization of genetic makeup, t-DNA transfer mechanism integration and expression in plants. Genetic engineering of nitrogen fixation; basic biology, prospects and future challenges. Direct method of gene transfer in plants: Chemical methods electroporation, particle gun delivery, lipofection, microinjection, macroinjection, pollen transformation, laser induced and silicon fiber mediated. Reporter (Luciferase, GUS and GFP) and marker genes.

**Unit V:** Biotechnology and society: Development of transgenic crop plants against biotic and abiotic stresses. Genetically modified crops: Golden rice, Bt cotton and Bt brinjal (as a model system). Molecular marker assisted plant breeding. Plant Breeder's Rights (PBR) and Intellectual Property Right (IPR) in current regime of WTO. Impact of GM crops on society and environment.

#### SUGGESTED LABORATORY EXERCISES

1. Demonstration of the technique of micropropagation by using different explants, e.g. auxiliary buds, shoot meristems
2. Demonstration of the techniques of anther culture
3. Isolation of protoplasts from different tissues using commercially available enzymes
4. Demonstration of root and shoot formation from the apical and basal portions of stem segments in liquid medium containing different hormones
5. Demonstrations/poster on GM Crops and related issues

#### Suggested Readings

- Bhojwani, S.S. Plant Tissue Culture: Application and Limitation, Elsevier Science Publishers, New York, USA, 1990
- Old, R.W. and Primrose, S.B. Principles of Gene Manipulation, Black well Scientific Publications, Oxford, U.K., 1986
- Raghavan, O. Embryogenesis in Angiosperms: A Developmental and Experimental Study, Cambridge University, Press, New York, USA, 1986

Vasil, I.K. and Thorpe, T.A. Plant Cell and Tissue Culture, Kluwer Academic Publishers, The Netherlands, 1994

#### SUGGESTED READINGS

(for Laboratory Exercises)

Ball, R.D. (ed.) Plant Cell Culture Protocols, Humana Press, Inc. New Jersey, USA, 1999

Dixon, R.A. (ed.) Plant Cell culture: a Practical Approach, IRL, Press Oxford, 1987

Glick, B.R. and Thompson, J.E. Methods in Plant Molecular Biology and Biotechnology, CRC Press, Boca Raton, Florida, 1993

Roberts, J. and Tucker, G.A. (eds.) Plant Hormone Protocols Humana Press, New Jersey, USA 2000.

## BIOTECHNOLOGY 2016

Max Marks: 50

### PAPER I: RECOMBIANT DNA TECHNOLOGY

**Unit I:** What is gene cloning and why do we need to clone gene? Tools and Techniques: Plasmid and other vehicle. Genomic-DNA, handling of DNA and RNA. Restriction enzymes and reagents. Laboratory techniques and other requirements.

**Unit II:** Safety measures and related regulations for recombinant DNA work, choice and selection of the tools and techniques. Vehicles: Plasmids and bacteriophages, available phagemids, cosmids and viruses.

**Unit III:** Purification of DNA from bacteria, plant and animal cells. Manipulation of purified DNA. Introduction of DNA into living cells. Cloning vectors for *E-coli*.

**Unit IV:** Cloning vectors for organism other than *E-coli*, yeast, fungi, plants- agro bacteria, plants viruses and animal viruses. Applications of cloning in gene analysis- how to obtain a clone of a specific gene, studying gene location and structure, studying gene expression.

**Unit V:** Gene cloning and expression of foreign genes in research and biotechnology. Production of protein from cloned genes. Gene cloning in medicine: Pharmaceutical compounds, artificial insulin gene, recombinant vaccine, and diagnostic reagents.

### PAPER II: PLANT BIOTECHNOLOGY

Max Marks: 50

**Unit I:** Introduction to in-vitro methods. Terms and definitions. Use of growth regulators. Beginning of in-vitro cultures in India (Ovary and Ovule culture), in-vitro pollination and fertilization. Embryo culture, embryo rescue after wide hybridization and its application.

**Unit II:** Introduction to processes of embryogenesis and organogenesis and their practical applications. Clonal multiplication of elite species (micropropagation) through axillary bud, shoot tip and meristem culture Haploids and their applications. Somaclonal variation and their applications.

**Unit III:** Endosperm culture and production of triploids. Single Cell suspension culture and their application in selection of variant mutants with or without mutagen treatment (of haploid cultures preferably).

**Unit IV:** Testing of viability of isolated protoplasts, various steps in the isolation and regeneration of protoplasts.

Somatic hybridization – Introduction, various methods of fusion of protoplasts (chemical and electrical), use of markers for selection of hybrid cells.

**Unit V:** Practical application of somatic hybridization (hybrids/cybrids). Use of plant cell, protoplasts and tissue culture for genetic manipulation of plants. Introduction to *Agrobacterium tumefaciens*: Tumour formation on plants using *A. tumefaciens* (monocots v/s dicots)

Hairy Root formation using using *Agrobacterium rhizogenes*

Practical applications of genetic transformation.

Plant genomics (e.g. Rice, Arabidopsis)

### **PAPER III: ENVIRONMENTAL AND ANIMAL BIOTECHNOLOGY**

Max Marks: 50

**Unit I:** General metabolism of animal cells. Special secondary metabolites/products (Insulin, growth hormone, Interferon, t- plasminogen activator, and factor VIII ) Expressing cloned proteins in animal's cells. Over production and processing of chosen protein: The need to express in animal cells.

**Unit II:** Production of vaccines in animal cells. Production of monoclonal antibodies. Growth factors promoting proliferation of animal cells (EGF, FGF, PGDF, IL-1, IL-2, NGF, and Erythropoietin). Bioreactors for large-scale culture of cells. Transplanting cultured cells.

**Unit III:** Renewable and Non-Renewable resources. What is Renewable should be Bio-assimilable / Biodegradable. Major consumable items: Food, Fuel and Fibers. Conventional Fuels and their Environmental impacts: Fire wood, Plant and Wastes, coal, gas, animal oils. Modern fuel and their environmental impacts: Methanogenic bacteria and biogas, microbial hydrogen production, conversion of sugars to ethanol the gasohol experiment, Solar energy converters - hopes from the photosynthetic pigments, plant based petroleum industry, cellulose degradation for combustible fuel.

**Unit IV:** Biotechnological inputs in producing good quality and natural fibers- transgenic animals and transgenic plants. Microbial quality of food and water .Treatment of municipal waste and industrial effluents.

Degradation of Pesticides and other toxic chemicals by micro organisms. Thuringiensis toxin as a natural pesticide, Biological control of other insects swarming the agricultural fields. Enrichment of ores by microorganisms, Biofertilizers. Nitrogen fixing microorganisms enrich the soil with assimilable nitrogen.

**Unit V:** Biodiversity and its conservation: Alpha- and Beta-biodiversity, steps to preserve biodiversity, in-situ and ex-situ conservation.

Intellectual property, IPR, and plant genetic resources, TRIPS and GATT

Patenting: Patenting of genetic material, obligations and complications, current issues:

• Ethics, Environmental safety. Risk assessment of GEOs (Genetically Engineered Organisms), Plant Breeder's right and farmer's rights.

#### **Practical**

1. Initiating Plant tissue culture: differentiation of explants.
2. Growth of plant cells into undifferentiated mass
3. Large-scale cultivation of plant cells in suspension
4. Induction of differentiation by modulating the hormonal balance

5. Culture of lymphocytes from blood samples
6. Preparation of media, filler sterilization, monitoring microbial contamination (bacteria, fungi & mycoplasma)
7. Cloning of animal cells by cell and colony purification
8. Fusion of cultured cells with myeloma cells.

### Books Recommended

Old & Primrose: Principles of gene manipulation, Blackwell Scientific Publications  
 Sambrose & Russell: Molecular cloning CSH Press  
 Ausber: Current protocols in molecular biology CSH Press  
 Michel: Introduction to environmental microbiology  
 B.D. Singh Plant Breeding: Kalyani Publisher  
 Alexander, M: Microbial Ecology, John Wiley & sons  
 EC Eldowney, Hardman & Waite: Pollution Ecology biotreatment- Longman Scientific Technical  
 Baker & Herson - Bioremediation –Tata McGraw Hill  
 P.C. Debergh & R.H. Zimmermann: Micropropagation Technique & Applications. Kluwer Academic Publishers  
 K. Lindsey & M.G. K. Jones: Plant Biotechnology in Agriculture  
 R.A. Meyers: Molecules Biology & Biotechnology VCH Publishers N.Y.  
 B. D. Singh: Plant Biotechnology, Kalyani Publishers  
 Indra K Vasil & Trevar A Thorpe: Plant Cell & Tissue Culture, Kluwer Academic Publishers  
 S.S Bhojwani & M.K. Razdan: Plant Tissue Culture Theory & Practice, Elsevier

### Practical

	Time 5:00 hr
	Max. Marks: 75
	Min. Marks: 27
1. Preparation of nutrient medium and its sterilization	13
2. Preparation of explant (pretreatment), sterilization and inoculation for the given tissue culture technique	08
3. Identification of microbial contamination in the given nutrient medium	07
4. Identify & comment upon the Spots (1 to 6)	27
5. Viva- Voce	10
6. Practical Record	10

### CHEMISTRY 2016

#### PAPER I: CH – 301 INORGANIC CHEMISTRY – III

##### Unit I: Metal-Ligand bonding in transition metal complexes:

Valence bond theory of complexes and its limitation, Crystal field theory, Crystal field splitting of energy levels in octahedral, tetrahedral and square planar complexes, crystal-field stabilization energy of octahedral complexes (Calculation Only).

**Unit II: Hard and soft Acid Base Concept (HSAB):** Classification of acid and base as hard and soft. Pearson's HSAB concept and its application.

**Magnetic properties of transition metal complexes:** Types of magnetic behaviour, magnetic properties of metal complexes, spin only formula, methods of determining magnetic moment and magnetic susceptibility.

**Unit III: Stability of metal complexes:** A brief outline of thermodynamic stability of metal complexes and factors affecting the stability. Kinetic stability, labile and inert complexes, colour of transition metal complexes, effective atomic number (EAN), pi acceptor ligands, experimental determination of stability constant and composition of complex (Job's Method and Bjerrum's Method).

**Unit IV: Organometallic Chemistry:** Definition, nomenclature and classification of organometallic compounds, bonding, preparation, properties and application of organometallic compounds of Li, Al, Hg and Sn (alkyls and aryl).

**Bioinorganic Chemistry:** Essential and trace elements in biological processes, Biological role of alkali (Na, K, Li) and alkaline earth (Mg, Ca) metals.

**Unit V: Basic principles of Metallurgy and metallurgical processes.**

Metallurgy of Copper, Zinc, Platinum and Uranium from their main ores.

**Books Recommended:**

1. Inorganic Chemistry Part I and part II by N.C.Sogani, M.L.Sharma, G.K.Rastogi
2. Inorganic Chemistry by G.C.Shivhare, V.P.Lawania
3. Text Book of Inorganic Chemistry by P.L.Soni
4. Text Book of Inorganic Chemistry by Satya Prakash, Tuli & Madan

**PAPER II: CH-302 ORGANIC CHEMISTRY**

**Unit I: Spectroscopy**

**Nuclear magnetic resonance (NMR) spectroscopy.**

Proton magnetic resonance ( $^1\text{H}$  PMR) spectroscopy, nuclear shielding and deshielding, chemical shift and molecular structure, spin-spin splitting and coupling constants, areas of signals, interpretation of PMR spectra of simple organic molecules such as ethyl bromide, acetaldehyde, 1,1,2-tribromoethane, ethyl acetate, toluene and acetophenone.

**Unit II: Heterocyclic Compounds**

Introduction: Molecular orbital picture and aromatic characteristics of pyrrole, furan, thiophene and pyridine. Methods of synthesis and chemical reactions with particular emphasis on the mechanism of electrophilic substitution. Mechanism of nucleophilic substitution reactions in pyridine derivatives. Comparison of basic nature of pyridine, piperidine and pyrrole.

Introduction to condensed five and six-membered heterocycles. Preparation and reactions of indole, quinoline and isoquinoline with special reference to Fisher indole synthesis, Skraup synthesis and Bischler-Napieralski synthesis. Mechanism of electrophilic substitution reactions of indole, quinoline and isoquinoline.

**Unit III: Carbohydrates**

Classification and nomenclature. Monosaccharides, interconversion of glucose and fructose, chain lengthening and chain shortening of aldoses. Configuration of monosaccharides. Erythro and threo diastereomers. Conversion of glucose into mannose, mechanism of osazone formation, Formation of glycosides, ethers and esters. Cyclic

structure of D(+)-glucose. Determination of ring size of monosaccharides, Mechanism of mutarotation. Structures of ribose and deoxyribose.

An introduction to disaccharides (maltose, sucrose and lactose) and polysaccharides(starch and cellulose)without involving structure determination.

#### **Unit IV: Amino Acids, Peptides, Proteins and Nucleic Acids**

Classification, structure and stereochemistry of amino acids; Acid-base behavior, isoelectric point, electrophoresis and separation of amino acids by chromatography.

Preparation and reactions of  $\alpha$ -amino acids. Structure and nomenclature of peptides and proteins. Classification of proteins. selective hydrolysis of peptides. Classical peptide synthesis, solid-phase peptide synthesis. Peptide structure determination, end group analysis, Structures of peptides and proteins. Levels of protein structure. Protein denaturation/renaturation.

**Nucleic acids:** introduction. Constituents of nucleic acids. Ribonucleosides and ribonucleotides. The double helical structure of DNA.

**Unit V: Fats, Oils, Detergents and Synthetic Polymers :** Natural fats, edible and industrial oils of vegetable origin, common fatty acids, glycerides, hydrogenation of unsaturated oils. Saponification value, iodine value, acid value. Soaps, synthetic detergents, alkyl and aryl sulphonates. Addition or chain-growth polymerization. Free radical vinyl polymerization, ionic vinyl polymerization, Ziegler-Natta polymerization and vinyl polymers. Condensation or step growth polymerization. Polyesters, polyamides, phenol formaldehyde resins, urea formaldehyde resins, epoxy resins and polyurethanes

#### **Books Recommended:**

1. Advanced Organic Chemistry by Morrison & Boyd
2. Organic Chemistry by Behal & Behal
3. Text Book of Organic Chemistry by M.K. Jain
4. Polymer Chemistry by P. Bahadur and N.V. Shastri.

### **PAPER III: CH-303 PHYSICAL CHEMISTRY – III**

#### **Unit I:** Elementary Quantum Mechanics

Black-body radiation, Planck's radiation law, photoelectric effect. Compton effect, De Broglie hypothesis, the Heisenberg's uncertainty principle, Schrodinger wave equation and its importance, physical interpretation of wave function.

Adsorption: Difference between adsorption, absorption and sorption, Chemisorption, adsorbent and adsorbate, reversible and irreversible adsorption, characteristics of adsorption, adsorption of gases by solids, factors affecting adsorption, types of adsorption, types of adsorption isotherms, Freundlich and Langmuir adsorption isotherms. Numericals

#### **Unit II:**Spectroscopy

Introduction: electromagnetic radiation, regions of the spectrum, Basic features of different Spectrometers, Born-Oppenheimer approximation, degrees of freedom.

Rotational Spectrum: Diatomic molecules, Energy levels of a rigid rotator (semi-classical principles), selection rules, spectral intensity, distribution using population distribution (Maxwell-Boltzmann distribution) determination of bond length, qualitative description of non-rigid rotator, isotope effect. Numericals.

### **Unit III: Vibration and Raman Spectroscopy**

Vibrational Spectrum: Infrared spectrum: Energy levels of simple harmonic oscillator, selection rules, pure vibrational spectrum, intensity, determination of force constant and qualitative relation of force constant and bond energies, effect of anharmonic motion and isotope on the spectrum.

Raman Spectroscopy: concept of polarizability, pure rotational and pure vibrational Raman spectra of diatomic molecules, selection rules. Numericals.

### **Unit IV: Electronic Spectrum:** Origin of electronic spectrum, Selection rules, vibrational course structure and rotational fine structures considering no interaction of rotational and vibrational energies. qualitative description of selection rules and Franck-Condon principle.

Photochemistry: Interaction of radiation with matter, difference between thermal and photochemical processes. Laws of photochemistry: Grothus – Drapper law, Stark – Einstein law, Jablonski diagram depicting various processes occurring in the excited state, qualitative description of fluorescence, phosphorescence, non-radiative processes (internal conversion, intersystem crossing), quantum yield, photosensitized reactions – energy transfer processes ( simple examples). Numericals

### **Unit V: Solid State**

Crystal state, classification of crystals, space lattice, unit cell.

Laws of crystallography – (i) Law of constancy of interfacial angles (ii) Law of rationality of indices (iii) Law of symmetry. Symmetry elements in crystals.

X-ray diffraction by crystals. Derivation of Bragg equation. Determination of crystal structure of NaCl, KCl and CsCl (Laue's method and powder method). Numericals.

### **Books Suggested:**

1. The Elements of Physical Chemistry, P.W. Atkins, Oxford.
2. Physical Chemistry Through problems, S.K. Dogra and S. Dogra, Wiley Eastern
3. Ltd.
4. Principles of Physical Chemistry, B.R. Puri, L.R. Sharma and M.S. Pathania,
5. Shobhan Lal Nagin Chand & Co.
6. Physical Chemistry by S.C.Ameta, A.V.Singh, R.Ameta, R.Mathur
7. Bhotic Rasayan by K.R. Genwa, RBD, Jaipur.

## CH 304 Laboratory Course – III

### Inorganic Chemistry:

#### **Preparations: [5]**

Micro cosmic salt., Tetraaminecopper(II) sulphate, Nickel ammonium sulphate, Sodium thiosulphate, Chrome Alum, Ferrous Sulphate, Ferrous Ammonium Sulphate

### Organic Chemistry:

- (a) **Qualitative Analysis:** - Analysis of an organic mixture is containing two solid components, using water,  $\text{NaHCO}_3$  and  $\text{NaOH}$  for separation. [15]
- (b) **Synthesis of organic compounds:-** [10]
- Acetylation of salicylic acid, aniline and p-nitroacetanilide.
  - Preparation of iodoform from ethanol and acetone.
  - Diazotization/Coupling of primary aromatic amines (aniline).
  - Preparation of methyl orange.
- (c) **Thin Layer Chromatography** [10]
- Separation of dyes
  - Separation of green leaf (Spinach) pigments.

### Physical Chemistry

[15]

- (a) **Colloids:** To determine precipitation value for the following sols and also verify Hardy's Schultz law (i)  $\text{As}_2\text{S}_3$  Sol (ii)  $\text{Fe}(\text{OH})_3$  Sol.
- (b) **Distribution law:** To determine the partition coefficient of benzoic acid between water and benzene at R.T.
- (c) **Adsorption:** To study the adsorption of acetic acid by activated charcoal and verify the Freundlich adsorption isotherm.

### **Viva**

[5]

### **Record**

[15]

### **Books Suggested (Laboratory Courses):**

- Practical Chemistry, S.Giri, D.N.Bajpai and O.P.Pandey Publ. S. Chand
- Experimental Organic Chemistry Vol I & II, P.R. Singh, D.S. Gupta and K.S. Bajpai, Tata McGraw Hill.
- Laboratory Manual in Organic Chemistry, R.K. Bansal, Wiley Eastern.
- Vogel's Textbook of Practical Organic Chemistry, B.S. Furniss, A.J. Hannaford, V. Rogers, P.W.G. Smith and A.R. Tatchell, ELBS.
- Experiments in General Chemistry, C.N.R. Rao and U.C. Agarwal, East-West Press.
- Experiments in Physical Chemistry, R.C. Das and B. Behra, Tata McGraw Hill.
- Advanced Practical Physical Chemistry, J.B. Yadav, Goel Publishing House.
- Advanced Experimental Chemistry, Vol. I-Physical, J.N. Gurtu and R. Kapoor, S. Chand & Co.

### **Examination & Marking Scheme**

Time: 5 hours

Max. Marks: 75

Min. Pass Marks: 27

Regular Student	Ex- Student		
Inorganic Preparation		05	05
Qualitative Analysis		15	15
Organic Synthesis		10	10
Chromatography		10	10
Physical Experiment		15	15
Viva- Voice		5	5
Sessional and Record		15	...

Total 75

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60\*  
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\*To be converted out of 75

## GEOLOGY 2016

Theory		
Paper I	Economic Geology	50 Marks
Paper II	Structural Geology	50 Marks
Paper III	Applied Geology	50 Marks
Practicals	: Practical Examination	75 Marks
		<hr/>
		Total 225 Marks
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Duration of each theory paper Examination

3 Hrs.

Duration of Practical Examination

3 Hrs.

### PAPER I : ECONOMIC GEOLOGY

**Unit I:** Ore forming process and deposits : Magmatic Concentration, Pegmatite, Contact metasomatism (including Skarns), Hydrothermal process and deposits.

**Unit II:** Ore forming process and deposits : Sedimentation (Chemical Precipitation and Evaporation), Weathering (Residual and Mechanical Concentration), Oxidation and Supergene sulphide enrichment. Volcanogenic, Metamorphic and Biogenic Process and deposits.

**Unit III:** Geological setup and economic aspects of ( a ) Gold deposits of India (including Kolar Gold Field), ( b ) Lead Zinc and Copper deposits of India (including Zawar, Rajpura-Dariba, Malanjkhand, Khetri and Singhbhum deposits) ( c ) Iron and manganese deposits of India ( d ) Aluminium, Chromium, Tin and Tungsten deposits of India.

Physical properties, mode of occurrence and genesis, Indian location and economic use of following Ore minerals : Native Gold, Galena, Sphalerite, Chalcopyrite, Limonite (Gossan), Magnetite, Hematite, Pyrolusite, Psilomelane, Wed Ore, Bauxite, Chromite, Wolframite and Cassiterite.

**Unit VI:** Description of minerals used in the industries including, Cement, Fertilizer, Refractory, Abrasive, and Gem Stones.

Introduction of mineral used in industries including, Glass and Ceramics, Paint and Pigments, Insulator, Electronic and Building Stones.

Physical properties, mode of occurrence and genesis, economic use and Indian location of following industrial minerals and rocks : Apatite, Phosphorite, Pyrite, Gypsum, Diamond, Zircon, Kyanite, Magnesite, Garnet, Corundum, Quartz, Feldspar, Asbestos, Wollastonite, Talc, Fluorite, Barite, Muscovite, Ochur, Malachite, Azurite, Graphite. Limestone, Marble and Granite.

**Unit V:** Energy Minerals : (A) Coal : Proximate and ultimate analysis of coal, classification of coals, ranks of coal, Origin of coal. Indian coal fields (B) Petroleum : Origin of Petroleum. Petroleum geology of Bombay High, Cambay basin, Northeastern India and Barmer-

Sanchar basin, (C) Nuclear Minerals : Types and Origin of various uranium and Thorium deposits. Geology of Jaduguda uranium deposit. Coastal Thorium Sand deposits.

### **PAPER II : STRUCTURAL GEOLOGY**

- Unit I:** Concept of Bed, Dip and Strike, True and Apparent dips. Toposheet, Clinometer, Brunton compass. Geological Map definition and components. Methods of geological mapping in the field. Determination of thickness of bed, dip and strike in the Geological map. Preparation of cross section of Geological maps.
- Unit II:** Determination of top and bottom of Sedimentary beds. Outlier, Inlier, Overlap and Offlap structures. Stereographic projection and its use in Structural analysis.
- Unit III:** Fold : Definition and morphology. Geometric and genetic classifications. Elementary idea about mechanism of folding. Recognition of folds in map and field.
- Unit IV:** Faults : Definition. Terminology of parts. Classifications. Effect of faulting on outcrops. Recognition of faults in map and field.
- Unit V:** Unconformities : types and recognition. Joints : Characteristics and Types. Cleavage, Schistosity and Lineation : types and their significance to recognize the major structures.

### **PAPER III : APPLIED GEOLOGY**

- Unit I:** Environmental Geology : Concept of natural ecosystem, Interaction and interrelation of Atmosphere, Hydrosphere, Lithosphere and Biosphere. Soils. Hydrological cycle. Remote Sensing : Fundamentals of Remote Sensing. Preparation and study of areal photographs for Geomorphology, Structural geology and Lithology. Preparation of Geological map using Remote sensing. Applications of Remote sensing.
- Unit II:** Groundwater hydrology : Groundwater and Surface water reservoirs. Aquifer, Aquiclude and Aquifuge. Darcy's law and its validity. Groundwater provinces of Rajasthan and India. Watershed management and linking of rivers. Quality of groundwater.
- Unit III:** Engineering Geology :Types and terminology of Dams and Tunnels. Geological considerations to locate dams and tunnels including (a) structural geology (b) Lithology and (c) Groundwater.
- Geological disasters : Earthquakes and Tsunami, Volcano, Flood and Landslide.
- Unit VI:** Mineral exploration : Surface and subsurface exploration methods. Remote sensing and exploratory mapping. Geophysical exploration : Gravity, Electrical, Magnetic, and Seismic methods of exploration. Geobotanical and geochemical methods of exploration. Drilling: Types, logging and problems.
- Unit V:** Principles of mineral economics : National policy. Strategic, critical and essential minerals. mineral production in India. Changing pattern of mineral consumption. Mineral concession rules. Marine mineral resources and Law of sea.

### **PRACTICALS**

1. Physical properties, mode of occurrence and genesis, Indian location and economic use of Metallic minerals\_(ores).
2. Physical properties, mode of occurrence and genesis, Indian location and economic use of Non Metallic (industrial Minerals) and Coals.
3. Preparation of map showing distribution of important economic deposits.
4. Preparation of Cross section of Geological maps and/or completion of outcrop maps.

5. Use of Stereographic projections for Structural geology.
6. Sessional Marks.

### SUGGESTED READING

- Jenson M and Bateman A M 'Economic Mineral Deposits'. John Wiley and Sons Newyork.
2. Gokhle KV and GK Rao 'Ore Deposits of India,. Thomson Press
  3. Vyas GK 'Arthik Bhu Vigyan'. Madhya Pradesh Hindi Granth Academy
  4. Manjrekar RP 'Arthik Evam Vyavharik Bhu Vigyan'. Madhya Pradesh Hindi Granth Academy
  - Rakshpal R. 'Bharat ki Khaniz Sampda Evam Udyog'. Rajasthan Hindi Granth Academy
  6. Billings M. P. 'Structural Geology'
  - Shrivastava D.K. Sanrachnatmak Bhu Vigyan Madhya Pradesh Hindi Granth Academy
  8. Arogyaswami RNP 'Mining Geology' CBS publishers
  9. Todd 'Groundwater Hydrology'
  10. Todd D. K. 'Bhaum Jal Vigyan' Madhya Pradesh Hindi Granth Academy
  11. Satyanarayan Swami B. S. 2000 : 'Engineerig Geology' Dhampat Rai and Cop Delhi
  - Pandey SN 1987 'Principles and Applications of Photogeology' Wiley Eastern New Delhi

## PHYSICS

### THEORY

			Pd/W (45mts.)	Exam. Hours	Max. Marks
					150
Phy.301	Paper I	Solid State Physics	2	3	50
Phy.302	Paper II	Nuclear Physics	2	3	50
Phy.303	Paper III	Relativity and Electrodynamics	2	3	50

### PRACTICAL

6 5 75

**TOTAL: 225**

### PAPER I : SOLID STATE PHYSICS

Note: The question paper for the examination will be divided in three parts i.e., Section – A, Section – B and Section – C.

**Section – A:** Will consist of 10 compulsory questions. There will be two questions from each unit and answer of each question shall be limited upto 30 words. Each question will carry 1 mark.

**Section – B:** Will consist of 10 questions. Two questions from each unit will be set and students will answer one question from each Unit. Answer of each question shall be limited upto 250 words. Each question carry 3.5 marks.

**Section – C:** Will consist of total 05 questions. The paper setter will set one question from each Unit and students will answer any 03 questions and answer of each question shall be limited upto 500 words. Each question will carry 7.5 marks.

**Unit I:**Crystal structure : Different terms of crystal structure, Fundamental types of lattices, Two and three dimensional lattice types; Seven system of crystals, Characteristics of sc, bcc, fcc, hcp; Miller indices, orientation of planes in cubic lattices; Distribution of Atoms in atomic planes of cubic lattices. Distance between successive planes; Von-Laue's equations of diffraction of X-rays, Bragg's Law, scattering from lattice of point-atoms. Scattering factor. Geometrical Scattering factor for sc, bcc, fcc. Reciprocal lattice and its properties.

**Unit II:**Crystal binding and lattice vibrations : Inter-atomic forces of solids. Crystal of inert gases, cohesive energy and bulk modulus. Ionic crystals, Madelung energy and bulk modulus. Covalent crystals. Hydrogen bonded crystals, Atomic radii. Concept of phonons Vibration of monatomic lattices, lattice with two atoms per primitive cell. Local phonon modes. Density of states in one dimension, three dimensions, lattice heat capacity for Einstein model, Debye model.

**Unit III:**Free Electron theory of metals : Free electron model, Density of states of electron gas, Fermi-Dirac distribution function, effect of temperature on Fermi-Dirac distribution function, Fermi energy at absolute zero temperature and low temperature. Electron heat capacity. Thermionic emission. Boltzmann transport equation, Sommerfeld theory of electrical conductivity, Thermal conductivity, Wiedmann-Franz Law. Hall effect.

**Unit IV:**Band theory: Formation of bands and origin of energy gap, Bloch theorem, Kronig Penney model, crystal momentum and velocity of an electron. Effective mass of electrons. Electrons and holes. Number of states in a band, insulator, semi-conductor and metal. Construction of Brillouin Zones and Fermi-surfaces. Fermi levels in intrinsic, n- type and p- type semi-conductors, Mass action Law. The static dielectric constants of solids. Local electric field at an atom.

**Unit V:**Magnetism : Diamagnetism and Larmor precession, classical theory of diamagnetism, Para-magnetism and its classical theory, free electron theory. Molecular theory of ferromagnetism.

Experimental Survey of Superconductivity : Zero resistance, persistent currents, effect of magnetic fields, flux exclusion, Intermediate state, Entropy effect, frequency effects, Gyromagnetic ratio, Isotope effect. Occurrence of superconductivity. Thermoelectric effects, thermal conductivity. High temperature oxide, superconductors and their properties. BCS theory (elementary idea without mathematical derivation), Magnetic levitation.

**Books Suggested:**

1. Kittel: Introduction to Solid State Physics, Wiley Eastern.
2. A.J. Dekker: Solid State Physics, McMillian India.
3. L. Azaroff: Theory of Solids.

**PAPER II: NUCLEAR PHYSICS**

Note: The question paper for the examination will be divided in three parts i.e., Section – A, Section – B and Section – C.

**Section – A:** Will consist of 10 compulsory questions. There will be two questions from each unit and answer of each question shall be limited upto 30 words. Each question will carry 1 mark.

**Section – B:** Will consist of 10 questions. Two questions from each unit will be set and students will answer one question from each Unit. Answer of each question shall be limited upto 250 words. Each question carry 3.5 marks.

**Section – C:** Will consist of total 05 questions. The paper setter will set one question from each Unit and students will answer any 03 questions and answer of each question shall be limited upto 500 words. Each question will carry 7.5 marks.

**Unit I:** Rutherford scattering and Rutherford's nuclear model. Constituents of nucleus, discovery of neutron. Mass of proton and neutron. Measurement of charge radius (i) by Hofstadter experiment, (ii) by electron scattering method, (iii) by Mesonic X-ray Method. Measurement of potential radius (i) from lifetime of  $\alpha$ -emitters (ii) from neutron scattering experiment. Variation of nuclear radius with mass number A. Nuclear spin and parity, Magnetic dipole moment of nuclei, Rabi's method for determination of nuclear magnetic moment. Electric quadrupole moment of nucleus.

**Unit II:** Mass defect, Mass difference, packing fraction and binding energy of nucleus. Plot of binding energy per nucleon against mass number. Liquid drop model of Nucleus. WEIZSACHER's Semi Empirical Mass formula (Volume, Surface, Coulomb – asymmetry and pairing energy terms). Prediction of stability against beta-decay for members of an isobaric family. Stability limits against spontaneous fission. Energetic of Symmetric fission.

**Unit III:** The law of radioactive decay, statistical nature of radioactivity. Radio active growth and decay. Ideal equilibrium, transient equilibrium and secular equilibrium Radioactive series. Types of nuclear reactions (only qualitative statement). The balance of Mass and energy in nuclear reactions. Q equation. Solution of the Q equations, concept of centre of mass in nuclear reaction, view of proton-proton collision and neutron-nucleus collision in CM frame.

**Unit IV:** Alpha decay: Disintegration Energy, Range of  $\alpha$ -particles, Geiger Nuttal's Law.  $\alpha$ -spectrum and fine structure. Long range  $\alpha$ - particles,  $\alpha$ - particles paradox–Barrier penetration, Gamow Theory of  $\alpha$ -emission. Beta Decay:  $\beta$ -ray spectrometer (principle and working).  $\beta$ -ray spectrum ;and its qualitative explanation.

Nuclear Energy: Nuclear induced fission, energy released in fission of U 235. Fission chain reaction, Neutron cycle in a thermal reactor. Four factor formula. Elementary idea of nuclear reactors. Nuclear fusion; fusion in stars, carbon and pp cycle problems of controlled fusion.

**Unit V:** Radiation Detectors: Introduction of various Methods used in detection of nuclear radiation. Detailed description of principle and working of following detectors based on detection of free-charge carriers – (i) Ionization Chamber, (ii) Proportional Counter, [iii) Geiger-Muller Counters, dead time, recovery time and paralysis time.

Particle accelerators: Principle and working of Vande-Graff Generators Cyclotron and linear accelerators.

Elementary Particles: Properties of particles, Classification into leptons, mesons and baryons, conservation laws (only qualitative discussion) energy, momentum, angular momentum, charge, Lepton numbers, Iso-spin, Strangeness and Baryon number. Quark model (only qualitative idea).

**Books suggested:**

4. Alonso & Finn: Fundamental University Physics – Vol. III, Addison Wesley.
5. S.N. Ghoshal : Atomic & Nuclear Physics – Vol. II, S. Chand, New Delhi.

**PAPER III: RELATIVITY AND ELECTRODYNAMICS**

Note: The question paper for the examination will be divided in three parts i.e., Section – A, Section – B and Section – C.

**Section – A:** Will consist of 10 compulsory questions. There will be two questions from each unit and answer of each question shall be limited upto 30 words. Each question will carry 1 mark.

**Section – B:** Will consist of 10 questions. Two questions from each unit will be set and students will answer one question from each Unit. Answer of each question shall be limited upto 250 words. Each question carry 3.5 marks.

**Section – C:** Will consist of total 05 questions. The paper setter will set one question from each Unit and students will answer any 03 questions and answer of each question shall be limited upto 500 words. Each question will carry 7.5 marks.

**Unit I:** Electromagnetic Waves: Displacement current, Maxwell's equations, Electromagnetic wave equation, Poynting theorem, Plane Electromagnetic waves in free space, wave impedance of free space, Propagation of plane Electromagnetic waves in non-conducting and conducting media, Skin depth, propagation of Electromagnetic waves in ionized gases, Polarization of Electromagnetic waves.

**Unit II:** Reflection and Refraction of Electromagnetic waves: Boundary conditions at the surface of discontinuity, reflection and refraction of Electromagnetic waves at the interface of non-conducting media, Fresnel's equations and their experimental verification, reflection and transmission coefficients, Brewster's Law and degree of polarization, total

internal reflection, phase difference between parallel and perpendicular components and polarization of the reflected wave, reflection from a conducting plane.

**Unit III:** Interaction of Electromagnetic waves with matter: Normal and anomalous dispersion of light, empirical relations, Lorentz theory of dispersion of gases, experimental demonstration of anomalous dispersion in gases, scattering of electromagnetic waves and scattering parameters, Thomson, resonant and Rayleigh's scattering cross-section, polarization of scattered light, coherent and incoherent scattered light, dispersion in liquids and solids, Clausius Mossotti equation and Lorentz-Lorentz formula.

**Unit IV:** Relativistic Mechanics: Coordinate transformation, contravariant and covariant vectors, tensors of second and higher rank, addition, subtraction, contraction, outer and inner product of tensors, covariance of tensor equations, Minkowski space, geometrical interpretation of Lorentz transformation, space like and time like intervals, four vectors, four dimensional gradient, divergence and curl operators, four-velocity, four-acceleration, four-momentum, four-force, relativistic classification of particles.

**Unit V:** Relativistic Electrodynamics: Invariance of charge, transformation of surface charge density, transformation of volume-charge density and current density, Equation of continuity in the covariant form, Scalar and vector potentials, Transformation of Electromagnetic potentials, Lorentz condition and its covariant form, Electromagnetic field tensor, Covariance of Maxwell's equations, Transformation of Electro-Magnetic fields, Lorentz-force in a covariant form, Electromagnetic field due to a moving charge.

**Books suggested:**

6. S.P. Puri: Electrodynamics, Tata McGraw Hill.
7. J.D. Jackson: Classical Electro-dynamics, John Wisely, New York
8. B.B. Laud: Electromagnetic, John Wisely, New York
9. E.C. Jordan: Electromagnetic waves, PHI, New Delhi
10. D. J. Griffiths: Introduction to Electrodynamics, PHI

**Practicals**

Note: These Practicals are divided into three sections, Lab. A, Lab. B & Lab. C.

1. Lab. A is for all students.
2. Lab. B is only for the students having Electronics as an optional subject in B. Sc.
3. Lab. C is for all the students except those who offer Electronics as an optional subject.

Examination Scheme for Laboratory Work:

1. Students with Electronics shall be examined in one experiment from each of Lab. A and Lab. B.
2. Students with Combinations not involving Electronics shall be examined in one experiment of Lab. A and one experiment from Lab. C

**LAB. A: PHYSICS PRACTICALS**

1. Determination of Planck's constant using solar cell/ LED.
2. Determination of Stefan's constant (B-B method).
3. Study of characteristics of a GM counter and verification of inverse square law for the same strength of a radioactive source.

4. Determination of coefficient of rigidity as a function of temperature using torsional oscillator (resonance method).
5. e/m measurement by Helical Method.
6. Measurement of magnetic field using Ballistic galvanometer and search coil.
7. Measurement of electric charge by Millikan's oil drop method.
8. To study hysteresis loss of transformer by B-H curve using CRO.
9. Determination of dielectric constant of solids and liquids.
10. Determination of velocity of sound in air.
11. Verification of Cauchy's formula.
12. Study of Lissajous patterns.
13. Determination of separation of plates of Etalon using spectrometer.
14. To verify Fresnel's formula for the reflection of light.

#### LAB. B: COMPUTER APPLICATIONS

The following exercises to be performed using MS Excel software

1. Solution of given differential equation using Euler's method.
2. Solution of given equation in one variable using Newton – Raphson method.
3. Calculating value of  $e^x$  for given x using series expansion.
4. Calculating value of  $\sin(x)$  for given x using series expansion.
5. Evaluating integral of given function using Simpson's Method.
6. Plotting time displacement graph for projectile motion.
7. Calculating mean and standard deviation of given data.

#### LAB. C: ELECTRONICS

1. Study of ripple factor for shunt capacitor, series inductor, L-section and  $\pi$  section filters using full wave rectifier circuit.
2. Study of frequency response of single stage transistor amplifier (variation of gain with frequency).
3. Study the characteristics of field effect transistor (FET).
4. Study the negative feedback effect on voltage gain, and input and output impedances of the amplifier.
5. Study of operational amplifier (OP-AMP).
6. Study of RC circuits as integrating and differentiating systems with Square input.
7. Study of series and parallel LCR resonance circuit.
8. Design and Voltage study of AND, OR, NOT, NAND and NOR gates circuits using diodes and transistors.
9. Design and study of RC phase shift oscillator.
10. Transient Analysis of C-R and L-R circuit.
11. Determination of parameter of transformer.

Note: - New experiments may be added on availability of equipments.

### **ELECTRONICS 2016**

## THEORY

			Pd/W (45mts.)	Exam. Hours	Max. Marks
Elec. 301	Paper I	Audio and Video systems	2	3	50
Elec. 302	Paper II	Electronic Instrumentation	2	3	50
Elec. 303	Paper III	Digital computer electronics	2	3	50
<b>PRACTICAL</b>			6	5	75
<b>Total</b>					<b>225</b>

### PAPER I: AUDIO AND VIDEO SYSTEMS

Note: The question paper for the examination will be divided in three parts i.e., Section – A, Section – B and Section – C.

**Section – A:** Will consist of 10 compulsory questions. There will be two questions from each unit and answer of each question shall be limited upto 30 words. Each question will carry 1 mark.

**Section – B:** Will consist of 10 questions. Two questions from each unit will be set and students will answer one question from each Unit. Answer of each question shall be limited upto 250 words. Each question carry 3.5 marks.

**Section – C:** Will consist of total 05 questions. The paper setter will set one question from each Unit and students will answer any 03 questions and answer of each question shall be limited upto 500 words. Each question will carry 7.5 marks.

**Unit I:** Radio Receiver: Characteristics and their measurements, tuned radio frequency receiver, frequency translation, superheterodyne receiver – block diagrams, typical transistor receiver circuit – explanation of various stages, FM receiver, trouble shooting and servicing of radio receiver, no sound, weak and noisy receiver, stereo transmission and reception.

**Unit II:** Television transmission: Broadcast channels, picture scanning, frequency band and resolution, camera tubes, block diagrams of transmitter and explanation of each block, colour transmission.

**Unit III:** Television Receiver: Scanning sequence and interlacing, synchronization and blanking, block diagrams of colour and monochrome receivers and explanation of each block, video tap recording and reproduction, troubles and trouble shooting.

**Unit IV:** Sound recording and reproduction: Construction of microphones and speakers, block diagrams of a tape recording system, recording, playback and erasing processes, tape

transport system, trouble in tape transport system and magnetic heads of tape recorders, disc recording, Hi- Fi systems and stereophony system.

**Unit V:** Radar system: Basic radar system, radar range equation, pulsed radar system, Doppler effect. CW Doppler radar system, moving target indicator principle, FM radar system.

satellite communication : orbital satellites, geo stationery satellite, orbital patterns, look angles, orbital spacing , satellite systems. link modules

## **PAPER II: ELECTRONIC INSTRUMENTATION**

Note: The question paper for the examination will be divided in three parts i.e., Section – A, Section – B and Section – C.

**Section – A:** Will consist of 10 compulsory questions. There will be two questions from each unit and answer of each question shall be limited upto 30 words. Each question will carry 1 mark.

**Section – B:** Will consist of 10 questions. Two questions from each unit will be set and students will answer one question from each Unit. Answer of each question shall be limited upto 250 words. Each question carry 3.5 marks.

**Section – C:** Will consist of total 05 questions. The paper setter will set one question from each Unit and students will answer any 03 questions and answer of each question shall be limited upto 500 words. Each question will carry 7.5 marks.

**Unit I:** Wave shaping circuits: Waveform terminology, RC wave shaping circuits, Differentiation and integration of step, pulse and square wave inputs, clipping and clamping circuits.

**Unit II:** Wave form generators: Astable, monostable and bistable multivibrators, Schmitt trigger, UJT as sawtooth waveform generator, synchronisation, general features of a time base signal, simple voltage and current sweep circuits.

**Unit III:** Regulated power supplies and controlled rectification : voltage regulation using transistors, Op-Amps and IC's, Controlled rectification using SCR, current rating of SCR, DIAC and TRIAC, phase control circuits

**Unit IV:** Laboratory Equipments: Standard signal generators, FETVM, digital voltmeter, digital multimeter, frequency counter, harmonic distortion – tuned circuit harmonic distortion analyzer, heterodyne harmonic analyzer, data acquisition system.

**Unit V:** Pulse height analysis : SCA and MCA, nuclear electronics systems, scintillation detectors, radiation counter, origin of bio-electric signals, ECG, cardiac monitor, sonography

## **PAPER III: DIGITAL COMPUTER ELECTRONICS**

Note: The question paper for the examination will be divided in three parts i.e., Section – A, Section – B and Section – C.

**Section – A:** Will consist of 10 compulsory questions. There will be two questions from each unit and answer of each question shall be limited upto 30 words. Each question will carry 1 mark.

**Section – B:** Will consist of 10 questions. Two questions from each unit will be set and students will answer one question from each Unit. Answer of each question shall be limited upto 250 words. Each question carry 3.5 marks.

**Section – C:** Will consist of total 05 questions. The paper setter will set one question from each Unit and students will answer any 03 questions and answer of each question shall be limited upto 500 words. Each question will carry 7.5 marks.

**Unit I:** Number system and basic logic circuits : Binary, octal, decimal, hexadecimal, BCD, ASCII and gray codes and their inter-conversion, basic logic gates and their electronic circuits (DTL and TTL), Boolean Algebra, De'Morgan theorems, study of logic circuit, Karnaugh Map.

**Unit II:** Building blocks of Computer : Half adder and full adder, half subtractor, RS flip flop, clocked RS flip flop, D flip flop, JK flip flop, JK master slave flip flop, level clock versus edge triggered clock, counters and shift registers, multiplexer, demultiplexer, decoder and encoder.

**Unit III:** Memories: Semiconductor memories, RAM, ROM, magnetic drum memory, magnetic disc, floppy disc, magnetic tape, magnetic bubble and CCD type memories, Hard disk, optical disk. Main and secondary memory, cache memory.

**Unit IV:** Microcomputer Architecture: Organisation of 8085 microprocessor: Registers, ALU, bus organization, memory and instruction set, architecture of simple I/O devices, minimum micro computer system, simple examples of 8085 programming.

**Unit V:** Data transfer: Types of data transfer, DMA data transfer, interrupts of 8085 and their interfacing, D/A conversion: Basic principles, weighted register method and R-2R ladder method, A/D conversion: counter method and SAR method.

**Books Suggested:**

B. Ram, Fundamental of Microprocessor and Microcomputers, Dhanpat Rai Publications, New Delhi

A.P. Malvino, Digital Computer Electronics, Tata McGraw Hill

A.P. Malvino and D. Leach, Digital Principle and applications, Tata McGraw Hill

Morris-Mano, Computer System Architecture, PHI

R. S. Gaonkar, Microprocessor Architecture, Programming and Applications. Wiley Eastern Ltd

**Experiments for Practical Work**

The practical work is divided into two parts, namely (A) Laboratory experiments and (B) Project, laboratory experiments will carry 30 marks and the project will carry 20 marks

**Part A**

1. AM Modulation and demodulation
2. Study of flip- flop circuits
3. RC Phase shift Oscillators
4. Hartley Oscillators
5. UJT Relaxation Oscillator
6. Differential and Integrating Circuits
7. Clipping and Clamping Circuits
8. Free running Multi-vibrator
9. Various logic Gates
10. 555 Timer application as Astable, monostable multivibrator
11. Simple exercise on microprocessors
12. Study of Timing circuit using IC555
13. Study of various characteristics of Radio receivers.
14. FM modulation and Demodulation.
15. Schmitt trigger circuit.
16. Study of registers and counters.
17. Study of multiplexer and demultiplexer.
18. Study of TV receiver
19. Study of log and antilog amplifier

**Part B: PROJECT**

Note: - New experiments may be added on availability of equipments.

**COMPUTER SCIENCE 2015**

**THEORY**

			Pd/W (45mts.)	Exam. Hours	Max. Marks
					150
CS. 301	Paper I	Computer Organisation –II	2	3	50
CS. 302	Paper II	Programming Language C and C++	2	3	50
CS. 303	Paper III	Computer Graphics	2	3	50

**PRACTICAL**

CS. 304		Advanced Computer Lab	6	5	75
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**PAPER I: COMPUTER ORGANIZATION – II**

Note: The question paper for the examination will be divided in three parts i.e., Section – A, Section – B and Section – C.

**Section – A:** Will consist of 10 compulsory questions. There will be two questions from each unit and answer of each question shall be limited upto 30 words. Each question will carry 1 mark.

**Section – B:** Will consist of 10 questions. Two questions from each unit will be set and students will answer one question from each Unit. Answer of each question shall be limited upto 250 words. Each question carry 3.5 marks.

**Section – C:** Will consist of total 05 questions. The paper setter will set one question from each Unit and students will answer any 03 questions and answer of each question shall be limited upto 500 words. Each question will carry 7.5 marks.

**Unit I:** Microprogram Control Organisation: Control memory, Address sequencing microprogram and its sequencing, microinstruction formats. Software aids, Advantages and applications of microprogramming.

**Unit II:** Arithmetic processors; Addition and subtraction Algorithms, multiplication and division Algorithms for arithmetic with 2's compliment, floating point arithmetic and decimal arithmetic operations and their hardware implementation.

**Unit III:** 8086 & other microprocessors; Organisation of 8086 –Instruction set, addressing modes and instruction codes, assembler directives and pseudo instructions, simple assembly language programming examples, interfacing with I/O and memories, 8086 interrupts and DMA.

**Unit IV:** Memory Organisation : Auxiliary memory, microcomputer memory, memory hierarchy, Associative memory, virtual memory, Cache memory, Memory mangement.

**Unit V:** Analog interface : O.P.- AMP basics, D/A converter , DAC 0800, successive approximation, A/D converter–ADC 0801, software handshaking, Hardware handshaking, successive approximation with software, voltage controlled oscillator, sample and hold circuits.

**PAPER II: PROGRAMMING LANGUAGE C AND C++**

Note: The question paper for the examination will be divided in three parts i.e., Section – A, Section – B and Section – C.

**Section – A:** Will consist of 10 compulsory questions. There will be two questions from each unit and answer of each question shall be limited upto 30 words. Each question will carry 1 mark.

**Section – B:** Will consist of 10 questions. Two questions from each unit will be set and students will answer one question from each Unit. Answer of each question shall be limited upto 250 words. Each question carry 3.5 marks.

**Section – C:** Will consist of total 05 questions. The paper setter will set one question from each Unit and students will answer any 03 questions and answer of each question shall be limited upto 500 words. Each question will carry 7.5 marks.

**Unit I:** Programming language C: structure of C program, Identifiers and keywords, data types, constants, arithmetic operations, library functions, expressions, input/output statements: getchar and putchar, scanf and printf, relational and logical operators, unary operators, hierarchy of operations.

**Unit II:** Transfer of control: IF-else statement, Switch statement, Goto statement, iterative statements: While, Do-while, For statement, nested loops, break statements, Arrays: definitions, one-dimensional and multi-dimensional, functions; define and accessing a function, arguments of a function, passing arguments and array to a function, recursion.

**Unit III:** Pointers: pointer declaration, operations on pointers, pointers to array, array of pointers, passing pointers to a function, user defined data types: structures, defining a structure, processing a structure, structure and pointers, passing structure to a function unions, Introduction to C++, Basic data types, Derived data types, reference variables, Input/ Output statements in C++.

**Unit IV:** Operators in C++, manipulators, type cast operator, functions in C++, main function, function prototyping, call by reference, return by reference, inline functions, friend function, virtual functions. Class data type, creating objects, member functions, private member functions, static data members, static member functions, pointers to members.

**Unit V:** Constructors, multiple constructors in a class, copy and dynamic constructors, destructors, operator overloading, type conversions: Basic to class, class to basic and class to class. Inheritance, single inheritance, multilevel inheritance, multiple inheritance, hierarchical inheritance, hybrid inheritance, pointers to objects.

### **Paper III: COMPUTER GRAPHICS**

Note : The question paper for the examination will be divided in three parts i.e., Section – A, Section – B and Section – C.

**Section – A:** Will consist of 10 compulsory questions. There will be two questions from each unit and answer of each question shall be limited upto 30 words. Each question will carry 1 mark.

**Section – B:** Will consist of 10 questions. Two questions from each unit will be set and students will answer one question from each Unit. Answer of each question shall be limited upto 250 words. Each question carry 3.5 marks.

**Section – C:** Will consist of total 05 questions. The paper setter will set one question from each Unit and students will answer any 03 questions and answer of each question shall be limited upto 500 words. Each question will carry 7.5 marks.

**Unit I:** Geometry and Line Generation: Points and lines, line segments, vectors, pixels and frame buffer, vector generation, DDA algorithm, Bresenham's algorithm, antialiasing of lines, thick lines, character generation.

**Unit II:** Graphic Primitives: Display devices, display file structure, and interpreters, normalized device coordinates, entering commands in display file, display file interpreter, entering text, line style, entering Polygons in display file.

**Unit III:** Transformation: Matrices, scaling transformation, angles, rotation, homogeneous coordinates, coordinate translations, coordinate transformation, rotation about arbitrary point, inverse transformations, transformation routines.

**Unit I:** Segmentation: Segment, segment creation, image transformations, saving and showing of segments, windowing and Clipping; window and view port, Viewing transformations, clipping, Cohen Sutherland algorithms.

**Unit V:** Graphic interactions: Principle and working of common interactive graphic devices, selectors and locators, Mouse, Joystick, light pen and tablet.

3D-Graphics : Introduction, geometrical and coordinate transformations, rotation about an arbitrary axis, various kinds of projections, parallel and perspective projections, viewing parameters, special projections.

**Books suggested:**

Rajaraman: Computer Programming in C, Prentice Hall of India

Gottfried, B.: Programming with C, Schaum's Outline Series, Tata McGraw Hill

Balguruswamy, E.: Programming in ANSI C, Tata McGraw Hill

Harrington S.: Computer Graphics. A Programming Approach, McGraw Hill

Hearn D. and Baker: Computer Graphics, Prentice Hall of India

Morris Mano: Computer System Architecture, Prentice Hall of India

Hall, D.V.: Microprocessor and Interfacing, Tata McGraw Hill.

Balguruswamy, E.: Object Oriented Programming with C++ in ANSI C, Tata McGraw Hill

**Experiments for Practical Work**

**ADVANCE COMPUTER LABORATORY (Programming Language C++)**

1. Write a program to show the use of arithmetic operations and library functions in evaluating expressions.
2. Write a program to show the use of input and output statements.
3. Write a program to show the use of if-else statement.
4. Write a program to show the use of switch and case statements.
5. Write a program to show the use of one dimensional and multi-dimensional arrays.
6. Write a program to show the use of while statements.
7. Write a program to show the use of do-while statements.
8. Write a program to show the use of for statements.

9. Write a program to show the use of functions.
10. Write a program to show the use of recursion.
11. Write a program to create a linked list using pointers.
12. Write a program to define and use a structure.
13. Write a program to find roots of an equation by Newton-Raphson method.
14. Write a program to sort a list of data using selection sort.
15. Write a program to manipulate strings.
16. Write a C++ program to show the use of class & object.
17. Write a C++ program to show the use of operator overloading.
18. Write a C++ program to show the use of pointers to objects.
19. Write a C++ program to show the inheritance.

### MATHEMATICS 2016

Paper I	: Abstract Algebra
Paper II	: Analysis and Laplace Transforms
Paper III	: Mechanics II (Dynamics of Rigid Bodies and Hydrostatics)

Note: **Each theory paper is divided in three parts i.e. Section – A, Section – B and Section – C**

**Section A:** Will consist of 10 compulsory questions. There will be two questions from each unit and answer of each question shall be limited up to 30 words. Each question will carry 2 marks.

**Section B:** Will consist of 10 questions. Each unit will be having two question; students will answer one question from each Unit. Answer of each question shall be limited up to 250 words. Each question will carry 5 marks.

**Section C:** Will consist of total 05 questions one from each unit. Students will answer any 03 questions and answer of each question shall be limited up to 500 words. Each question will carry 10 marks.

*Total Marks: 75*

#### PAPER I: ABSTRACT ALGEBRA

**Unit I:** Definition and example of groups. General properties of groups, Order of an element of a group. Permutations : Even and Odd permutations. Groups of permutations. Cycle group, Isomorphism, Isomorphism of cyclic groups, Cayley's theorem.

**Unit II:** Subgroups, Cosets, Lagrange's theorem, Product Theorem of subgroups, Conjugate elements, conjugate complexes, Central of a groups, Normaliser of an element and of a complex. Normal subgroups, quotient Groups, Commutator subgroup of a group. Homomorphism, Fundamental theorem of homomorphism.

**Unit III:** Definition and kinds of rings, Integral domain, Division ring, Field, Subring of a ring, Subfield of a field. Characteristic of a ring and field.

**Unit IV:** Ideals of a ring, Quotient rings, Prime fields, Prime ideals, Field of quotients of an integral domain, Definition and examples of a vector space, subspace of a vector space, Linear combination and linear space, Linear dependence and independence of vectors. Direct product of vector spaces and internal direct sums of subspaces.

**Unit V:** Bases and dimension of a finitely generated spaces, Quotient space, Isomorphism, Linear transformation (Homomorphism), Rank and nullity of linear transformation.

### **Suggested Books**

Sharma, G.C. : Modern Algebra; Ram Prasad & Sons, Agra.

Bansal & Bhargava : Abstract Algebra (Hindi Ed. ); Jaipur Publishing House, Jaipur.

Agarwal, R.S. : Text Book on Modern Algebra; S. Chand & Co., New Delhi.

Gokhroo & Saini : Abstract Algebra (Hindi Ed. ); Jaipur Publishing House, Jaipur.

## **PAPER II: ANALYSIS AND LAPLACE TRANSFORMS**

**Unit I:** Dedekinds theory of real numbers. Linear sets. Upper and Lower bounds, Limiting points, Weierstrass's theorem. Derived sets, Enumerable Sets, Open and Closed sets.

**Unit II:** Theory of Riemann integration, Darboux theorem. Fundamental theorem of integral calculus, Mean value theorem of integral calculus.

**Unit III:** Functions, Limits, and continuity. Differentiability, Concept of an analytic function, Cartesian and Polar form of Cauchy-Riemann equations. Harmonic function, Conjugate function, Laplace's differential equations, Orthogonal system, Construction of analytic functions. Power Series: Absolute convergence of power series, circle and radius of convergence of power series, sum function of a power series.

**Unit IV:** Basic definition and Properties of complex integration Complex integration as the sum of two line integrals, Inequality for complex integrals. Curves in complex plane, Cauchy-Goursat theorem, Connected regions, Indefinite integral (or Anti Derivative). Derivative of Single-valued functions  $F(z)$ . Cauchy's integral formula, Extension of Cauchy's integral formula to multiconnected, regions, Cauchy's integral formula for the derivative of an analytic function, Successive derivative of an analytic function, Morera's Theorem. Liouville's Theorem, Poisson's integral formula.

**Unit V:** Laplace Transforms and Inverse Laplace Transforms. Laplace transforms of derivatives and integrals. Shifting theorems. Convolution theorem. Applications of Laplace Transform to the solution of differential equations.

### **Suggested Books**

Shanti Narayan: Real Analysis; S.Chand & Co., New Delhi.

G.N.Purohit: Real Analysis; Jaipur Publishing House, Jaipur.

Bhargava, Goyal: Real Analysis (Hindi Ed.); Jaipur Publishing House, Jaipur.

Gokhroo, Saini, Ozgha: Real Analysis (Hindi Ed.); Jaipur Publishing House, Jaipur.

Shanti Narayan: Theory of Functions of a Complex Variable; S.Chand & Co., New Delhi.

Gupta, K.P. : Complex Analysis; Pragati Prakashan; Meerut

Gokhroo, Saini & Yadav: Complex Analysis (Hindi Ed.); Navkar Publication, Ajmer

G.N. Purohit: Complex Analysis; Jaipur Publishing House, Jaipur.

S. Ponnusamy: Foundations of Complex Analysis, Narosa Publishing House, Bombay, New Delhi.

V. Karunakaran: Complex Analysis, Narosa Publishing House. Bombay, New Delhi (2002).

N. Levinson and R.M. Redheffer: Complex Variables, Tata McGraw-Hill Publ. Co. Ltd., New Delhi (1980).

**PAPER III: MECHANICS – II**  
**(DYNAMICS OF RIGID BODIES AND HYDROSTATICS)**

**Unit I:** Moments and Products of inertia. D'Alembert's principle, the general equations of motion of a rigid body, Motion of the center of inertia and motion relative to the center of inertia. Motion about a fixed axis under finite forces.

**Unit II:** The compound Pendulum. Reaction of the Axis of rotation. Motion of a rigid body in two dimension under finite forces.

**Unit III:** Fluids and Fluid Pressure, homogeneous and heterogeneous fluids, Surface of equal pressure, fluid at rest under action of gravity, Fluid pressure on Plane surfaces.

**Unit IV:** Centre of pressure, resultant pressure on curved surfaces.

**Unit V:** Equilibrium of floating bodies, Centre of buoyancy, Surface of buoyancy. Stability of equilibrium of floating bodies, Meta Centre.

**Suggested Books**

Loney, S.L. : Rigid Body Dynamics; Cambridge Univ. Press.

Gupta, P.P. : Rigid Body Dynamics, Vol.I; Krishna Prakashan, Mandir; Meerut

Bansal, J.L. : Rigid Body Dynamics; Jaipur Publishing House, Jaipur.

Prasad, B.N. : Hydrostatics; Krishna Prakashan, Mandir; Meerut

Mathur, S.M. : A Text Book of Hydrostatics; Ramesh Book Depot, Jaipur.

Sharma, Gokhroo, K. Saini, Agarwal.: Elements of Hydrostatics; Jaipur Publishing House, Jaipur.

**B.A. / B.SC. PART III EXAMINATION 2016**

**STATISTICS**

Paper I : Sampling Distribution, Estimation and Testing of Hypothesis

Paper II : Statistical Quality Control & Operation Research

Paper III: Designs of Experiments and Non-Parametric Tests

**Practical**

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Note: **Each theory paper is divided in three parts i.e. Section – A, Section – B and Section – C.**

**Section A:** Will consist of 10 compulsory questions. There will be two questions from each unit and answer of each question shall be limited up to 30 words. Each question will carry 1 mark.

**Section B:** Will consist of 10 questions. Two questions from each unit will be set and students will answer one question from each Unit. Answer of each question shall be limited up to 250 words. Each question will carry 3.5 marks.

**Section – C:** Will consist of total 05 questions one from each unit. The paper setter will set one question from each Unit and Students will answer any 03 questions and answer of each question shall be limited up to 500 words. Each question will carry 7.5 marks.

**Total Marks: 50**

## **PAPER I: SAMPLING DISTRIBUTION, ESTIMATION AND TESTING OF HYPOTHESIS**

**Unit I:** Concepts of sampling distribution and standard error, derivation of  $X^2$  (chi-square), t and F distribution, their simple properties.

**Unit II:** Concepts of point estimation, properties of point estimators such as consistency, unbiasedness, minimum variance. Unbiased estimators, efficiency and simple notion of sufficiency, factorization theorem (without proof).

**Unit III:** Different methods of finding estimators such as method of moments, method of minimum variance, method of least square and maximum likelihood (without detailed discussion of their properties).

**Unit IV:** Testing of hypothesis, simple and composite hypotheses, two types of errors, idea of best critical region, power of a test, power curves in simple cases. Neyman- Pearson lemma.

**Unit V:** General theory of test of significance, Large sample tests for mean and proportions. Applications of  $X^2$  (chi-square) t and F in testing of hypotheses. The interval estimation of Normal population mean, variance, difference of means, ratio of variances.

### **Suggested Books**

Gupta, S.C. and Kapoor, V.K.: Fundamental of Mathematical Statistics, Sultan Chand and Sons, Delhi.

Surendran, P.U. and Saxena, H.C.: Statistical Inference, S.Chand & Co., Delhi.

## PAPER II: STATISTICAL QUALITY CONTROL & OPERATION RESEARCH

- Unit I:** Concept of Statistical quality control, Control charts:  $(\bar{x}, R), (\bar{x}, \sigma), p, np, c$ -charts, their constructions and uses.
- Unit II:** Sequential Analysis: Sequential probability ratio test, O.C. and A.S.N. functions and their applications.
- Unit III:** Sampling Inspection by attributes: Producer's risk, consumer's risk, AOQL, ASN, OC, Single, Double and Sequential Sampling plans and their comparison.
- Unit IV:** Introduction to operation Research, Queuing theory (I): Queuing systems, characteristics of queuing system, Poisson process, exponential distributions of number of arrivals, inter arrival time, service time.
- Unit V:** Queuing Theory (II): Classification of queues, model I: Model (M/M/1): ( $\infty$  / FIFO) and its characteristics, waiting time distribution. Introduction of Model II (M/M/1): ( $< \infty >$  / SIRO).

### Books Suggested

- Gupta, B.N.: Statistics (Theory and Practical), Sahitya Bhawan, Agra.
- Saini, Yashpan and Fiedman: Operation Research Methods and Problems, Hohn Wiley and Sons, New York.
- Goon, Gupta, Dasgupta: Fundamentals of Statistics, Vol. II
- Grant, E.L.: Statistical Quality Control, Mc-Graw Hill, New York.

## PAPER III: DESIGNS OF EXPERIMENTS AND NON-PARAMETRIC TESTS

- Unit I :** Analysis of variance, one way and two way classification, including multiple but equal number of observations per cell.
- Unit II:** The completely randomized design, Randomized block design, comparison of RBD with CRD, Lay-out of RBD.
- Unit III:** The latin square design, its layout and analysis. Factorial experiments, the main effects and interactions layout and its analysis (in  $2^2$  and  $2^3$  carried out in a RBD only).
- Unit IV:** Non-parametric Tests: Order Statistics Cumulative and probability distribution function of a Single Order Statistics, expectation of function of order statistics. Non-parametric methods and advantages and disadvantages, Power efficiency, Sign test (Simple, for paired observations), Run test for randomness.
- Unit V:** Wilcoxon signed Rank test, Median Test, Mann-Whitney Wilcoxon U-Test, Wald-wolfowitz Run test (two sample problem), Kolmogorov-Smirnov Goodness of fit test.

### Books Suggested

- Gupta, S.C. and Kapoor, V.K.: Fundamentals of Applied Statistics, Sultan Chand & Sons, Delhi.
- Goon, Gupta, Dasgupta: Fundamentals of Statistics, Vol. II, World Press, Calcutta.
- Rahatgi, V.: Statistical Inference, Wiley.

### Practical

The students will be asked to attempt three exercises out of five exercises. The distribution of marks will be as follows:

	Regular Students	Ex-Students
(a) Three Practical exercise	45 Marks	45 Marks
(b) Practical record work	10 Marks	-
(c) Viva-Voce	20 Marks	20 Marks
<b>Total</b>	<b>75 Marks</b>	<b>65 Marks*</b>

\*To be converted out of 75 marks.

The following topics are prescribed for practical works:

1. Analysis of variance: One way and two way classifications.
2. Analysis of (i) completely randomized (ii) randomized block and latin square designs, factorial experiments.
3. Practical on SQC (Covered in Paper III).
4. Test of significance based on normal,  $X^2$ , t and F tests, power curve.
5. Practical on Non-Parametric Tests (covered in Paper – III).
6. ‘Working knowledge of SPSS Package’.

<b>ECONOMICS 2016</b>			
Part	Total no. Q.	Marks each Q.	Total Marks
A	10	2	20
B	7	5	35
C	3	15	45
		Total	100

B.A. / B.Sc. III Year

**ECONOMICS**  
**PAPER I: HISTORY OF ECONOMIC THOUGHT**

Max. Marks : 100

Time : 3 Hours

**Unit I:** Meaning and Importance of History of Economics Thought, History of Economic Analysis and Economic History, Mercantilism, Physiocrats, Adam Smith

**Unit II:** David Ricardo, Thomas Robert Malthus, Sismondi, JS Mill

**Unit III:** Utopian socialists – Robert Owen, Charles Fourier and Pierre Joseph Proudhon ; Friedrich List, Karl Marx – an Elementary Treatment

**Unit IV:** Austrian School : Karl- Menger, Friedrich- Von Wieser, Eugen von Bohm- Bawerk and Alfred Marshall

**Unit V:** Indian Economic Thought : Kautilya, Mahadev Govind Ranade, Gopal Krishna Gokhale, Mahatma Gandhi and Jawahar Lal Nehru.

**Recommended Readings**

Gide and Rist : History of Economic Doctrines

Haney, L.N. : History of Economic Thought

Eric Roll : History of Economic Thought

Ghosh, B.N. and Ghosh, R.R. : Concise History of Economic Thought, (Himalaya Publishing House), Delhi Loknathan, V. : A History of Economic Thought, S. Chand, Delhi

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Gide and Rist : History of Economic Doctrines

Haney, L.N. : History of Economic Thought

Eric Roll : History of Economic Thought

Ghosh, B.N. and Ghosh, R.R. : Concise History of Economic Thought, (Himalaya Publishing House), Delhi Loknathan, V. : A History of Economic Thought, S. Chand, Delhi

## PAPER II: BASIC STATISTICS AND ELEMENTARY MATHEMATICS

Max. Marks : 100

Time : 3 Hours

**Unit I:** Meaning, uses and limitations of statistics, Collection of Statistics Data- Census and sample investigation, classification and presentation of Data-Statistics Tables, Graphs, Frequency Distribution, Diagrams.

**Unit II:** Measures of Central Tendency : Arithmetic Mean, Median, Mode, Geometric Mean and Harmonic Mean.

**Unit III:** Measures of Dispersion : Range, Quartile Deviation, Mean Deviation, standard Deviation and Co-efficient of Variation simple Correlation : Karl Pearson's Correlation co-efficient and Spearman's rank correlation.

**Unit IV:** Simple two variable Linear regression, Fisher's Index numbers, Interpolation and extrapolation – Newton and Lagrange method

**Unit V:** Elementary Mathematics

Simultaneous and Quadratic Equations

Arithmetic and Geometric Progressions, Logarithms

### Recommended Readings

Elhance, D.N: Fundamental of Statistics

Singhal, M.L. : Elements of Statistics

Nagar, A.L. and Das, R.K. : Basic Statistics

Mehta and Madnani: Elementary Mathematics in Economics (Hindi and English ed.)

Croxton Cowden : Applied General Statistics

Nagar, K.N. : Sankhyiki ke mool tatva

Gupta : BN : Sankhyiki

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Elhance, D.N: Fundamental of Statistics

Singhal, M.L. : Elements of Statistics

Nagar, A.L. and Das, R.K. : Basic Statistics

Mehta and Madnani: Elementary Mathematics in Economics (Hindi and English ed.)

Croxton Cowden : Applied General Statistics

### **GEOGRAPHY 2016**

Note: There will be two theory papers of 3 hours duration carrying 75 marks each, and a practical of 50 marks. Candidates will have to pass in theory and practical separately.

**Theory - Max. Marks : 75      Min marks : 27**

**Practical- Max. Marks : 50      Min marks : 18**

### **PAPER I:ECONOMIC GEOGRAPHY**

**Unit I:** Nature, scope and methods of economic geography ; economic resources; their classification and conservation; fundamental occupations of man: fishing and livestock raising

**Unit II:** Agriculture : subsistence, intensive commercial grain farming, plantation agriculture and mixed farming, dairying; principal agricultural crops: wheat, rice, maize, tea, coffee, rubber, cotton, sugarcane and sugar beet

**Unit III:** Minerals : Iron ore, Manganese and Copper ore; Sources of power: Coal, Petroleum, Hydroelectricity and Nuclear

**Unit IV:** Industries : Iron and Steel, Cotton Textile, Pulp and Paper, Major Industrial Regions: The Lake region of U.S.A., Ruhr basin of Germany and Manufacturing belts of Japan.

**Unit V:** Transportation : Rail, Water-major ocean routes and inland waterways of Europe, former USSR; Air-factors affecting air transportation, Principal air-routes of the world; International trade: Bases of international trade; barriers to trade and pattern of world trade

### **Books Recommended**

Hartshorn, T.A. and Alexander, J.W. : Economic Geography, prentice-Hall of IndiaPvt.Ltd.,New Delhi, 1988.

Das, Gupta and Kapur: Adhunik Arithikva Vanijiya Bhugol, Premier Publishing Company, Delhi  
 Dubey, R.N. : Economic and Commercial Geography Kitab Mahal, Allahabad  
 Leong, G.C. and Morgan, G.C. : Human and Economic Geography, OUP, Oxford, 1986.  
 Wheeler and Muller : Economic Geography, John Wiley and Sons, N.Y. II Edition.  
 Mamoria, C.B. : Arithik Vanijiya Bhugol, Gaye Prasad and Sons, Agra  
 Negi, B.S. : Geography of Resources, Kedarnath Ramnath, Meerut, 1980.  
 Ranner, G.T. : World Economic Geography  
 Singh, A and Raza : Parkratik Sansadhan, 1980  
 Singh, K.N. and Singh J. : Arithik Bhugol ke Multatva, Gyanodaya Prakashan, Gorakhpur, 1996.  
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## **PAPER II: ENVIRONMENTAL GEOGRAPHY**

- Unit I:** Definition and scope of Environmental Geography : its relationship with other subjects; elements of environment; man-environment relationships, Percipient and quality of environment.
- Unit II:** Ecology: definition\scope and types; ecosystem; meaning, types; components, functioning, productivity and stability; geobiochemical cycles : Water, Carbon, Nitrogen and oxygen
- Unit III:** Environments problems: Causes, population increase;urbanisation, industrialisation, transportation, pesticides and wars; environmental pollution: air, water, soil and noise, measure for control
- Unit IV:** Environmental hazards: Ozone depletion, green house effect, El-nino, Global warming, acid rain, floods, droughts, volcanoes, earthquakes, landslides, collapse of big dams, health hazards and energy crisis
- Unit V:** Ecological basis of environmental management: sustainability of human ecosystem; conservation of natural resources: soil, water, forests, minerals and energy ; national and international efforts on environmental management; environmental education

### **Recommended Readings**

Arvilla, R: Man and Environmental: Crisis and Strategy of Choice, Penguin, Hammonds – Worth, 1967.

Botkin, D.B. and E.A. Keller: Environmental Studies, C.F. Merrill Pub. Co. Columbus, Ohio, 1982.

Das Saman, R.F. : Environmental Conservation, John Wiley & Sons, New York, 1976.

Detwyler, R. : Man's Impact on Environment, John Wiley & Sons, New York 1972.

Duffey, E : Conservation of Nature, Collins, London, 1970.

Edington J.M. and M.A. Edington: Ecology and Environmental Planning, Champan and Hall, London, 1977.

Furley, P.A. and W.W. Newey : Man and the Biosphere, Butterworths, London, 1983.

Gerasimov, I.P. : Geography and Ecology , Progress Publication, Moscow, 1983.

Jonathan T : Introduction to Environmental Studies Sanders College Publishing, Philadilphia Holt-Saunders, Japan, 1985.

M.I.T. : Study of Critical Environmental Problems, The M.I. T. Press, Cambridge, Massachusetts, 1970.

Park C. C. : Ecology and Environmental Management, Butterworths, London, 1980.  
 Singh, P. : Environmental Pollution and Management, Chugh Publication, Allahabad, 1985.  
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## GEOGRAPHY PRACTICAL SCHEME

### Four Practical Periods per week per group of 20 students

Max. Marks : 50      Min marks : 18      Duration : 6 Hrs.

			Marks
1.	Lab Work (Written paper)	: 02 Hours	21 Marks
2.	Record Work & Viva-voce	: 02 Hours	9+5 = 14Marks
3.	Field Survey & Viva-Voce	: 02 Hours	10+5=15 Marks
			<b>Total Marks: <u>50 Marks</u></b>

Note : Each Candidate is required to complete at twentyfive exercises.

### Syllabus:

1. Study and interpretation of topographical sheets of typical areas of India; scheme of Indian topographical sheets with a complete knowledge of their latest version
2. Profile drawing: serial, super-imposed, composite and projected; Knowledge of vertical exaggeration
3. Geographical construction of following map projections: Cylindricalprojection; Simple Cylindrical (Equidistant), Cylindrical Equal Area, Mercator; Conical Projection: One standard parallel, Two standard parallel, Bonne, Poly-Conic, Zenithal Protection ( Polar (Case only) : Equidistant, equal area, Gnomonic, Stereographic, Orthographic
4. Measure of Central Tendency : Mean, Median Mode and Standard Deviation
5. Prismatic Compass Survey: Corrections of Bearings and Closing of errors by Bowditch method

### RECOMMENDED READINGS

Sing, R.L. : Elements of Practical Geography, Students Friends, Varanasi, 1987.  
 Singh, R. and Kanaujia, L.R.S. : Map work and Practical Geography, Central Book Depot, Allahabad.  
 Monkhouse, F.J. and Wilkinson, H.R. Map and Liagrams, Methudn, London 1994.  
 Robinson, A.H. : Elements of Cartography, Jonh Willy & Sons, New York.  
 Mishra, R.P.: Fundamental of cartography, Macmillan, New Delhi.

Kellay, Geogrp : Map Projections, Methuen & Co., London.  
 Steers, J.K. : Map Projections, University of London Press, London.  
 Sharma, J.P. : PrayogikBhoogol, RastogiPrkashan, Meerut.  
 Jain, S.M.: Prayogatmak, Bhoogol, SahityaBhawan, Agra.

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**Books Recommended**

Hartshron, T.A. and Alexander, J.W. : Economic Geography, prentice-Hall of India Pvt.Ltd.,New Delhi, 1988.  
 Das, Gupta and Kapur: AdhunikArithikvaVanijiyaBhugol, Premier Publishing Company, Delhi  
 Dubey, R.N. : Economic and Commercial Geography KitabMahal, Allahabad  
 Leong, G.C. and Morgan, G.C. : Human and Economic Geography, OUP, Oxford, 1986.  
 Wheeler and Muller : Economic Geography, Jonh Wiley and Sons, N.Y. II Edition.  
 Matoria, C.B. : ArithikVanijiyaBhugol, Gaye Prasad and Sons, Agra  
 Negi, B.S. : Geography of Resources, KedarnathRamnath, Meerut, 1980.  
 Ranner, G.T. : World Economic Geography  
 Singh, A and Raza : ParkratikSansadhan, 1980  
 Singh, K.N. and Singh J. : ArithikBhugolgeMultatva, GyanodayaPrakashan, Gorakhpur, 1996.  
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## Recommended Readings

Arvilla, R: Man and Environmental: Crisis and Strategy of Choice, Penguin, Hammonds – Worth, 1967.

Botkin, D.B. and E.A. Keller: Environmental Studies, C.F. Merrill Pub. Co. Columbus, Ohio, 1982.

Das Saman, R.F. : Environmental Conservation, John Wiley & Sons, New York, 1976.

Detwyler, R. : Man's Impact on Environment, John Wiley & Sons, New York 1972.

Duffey, E : Conservation of Nature, Collins, London, 1970.

Edington J.M. and M.A. Edington : Ecology and Environmental Planning, Champan and Hall, London, 1977.

Furley, P.A. and W.W. Newey : Man and the Biosphere, Butterworths, London, 1983.

Gerasimov, I.P. : Geography and Ecology , Progress Publication, Moscow, 1983.

Jonathan T : Introduction to Environmental Studies Sunders College Publishing, Philadilphia Holt-Saunders, Japan, 1985.

M.I.T. : Study of Critical Environmental Problems, The M.I. T. Press, Cambridge, Massachusetts, 1970.

Park C. C. : Ecology and Environmental Management, Butterworths, London, 1980.

Singh, P. : Environmental Pollution and Management, Chugh Publication, Allahabad, 1985.

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## ZOOLOGY

Theory

Marks

(Min. Pass Marks; 54)

Paper I : Animal Physiology and Biochemistry

50

Paper II : Behavior and Ecology

50

Paper III : Applied Zoology

50

Practical :

75

(Min. Pass Marks; 27)

Duration of each theory paper

3 hours

Duration of practical examination

5 hours

*Note:* Each theory paper is divided in three parts i.e. Section-A, Section –B and Section –C.

Section-A: Will consist of 10 compulsory questions. There will be two questions from each unit and answer of each question shall be limited up to 30 words. Each question will carry of 1 mark.

Section –B: Will consist of 10 questions. Each unit will be having two questions; students will answer one question from each Unit. Answer of each question shall be limited up to 250 words. Each question carries 3.5 Marks.

Section-C: will consist of total 05 questions. Students will answer any 03 questions and answer of each question shall be limited up to 500 words. Each question carries 7.5 Marks.

### **PAPER I: ANIMAL PHYSIOLOGY AND BIOCHEMISTRY**

**Unit I:** Digestion; digestive enzymes, process of digestion, digestion of protein, carbohydrate and lipid

Blood: Composition and functions, Blood groups, Rh factor and their significance, blood clotting mechanism, blood pressure and cardiac cycle, respiratory pigments, cardiac muscle activity.

**Unit II:** Muscle: Structure of various types of muscles and mechanism of muscle contraction

Excretion: Structure of kidney, types of nephron, mechanism of urine formation and its elimination and arginine, ornithin cycle.

**Unit III:** Respiration: Structure of lung, mechanism of respiration, respiratory pigment, exchange and transport of oxygen and carbon dioxide.

Nervous System: Structure of neuron and its classification, Nerve impulse, impulse conduction and reflex action.

**Unit IV:** Endocrine glands: Structure and functions of various endocrine glands, diseases caused by hormonal deficiency; Mechanism of hormone action.

**Unit V:** Structure of Protein and Carbohydrates; oxidation of glucose through glycolysis, Krebs cycle and oxidative phosphorylation, deamination, transamination and decarboxylation.

### **PAPER II: ECOLOGY AND BEHAVIOUR**

**Unit 1:** Introduction of ecology, definition, history, sub division and scope of ecology.

Environmental factors; physical factors- soil, water, air and temperature. Biotic factors- interspecific and intraspecific relations, neutralism, mutualism, commensalism, antibiosis, parasitism, predation, competition. Concept of limiting factors, Liebig's law of minimum, Shelford's law of tolerance, combined concept of limiting factors.

**Unit II:** Population and community ecology, measurement of population density, Factors affecting population growth, growth factors, dispersal, characteristic of community, concept of ecosystem and niches.

Food chain, food web, Ecological pyramid. Energy flow in an ecosystem, biogeochemical cycles of CO<sub>2</sub>, N<sub>2</sub>, O<sub>2</sub>, S and P; Prospects and strategies of sustainable development.

**Unit III:** Brief introduction to the major ecosystem of the world and ecological succession, conservation of natural resources; Ecology in relation to Thar desert, Brief account of environmental pollution, global warming and its impact upon Human race.

**Unit IV:** General survey of various types of animal behavior; Methods of studying animal behavior, Role of hormones and pheromones in behavior, Biological rhythms.

**Unit V:** Learning and Memory: Conditioning, Habituation, Insight learning, Association learning, Reasoning and Communication; Wildlife of Rajasthan and its conservation.

### **PAPER III: APPLIED ZOOLOGY**

**Unit I:** Poultry keeping: Types of poultry breeds, poultry housing, farm and farm management, system of poultry farming; Grading, handling and marketing of eggs; Poultry diseases and Vermiculture; Methodology and products.

**Unit II:** Sericulture: Different kinds of silk producing insects in India and its potentialities, Host plants of silk insects, Grainage, rearing and life cycle, Breeding and various diseases of silkworm, Reeling and fibre technology, Economics of sericulture.

**Unit III:** Apiculture: Different kinds of honey bees found in India and, their identification. Identification of Queen, worker and drone, Importance of keeping bees in artificial hives and different kinds of hives, Care and management of bee colonies, Bee enemies and their control, Extraction and processing of honey from the comb, Utility and economics of production of honey, Honey bees and pollination strategy in agricultural crops.

**Unit IV:** Pest Management : Insect pests of important crops (cotton, Rice, sugar cane & pulses), insect pest of veterinary and medical importance, pest outbreaks and assessment of losses caused by the insect pests on crops; population dynamics of insect pests; Principles of Biological, mechanical and cultural methods of pest control, Integrated Pest Management (IPM), Principles of pest control by pesticides, Important vertebrate pests, birds and mammals with special reference to rodents and their management.

**Unit V:** General principles of aquaculture; transportation of fish seed and brooders, Induced Breeding, Composite fish culture, Lay out of fish farm and its management, By-products of fishing industry; Prawn culture; Management of water bodies for aquaculture.

### **Practical**

1. Haemoglobin estimation of mammalian blood
2. Preparation of heamin crystals
3. Osmotic effect of R.B.C.
4. Preparation of mammalian blood film and identification of different types of blood cells
5. Determination of blood groups and Rh-factor
6. To determine the rate of oxygen consumption of rat
7. Analysis of urine for sugar, protein and pH

8. Estimation of E.S.R.
9. Demonstration of amylase activity
10. Estimation of packed cell volume [PCV]
11. Demonstration of working of pH meter
12. Demonstration of working of colorimeter
13. Measurement of blood pressure
14. Study of different spraying and dusting equipment
15. Use of pesticides and precautionary measures
16. Measurement of temperature and relative humidity
17. Estimation of soil moisture
18. Estimation of water holding capacity of different soils
19. Ecosystem study : Aquarium
20. Pond water study to identify zoo-planktons and their permanent preparations
21. Permanent preparation of any two stored grain pests. Two parasitic insects and termites
22. Honey bee : Permanent preparation of pollen basket and mouth parts
23. Permanent preparation of mouth parts of butterfly, moth, mosquito and cockroach
24. Project report based upon study of local fauna
25. Dissection of nervous system of grasshopper/locust and cockroach

*Distribution of Marks*

Maximum Marks: 75  
Minimum Pass Marks: 27

	<u>Regular</u>	<u>Ex.</u>
Physiology Experiment	12	15
Ecology Experiment	12	15
Spots (six)	12	18
Dissection	07	10
Project report on local fauna	07	--
Permanent preparation	05	07
Viva-voce	10	10
Record	10	--
Total	75	75

*List of Recommended Books:*

1. Srivastava, H.S. : Elements of Biochemistry, Rastogi Publications, Meerut
2. Goel, K.A. and Shastry, K.B. : Animal Physiology, Rastogi Publication, Meerut
3. Dalela, R.C. : Animal Physiology, S. Chand & Co. Ltd., New Delhi
4. Agarwal, R.A., Srivastava, Anil Kumar and Kaushal Kumar : Animal Physiology and Biochemistry, S. Chand & Co. Ltd., New Delhi
5. Kulshrestha, V.V. : Experimental Physiology, Vikas Publishing House, New Delhi
6. Samasiviah, I. et.al. : Text Book of Animal Physiology and Ecology, S. Chand & Co. Ltd., New Delhi

7. Verma, P.S., Tyagi, B.S. and Agarwal, V.K. : Animal Physiology, S. Chand & Co. Ltd., New Delhi
8. Hoar, S.: General and Comparative Physiology, Prentice Hall of India Pvt. Ltd.
9. Wood, D.W.: Principles of Animal Physiology
10. Prosser, C.B.: Comparative Animal Physiology, Satish Book Enterprise
11. Eckert, Animal Physiology. (W.H. Freeman)
12. Parihar, R.P.: Fish Biology and Indian Fisheries, Central Publication House, Allahabad
13. Kovaleve, P.A., Silkworm Breeding Stocks, Central Silk Board, Marine Drive, Mumbai
14. Roger, A. Morse, The ABC and XYZ of Bee Culture, A.I. Root & Co., Medina, Ohio 44256.
15. Metcalf C.L. and W.P. Flint, Destructive and Useful Insects, Tata McGraw Hill Publishing Co. Ltd., New Delhi – 110 051
16. Bomford, Mason and Swash, Hutchinson's Clinical Methods, Beilliers Tindal, ELBS edition
17. Gorbman, A., Dickhoff, W.W., Vigna, S.R., Clark, N.B. and Ralph, C.L. Comparative Endocrinology, John Wiley & Sons Inc., New York
18. Beauchamp, T.L. and J.F. Chidress. Principles of Biomedical ethics. Oxford University Press.
19. Nayar, B.V., Pest Management and Pesticides Indian Scenario, Namratha Publications, Madras
20. Odum : Ecology (Amerind)
21. Odum : Fundamentals of Ecology (W.B. Saunders)
22. Ricklefy: Ecology (W.H. Freeman)
23. Turk and Turk: Environmental Science (W.B. Saunders)
24. Dobzhansky, Ayala & Valentine: Evolution (W.H. Freeman)
25. Dobzhansky: Genetics and Origin of species (Columbia University Press)
26. Major: Population, Species & Evolution
27. White: Animal Cytology & Evolution.