

**SYLLABUS**  
**BACHELOR OF SCIENCE**  
**SECOND YEAR – 2016-2017**  
**FACULTY OF SCIENCE**

**DEPARTMENT OF BOTANY**  
**B.Sc. SECOND YEAR-2017**

**Theory**

Course	Nomenclature	Number of Papers	Number of Periods per week	Maximum marks	Minimum marks
Paper I	Taxonomy and Embryology of Angiosperms	1	2	50	54
Paper II	Anatomy of Angiosperms, Economic Botany and Ethnobotany	1	2	50	
Paper III	Cell Biology, Genetics, Plant Breeding and Evolution	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: TAXONOMY AND EMBRYOLOGY OF ANGIOSPERMS**

**Unit I: Diversity in plant form in annuals, biennials and perennials, Canopy architecture in angiosperms: tree-origin, development, arrangement and diversity in size and shape, Flower-modified shoot, structure and development of flower, Inflorescence-types of Inflorescence.**

**Unit II: Angiosperms: Origin and evolution. Some examples of primitive angiosperms. Angiosperm taxonomy; (Alpha-taxonomy, Omega-taxonomy, holotaxonomy)**

**Taxonomic literature. Botanical nomenclature; principles and rules; taxonomic ranks, type concept, principle of priority. Classification of angiosperms; salient features of the systems proposed by Bentham and Hooker and Engler and Prantl.**

**Unit III: Major contributions of cytology and molecular biology, phytochemistry and taximetrics to taxonomy. Diversity of flowering plants as illustrated by members of the families Ranunculaceae, Papaveraceae, Caryophyllaceae, Capparidaceae, Cucurbitaceae, Rutaceae and Apiaceae.**

**Unit IV: Diversity of flowering plants as illustrated by members of the families Asteraceae, Acanthaceae, Apocynaceae, Asclepiadaceae, Scrophulariaceae, Lamiaceae, Euphorbiaceae, Musaceae and Poaceae.**

**Unit V: Embryology: Structure of anther and pistil. Development of the male and female gametophytes; pollen-pistil interactions, self incompatibility; Double fertilization; Development of endosperm and embryo; Brief account of experimental embryology. Basics of gene imprinting.**

### **Suggested Laboratory Exercises**

Field study of diversities found in leaf shapes, size, thickness and surface properties.

The following families are for detailed taxonomic studies:

1. Ranunculaceae: *Ranunculus*, *Delphinium*
2. Papareraceae: *Papaver*, *Argemone*
3. Caryophyllaceae: *Dianthus*, *Gypsophylla*, *Saponaria*
4. Capparidaceae: *Capparis*, *Cleome*
5. Rutaceae: *Murraya*, *Citrus*
6. Apiaceae: *Coriandrum*, *Foeniculum*, *Anethum*
7. Cucurbitaceae: *Luffa* or anyCucurbit
8. Asteraceae: *Helianthus*, *Calandula*, *Sonchus*
9. Acanthaceae: *Adhatoda*, *Barleria*
10. Apocynaceae: *Catharanthus*, *Thevetia*, *Nerium*
11. Asclepiadaceae: *Calotropis*
12. Scrophulariaceae: *Linaria*, *Antirrhinum*
13. Euphorbiaceae: *Euphorbia*, *Phyllanthus*
14. Lamiaceae: *Ocimum*, *Salvia*
15. Musaceae: *Musa*

16. Poaceae: *Avena*, *Triticum*, *Hordeum*, *Poa*, *Sorghum*

### **Suggested Readings**

Bhandari, M.M. Flora of Indian Desert.

Bhojwani, S.S. and Bhatnagar, S.P. The Embryology of Angiosperms, 4th Revised and enlarged edition, Vikas Publ., New Delhi, 2002.

Davis, P.H. and Heywood, V.H. Principles of Angiosperm Taxonomy, Oliver and Boyd, London, 1963.

Fegerig K. and Vender Pifi The Principles of Pollination Ecology, Pergamon Press, 1979.

Gifford, E.M. and Foster, A.S. Morphology and Evolution of Vascular Plants, W.H. Freeman and Company, New York, 1979.

Heywood, V.H. and Moore, D.M. (eds.) Morphology and Evolution of Vascular Plants, W.H. Freeman and Company, New York, 1984.

Jeffrey, C. An Introduction to Plant Taxonomy, Cambridge University Press, Cambridge, London, 1982.

Jones, S.D. Jr. and Suchsinger, A.E. Plant Systematic (2nd ed.) McGraw-Hill Book Co., New York, 1986.

Maheshwari, J.K. Flora of Delhi, CSIR, New Delhi, 1963.

Redford, A.E.: Fundamentals of Plant Systematics, Harper and Row, New York, 1986.

Sharma, O.P. Taxonomy: Tata McGraw Hill Pub. Company Ltd., New Delhi 2000.

Singh, G. Plant Systematics – Theory and Practices, Oxford and IBH Pvt. Ltd., New Delhi, 1999.

Singh, V., Pandey, P.C. and Jain, D.K. Angiosperms, 2005, Rastogi Pub., Meerut.

## **PAPER II: ANATOMY OF ANGIOSPERMS, ECONOMIC BOTANY AND ETHNOBOTANY**

**Unit I: Anatomy of Angiosperms: Concept of stem cell in plants. Root system; Root apical meristem; differentiation of primary and secondary tissues and their roles; structural modification for storage, respiration, reproduction and for interaction with microbes.**

**Unit II: Shoot system: The shoot apical meristem and its histological organization; vascularization of primary shoot in monocotyledons and dicotyledons; cambium and its functions; formation of secondary xylem, a general account of wood structure in relation to conduction of water and minerals; characteristics of growth rings, sapwood and heart wood; secondary phloem-structure, function relationship; Periderm.**

**Unit III: Abnormal secondary growth and Leaf: Abnormal secondary growth in stems due to abnormal origin and activity of cambium. Leaf: Internal structure in relation to photosynthesis and water loss; adaptations to water stress; senescence and abscission.**

**Unit IV: Economic Botany, Food plants: Rice, wheat, maize, potato, sugarcane. Fibers: Cotton and Jute. Vegetable oils: Groundnut, mustard and coconut, General account of sources of firewood, timber and bamboos. Beverages: Tea and coffee; Rubber.**

**Unit V: Spices and Condiments: General account. Medicinal plants with special reference to Rajasthan: *Aloe, Asparagus, Commiphora, Boswellia, Pedalium, Zyziphus, Haloxylon, Tribulus, Vitex*, and *Withania*. Ethnobotany: Introduction, Methods of Ethnobotanical studies, knowledge of aboriginals in Rajasthan.**

### **Suggested Laboratory Exercises**

ANATOMY: L.S. of Shoot tip of study Cytohistological zonation and origin in leaf primordial. Anatomy of primary and secondary growths in monocots and dicots using hand sections (or prepared slides). Structure of secondary phloem and xylem. Growth rings in wood. Microscopic study of wood in T.S., T.L.S. and R.L.S. Internal structure of leaf. Structure and development of stomata (using epidermal peels of leaf). Anatomy of root, primary and secondary structures, Abnormal secondary growth in stem.

ECONOMIC BOTANY: Food plants: Study of morphology and structure. Simple microchemicals tests of the food storing tissues in rice, wheat, maize, potato and sugarcane. Microscopic examination of starch in these plants (except sugarcane)

Fibers: Study of cotton fiber, tests for cellulose. Vegetable oils: study of hand sections of Groundnut, Mustard and Coconut and staining of oils droplets by Sudan III and Sudan Black

Field visits: To study sources of firewood (10 plants), timber-yielding trees (10 trees) and bamboos. A list to be prepared mentioning special features

Medicinal Plants & Spices: Black pepper, cloves, cardamom describe them in briefly. Study of 10 medicinal plants. Write their botanical and common names, parts used and diseases/disorders for which they are prescribed.

Beverages & Rubber: Coffee, Tea & Rubber

ETHNOBOTANY: Ethnobotanically important plants of Rajasthan (Abrus, Leptidenia and Calotropis)

### **Suggested Readings**

Cutter, E.G. Plant Anatomy: Experiment and Interpretation, Part II. Organs, Edward Arnold, London, 1971.

Esau, K. Anatomy of Seed Plants, 2nd John Wiley & Sons, New York, 1977.

Fahn, A. Plant Anatomy. 2nd ed. Pergamon Press, Oxford, 1974.

Kocchar, S.L. Economic Botany in Tropics. 2nd ed. Mac-millan India Ltd., New Delhi, 1998.

Mauseth, J.D. Plant Anatomy, The Benjamin/Cummings Publ. Company Inc., Menloc Park, California, USA, 1988.

Sambamurthy, A.V.S.S. and Subramanyam, N.S. A Text book of Economic Botany, Wiley Eastern Ltd., New York, 1989.

Sharma, O.P. Hill's Economic Botany (Late Dr. A.F. Hill, Adapted by O.P. Sharma), Tata McGraw Hill Co., Ltd., New Delhi, 1996.

Simposon, B.B. and Conner-Ororzaly, M. Economic Botany Plants in Our World, McGraw Hill, New York, 1986.

### **PAPER III:CELL BIOLOGY, GENETICS, PLANT BREEDING AND EVOLUTION**

**Unit I:** History of cell biology: Concept of cell and cell theory. Cell cycle and its regulation. Mitosis and meiosis. Structural and Molecular organization of cell. Structure and function of cell wall; plasmodesmata, plasma membrane; golgi complex, plastid, mitochondria, endoplasmic reticulum, peroxisomes, vacuoles and nucleus.

**Unit II:** Chromatin organization: Organization and structure of chromosomes. Concept of nucleosomes, chromatin remodeling. Types of chromosomes and determination of sex in plants. Chromosome alteration: Structural alteration; deletion, duplication, translocation, inversion; Numerical variation: aneuploidy and polyploidy. Molecular basis of mutation: Spontaneous and induced, brief account of DNA damage and repair. Introduction to epigenetics.

**Unit III:** Nature of inheritance; Laws of Mendelian inheritance and its exceptions. Crossing- over and linkage analysis. DNA the genetic material: Structure and replication, brief account of DNA- protein interaction. Definition of a gene-modern Concept of gene (Promoter, coding sequences, terminator). RNA polymerases and general transcription. Regulation of gene expression in prokaryotes and basics of gene regulation in eukaryotes.

**Unit IV:** Origin of Agriculture, Centers of origin of crop plants and centers of Diversity. Concepts of Centers and Non-center (Harlan Hypothesis) Principles of plant breeding- Domestication, Introduction, Selection, Clonal propagation, Hybridization, Mutation breeding; Breeding work done on wheat; Green revolution; Assessment and Consequences; Biodiversity and Conservation of germplasm.

**Unit V:** Theories of Evolution: Catastrophism, The Lamarck's theory, Darwin's theory, Evidences of organic evolution, mechanism of evolution. Origin of basic biomolecules evolution of prokaryotic and eukaryotic cell. and Origin of species Population genetics: Allele and genotype frequency, Hardy- Weinberg principles.

### **Suggested Laboratory Exercises**

#### **CYTOLOGY**

1. Study of cell structure from onion leaf peels
2. Comparative study of cell structure in onion cells and *Hydrilla*
3. Smear preparation of root tips for different stages in *Allium* root tip
4. Cytological examination special types of chromosomes (Slides)
5. Examination of electron micrographs of eukaryotic cells and cell organelles

#### **GENETICS**

1. Working out laws of inheritance using seed mixtures
2. Monohybrid, dihybrid and test crosses using seed samples

#### **PLANT BREEDING**

1. Demonstration of Emasculation techniques.

### **Practical Exam Scheme**

### **B.Sc. Botany Part II**

Q1. Describe a given flower in semi-technical language with flower diagram and formula mentioning special feature of identification. Cut a T.S. of anther/ovary/ovule of the same flower and describe from embryological point of view.

(10+4) (10+6)

Q2. Cut a T.S./V.S. of given stem/root/leaf and make a double stained preparation of the same. Draw a labeled diagram (outline and cellular), identify with special features.

(8+6) (9+7)

Q3. Prepare a smear of onion root tip, for observation of metaphase and anaphase stage of mitosis. Draw a labeled diagram of the same.

(12+4) (11+3)

Q4. Spots (1-9) three from each paper

(27) (27)

Q5. Practical record

(6) -

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75

75

### Suggested Readings

Alberts, B., Bray, D., Lewis, J., Raff, M., Roberts, K. and Watson, I.D. *Molecular Biology of cell*. Garland publishing Co., New York, USA

Chaudhary, H.K. *Elementary principles of plant Breeding*, Oxford & IBH Publishing New Delhi.

Gupta, P.K. *A Textbook of cell and Molecular Biology*, Rastogi Publications, Meerut, 1999

Gupta, P.K. *Cytology, Genetics, Evolution and plant Breeding*, Rastogi, Publication, Meerut, 2000.

Lodish, H., Berk, A., Zipursky, S.L., Matsudaira, P., Baltimore, D. and Darnell, J. *Molecular Cell Biology*, W.H. Freeman & Co. New York, USA

Miglani, G.S. *Advanced Genetics*, Narosa publishing Co., Inc., USA

Russel, P.J. *Genetics*. The Benjamin/ Cummings Publishing Co., Inc., USA

Shukla, R.S. and Chandel, P.S. *Cytogenetics, Evolution and Plant Breeding*, S.Chand&Co.Ltd., New Delhi



Singh B.D. Textbook of plant Breeding. Kalyani publishers, Ludhiana, 1999

Sinha, U. and Sinha, S. Cytogenetics, Plant Breeding and Evolution, Vikas Publishing House, New Delhi, 1997

Sunstand, D.P. and Simmons, M.J. Principles of Genetics, John Wiley & Sons Inc., USA 2000

## BIOTECHNOLOGY 2017

### PAPER I: MOLECULAR BIOLOGY

Max Marks: 50

**Unit 1:** Molecular basis of life, Structure of DNA, DNA replication in prokaryotes and eukaryotes. Concepts of genomics and proteomics.

**Unit 2:** DNA recombination-molecular mechanism in prokaryotes and eukaryotes. Insertion elements and transposons. Structure of prokaryotic genes.

**Unit 3:** Prokaryotic transcription, prokaryotic translation, prokaryotic gene expression (*lac*, *his*, *trp*, catabolic repression).

**Unit 4:** Structure of eukaryotic genes- transcription, eukaryotic translation, eukaryotic gene expression and transcription factors.

**Unit 5:** Gene expression in yeast, post translation regulation of gene expression. Developmental and environmental regulation of gene expression.

### PAPER II: BIOPHYSICS

Max Marks: 50

**Unit I:** Law of thermodynamics, Enthalpy, Free Energy, Heat dissipation and heat conservation. Primary events in Photosynthesis.

**Unit II:** Strategies of light reception in microbes, plants and animals. Electrical properties of biological components.

**Unit III:** Generation and reception of sonic vibrations. Hearing aids, Intra and intermolecular interactions in biological system.

**Unit IV:** Physical methods applied to find out molecular structure: X-ray crystallography and NMR. General Spectroscopy, Lambert-Beer Law, Spectrophotometry & Colorimetry, UV-VIS, Fluorescence, AAS, IR, Raman Spectra

**Unit V:** Physical methods of imaging intact structure:

Ultra sound, Optical filters, X-ray, CAT scans, ECG, EEG, NMR imaging.

### **PAPER III: IMMUNOLOGY AND CELL CULTURE**

Max. Marks: 50

**Unit I:** The immune system along with historical perspectives. Non-specific & specific immune mechanism, organs and cells of immunity and their function. Concept of Acquired and innate immunity and antigen.

**Unit II:** Structure and function of various classes of immuno-globulins

Humoral Immunity – Mechanism involved

Cell mediated immunity role of MHC, mechanism and cells involved.

Vaccines – Dead, live attenuated, recombinant, edible and chimeric vaccines.

**Unit III:** History of animal cell cultures. Biology of cultured Cells-the culture environment, Cell adhesion, Cell proliferation, energy metabolism.

Culture Vessels: The substrate, choice of culture vessels.

Laboratory requirements and sterilization techniques.

Simulating natural condition for growing animal cells- Importance of growth factor is serum.

**Unit IV:** Primary cultures: Isolation of tissue, primary explants cell line– Nomenclature, Subculture & Propagation, finite and continuous cell lines.

Commonly used cell lines: their origin and characteristics, growth kinetic and cell lines.

**Unit V:** Application of animal cell culture

Cell Separation, characterization and differentiation

Transformation–Characteristics and applications

Transfection of animal cell & selectable markers.

### **Practical**

1. Separation of molecules in cellular extract in aqueous buffer
  - (a) Gel Filtration
  - (b) Ion exchange chromatography
  - (c) TLC of extracted material
  - (d) Isolation of chromosomal and plasmid DNA from bacteria
  - (e) Restriction digestion of DNA and assigning restriction sites (demonstrations)
  - (f) Making competent cells of E-coli
  - (g) Transfection cells of plasmid DNA and selection for transformants.
2. Purification of antigens and antibodies
  - (a) Raising polyclonal antibodies
  - (b) Enzyme Linked Immunoassay
  - (c) Radio immunoassay
  - (d) Diagnosis of an infectious disease by an immunoassay

### **Book Recommended**

Buchanan, Gruissem& Jones: Biochemistry and molecular biology of plants –American Society of Plant Physiologist, Maryland USA

Peter Paoletta: Introduction to molecular biology. Tata McGraw Hill

Alberts, Bray, Lewis, Raff, Roberts & Watson: Molecular Biology of the cell. Garland Publishing Inc.

Darnell, Lodish& Baltimore: Molecular cell Biology –Scientific American Books

Roitt, Male &Brostoff: Immunology. Mobey, London

Roitt: Essential Immunology – Blackwell Scientific

Lewin: Gene VIII, Oxford University Press

Kuby J: Immunology –Understanding of immune system Wiley Liss NY

VolKenshtein: Biophysics, Russian Press

Deniel, M: Basic biophysics for biologists, Agrobios

Van Holde: Principles of Physical biochemistry, Prentice Hall

## **Practical**

Time: 5.00 Hr

Max Mark: 75

Min Mark: 27

- |    |                                                                         |    |
|----|-------------------------------------------------------------------------|----|
| 1. | Perform and explain the given Molecular Biology experiment.             |    |
|    | Show the result to the examiner                                         | 12 |
| 2. | Perform and explain the given Biophysics experiment.                    | 12 |
| 3. | Perform and explain the given immunology and/or cell culture Experiment | 12 |
| 4. | Identify and Comment upon the spots (1 to 7)                            | 21 |
| 5. | Viva-Voce                                                               | 10 |
| 6. | Practical Record                                                        | 08 |

## **DEPARTMENT OF CHEMISTRY** **B.Sc. SECOND YEAR-2017**

### **1. PAPER - I**

#### **CH-201 Inorganic Chemistry – II**

#### **UNIT I**

##### **Chemistry of Transition Elements**

General Characteristics and Periodicity in properties with emphasis on their electronic configuration and multiple oxidation states of 3d, 4d and 5d series elements.

Colored ion formation, magnetic, catalytic properties and complex formation tendency in 3d series elements.

## **UNIT II**

### **Coordination compounds**

Werner's coordination theory and experimental verification, Effective Atomic Number concept, chelates, nomenclature of coordination compounds, stereoisomerism in complexes of coordination number 4 and 6. Complexometric titrations and theory of metallochrome indicators.

## **UNIT III**

### **f-Block elements**

Chemistry of Lanthanides: Electronic structure, oxidation state, ionic radii, colors, spectral and magnetic properties. Lanthanide contraction and its consequences.

Chemistry of actinides: General characteristics, comparative treatment with lanthanides in respect to ionic radii, oxidation states, Magnetic behavior and spectral properties.

## **UNIT IV**

Concepts of acids and bases: Arrhenius, Bronsted-Lowry, Lewis and Usanovich concept. Acid base titrations, Theory of indicators, Redox titrations

Non aqueous solvents: Physical properties of solvent, types of solvents and their general characteristics. Reactions in non aqueous solvents with reference to

liquid  $\text{NH}_3$  and liquid  $\text{SO}_2$

## **UNIT V**

### **Quantitative analysis**

Types of quantitative analysis: Gravimetric and volumetric analysis.

Precipitation, Co-precipitation and Post precipitation.

Errors in chemical analysis: types of error and their minimization;

Accuracy, Precision, Standard Deviation.

Books Recommended:

1. Inorganic Chemistry by Satya Prakash
2. Inorganic Chemistry by B.R.Puri & L.R. Sharma
3. Inorganic Chemistry by Sangeeta Loonkar , Ramesh Book Depot, Jaipur

2.

### 3. PAPER - II

## CH-202 Organic Chemistry

### UNIT : I

#### Electromagnetic Spectrum : Absorption Spectra

Ultraviolet (UV) absorption spectroscopy – absorption laws (Beer-Lambert law), molar absorptivity, presentation and analysis of UV spectra, types of electronic transitions, effect of conjugation. Concept of chromophore and auxochrome. Bathochromic, hypsochromic, hyperchromic and hypochromic shifts. UV spectra of conjugated enes and enones. UV applications including identification of groups

### 4. UNIT : II

#### Alcohols

Classification and nomenclature.

Monohydric alcohols – nomenclature, methods of formation by reduction of aldehydes, ketones, carboxylic acids and esters. Hydrogen bonding. Acidic nature. Reactions of alcohols.

Dihydric alcohols – nomenclature, methods of formation, chemical reactions of vicinal glycols, oxidative cleavage  $[\text{Pb}(\text{OAc})_4$  and  $\text{HIO}_4$ ] and pinacol-pinacolone rearrangement.

Trihydric alcohols – nomenclature and methods of formation, chemical reactions of glycerol.

#### Phenols

Nomenclature, structure and bonding. Preparation of phenols, physical properties and acidic character. Comparative acidic strengths of alcohols and phenols, resonance stabilization of phenoxide ion. Reactions of phenols – electrophilic aromatic substitution, acylation and carboxylation. Mechanisms of Fries rearrangement, Claisen rearrangement, Gatterman synthesis, Hauben-Hoesch reaction, Lederer-Manasse reaction and Reimer-Tiemann reaction.

### 5. UNIT : III

#### Aldehydes and Ketones

Nomenclature and structure of the carbonyl group. Synthesis of aldehydes and ketones with particular reference to the synthesis of aldehydes from acid chlorides, synthesis of aldehydes and ketones using 1,3-dithianes, synthesis of ketones from nitriles and from carboxylic acids. Physical properties. Mechanism of nucleophilic additions to carbonyl group with particular emphasis on benzoin, aldol, Perkin and Knoevenagel condensations. Condensation with ammonia and its derivatives. Wittig reaction. Mannich reaction. Use of acetals as protecting group. Oxidation of aldehydes, Baeyer-Villiger oxidation of ketones, Cannizzaro reaction. MPV, Clemmensen, Wolff-Kishner,  $\text{LiAlH}_4$  and  $\text{NaBH}_4$ .

#### **UNIT : IV**

##### **Carboxylic Acid**

Nomenclature, structure and bonding, physical properties, acidity of carboxylic acids, effects of substituents on acid strength. Preparation of carboxylic acids. Reactions of carboxylic acids. Hell-Volhard-Zelinsky reaction. Reduction of carboxylic acids. Mechanism of decarboxylation, esterification and hydrolysis of esters (acidic and basic). Reactive methylene compounds: malonic ester and acetoacetic ester – preparation and synthetic applications. Mechanism of Claisen condensation

##### **Ethers and Expoxides**

Nomenclature of ethers and methods of their formation, physical properties. Chemical reactions – cleavage and autoxidation, Ziesel's method for methoxy group.

Synthesis of epoxides. Acid and base-catalyzed ring opening of epoxides, orientation of epoxide, reactions of Grignard and organolithium reagents with epoxides.

#### **UNIT : V.**

##### **Organic Compounds of Nitrogen**

Preparation of nitroalkanes and nitroarenes. Chemical reactions of nitroalkanes. Mechanisms of nucleophilic substitution in nitroarenes and their reductions in acidic, neutral and alkaline media. Picric acid.

Alkyl and Aryl amines : Reactivity, structure and nomenclature of amines, physical properties. Stereochemistry of amines. Separation of a mixture of primary, secondary and tertiary amines. Structural features effecting basic nature of amines. Amine salts as phase-transfer catalysts. Preparation of alkyl and aryl amines (reduction of nitro compounds, nitriles), reductive amination of aldehydic and ketonic compounds. Gabriel-phthalimide

reaction, Hofmann bromamide reaction. Reactions of amines, electrophilic aromatic substitution in aryl amines, reactions of amines with nitrous acid. Synthetic transformations of aryl diazonium salts, azo coupling.

#### **Books Recommended:**

1. Advanced Organic Chemistry by Mukherji, Singh & Kapoor
2. Organic Chemistry by Bahal and Bahal
3. Advanced Organic Chemistry by Morrison & Boyd
4. Carbanic Rasayan By K.M Gangotri RBD

### **6. PAPER - III**

#### **CH-203 Physical Chemistry**

### **7. UNIT I**

#### **Thermodynamics – I**

First Law of Thermodynamics: statement, definition of internal energy and enthalpy. Joule-Thomson Effect, Joule – Thomson coefficient and inversion temperature. Calculation of  $w$ ,  $q$ ,  $dU$  &  $dH$  for the expansion of ideal gases under isothermal and adiabatic conditions for reversible process. Second Law of Thermodynamics: need for the law, different statements of the law. Carnot cycle and its efficiency, Carnot theorem. Numericals.

### **8. UNIT II**

#### **Thermodynamics – II**

**Entropy:** Concept of Entropy, entropy as a state function, entropy as a function of  $V$  &  $T$ , entropy as a function of  $P$  &  $T$ , entropy change in physical change, Clausius inequality, entropy as a criteria of spontaneity and equilibrium. Entropy change in ideal gases and mixing of gases. Gibbs and Helmholtz function as thermodynamic quantities, Gibbs – Helmholtz equation. Equilibrium constant and free energy. Reaction isotherm and reaction isochore. Clapeyron equation and Clausius – Clapeyron equation, applications. Third law of thermodynamics: Nernst heat theorem, Statement of third law and evaluation of absolute entropy from heat capacity data. Numericals.

### **UNIT III**

#### **Phase Equilibrium**

Statement and meaning of the terms – phase, component and degree of freedom, Gibbs phase rule, phase equilibria of one component system – water and sulphur systems.

Phase equilibria of two-component system: simple eutectic systems,– Pb-Ag system, desilverisation of lead.



Two Component Systems– compound formation with congruent melting point (Mg-Zn) and incongruent melting point, (FeCl<sub>3</sub>-H<sub>2</sub>O) system. Freezing mixtures.

Nernst distribution law, deviations from Nernst Law, applications to study of complex ion and solvent extraction.

## **9. UNIT IV**

### **Electrochemistry – I**

Conductance, Specific conductance and equivalent conductance. Activity, activity coefficient and ionic strength. Debye-Huckel-Onsager's equation for strong electrolytes (elementary treatment only). Transport number, definition and determination by Hittorf method and moving boundary method.

Applications of conductivity measurements: determination of degree of dissociation, determination of K<sub>a</sub> of acids, determination of solubility product of a sparingly soluble salt, Conductometric titrations and their types.

## **UNIT V**

### **Electrochemistry – II.**

Nernst equation, derivation of cell E.M.F. and single electrode potential, standard hydrogen electrode, reference electrodes, standard electrode potential, sign conventions. Electrolytic and Galvanic cells – reversible and irreversible cells, conventional representation of electrochemical cells. EMF of a cell and its measurements. Computation of cell EMF. Calculation of thermodynamic quantities of cell reactions ( $\Delta G$ ,  $\Delta H$  and  $K$ ). Concentration cell with and without transport (mathematical treatment), liquid junction potential, application of concentration cells, valency of ions, solubility product and activity coefficient.

Potentiometric titrations, Determination of pH using hydrogen, quinhydrone and glass electrodes. 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 Ltd.
3. Principles of Physical Chemistry, B.R. Puri, L.R. Sharma and M.S. Pathania, Shobhan Lal Naginchand & Co.
4. Physical Chemistry By K.R. Genwa RBD

5. Physical Chemistry, Bahal & Tuli, S. Chand & Co. Ltd.

6. Physical Chemistry, R.C. Saraswat and A.K. Goswami, RamPrasad & Sons.

### **CH-204 Laboratory Course – II**

#### **Inorganic Chemistry:**

**[20]**

Gravimetric analysis

- (i) To estimate Barium as barium sulphate.
- (ii) To estimate copper as cupric oxide/ copper (I) thiocyanate.
- (iii) To estimate Zinc as Zinc oxide.

#### **Organic Chemistry:**

**[20]**

- (i) Calibration of Thermometer: - The following compounds may be used for the calibration purpose 80<sup>0</sup>-82<sup>0</sup> (Naphthalene), 113.5<sup>0</sup>-114<sup>0</sup> (Acetanilide), 132.5<sup>0</sup>-133<sup>0</sup> (Urea) and 122<sup>0</sup> (Benzoic acid).
- (ii) Qualitative Analysis: - Identification of organic compounds (one liquid one solid) through the functional group analysis (containing only one functional group).

#### **Physical Chemistry:**

**[15]**

#### **Chemical Kinetics:**

- (i) To study the hydrolysis of an ester catalyzed by an acid and determine the rate constant and order of reaction.
- (ii) To study saponification of ester and determine the rate constant and order of reaction.
- (iii) To study the reaction b/w acetone and iodine with respect to iodine and determine the rate and order of reaction.

#### **Viva**

**[5]**

#### **Record**

**[15]**

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

1. Experimental Organic Chemistry Vol I & II, P.R. Singh, D.S. Gupta and K.S. Bajpai, Tata McGraw Hill.
2. Practical Chemistry, S.Giri, D.N.Bajpai and O.P.Pandey Publ. S. Chand
3. Laboratory Manual in Organic Chemistry, R.K. Bansal, Wiley Eastern.
4. Experiments in General Chemistry, C.N.R. Rao and U.C. Agarwal, East-West Press.
5. Advanced Practical Physical Chemistry, J.B. Yadav, Goel Publishing House.
6. Advanced Experimental Chemistry, Vol. I-Physical, J.N. Gurtu and R. Kapoor, S. Chand & Co.
7. Selected Experiments in Physical Chemistry, N.G. Mukherjee, J.N. Ghose & Sons.
8. ....

## Examination & Marking Scheme

Time: 5 hours

Max. Marks: 75

Min. Pass Marks: 27

	Regular Student	Ex Student
Gravimetric Exercise	20	20
Qualitative Organic Analysis	20	20
Physical Experiment	15	15
Viva- Voice	5	5
Sessional and Record	15	...
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Total	75	60*

\*To be converted out of 75

Gravimetric Exercise- An error up to 0.5% carries full marks. For each subsequent 0.1% error deduct 1 mark, 8 marks reserved for procedure.

Qualitative Organic Analysis: Two organic compounds (one solid and one liquid) 2 mark each for correct identification of functional group, 2 marks each for element detection, 4 marks each for identification and 2 mark each for systematic work and proper record.

Physical Experiment: Observations- 6 mark, Calculation and Formula-5, Result-4 marks.

**DEPARTMENT OF GEOLOGY**  
**B.Sc. SECOND YEAR-2017**

**Theory**

Paper I	Igneous and Metamorphic Petrology	50 Marks
Paper II	Sedimentary Petrology	50 Marks
Paper III	Stratigraphy	50 Marks
Practicals	: Practical Examination	75 Marks

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Total 225 Marks

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Duration of each theory paper Examination

3 Hrs.

Duration of Practical Examination

3 Hrs.

**PAPER I : IGNEOUS AND METAMORPHIC PETROLOGY**

**Unit I :**

Composition of magma. Crystallization of Unicomponent(Silica), Bicomponent(Ab-An) and Tricomponent magma(Ab-An-Di). Bowen's Reaction Series. Forms and Structures of Igneous rocks

**Unit II :**

Textures and their genetic implications for Igneous rocks. Elementary idea of classification of Igneous rocks based on Mineralogical, mode of occurrence and Geochemical factors. Tabular classification of Igneous rocks.

**Unit III :**

Metamorphism and its kinds and agents. Concept of depth zones, facies and grades of metamorphism. Texture and structures of metamorphic rocks.

**Unit VI :**

Regional metamorphism of argillaceous, arenaceous and mafic rocks. Thermal metamorphism of impure carbonate rocks. Cataclastic metamorphism.

**Unit V :**

Field, megascopic and microscopic characteristics and petrogenesis of following rocks.  
(A) Granite, Syenite, Gabbro, Anorthosite, Peridotite, Pegmatite, Lamprophyre, Rhyolite, Basalt. (B) Quartzite, Marble, Phyllite, Schist, Slate, Gneiss, Migmatite, Granulite and Charnokite.

## **PAPER II : SEDIMENTARY PETROLOGY**

### **Unit I :**

Sediments and Sedimentary rocks, the process of their formation;

Sedimentary structure: Surface structure- ripple marks, sole marks, rill marks, rain prints. Internal structure : bedding, graded bedding, cross bedding and penecontemporaneous deformation. Biogenic structures : stromatolites and ichnofossils.

### **Unit II :**

Texture of sedimentary rocks; grain size their distribution and geological significance, shape sphericity and roundness, packing orientation and internal fabric of sedimentary rock.

Heavy minerals,: The process of separation and study for provenance determination.

### **Unit III :**

Types of sediments and sedimentary rocks- clastic rocks, their classification and characteristics, Petrogenesis of common clastic rocks. Characteristics of Sandstone, Siltstone, Shale, Conglomerate and Breccia.

### **Unit IV :**

Chemical and Biogenic Rocks : Characteristics, classification and origin. Characteristics of Limestone, Dolomite, Phosphorite, Lignite and Coal.

### **Unit V :**

Elementary knowledge of sedimentary environments. Characteristics of their products, : Glacial, Lacustrine, Fluvial, Deltaic Shore line, Shelf and deep marine environments.

## **PAPER III : STRATIGRAPHY**

### **Unit I :**

Geological Time Scale: various boundaries and characteristics of each division and Indian equivalents. Rock unit, Time unit and Rock-Time unit. Principles of stratigraphy. Stratigraphic correlation and various methods of its determination.

### **Unit II :**

Archean Geology of Dharwar Craton, Singhbhum Craton, Baster Craton and Eastern Ghat Craton and Rajasthan Craton ( Bhilwara Supergroup to include BGC and Pre Aravalli metasediments).

### **Unit III :**

Proterozoic : Aravalli Supergroup, Cuddapah Supergroup, Delhi Supergroup, Vindhyan Supergroup and Malani Igneous Suite.

### **Unit IV :**

Palaeozoics and Mesozoics of Salt Range, Spiti, Kashmir and Kumaon Himalaya. Marwar Supergroup and Mesozoics of Rajasthan. Jurassic of Kutch, Cretaceous of Trichinopoly. Gondwana Supergroup and Deccan Traps.

### **Unit V**

Tertiary of Sindh-Baluchistan, Northeastern India and Petroleum resources, Siwalik Supergroup and western Rajasthan. Quaternary Geology : Indogangetic plains, Thar Desert, Himalayan morphology, upheavals and lost of river Saraswati, Pleistocene glacial and interglacial periods and evidences.

## **PRACTICALS**

1. Petrological characteristics (Mineralogy, texture and structural and Petrogenesis ) of important Igneous, Metamorphic and Sedimentary rocks in handspecimens.

2. Petrological characteristics (Mineralogy, texture and structural and Petrogenesis ) of important Igneous, Metamorphic and Sedimentary rocks under Petrological Microscope.
3. Identification and Stratigraphic Ordering of rocks samples.
4. Demarcation of important Supergroups of Indian Stratigraphy in outline map of india.
5. Preparation of Geological map of western Rajasthan in Lab.
6. Sessional Marks.

### **SUGGESTED READING**

1. Tyrell GW Principles of Petrology
2. Tyrell GW Sailiki ke Sidhant, Madhya Pradesh Hindi Granth Academy, Bhopal.
3. Pettijohn Sedimentary Rocks, C. B. S. Publication, New Delhi
4. Best, M. G. 1986 Igneous and Metamorphic Petrology C. B. S. Publication, New Delhi.
5. Krishnan M S Geology of India and Burma, C. B. S. Publication, New Delhi.
6. Ravindra Kumar Fundamentals of Historical geology and Stratigraphy of India. Willey Eastern New Delhi
7. Wadia D N Geology of India
8. Bharatvarsh ka Bhu Vigyan, , Madhya Pradesh Hindi Granth Academy, Bhopal.

**DEPARTMENT OF MATHEMATICS & STATISTICS**  
**B.Sc. SECOND YEAR-2017**

**TEACHING AND EXAMINATION SCHEME**

Subject/Paper	Period/Week		Exam. Hours	Max Marks	Min.Pass Marks
	L	P			
<b>MATHEMATICS</b>					
Paper I	3	-	3	75	81
Paper II	3	-	3	75	
Paper III	3	-	3	75	
<b>STATISTICS</b>					
Paper I	2	-	3	50	54
Paper II	2	-	3	50	
Paper III	2	-	3	50	
<b>PRACTICALS</b>	6	-	4	75	27



**DEPARTMENT OF MATHEMATICS & STATISTICS**  
**B.Sc. SECOND YEAR-2017**

Paper I : Numerical Analysis and Linear Programming.  
Paper II : Differential Equations.  
Paper III : Mechanics I (Statics and Dynamics of particle)

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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 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**  
**Numerical Analysis and Linear Programming**

**Unit 1:** Difference operators and factorial notation, Differences of polynomial, Newton's formulae for forward and backward interpolations. Divided differences, relation between divided differences and Simple difference. Newton's general interpolation formulae, Lagrange interpolation formula.

**Unit 2:** Central differences, Gauss, Stirling and Bessel interpolation formulae. Numerical Differentiation. Numerical integration, Trapezoidal, Simpsons and Weddles rules.

**Unit 3:** Solution of linear difference equations with constant and variable coefficients. Solution of Algebraic and Transcendental equations, Iterative, Regula Falsi and Newton Raphson methods.

**Unit 4:** Convex sets and their properties, introduction to linear programming problems. Mathematical formulation; Graphical method of solution of linear programming problems for two variables.

**Unit 5:** The simplex technique and its application to simple L.P. problems. Concepts of duality in linear programming. Framing of dual programming. Elementary theorems of duality.

**SUGGESTED BOOKS**

Gokhroo, Saini : Linear Programming (Hindi Ed. ), Navkar Prakashan, Ajmer.  
Mittal, Sethi : Linear Programming, Pragati Prakashan, Meerut  
Goyal, Mittal : Numerical Analysis, Prograti Prakashan, Meerut  
Bansal, Bhargava : Numerical Analysis (Hindi Ed.); Jaipur Publishing House, Jaipur  
Saxena, H.C. : Numerical Analysis; S.Chand & Co., New Delhi  
Gokhroo : Numerical Analysis (Hindi Ed.); Navkar Prakashan, Ajmer  
Bhargava, Sharma, Bhati : Linear programming (Hindi Ed.); Jaipur Publishing House, Jaipur.

## Paper II

### Differential Equations

**Unit 1:** Exact and reducible to exact differential equations of first order and first degree. First order higher degree differential equations solvable for x,y,p. Clairaut's form and singular solutions.

**Unit 2:** Linear differential equations with constant coefficients, Homogeneous linear differential equations with variable coefficients. Simultaneous differential equations, Total differential equations of the form  $Pdx + Qdy + Rdz = 0$ , by method of inspection and method for homogeneous equations.

**Unit 3:** Linear differential equations of second order of the form  $\frac{d^2y}{dx^2} + P \frac{dy}{dx} + Qy = R$ .

Exact Linear differential equations of n

th

order. Exact Non-Linear differential equations. Differential

equations of the various forms e.g., (i)  $\frac{d^2y}{dx^2} = f(y)$  (ii) Equations not containing y directly (iii)

Equations not containing x directly and other forms. Method of variation of parameters to the solution of second order linear differential equations.

**Unit 4:** Series solutions of Second Order Linear differential equations, Power series method, Bessel and Legendre equations. Partial differential equations of the first order. Lagrange's solution. Some special types of equations which can be solved easily by methods other than the general method. Charpit's (general) method of solution.

**Unit 5:** Partial differential equations of second and higher order. Classification of linear partial differential equations of second order. Homogeneous and non-homogeneous equations with constant coefficients. Partial differential equations reducible to equations with constant coefficients. Monge's method of integrating  $Rr + Ss + Tt = V$ .

### SUGGESTED BOOKS

Sharma, Gupta : Differential Equations; Krishna Prakashan, Meerut

Ray, Chaturvedi : Differential equations; Kedar Nath, Ram Nath & co., Agra.

Bansal, Dharmi : Differential equations (Vol. II); Jaipur Publishing House, Jaipur

Gokhroo, Saini, Kumbhat : Differential equations (Hindi Ed.); Navkar Prakashan, Ajmer

Gokhroo, Saini, Oza : Partial differential equations; Jaipur Publishing House, Jaipur.

**Paper III**  
**Mechanics – I**

**(Statics and Dynamics of a Particle)**

**Unit 1:** Resultant and equilibrium of coplanar forces acting on a rigid body. Friction.

**Unit 2:** Stable and Unstable equilibrium. Forces in three dimensions, Poinsot's central axis, Wrenches.

**Unit 3:** Virtual work and common catenary.

**Unit 4:** Velocities and accelerations along radial and transverse directions and along tangential and normal directions. Simple harmonic motion and motion under inverse square law.

**Unit 5:** Motion on smooth and rough plane curves, circular and cycloidal motions. Central forces and central orbits (excluding planetary motion).

**SUGGESTED BOOKS**

S.L. Ioney : Statics

R.S. Verma : A Text Book on Statics; S. Chand & Co., New Delhi.

S.L. Loney : Dynamics of a particle & Rigid bodies.

Ray, M : A Text book on Dynamics; S. Chand & Co., New Delhi

Gokhroo, Saini & Yadav : Higher Dynamics II (Hindi Ed.); Navkar Prakashan, Ajmer

Bhargava, Agarwal : Dynamics (Hindi Ed. );Jaipur Publishing House, Jaipur

Bhargava, Agarwal, Gupta : Statics (Hindi Ed.); Jaipur Publishing House, Jaipur

Gokhroo : Statics (Hindi Ed.); Navkar Prakashan, Ajmer.

**B.A. / B.Sc. Part II Examination 2017**  
**Statistics**

**Paper I : Probability and Probability Distributions**

**Paper II : Correlation and Numerical Methods**

**Paper III: Sampling Techniques**

**Practical**

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

There will be two questions from each unit

**Section A:** Will consist of 10 compulsory questions. answer of each question shall be limited up to 30 words.

and 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**

**Probability and Probability Distributions**

**Unit 1:** Discrete probability distributions and their properties: Bernoulli, Binomial, Poisson, negative binomial, geometric, hypergeometric, multinomial and discrete uniform distributions.

**Unit 2:** Continuous probability distributions and their properties: Uniform, Normal, Exponential, Beta type I and type II, Gamma and Cauchy distributions.

**Unit 3:** Distributions of functions of random variables, cumulative distribution, function techniques, distribution of sum, difference, product and quotient of two random variables, the moment generating functions and transformation techniques (Chapter V of Mood, Graybill and Boes Book).

**Unit 4:** Concepts of conditional expectations, the conditional variance, the joint moment generating function and moments, the bi-variate normal distribution and its properties.

**Unit 5:** Stochastic convergence: Chebyshev's inequality and its generalized form, weak and strong law of large numbers, simple form of central limit theorem.

**BOOKS SUGGESTED:**

Mood, A.M. , Graybill, F.A. and Boes, D.C. Introduction to the Theory of Statistics (Third edition), Mc-Graw-Hill.

Hogg, R.V. and Graig, A.T.: Mathematical Statistics, Amerind

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

## **Paper II**

### **Correlation and Numerical Methods**

**Unit 1:** Method of least squares, its application in fitting of straightline, Second degree parabola, logarithmic and exponential curves. The bi-variate data marginal and conditional frequency distribution, covariance, variance of a linear function of variates.

**Unit 2:** Correlation and regression, the rank correlation, intraclass correlation, the correlation ratio, probable error.

**Unit 3:** Multivariate data, concept of multiple correlation and regression, partial correlations, multiple regression equation (for three variables).

**Unit 4 :** Time series and its components, method of moving average and curve fitting for determining trend, determination of seasonal indices. Link relative method.

**Unit 5:** Statistical applications of numerical methods: Methods of intra and extra polations due to Newton, Lagrange and Gauss. Divided differences and Newton's formula. Numerical Integrations: Trapezoidal and Simpson's formulae.

### **BOOKS SUGGESTED**

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

Kapoor, J.N. and Saxena H.C.: Mathematical Statistics, S.Chand and Co., Delhi. Scarborough, J.B.: Numerical Mathematical Analysis, Oxford and IBH.

## **Paper III**

### **Sampling Techniques**

**Unit 1:** Sampling surveys vs. complete enumeration, random and purposive sampling. Methods of drawing random sample, the principal steps in sample surveys, sampling and non sampling errors.

**Unit 2:** Simple random sampling with and without replacement, stratified random sampling, comparison of stratified sampling with SRSWOR.

**Unit 3:** Ratio and regression methods of estimation, estimation of population mean and total in large sample size. Comparison with simple estimator.

**Unit 4:** Systematic Sampling: unbiased estimator, variance of the estimator (including in terms of intra class correlation coefficient), Comparison with SRS, elementary idea of estimation of variance".

Cluster Sampling with equal cluster size: Unbiased estimator, variance of the estimator / (including in terms of intra class correlation coefficient), estimation of variance.

**Unit 5:** Two stages sampling in case of equal cluster size at both the stages. Two phase sampling: ratio and regression estimation.

## BOOKS SUGGESTED

Cochran, W.G.: Sampling Technique, John Wiley Publication, New York.

Sukhatme, P.V. and others: Sample Surveys and its application, ISAS, Delhi –

12.

## 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
Total	75 Marks	65 Marks*

\*To be converted out of 75 marks.

The following topics are prescribed for practical works:

1. Computation of co-efficient of (i) Simple correlation (ii) Rank correlation.
2. Preparation of correlation table from ungrouped data.
3. Determination of regression lines from (i) Ungrouped data (ii) Correlation table.
4. Fitting of linear regression in case of three variables, computation of partial and multiple correlations coefficient for three variables.
5. Fitting of (i) Straight line (ii) Second degree parabola (iii) Exponential curve by least square method.
6. Fitting of distributions (i) Binomial (ii) Poisson (iii) Normal distributions and testing of goodness of fit.
7. Moving average method for determining trend, seasonal indices.
8. Practical on Numerical methods (Covered in Paper II).
9. Practical on sampling techniques (Covered in Paper III).

**DEPARTMENT OF PHYSICS**  
**B.Sc. SECOND YEAR-2017**

TEACHING & EXAMINATION SCHEME  
For the Examination – 2016-17  
**PHYSICS**

**B.Sc. Part II**

**THEORY**

			Pd/W (45mts.)	Exam. Hours	Max. Marks
Phy.201	Paper I	Statistical and Thermal Physics	2	3	50
Phy.202	Paper II	Quantum Mechanics and Spectroscopy	2	3	50
Phy.203	Paper III	(A) Electronics (Except for those who opt Electronics as a subject) Or			
	Paper III	(B) Computer Systems and Networking (For the students who have offered Electronics as an Optional subject)	2	3	50
<b>PRACTICAL</b>			6	5	75
	<b>Total</b>				<b>225</b>

**B. SC. PART-II**

**PAPER I: STATISTICAL AND THERMAL 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-1 :

Statistical Method: Particle States, distribution of particles in two particle states, Probability of a given distribution, distribution corresponding to maximum probability, relative



probability curve with increasing number of particles, binomial distribution, Standard deviation, micro-states and macro-states of a system, principle of equal 'a priori' probabilities, equilibrium state, fluctuations, reversibility and irreversibility, States of a particle inside a box, number of accessible states between an infinitesimally small energy interval, momentum interval, phase space, statistical weight of a configuration of a macro-state, indistinguishable and distinguishable particles, entropy and principle of increase of entropy, statistical ensemble, time and ensemble averages; Thermal interaction between two systems, zeroth law of thermodynamics, concept of temperature.

#### UNIT-2 :

Canonical ensemble, Boltzmann canonical distribution, partition function, a two state system, paramagnetic susceptibility, heat capacity, Boltzmann formula for entropy, average energy and fluctuations, free energy, adiabatic interaction, enthalpy, general interaction, Gibbs free energy, first law of thermodynamics, phase transitions, Clausius-Clapeyron equation.

Ideal Classical Gas, Maxwell velocity and speed distributions, partition function, entropy (Sackur-Tetrode relation), Gibbs paradox; equation of state, ideal gas temperature scale, Vander-Waal's equation of state; heat capacities of monatomic and diatomic gases, ortho and para hydrogen.

#### UNIT-3 :

Systems with variable Energy and Particle Number: Chemical potentials, grand canonical distribution, Partition function, number fluctuations, grand potential, equation of state of an ideal classical gas, Saha's ionization formula, Maxwell-Boltzmann, Fermi-Dirac and Bose-Einstein Statistics, Fermi gas at 0K temperature; thermionic emission, strongly degenerate boson gas; Bose-Einstein Condensation, liquid helium.

#### UNIT-4 :

Macroscopic Thermodynamics: Second law of thermodynamics; Carnot cycle, Carnot theorem, thermodynamic temperature scale and its identity with perfect gas temperature scale, entropy change in isothermal, and adiabatic expansions of an ideal gas; Thermodynamic potentials, Maxwell's equations  $C_p - C_v$ ,  $C_p/C_v$ , Black body radiation, energy density and pressure, Stefan-Boltzmann law, Wien's displacement law, Planck's law.

#### UNIT-5 :

Temperature changes in Joule and Joule-Thomson expansions, Regenerative cooling, adiabatic demagnetization and production of low temperatures, third law of thermodynamics, negative temperatures.

Transport Phenomena: Mean free path, collision cross-sections, mean free time, viscosity, thermal conductivity and self-diffusion.

#### **Books suggested:**

1. Reif : Statistical Physics, Berkeley, Vol. 5, McGraw Hill.
2. Mandl : Statistical Physics, ELBS and Wiley.
3. Reif : Fundamentals of Statistical and Thermal Physics, McGraw Hill.
4. C. Kittel and H. Kroemer : Thermal Physics, CSS.
5. W.G.V. Rosser: An Introduction to Statistical Physics, Elis Horwood.
6. Lokanathan and Gambhir: Statistical and Thermal Physics, Prentice Hall.

## PAPER II : QUANTUM MECHANICS AND SPECTROSCOPY

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-1. :

Development of quantum theory: Blackbody radiation and their characteristics, failure of classical physics to explain spectral distribution of blackbody radiation, Planck's quantum Hypothesis, Average energy of Planck oscillator, Planck's radiation formula, Wien's law, Rayleigh-Jean's Law, Stefan-Boltzmann's Law; Failure of classical physics to explain photo-electric effect and Compton effect, photons as carrier of energy and momentum of electromagnetic waves.

### UNIT-2 :

Wave Mechanics and Schrödinger equation: Phase velocity and group velocity of waves, wave particle duality; De Broglie Hypothesis; De Broglie group and phase velocity, wave packet, Heisenberg uncertainty principle, Statement and its equation from wave-packet in space and time; Application of uncertainty principle such as (i) Non-existence of electron in nucleus, (ii) Ground state of H-atom, (iii) Natural line width of spectral lines, X-ray microscope, Particles passing through (a) single slit and (b) double slit and observed on screen behind, explanation of distribution in terms of probability amplitude and interference of probability amplitude.

Postulates of Quantum Mechanics: Wave functions, Schrödinger superposition principle, operators in Quantum mechanics, Hermitian operators, expectation values, Interpretation of wave-function, symmetric and anti-symmetric wave functions, concept of parity; Probability density, Schrödinger equation, Schrödinger equation for free particle; Arguments in favour of this equation.

### UNIT-3 :

Application of Schrödinger equation: Schrödinger equation for particle moving in potential field, Time dependent and time independent Schrödinger equation, Stationary states, Orthogonality of wave functions, Probability current density, Ehrenfest Theorem, Simple solution of Schrodinger equation (Restricted to one dimensional case), Particle in one dimensional infinite well, Particle in one dimensional finite well (one or both sides of well may be non-rigid), Calculation of reflection and transmission coefficient for potential step and potential barrier.

### UNIT-4 :

Atomic Spectroscopy: Orbital angular momentum, electron spin and Stern Gerlac experiment, Total angular momentum, Spin-orbit interaction, Vector model of atom and quantum numbers associated with atom, L-S coupling and j-j coupling, Statement of Hund's Rule and Lande Interval Rule (without derivation), Fine structure of spectral lines, spectral terms up to two valence electron system, Pauli's exclusion principle.

#### UNIT-5 :

Atom in magnetic field: Magnetic moment of atom, contribution from orbital and spin angular momentum, gyro-magnetic ratio; Interaction energy of atom in magnetic field, splitting of energy levels, using good quantum numbers in Normal Zeeman effect, Anomalous Zeeman effect and Paschen-Back effect, Selection rules for dipole transitions.

Molecular spectroscopy: qualitative features of molecular spectra, rigid rotator, rotational and vibrational energy levels of diatomic molecules, rotational-vibrational spectra.

#### **Books suggested:**

1. Semat: Atomic Physics
2. Alonso and Finn: Fundamental University Physics, Vol. – III.
3. Beiser: Concepts in Modern Physics
4. Waghmare: Quantum Mechanics
5. Wehr, Richards, Adair: Physics of the Atom, Narosa.

### **PAPER III (A): ELECTRONICS**

(Except for those students who opt Electronics as a subject)

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-1. :

Intrinsic and extrinsic semi-conductors, Fermi levels, mass-action law; carrier injection, recombination, diffusion and diffusion length, drift and diffusion currents, continuity equation; p-n junction, potential barrier, biasing, current-voltage relation, space charge and diffusion capacitances; varactor diode; Zener diode; tunnel diode; photovoltaic effect, solar cell.

Power supplies: Full wave and half wave rectifiers; ripple factor, voltage regulation; filters; Zener regulation.

#### UNIT-2 :

Network theorems – Thevenin, Norton, Maximum power transfer and Miller theorems.

Dipolar junction transistors, Ebers-Moll equations; CB, CE and CC configurations, BJT characteristics; biasing and thermal stabilization, self bias; hybrid parameters of a two port network; small signal hybrid equivalent model of a BJT at low frequencies, current, voltage and power gains; input and output impedances; high frequency hybrid pi model, short circuit current gain,  $f_{\beta}$  and  $f_{\alpha}$ ; current gain with resistive load.

### UNIT-3:

Field effect transistors, JFET, MOSFET, construction and characteristics; FETs as voltage Controlled Devices, small signal model.

Large signal amplifiers, class A, B and C operations and efficiencies; distortions; determination of second harmonic distortion; push-pull amplifiers; impedance matching.

### UNIT-4:

Negative Feedback: Current and voltage negative feedbacks; effect on stability, input and output impedances, distortion, frequency response; emitter follower.

Oscillators: Positive feedback, Barkhausen criterion; RC phase-shift oscillator; Hartley and Colpitts oscillators, UJT and sweep generators using UJT; Transistor as a switch and Astable multi-vibrator.

### UNIT-5 :

Operational amplifiers, inverting and non-inverting; differential amplifiers, CMRR; measurement of OP AMP parameters; use of OP AMPs as adder, in analog integration and differentiation.

Digital circuits, Boolean algebra; AND, OR, NOT, NOR, NAND, XOR gates; logic gate circuits; realization of logic functions.

### Books suggested:

1. J. Millman and CC Halkias: Integrated Electronics : Analog and Digital Circuits and Systems, Tata McGraw Hill.
2. A. Mottershead: Electronic Devices and Circuits – An Introduction, Prentice Hall India.

## PAPER III (B): COMPUTER SYSTEMS AND NETWORKING

(For the students who have offered Electronics as an Optional subject)

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-1

Introduction to computers: Development of computers with electronic devices, brief history of computers, computer generations, IC technology, LSI and VLSI, microprocessors and microcomputers (only elementary description and block diagrams). The Intel microprocessor family, recent advances in microprocessor technology: architecture, speed and other characteristics. Components of a microcomputer: Block diagram of motherboard, Northbridge and Southbridge, slots on motherboard: PCI, USB, BIOS, ISA, IDE, RAM and

AGP; processor, memory, primary memory, cache, RAM and ROM, secondary memory, HDD, CD drive, Pen drive, Power supply, input and output devices (only definitions and functions of the devices).

## **UNIT-2**

System software: Operating system, need of OS, functions of OS, different types of OS, batch processing OS, multi programming OS, single user OS and multi user OS, time sharing OS, OS for Personal Computer, DOS, Windows OS, features of Windows OS, Unix OS, Open source OS Linux. Low level languages: machine language, Assembly language, assembler, high level languages, features of high level languages, interpreters and compilers .

## **UNIT-3**

Application software: Program development in high level languages, algorithm and flow chart, execution of user application programs. Software packages: MS Office package, word processing, MS Word, preparing and printing documents in MS Word, MS Excel; using formulas and functions, plotting graphs, Power point presentation. Computer graphics, graphic software packages, Origin software package, plotting graphs in Origin.

## **UNIT-4**

Basic Network Functions: Overview, evolution of computer networks, elements of LAN and WAN, Network architecture, ISO-OSI architecture, hardware elements: modems, multiplexers, concentrators, transmission media, twisted pair, coaxial cable, optical fibre, LAN topologies: bus, ring and star.

## **UNIT-5**

Network interconnection issues: Internetworking bridges, routers, communication methods, store and forward techniques, circuit switching, packet switching, introduction to TCP/IP protocol family, issues related to network reliability and security.

### **Books suggested:**

A. Mottershed: Electronic Devices and Circuits, PHI.  
V. Rajaraman: Fundamentals of Computers, PHI.  
Martin, J.: Networks and Distributed Processing, PHI.

## **PRACTICALS**

1. Study of dependence of velocity of wave propagation on line parameters using torsional wave apparatus.
7. Study of variation of reflection coefficient on nature of termination using torsional wave apparatus.
8. Using a platinum resistance thermometer find the melting point of a given substance.
9. Determine thermal conductivity of a bad conductor by Lee's method.
10. Determination of Ballistic Constant of a Ballistic galvanometer using condenser.
11. Determination of Ballistic Constant of a Ballistic galvanometer by steady deflection method.
12. Determination of high resistance by method of leakage.
13. Study of variation of total thermal radiation with temperature.
14. Plot thermo emf versus temperature and find the neutral temperature and temperature of inversion.
15.  $e/m$  by Thomson's method.
16. Measurement of inductance of coil by Anderson's bridge.
17. Measurement of capacitance and dielectric constant of a liquid and gas by De-Sauty Bridge.
18. Study of Gaussian distribution using statistical board.
19. Determination of Self Inductance of a Coil using Ballistic galvanometer.
20. Determination of mutual inductance of a coil.
21. To study the electromagnetic damping of a compound pendulum.
22. Experimental verification of the first law of thermodynamics by discharging the condenser.
23. To determine the energy Band gap in a semiconductor using junction diode.
24. Study of the characteristics of a given transistor (PNP/NPN) in common emitter configuration and find the value of parameter of given transistor.
25. Study of the characteristics of a given transistor (PNP/NPN) in common base configuration and find the value of parameter of given transistor.
26. Study the characteristics of rectifier junction diode and Zener diode.

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

**DEPARTMENT OF PHYSICS**  
**B.Sc. SECOND YEAR-2017**

**TEACHING & EXAMINATION SCHEME**  
**For the Examination – 2016-17**  
**COMPUTER SCIENCE**

**B.Sc. Part-II**

**THEORY**

			Pd/W (45mts.)	Exam. Hours	Max. Marks
CS 201	Paper I	Computer Organisation –I	2	3	50
CS 202	Paper II	10. Pascal and Data Structures	2	3	50
CS 203	Paper III	System Analysis and Design	2	3	50
<b>PRACTICAL</b>					
CS 204	Practicals		6	5	75
<b>Total</b>					<b>225</b>

**B.Sc. PART-II**

**PAPER I**

**COMPUTER ORGANIZATION - I**

**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 1:**

Architecture of 8085 microprocessor and programming: Organization of 8085: Register organization, Bus organization, timing and controls. Data transfer: synchronous and asynchronous data transfer, memory mapped I/O and peripheral mapped I/O, Interrupt data transfer and DMA transfer.

#### UNIT 2:

Peripheral devices and controllers: Architecture of simple I/O devices: Hex keyboard, LED display, VDU, Floppy disk, Hard disk and Optical disk data storage devices, block diagram representation of programmable keyboard/display interface, CRT controller, and floppy disk controller.

#### UNIT 3:

Interfacing devices: I/O ports, interfacing memory and I/O with microprocessor, general purpose interfacing Devices: programmable peripheral interface 8255 A, 8253 programmable interval timer, 8259 programmable interrupt and DMA controller.

#### UNIT 4:

Assembly language programming: Instruction set of 8085: Instruction codes, functional groups and addressing modes, fetch and execution of instructions, Assembly language programming, stack and subroutines, Assembler and assembler directives, pseudo instructions.

#### UNIT 5:

Applications of 8085: Designing of a microcomputer system: Hardware design, software design and program coding. Transfer of data between two microcomputers in distributed processing, Temperature monitoring system, Data acquisition system.

## PAPER II

### 11. PASCAL AND DATA STRUCTURES

**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 1:

PASCAL: Constants, variables and labels, standard scalar data type, user defined scalar data type, type declaration, structure of Pascal program, Expressions, input and output statements, relational and logic operators, transfer of control: unconditional transfer, conditional transfer, IF-then, IF-then-else, case statements, iterative statements, While, Repeat and For statements, nested loops.

#### UNIT 2:



Structured data types: Arrays, one dimensional and multi dimensional arrays, declaration of arrays, Records, declaration of records, accessing the fields of record, hierarchical records, array of records, WITH statement,

Functions and procedures: function subprogram, declaration and calling a function, procedures, declaration and calling a procedure, block structure, Local and Global identifiers, values and variables parameters, Recursion.

**Pointers: pointer data type, defining pointer data type, variable declaration, operations on pointers, dynamic variables, dynamic data structure, Link Lists.**

#### UNIT 3:

Stack: stack data structure, operation on stack, PUSH and POP operation, array and record implementation of stack, application of stack: evaluation of arithmetic expressions, recursion, Postfix, Prefix and Infix notations, converting infix expression to postfix, evaluating post fix expression.

Queues: Queue data structure, entering and deleting elements in queue, array implementation of queue, circular queue.

#### UNIT 4:

Link LISTS: linked representation, structure of list, linear linked list, insertion and deletion in a linear linked list, Header and Trailer nodes, Circularly linked list.

Tree: Tree data structures, general and binary tree, tree terminology, linear and linked representation, inserting and deleting elements in a binary tree, tree traversal, in order, pre order and post order traversal.

#### UNIT 5:

Graph : definition and representation, adjacency matrix, graph traversal, depth first search traversal, breadth first search traversal, Sorting: Introduction, Internal sorting and external sorting, Selection sort, Insertion sort, Bubble sort, Quick sort, Merge sort.

### PAPER III

### SYSTEM ANALYSIS & DESIGN

**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 1:

System concepts : Definition, characteristics, types of systems, management information system, definition and importance in business organization, system development life cycle, recognition of need, feasibility study, analysis, design, implementation and maintenance, planning and control for system success, prototyping.

#### UNIT 2:

System Planning and initial investigation : Information gathering about user staff, work flow, information gathering tools : review of literature, procedure and forms, on-site observation, interview and questionnaire, their types. Analysis tools: Data flow diagrams, data dictionary, decision trees and structures English, decision-tables, pros and cons of each tool, feasibility study and objectives, cost benefit analysis.

#### UNIT 3:

System Design and Implementation : Logical and physical design, structured design, IPO charts, processing controls and data validation, audit trails, documentation, input and output forms design, system testing and quality assurance, system security and disaster recovery.

#### UNIT-4:

Basic Network Functions: Overview, evolution of computer networks, elements of LAN and WAN, Network architecture, ISO-OSI architecture, hardware elements: modems, multiplexers, concentrators, transmission media, twisted pair, coaxial cable, optical fibre, LAN topologies: bus, ring and star.

#### UNIT 5:

Network interconnection issues: Internetworking bridges, routers, communication methods, store and forward techniques, circuit switching, packet switching, introduction to TCP/IP protocol family, issues related to network reliability and security.

#### **Books suggested :**

Award, E.M. : System Analysis and design, Galgotia Publications

Martin, J. Networks and Distributed Processing, Prentice Hall of India.

Marris-Mano : Computer System Architecture, Prentice Hall of India

Mathur, A.P. : Introduction to Microprocessors, Tata McGraw Hill

Gaonkar, R: Microprocessor Architecture, Programming and Application, New Age International

Ram, B. : Fundamentals of Micro-Processor and Micro-Computers, Dhanpat Rai & Sons, New Delhi

Raffiquzaman.M : Microprocessor : Theory and Application, Prentice Hall Of India

Gosh and Sridhar : Introduction to Microprocessor for Engineers and Scientists, Prentice Hall Of India Grover P.S. : PASCAL Programming and Fundamentals, Allied Publishers

Rajaraman : Computer Programming in PASCAL, Prentice Hall of India

Jensen, K. and Wirth, N. : PASCAL Users Manual and Report, Narosa Publishers House

Dale, N. and Lily, S.C. : PASCAL Plus Sdata Structure, Algorithms and Advance Programmking,  
Tata McGraw Hill  
Tremblaman, J.P. and Sorensen, P.G. : An Introduction to Data Structures with Applications,  
McGraw Hill

## EXPERIMENTS FOR PRACTICAL WORK

### MICRO PROCESSOR LABORATORY

#### (i) Digital Laboratory

- (1) To study 4 bit adder and 4 bit subtractor.
- (2) To design and study 2 bit parity generator and checker.
- (3) To design and study 2 to 1 multiplexer and 1 to 2 de multiplexer.
- (4) To design logic circuit to find 2's complement of a 4 bit number.
- (5) To study a 4 bit magnitude comparator.

#### (ii) Assembly Language Programming

**Note: All programmes be written in indirect addressing mode.**

- (1) Write a program to find the sum of a series of 8 bit numbers.
- (2) Write a program to find the sum of a series of 16 bit numbers.
- (3) Write a program to find 2's compliment of 16-bit number.
- (4) Write a program to find least/most significant 4 bits of an 8-bit number.
- (5) Write a program to find the smallest of the series of 8 bit numbers.
- (6) Write a program to find the largest of the series of 8 bit numbers.
- (7) Write a program to arrange a series of 8 bit numbers into ascending order/  
descending order.
- (8) Write a program to find the product of (i) 8-bit \* 8-bit (ii) 16-bit \* 8-bit.
- (9) Write a program to divide an 8-bit number by an 8-bit number up to 1  
binary  
Point.

(10) Write a program to divide a 16bit number by an 8-bit/ 16: bits number.

(11) Write a program to find square root of a perfect/imperfect 8-bit number.

### SOFTWARE LABORATORY

#### (i) Elementary PASCAL Programming

- (1) Write a program to show the use of different standard scalar data types.
- (2) Write a program to show the use of sub range and enumerated data types
- (3) Write a program to show the use of arithmetic operations and build in  
functions in expression evaluation
- (4) Write a program to show the use of if-then and if-then-else statements.
- (5) Write a program to show the use of if-then and case statement.

- (6) Write a program to show the use of arrays.
- (7) Write a program to show the use of while, repeat and for statements.
- (8) Write a program to show the use of procedure.
- (9) Write a program using recursion
- (10) Write a program to show the use of record data type.
- (11) Write a program to implement stack using array.
- (12) Write a program to show the operation of pointers.
- (13) Write a program to create a linked list using pointers.
- (14) Write a program to sort data using selection sort.
- (15) Write a program to sort data using insertion sort.
- (16) Write a program to sort data using bubble sort.

**DEPARTMENT OF PHYSICS**  
**B.Sc. SECOND YEAR-2017**

**TEACHING & EXAMINATION SCHEME**

For the Examination – 2016-17

**ELECTRONICS**

**B.Sc. Part II**

**THEORY**

			Pd/W (45mts.)	Exam. Hours	Max. Marks
Elec. 201	Paper I	Amplifiers	2	3	50
Elec. 202	Paper II	12. Feedback systems	2	3	50
Elec. 203	Paper III	Communication Electronics	2	3	50
<b>PRACTICAL</b>			6	5	75
<b>Total</b>					<b>225</b>

**B.Sc. PART II**

**PAPER I : AMPLIFIERS**

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 1 :**

Transistor biasing, bias stabilization and Operating point, thermal instability, stability factor, fixed bias, collector to base bias, emitter bias, voltage divider bias with emitter bias and emitter by pass capacitor.

**UNIT 2 :**

Small signal transistor amplifier Small signal hybrid equivalent circuits at low frequencies, analysis of transistor amplifier using h - parameters, current gain, input impedance, voltage gain and

output impedance, comparison of CE, CB, CC amplifiers, Maximum available power gain, cascading transistor amplifiers.

**UNIT 3:**

Frequency response of amplifier : Amplifier using triode, pentode, FET's, input capacitance, miller effect, bias methods, R.C. coupled amplifiers, voltage gain at low, mid and high frequencies, gain band width product. effect of cascading on gain and bandwidth.

**UNIT 4:**

Large signal (power) amplifier : Class A, Class B and class C operations, efficiencies, distortions, power amplification, push pull amplifiers using transistors, transistor phase inverter, Class C tuned amplifier, commercial AF amplifier.

**UNIT 5 :**

Wide band (or video) amplifier : Band width requirement, high frequency hybrid  $\pi$  circuits for transistors, pulse testing, rise time, sag, various compensation techniques

## **PAPER II : FEEDBACK 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 1:**

Feedback : General theory of feedback, characteristics of negative feedback - gain, stability, distortion, noise, frequency response, effect of negative feedback on input and output impedances of an amplifier, Voltage feedback- series input, shunt input, current feedback- series input and shunt input.

**Unit 2 :**

Feedback amplifier: CE amplifier with current series and voltage shunt feedback, emitter follower, cathode follower and source follower, Cascade amplifier for tube, transistor and FET, Darlington pair, bootstrapping principle.

**UNIT 3 :**

Oscillators : Positive feedback and Barkhausen criterion, RC phase shift oscillator, Wein bridge oscillator, LC oscillators, tuned collector and tuned base, Hartley and Colpitt oscillators.

**UNIT 4:**

Operational Amplifier : Ideal operational amplifier, practical inverting and non inverting operational amplifiers, differential amplifier, common - mode rejection ratio ( CMMR)

emitter coupled differential amplifier, offset error voltages and currents, universal balancing techniques, input and output impedances of Op-Amp amplifier, oscillators using Op-Amp.

#### UNIT 5 :

Analog Computation : Basic building blocks of analog computer, solution of linear differential equations with constant coefficients, analog computer symbols, time and amplitude scaling technique, estimation of maximum values, combined time and amplitude scaling

### PAPER III : COMMUNICATION 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.

[Except for those students who opt Electronics as a subject]

**UNIT-1:** Intrinsic and extrinsic semi-conductors; Fermi levels, basic concept of carrier injection, recombination, life time, diffusion and diffusion length (without mathematical derivation), expression for drift and diffusion currents, p-n junction; potential barrier, biasing, current-voltage relation, tunnel diode, solar cell.

Power supplies: Full wave and half wave rectifiers; ripple factor, various filter circuits (qualitative idea only), Zener diode and Zener regulator circuit.

**UNIT-2:** Bipolar junction transistors; CB, CE and CC configurations and their characteristics, biasing and thermal stabilization; fixed and potential divider bias, hybrid parameters of a two port network; small signal hybrid equivalent model of an amplifier and its current, voltage and power gains, input and output impedances, frequency response of a transistor amplifier.

Network theorems - Thevenin, Norton and Maximum power transfer theorems.

**UNIT- 3:** Field effect transistors; JFET, MOSFET, construction and characteristics, FET as an amplifier; small signal model and its expression for voltage gain.

Large signal (power) amplifiers - class A, B and C operations and efficiencies, distortions in amplifiers, push-pull amplifiers, impedance matching

**UNIT-4:** Negative Feedback: Current and voltage negative feedbacks; effect on stability, input and output impedances, distortion, frequency response; emitter follower.

Oscillators: Positive feedback, Barkhausen criterion; RC phase-shift oscillator; Hartley and Colpitts oscillators, UJT as a relaxation oscillator, Astable multivibrator.

**UNIT- 5:** Operational amplifiers; inverting and non-inverting, differential amplifiers, CMRR, OP AMP parameters, use of OPAMPs as adder, integrator and differentiator.

Digital circuits: AND, OR, NOT, NOR, NAND, XOR gates; DTL circuits of logic gate and their realization.

#### **Books Suggested**

1. Allen Mottershead , "Electronic Devices and Circuits: An Introduction", Prentice-Hall of India
2. Jacob Millman and C. Halkias Mill, "Integrated Electronics", Tata McGraw-Hill Publishing LTD.
3. Bhargava, Kurukshetra & Gupta , "Basic Electronics and Linear Circuits", Tata McGraw-Hill Publishing LTD.
4. V.K. Mehta , "Principles of Electronics", S.Chand and Company LTD.

#### **EXPERIMENTS FOR PRACTICAL WORK**

1. Characteristics of Pentode
2. Two Stage RC coupled Transistor Amplifier
3. Two Stage RC coupled FET Amplifier
4. Current series negative feedback Amplifier
5. Input and output impedance of an amplifier
6. Emitter Follower
7. Source Follower
8. Cathode Follower
9. Design and study of passive Filter Circuits (low pass, High pass and band pass)
10. Cascading of filters circuits to simulated transmission lines
11. Study of Half Wave and Full wave rectifier with different filters.
12. To trace the output of Half Wave and Full wave rectifier with different filters using CRO.
13. Study the V-I characteristics of SCR.
14. Study the V-I characteristics of the UJT.
15. Study the V-I characteristics of a solar cell.
16. Study of Darlington pair Emitter follower.
17. Study the frequency response of operational amplifier as inverting amplifier.
18. Study of Differential amplifier and determine its CMRR.
19. Study of voltage divider bias for BJT amplifier and find its operating (Q) point.
20. Study of Cascade Amplifier.
21. Two stage RC coupled Tube Amplifier
22. Measurement of transistor Hybrid parameters.
23. Study of power amplifier.
24. Phase diagram and phase angles of RC circuits using CRO.
25. Measurement of ac voltage operating range and determination of Band width using CRO for a single stage CE amplifier.



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

**DEPARTMENT OF ZOOLOGY**  
**B.Sc. SECOND YEAR-2017**

Theory		Marks
		(Min. Pass Marks; 54)
Paper I	: Chordate Structure and function	50
Paper II	: Developmental Biology	50
Paper III	: Immunology, Microbiology and Biotechnology	50
		Practical: 75
		(Min. Pass Marks; 27)
Duration of Theory examination		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**

**Chordate Structure and Function**

Unit 1: Classification and characters of phylum Chordata (excluding extinct forms) up to orders, Comparisons of habit, habitat, external features and anatomy of *Balanoglossus*, *Herdmania* and *Branchiostoma* (excluding development).

Unit 2: Ascidian tadpole larva and its Metamorphosis, Affinities of Hemichordate, Urochordate and Cephalochordates, Habit, Habitat and salient features of Petromyzon, Ammocoete larva.

Unit 3: Integument including structure and development of placoid scales, feathers and hairs, Jaw suspensorium, limbs and girdles of *Rana*, *Uromastix*, *Columba* and *Oryctolagus*.

Unit 4: Heart and aortic arches, respiratory system and alimentary canal of *Scoliodon*, *Rana*, *Uromastix*, *Columba* and *Oryctolagus*.

Unit 5: Brain, urinogenital system (*Scoliodon*, *Rana*, *Uromastix*, *Columba* and *Oryctolagus*), Identification of poisonous and non poisonous snakes. Biting mechanism in snakes, flight adaptations in birds. Adaptations in aquatic mammals.

**PAPER II**

**Developmental Biology**

- Unit 1: Formation of egg and sperm, vitellogenesis and fertilization. Types of eggs and sperms, parthenogenesis, regeneration.
- Unit 2: Planes and patterns of cleavage in chordates, significance of cleavage and blastulation, Morphogenetic cell movement, Fate maps and significance of gastrulation.
- Unit 3: Development of *Branchiostoma (Amphioxus)* up to gastrulation; chick egg and its development up to the formation of primitive streak, Extra embryonic membranes of chick, development of placenta in rabbit, types and functions of placenta in mammals.
- Unit 4: Various types of stem cells and their applications (with special reference to embryonic stem cells), Cloning of animals: nuclear embryonic transfer technique, nuclear transfer technique; Identical, Siamese and fraternal twins and Artificial insemination.
- Unit 5: Organogenesis of alimentary canal, eye, kidney, gonads and brain in mammal.

### PAPER III

#### **Immunology, Microbiology and Biotechnology**

- Unit 1: Types of immunity (innate and acquired, humoral and cell mediated), Antigen: Antigenicity of molecules, haptens, Antibody: Structure and functions of each class of immunoglobulins (IgG, IgM, IgD, IgA and IgE), antigen – antibody reactions.
- Unit 2: Theory of spontaneous generation; Germ theory of fermentation and diseases: Works of Louis Pasteur, John Tyndal, Rober-Koch and Jenner, Bacteria: Cell membrane, patterns of arrangement; structure of capsule and cell envelopes; organization of cytoplasmic membrane of Gram - negative and Gram - positive strains, Genetic material of bacteria: (i) Chromosome (ii) Plasmids.
- Unit 3: Asexual and sexual reproduction in Bacteria ,Culture of Bacteria: Carbon and energy source, Nitrogen and minerals and Organic growth factors, Effect of environmental factors on bacterial culture: Temperature, hydrogen ion concentration; Medical importance of Gram-negative and Gram-positive bacteria.
- Unit 4: Recombinant DNA technology: Introduction and principles, restriction endonucleases, cloning vehicles (plasmids, bacteriophages); methods of gene transfer and applications.
- Unit 5: Environmental Biotechnology (outline idea only): Metal and petroleum recovery, pest control, waste-water treatment, Food, Drink and Dairy Biotechnology (outline idea only): Fermented food production: dairy products, alcoholic beverages and vinegar: microbial spoilage and food preservation.

#### **Practical**

1. Study of microbes in food material (like curd, etc.)
2. Bacteria culture
3. DISSECTIONS

*Scoliodon* : General anatomy, alimentary canal, afferent and efferent blood vessels, urinogenital system, brain and cranial nerves – V, VII, IX and X only and internal ear *Labeo / Wallago*, Brain V, VII, IX and X Cranial nerves, afferent and efferent blood vessels, air sacs, and internal ear.

*Rattus*: General anatomy, digestive, blood vascular and urinogenital systems

#### **4.OSTEOLOGY**

Articulated and disarticulated skeleton of *Rana*, *Varanus*, *Gallus* and *Oryctolagus*

#### 5. PERMANENT PREPARATIONS

*Scoliodon*: Placoid scales, Ampulla of Lorenzini.

6. Identification, systematic position and comments of the following animals:

Hemichordata: *Balanoglossus*

Urochordata: *Salpa*, *Doliolum* and *Herdmania*

Cephalochordata: *Petromyzon* and *Myxine*

Pisces: *Zygaena*, *Scoliodon*, *Pristis*, *Torpedo*, *Trygon*, *Protopterus*, *Labeo*,

*Heteropneustis* (*Saccobranchus*), *Belone*, *Exocoetus*, *Anabas* and *Echeneis*

Amphibia: *Necturus*, *Amphiuma*, *Amblystoma*, *Axolotal larva*, *Hyla*, *Uraeotyphlus*

Reptilia: *Trionyx*, *Chelone*, *Varanus*, *Uromastix*, *Ophiosaurus*, *Naja*, *Bungarus*,

*Echis*, *Hydrophis*, *Eryx*, *Ptyas*, *Crocodylus* and *Gavialis*

Aves: *Columba*, *Pavo*, *Choriotis*, *Francolinus*, *Streptopelia*

Mammalia: *Meriones*, *Funambulus*, *Rattus*, *Hemiechinus*, *Suncus*, *Pteropus*,

*Presbytis* and *Macaca*

#### 7. Microscopic Study

Hemichordata: Section through proboscis and branchiogenital region

*Branchiostoma*: T.S. oral hood, pharynx, gonads, intestine and caudal region

*Scoliodon*: T.S. gill and scroll valve

*Rana*: T.S. through various organs, T.S. and L.S. of developmental stages

Reptilia: V.S. skin of lizard

Aves: V.S. skin, different types of feathers

Chick embryology: Whole mounts of embryos of 18, 24, 33, 48 and 72 hours

Mammalia: T.S. through various organs

Note: Each regular student is required to keep a record of practical work done by him/her duly checked by the teacher which will be submitted at the time of practical examination.

#### Distribution of Marks

	Maximum Marks: 75	
	Minimum Pass Marks: 27	
	<u>Regular</u>	<u>Ex.</u>
Major dissection (one)	15	20
Minor dissection (one)	06	11
Permanent preparation (one)/Study of microbes in food material (like curd, etc.)/Bacteria culture	10	10
Spots (eight)	24	24
Viva-voce	10	10
Practical record	10	---
Total	75	75

#### List of Recommended Books

1. Arey, L.B. : Developmental Anatomy, Asia Publishing House, Mumbai
2. Chopra, V.L. : Genetic Engineering and Biotechnology, Oxford & I.B.H., New Delhi
3. Das, S.M. : The Indian Zoological Memoirs, Herdmania, Lucknow Publishing House, Lucknow
4. Jorden, E.L. and Verma, P.S.: Chordate Zoology and Animal Physiology, S. Chand & Co., N. Delhi
5. Kotpal, R.L. : Chordate Zoology, Rastogi Publication, Meerut
6. Dalela, R.C. : A Text Book of Chordate Zoology, Jai Prakash Nath Publication, Meerut

7. Bhatia, A., Jain, N. and Kohli, N.S.: An outline of Biotechnology, Ramesh Book Depot, Jaipur
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