

SECOND YEAR SCIENCE, 2005-2006

BOTANY

Papers	No. of Papers	No. of Periods per week	Maxi- mum Marks	Min. pass Marks
Paper I	3	3	50	
Paper II	3	3	50	54
Paper III	3	3	50	
PRACTICALS	6	5	75	27

There shall be three written papers of three hours duration each. The candidates will be required to pass in theory and practical examinations separately.

THEORY

Paper I : Taxonomy and Embryology of Angiosperms	50
Paper II : Anatomy of Angiosperms, Economic Botany and Ethnobotany.	50
Paper-III: Cytogenetics, Plant Breeding, Evolution and Biostatistics.	50

PRACTICALS :

Duration of each Theory Paper	3 hours
Duration of Practicals (in one day)	5 hours

PAPER-I TAXONOMY AND EMBRYOLOGY OF ANGIOSPERMS

Unit-1

Taxonomic categories; concept of species, genus and family; Herbarium techniques. Systems of classification of Bentham and Hooker, Engler and Prantl, Hutchinson and Takhtajan.

Unit-2

International rules of nomenclature, range of floral structure, floral variation, and economic importance of Ranunculaceae, Brassicaceae, Papaveraceae, Capparidaceae, Caryophyllaceae, Malvaceae, Rutaceae, Cucurbitaceae, Myrtaceae, Leguminosae, Rosaceae, Apiaceae (Umbelliferae).

Unit-3

Range of floral structure, floral variation and economic importance of Rubiaceae, Asteraceae, Primulaceae, Solanaceae, Asclepiadaceae, Convolvulaceae, Apocynaceae, Acanthaceae, Lamiaceae, (Labiatae), Euphorbiaceae, Poaceae(Graminae).

Unit-4

Classical theory of morphology of flower; Primitive stamens and carpel; Microsporogenesis, Megasporogenesis, Structure and development and male and female gametophytes, Fertilization, Nutrition of Embryo sac.

Unit-5

Structure, development and types of endosperm and embryo, Polyembryony, Apomixis, Experimental embryology; Culture of anther, endosperm and embryo.

Note :

The paper setter is required to set questions of 3 types contained in 3 Sections (**Section A**- 10 questions, **Section B**- 10 questions and **Section C**- 4 questions) from the 5 units of each paper. There will be 10 questions in **Section A** which will be asked from all the 5 units, i.e., 2 questions from each unit. These questions have to be answered in one word or a few words only. Each question will be of half mark . All the questions in **Section A** are compulsory. In **Section B**, 10 questions will be set from the 5 units, i.e., 2 questions from each unit. Students are required to attempt at least 1 question from each unit. Each question will carry 5 marks . The answers of each question should be given in about 250 words. In **Section C** there will be 4 descriptive type questions set from all the 5 units, not more than 1 question from each unit. These questions may also have subdivisions. The students are required to answer 2 questions, each in approximately 500 words. Each question will carry 10 marks .

In short, pattern of question paper and distribution of marks for UG classes will be as under :

Section A : 10 questions, 2 questions from each unit, short answer, all questions compulsory.

Total marks : **05**

Section B : 10 questions, 2 question from each unit, 5 question to be attempted, at least 1 from each unit, answer approximately in 250 words. Total marks : **25**

Section C : 04 questions (question may have sub-division), not more than 1 question from each unit, descriptive type, answer in about 500 words, 2 questions to be attempted. Total marks : **20**

PAPER II
ANATOMY OF ANGIOSPERMS, ECONOMIC
BOTANY AND ETHNOBOTANY

Unit-1

Plant anatomy : Introduction, organization of meristems; theories related to their organization; cell wall gross microscopic structure and chemistry.

Unit-2

Tissue and tissue systems; Parenchyma, Collenchyma, Sclerenchyma, Xylem, Phloem, Secretory structures and periderm.

Unit-3

Primary and Secondary Structure : Structure of root, stem and leaf. Primary and secondary anomalous structure with special reference to *Aristolochia*, *Salvadora*, *Bignonia*, *Achyranthes*, *Amaranthus*, *Boerhaavia*, *Mirabilis*, *Chenopodium*, *Dracaena*, *Tinospora*.

Unit-4

Study the economic botany of the following :

Cereals : *Triticum*, *Zea*

Pulses : *Glycine max*, *Cajanus cajan*

Fibres : Classification; *Gossypium*, *Crotalaria*, *Corchorus*; artificial fibres.

Wood : Classification, mechanical properties; *Shorea*, *Tectona*, *Pinus*, *Cedrus*.

Paper : Raw materials and manufacture.

Sugar : Sugarcane, Beet.

Unit-5

Study of economic uses of the following :

Medicinal Plants : *Rauwolfia*, *Datura*, *Cinchona*, *Papaver*.

Beverages : Alcoholic; Non-alcoholic: tea and coffee.

Spices and Condiments : *Coriandrum*, *Cuminum*, *Ferula*, *Curcuma*, *Trigonella*, *Elettaria*, *Capsicum*, *Piper*, *Zingiber*.

Oil : *Arachis*, *Cocos*, *Helianthus*.

Ethnobotany : Introduction; Aims and Objectives; knowledge of important plants of various groups from Ethnobotanical point of view as food, fodder and Medicine with special reference to Rajasthan.

Note :

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from the 5 units of each paper. There will be 10 questions in **Section A** which will be asked from all the 5 units, i.e., 2 questions from each unit. These questions have to be answered in one word or a few words only. Each question will be of half mark. All the questions in **Section A** are compulsory. In **Section B**, 10 questions will be set from the 5 units, i.e., 2 questions from each unit. Students are required to attempt at least 1 question from each unit. Each question will carry 5 marks. The answers of each question should be given in about 250 words. In **Section C** there will be 4 descriptive type questions set from all the 5 units, not more than 1 question from each unit. These questions may also have subdivisions. The students are required to answer 2 questions, each in approximately 500 words. Each question will carry 10 marks.

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PAPER-III

CYTOGENETICS, PLANT BREEDING, EVOLUTION AND BIOSTATISTICS

Unit-1

Cell Biology - Structure of cell (of both prokaryotes and eukaryotes); membranes; cell organelles, ergastic substances. Chromatin- euchromatin, heterochromatin. Chromosomes - Type and organization; morphology, chemical constituents; Structural changes in chromosomes and their significance.

Unit-2

Cell Division - Amitosis, mitosis, meiosis; synaptonemal complex; Linkage and crossing over. Gene (Chromosomal) mapping; Sex determination.

Unit-3

Mendel's laws of inheritance - Monohybrid and dihybrid ratio, incomplete dominance; Modifications of dihybrid ratio; cytoplasmic inheritance (Inheritance of plastids and streptomycin resistance in *Chlamydomonas*); Principles of plant breeding. Selection, introduction, clonal propagation, hybridization, mutation breeding.

Unit-4

Green Revolution, conservation of germplasm, centres of origin. Cytology in relation to taxonomy; Apomixis; Polyploidy; Breeding work on wheat.

Unit-5

Evolutionary theories, catastrophism, the Lamarck's theory, development of Darwin's theory, Evidences of evolution, adaptations, natural selection patterns of evolution, origin of species. Elementary study of bio-statistics; mean, mode, median, standard deviation.

Note :

The paper setter is required to set questions of 3 types contained in 3 Sections (**Section A**- 10 questions, **Section B**- 10 questions and **Section C**- 4 questions) from the 5 units of each paper. There will be 10 questions in **Section A** which will be asked from all the 5 units, i.e., 2 questions from each unit. These questions have to be answered in one word or a few words only. Each question will be of half mark . All the questions in **Section A** are compulsory. In **Section B**, 10 questions will be set from the 5 units, i.e., 2 questions from each unit. Students are required to attempt at least 1 question from each unit. Each question will carry 5 marks . The answers of each question should be given in about 250 words. In **Section C** there will be 4 descriptive type questions set from all the 5 units, not more than 1 question from each unit. These questions may also have subdivisions. The students are required to answer 2 questions, each in approximately 500 words. Each question will carry 10 marks .

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Section C : 04 questions (question may have sub-division), not more than 1 question from each unit, descriptive type, answer in about 500 words, 2 questions to be attempted. Total marks : **20**

PRACTICALS

The practical exercises have been divided into following two groups :

Group-I : Taxonomy, Embryology and Economic Botany.

Group-II : Anatomy, Cytology and Statistics.

GROUP-I

(A) TAXONOMY

1. Ranunculaceae : *Ranunculus, Nigella, Delphinium*
2. Brassicaceae : *Brassica, Raphanus, Iberis*
3. Papaveraceae : *Argemone, Papaver.*
4. Capparidaceae : *Capparis, Cleome.*
5. Caryophyllaceae : *Stellaria, Spergula, Viscaria, Dianthus (Single), Gypsophylla.*
6. Malvaceae : *Hibiscus, Althaea*
7. Rutaceae : *Citrus, Ruta, Murraya*
8. Leguminosae : *Pisum, Crotalaria; Cassia, Caesalpinia, Bauhinia, Tamarindus; Acacia, Prosopis, Mimosa.*
9. Myrtaceae : *Callistemon, Eucalyptus*

10. Cucurbitaceae : *Citrullus, Cucumis*
11. Apiaceae : *Coriandrum, Foeniculum*
12. Rubiaceae : *Hamelia*
13. Asteraceae : *Helianthus, Tridax, Launaea, Ageratum.*
14. Primulaceae : *Anagallis.*
15. Apocynceae : *Catharanthus, Nerium, Thevetia.*
16. Asclepiadaceae : *Calotropis, Leptadaenia, Cryptostegia*
17. Solanaceae : *Solanum, Nicotiana, Petunia.*
18. Acanthaceae : *Barleria, Adhatoda, Justicia, Peristrophe.*
19. Lamiaceae : *Ocimum, Salvia*
20. Euphorbiaceae : *Euphorbia, Ricinus*
- 21 Poaceae : *Triticum.*

The above list of plants is only suggestive and can be replaced depending on local availability.

(B) EMBRYOLOGY SLIDES :

1. Placentation : Types
2. Ovules : Types
3. T.S. Anther

4. L.S. Mature Seed : Maize/Gram/Pea
5. L.S. bud with anther and gynoecium.
6. Pollinium whole mount.
7. V.S. Cyathium.
8. V.S. *Ficus* inflorescence.

(C) ECONOMIC BOTANY AND ETHNOBOTANY

All plants as prescribed in theory paper.

GROUP-II

(A) ANATOMY

1. Stem : *Boerhaavia*, *Achyranthes*,
Bignonia, *Chenopodium*,
Leptadaenia, *Nyctanthes*,
Salvadora, *Dracaena*, *Triticum*,
Mirabilis, *Aristolochia*,
Amaranthus, *Chenopodium*.
2. Root : *Tinospora*, *Ficus*.

(B) CYTOLOGY

Smear preparation of root tips and onion bud for different stages of mitosis and meiosis.

(C) STATISTICS

Mean, Mode, Median, Standard Deviation. Monohybrid and Dihybrid crosses and test cross.

(D) EMASCULATION

MARKING SCHEME

There shall be a practical examination of five hours duration and the distribution of marks shall be as follows :

	Students	
	Regular	Ex
1. An angiosperm material for anatomical study with (i) double stained, (ii) labelled cellular sector diagram, (iii) identification and (iv) special (anatomical/ecological) character (2.5 marks each (i) to (iv).	10	13
2. Economic/ Ethnobotany.	5	6
3. Description in semi-technical language of given twig, (i) with diagrams, (ii) description and (iii) identification with characters.	12	14
4. Embryology	05	05
5. Smear preparation for two stages of cell division.	05	05
6. Genetic exercise		
Or		
Emasculation technique.	05	06
7. Statistical exercise.	05	06
8. Spots five (At least one from each paper)	10	10
9. Viva-voce	10	10
10. Records and collection.	08	-
Total	75	75

BOOKS SUGGESTED

Bhojwani, S.S. and Bhatnagar, S.P.: The Embryology of Angiosperms, Vikas Publishing House, Delhi, 1974.

Dutta, S.C.: Hand Book of Systematic Botany, Asia Publishing House, Bombay, 1979.

Gupta, P.K.: Cytology, Genetics and Evolution, Rastogi Publications.

Hill, A.H.: Economic Botany, McGraw Hill Book Co., 1952.

Mitra, J.N. : Elements of Systematic Botany of Angiosperms and Plant Ecology, The World Press Pvt. Ltd., Calcutta, 1977. Vikas Publishing House, Delhi.

Pandey, B.P.: Economic Botany, S. Chand And Co.Pvt. Ltd., 1988.

Tiagi, Y.D. and Kshetrapal, S. : An Introduction to Taxonomy of Angiosperms. Ramesh Book Depot, Jaipur, 1974.

P.K. Gupta : Genetics.

Sinha, U. and Sinha: Cytogenetics, Plant Breeding and Evolution.

Shukla and Chandel: Cytogenetics and Plant Breeding.

Choudhary, H.K. Elementary Principles of Plant Breeding.

SECOND YEAR SCIENCE, 2005-2006

CHEMISTRY

The examination shall consist of three theory papers and one practical.

Paper & Course	Hrs/week	M. Marks
Paper -I Inorganic Chemistry	2	50
Paper- II Organic Chemistry	2	50
Paper- III Physical Chemistry	2	50
Practical	4	75

PAPER-I INORGANIC CHEMISTRY

Time-3 Hrs.

M.M. 50

NOTE : The paper will be divided into THREE sections.

Section-A Ten questions (short type answer) two from each Unit will be asked. Each question will be of half mark and the candidates are required to attempt all questions. **Total 5 marks**

Section-B Five questions (answer not exceeding 250 words) one from each Unit with internal choice will be asked and the candidates are required to attempt all questions. Each question will be of 5 marks.

Total 25 marks

Section-C Four questions may be in parts covering all the five Units (answer not exceeding 500 words) will be asked. The candidates are required to attempt any TWO questions. Each question will be of 10 marks.

Total 20 marks

UNIT- I

Chemistry of Elements of First Transition Series - Characteristic properties of d-block elements (colour, variable valency, magnetic and catalytic properties and ability to form complexes). Properties of the elements of the first transition series, their binary compounds and complexes illustrating relative stability of their oxidation states, coordination number and geometry.

Chemistry of Elements of Second and Third Transition Series - General characteristics, comparative treatment with their 3d-analogues in respect of ionic radii, oxidation states, magnetic behavior, spectral properties and stereochemistry.

UNIT II

Oxidation and Reduction - Use of redox potential data, analysis of redox cycle, redox stability in water - Frost, Latimer and Pourbaix diagrams, principles involved in the extraction of the elements.

Coordination Compounds - Werner's coordination theory and its experimental verification, effective atomic number concept, nomenclature of coordination

compounds, isomerism in coordination compounds, valence bond theory of transition metal complexes, chelate and chelate effects.

UNIT- III

Chemistry of Lanthanides - Electronic structure, oxidation states and ionic radii, lanthanide contraction, complex formation, occurrence and isolation, lanthanide compounds.

Chemistry of Actinides - General feature and chemistry of actinides, chemistry of separation of Np, Pu and Am from U, similarities between the later actinides and the later lanthanides

UNIT- IV

Gravimetric Analysis- Principles, solubility, formation and preparation of precipitation, colloidal properties, ageing and contamination of the precipitates, co-precipitation and post-precipitation.

Simple Organic Reagents used in Inorganic Analysis- 8-Hydroxyquinoline, Dimethylglyoxime, α -nitroso- β -naphthol, Anthranilic acid, Arsonic acids, Cupron and Cupferron.

UNIT- V

Chromatography - Basic principles, instrumentation and application of adsorption, and partition chromatography, ion exchange separation.

Errors in Quantitative Analysis - Accuracy and precision, determinate, indeterminate and accidental

errors, precision of a single measurement, precision of mean, rejection of a result, errors in a derived result, methods of checking the accuracy of analysis, significant figures, computation values.

Book Recommended:

1. Text Book of Quantitative Inorganic Analysis: A. I. Vogel (Chapter- I, II and XXIII).
2. Text Book of Quantitative Inorganic Analysis: I. M. Kolthoff and E. R. Sandell.
3. Concise Inorganic Chemistry: J. D. Lee.
4. General Inorganic Chemistry: J. A. Duffy.
5. Principle of Inorganic Chemistry: B. R. Puri and L. R. Sharma.
6. Basic Inorganic Chemistry: Cotton and Wilkinson and Gaus, Willey.
7. Inorganic Chemistry (Hindi ed.): Suresh Ameta, A. Sharma and M. Mehta, Himanshu Pub.

**PAPER II
ORGANIC CHEMISTRY**

Time-3 Hrs.

M.M. 50

NOTE : The paper will be divided into THREE sections.

Section-A Ten questions (short type answer) two from each Unit will be asked. Each question will be of half mark and the candidates are required to attempt all questions. **Total 5 marks**

Section-B Five questions (answer not exceeding 250 words) one from each Unit with internal choice will be asked and the candidates are required to attempt all questions. Each question will be of 5 marks. **Total 25 marks**

Section-C Four questions may be in parts covering all the five Units (answer not exceeding 500 words) will be asked. The candidates are required to attempt any TWO questions. Each question will be of 10 marks. **Total 20 marks**

Unit-I

Alcohols and Epoxides

Unsaturated alcohols- Vinyl and Allyl alcohol

Dihydric alcohol - Nomenclature, method of formation and chemical reactions of vicinal glycols.

Pinacol- Pinacolone rearrangement.

Trihydric alcohols - Formation and chemical reactions of glycerol.

Epoxides - Synthesis and reactions of epoxides, orientation of epoxide ring opening.

Phenols - Nomenclature, structure and bonding, preparation of phenols, physical properties and acidic character, comparative acidic strength of alcohols and phenols, resonance stabilization of phenoxide ion.

Reactions of phenols - Electrophilic aromatic substitution, acylation and carboxylation, Mechanism of Fries rearrangement, Claisen rearrangement, Gatterman synthesis, Hauben-Hoesch reaction, Lederer-Manasse reaction and Reimer-Tiemann reaction.

Unit II

Aldehydes and Ketones - Synthesis, chemical and physical properties of aromatic aldehydes and ketones, mechanism of nucleophilic addition 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, Clemmenson, Wolff-Kishner, LiAlH_4 and NaBH_4 reductions, Halogenation of enolizable ketones.

An introduction to α , β - unsaturated aldehydes and ketones.

Unit III

Carboxylic Acids and their derivatives - Nomenclature, structure and bonding, acidity of carboxylic acids, effects of substituents on acid strength, mechanism of decarboxylation, Methods of formation, physical properties and chemical reactions of dicarboxylic acids - oxalic, succinic and phthalic acid.

Substituted Acids -Methods of formation & chemical reactions of halo acids, hydroxy acids, malic, tartaric, citric and salicylic acids.

Unsaturated Acids - Acrylic and cinnamic acid.

Introduction to acids derivatives - Preparation, properties and uses of acid halides, amides, anhydrides and esters. Interconversion of acid derivatives by nucleophilic acyl substitution. Mechanism of HVZ reaction, Hofmann - bromamide reaction and ester hydrolysis.

UNIT - IV

Organic Compounds of Nitrogen - Preparation & chemical reactions of nitroarenes. Reactivity of nitro substituted arenes.

Aromatic amines, classification, preparation, properties and uses of primary amino compounds - aniline, acetanilide, nitroanilines.

Secondary amino compounds- diphenylamine and N-methylaniline

Tertiary amino compounds- Triphenylamine and N,N-dimethylaniline

Aryl alkyl amine- Benzylamine

Basic strength of amines- similarities and differences between aliphatic and aromatic amines.

Diazonium salt- formation, properties and synthetic uses of benzene diazonium salts, Diazo coupling & its mechanism.

Organic Sulphur Compounds: Preparation and properties of thiols, sulphonic acid, sulphonyl chloride, saccharides, chloramine - T, dichloramine-T and sulphonamides.

UNIT V

Polynuclear Hydrocarbons - Nomenclature of naphthalene and anthracene derivatives, preparation and properties of naphthalene, anthracene, naphthol, naphthylamine, naphthaquinone and anthraquinone.

Mechanism and orientation of electrophilic substitution reaction in naphthalene and anthracene.

Organometallic Compounds - Preparation, properties and synthetic uses of organo lithium and organo zinc compounds.

Books Recommended

1. A Text Book of Organic Chemistry: K. S. Tiwari, S. N. Mehrotra and N. K. Vishnoi.
2. Modern Principles of Organic Chemistry: M. K. Jain & S. C. Sharma
3. A Text Book of Organic Chemistry: (Vol. I & II) O. P. Agarwal
4. A Text Book of Organic Chemistry: B. S. Bahl and Arun Bahl.
5. A Text Book of Organic Chemistry: P. L. Soni.
6. Organic Chemistry: (Vol. I, II & III) S. M. Mukherji, S. P. Singh and R.P. Kapoor.
7. Organic Chemistry (Hindi Ed.) : Suresh Ameta, P. B. Punjabi and B. K Sharma, Himanshu Pub.

PAPER-III
PHYSICAL CHEMISTRY

Time-3 Hrs.

M.M. 50

NOTE : The paper will be divided into THREE sections.

Section-A Ten questions (short type answer) two from each Unit will be asked. Each question will be of half mark and the candidates are required to attempt all questions. **Total 5 marks**

Section-B Five questions (answer not exceeding 250 words) one from each Unit with internal choice will be asked and the candidates are required to attempt all questions. Each question will be of 5 marks. **Total 25 marks**

Section-C Four questions may be in parts covering all the five Units (answer not exceeding 500 words) will be asked. The candidates are required to attempt any TWO questions. Each question will be of 10 marks. **Total 20 marks**

UNIT I

Thermodynamics-I : Definition of thermodynamic terms, system, surrounding, etc., types of systems, intensive and extensive properties, state and path

functions, their differentials, thermodynamic process, concept of heat and work.

First law of Thermodynamics - Statement, definition of internal energy and enthalpy, heat capacity, heat capacities at constant volume and pressure and their relationship, Joule's law, Joule-Thomson coefficient and inversion temperature, calculation of w , q , dU and dH for the expansion of ideal gases under isothermal and adiabatic conditions for reversible process.

Thermochemistry: Standard state, standard enthalpy of formation, Hess's law of heat summation and its applications, Heat of reaction at constant pressure and at constant volume, Enthalpy of neutralization, bond dissociation energy and its calculation from thermochemical data, temperature dependence of enthalpy, Kirchhoff's equation.

UNIT-II

Thermodynamics-II : Second law of thermodynamics: need for the law, different statements of the law, Carnot cycle and its efficiency, Carnot theory, thermodynamic scale of temperature.

Concept of entropy: Entropy as a state function, entropy as a function of V and T , entropy as a function of P and 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.

Third Law of Thermodynamics - Nernst heat theorem, statement and concept of residual entropy, evaluation of absolute entropy from heat capacity data. Gibbs and Helmholtz function, Gibbs function (G) and Helmholtz function (A) as thermodynamic quantities, A & G as criteria for thermodynamic equilibrium and spontaneity, their advantage over entropy change, variation of G and A with P, V and T.

Chemical Equilibrium - Equilibrium constant and free energy, thermodynamic derivation of law of mass action, distribution law and phase rule, Le Chatelier's principle, Nernst's distribution law for solute, principle of extraction of solute from solution and washing of precipitates.

Reaction isotherm and reaction isochore - Clapeyron equation and Clausius - Clapeyron equation, applications, partial molar quantities, partial molar volume and its distribution, chemical potential and its physical significance, Gibbs-Duhem equation.

UNIT-III

Macromolecules - Nomenclature, classification, properties of polymer, mass of macromolecules, number average and weight average molecular mass, determination of molecular weight by osmotic pressure, viscosity and light scattering and sedimentation (ultra centrifuge) methods.

Surface Chemistry - Sorption at surfaces, physical and chemical adsorption, Freundlich, Langmuir and

Gibbs adsorption isotherms and their derivation, Streaming potential, electrophoresis and electrosmosis.

UNIT-IV

Phase Equilibrium - Statement and meaning of the terms - phase, component and degree of freedom, derivation of Gibb's phase rule, phase equilibrium of one component system- water, CO₂ and S - system.

Phase equilibria of two component system - Solid - liquid equilibria, simple eutectic, Bi-Cd, Pb-Ag systems, desilverization of lead.

Solid solutions - Compound formation with congruent melting point (Mg - Zn) and incongruent melting point, (NaCl - H₂O), (FeCl₃ - H₂O) and (CuSO₄ - H₂O) systems, freezing mixtures, acetone - dry ice.

Liquid - liquid mixtures: Ideal liquid mixtures, Raoult's and Henry's law, Non -ideal system, azeotropes: HCl - H₂O and ethanol - water systems.

Partially miscible liquids: phenol - water, trimethylamine - water, nicotine - water systems, lower and upper consolute temperature, effect of impurity on consolute temperature.

Immiscible liquids, steam distillation.

UNIT V

Electrochemistry : Types of reverse electrode : gas - metal ion, metal-metal ion, metal-insoluble salt - anion and redox electrodes, electrode reactions,

Nernst equation, derivation of cell E.M.F. and single electrode potential, standard hydrogen electrode-reference electrodes-standard electrode potential, sign conventions, electrochemical series and its significance, 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 (ΔG , ΔH and K) polarization, over potential and hydrogen over voltage. Concentration cell with or without transport, liquid junction potential, application of concentration cells, valency of ions, solubility product and activity coefficient, potentiometric titrations.

Ionic Equilibria - Arrhenius theory of electrolyte and its application, Ostwald's dilution law, its uses and limitations. Debye - Huckle theory of strong electrolytes, asymmetric, electrophoretic, Debye-Falkenhagen and Wein effects, Activity coefficient, mean activity coefficient, ionic strength, Debye-Huckel limiting law.

Books Recommended:

1. Principle of Physical chemistry: B. R. Puri Sharma and M. S. Pathania,
2. A Text Book of Physical Chemistry: A. S. Negi and S.C. Anand.
3. A Text Book of Physical Chemistry: Kundu and Jain.
4. Physical Chemistry (Hindi Ed.): Suresh Ameta, R.C. Khandelwal, R. Ameta and J. Vardia.

SECOND YEAR CHEMISTRY PRACTICALS 2005-2006

Distribution of Marks

Time 5 Hrs. (one day)	M.M. 75
	Marks
Exercises-	
1. Volumetric estimation	20
or	
Gravimetric analysis	
2. Determination of R_f values and identification of given organic compounds using thin layer / paper chromatography.	10
3. Identification of given organic compound through functional group analysis	10
4. Physical chemistry Experiments	15
5. Viva - Voce	10
6. Record	10
Total	75 Marks

List of Experiments

(1) Volumetric Analysis: (Any one of the following exercise may be given in the examination.)

- (a) Determination of acetic acid in commercial vinegar using NaOH

- (b) Determination of alkali content- antacid tablet using HCl.
- (c) Estimation of calcium content in chalk as calcium oxalate using permanganate.
- (d) Estimation of hardness of water by EDTA.
- (e) Estimation of ferrous and ferric ions by dichromate methods.
- (f) Estimation of copper using thiosulphate.
- (g) Estimation of Mg^{2+} , Ca^{2+} or Ba^{2+} complexometrically.

OR

Gravimetric Analysis :

Analysis of Cu as CuSCN and Ni as Ni (dimethylglyoxime)

Note: Candidates are required to prepare standard solutions by proper weighing.

2. Thin Layer Chromatography :

Determination of R_f values and identification of organic compounds.

- (a) Separation of green leaf pigments (spinach leaves may be used)
- (b) Preparation and separation of 2,4-dinitrophenylhydrazones of acetone, 2-butanone, hexane-2-and 3-ones using toluene and light petroleum (40:60)
- (c) Separation of a mixture of dyes using cyclohexane and ethyl acetate (8.5:1.5)

Paper Chromatography:

Determination of R_f values and identification of organic compounds in a mixture of amino acids / monosaccharides.

3. Identification of Organic Compounds:

An organic compound from the following list be given for systematic identification:

- (i) Formic, Acetic, Propanoic and Butanoic acids.
- (ii) Phenols- Phenol, Resorcinol, Hydroquinone, p-Cresol, α -Naphthol, β -Naphthol.
- (iii) Alcohols- Methyl, Ethyl, Propyl, Isopropyl, n-butyl, isobutyl and tert. butyl alcohol.
- (iv) Carboxylic acids- Oxalic, Tartaric, Citric, Succinic, Benzoic, Cinnamic, Salicylic, Phthalic acids
- (v) Carbohydrates- Glucose, Fructose, Cane sugar and Starch.
- (vi) Aldehydes- Formaldehyde, Acetaldehyde and Benzaldehyde.
- (vii) Ketones- Acetone, Methyl ethyl ketone, Acetophenone and Benzophenone.
- (viii) Nitro compounds - Nitrobenzene, p-Nitrotoluene and m-Dinitrobenzene.
- (ix) Amino compounds - Aniline, o-, m- and p-toluidine, α -Naphthylamine and β -Naphthylamine.
- (x) Anilides - Acetanilide and Benzanilide.

- (xi) Amides - Acetamide, Benzamide and Urea.
- (xii) Esters - Methyl acetate, Ethyl acetate.
- (xiii) Thioamide - Thiourea.
- (xiv) Hydrocarbons - Benzene, Toluene, Naphthalene and Anthracene.
- (xv) Halogen containing compounds - Chloroform, Chloral hydrate, Iodoform, Chlorobenzene, p-Dichlorobenzene and p-Dibromobenzene.

4. Physical Chemistry Experiments- Any one of the following experiments may be given in the examination.

Chemical Kinetics:

- (i) To determine the specific reaction rate of the hydrolysis of methyl acetate/ ethyl acetate catalyzed by hydrogen ions at room temperature.
- (ii) To study the effect of acid strength on the hydrolysis of an ester.
- (iii) To study kinetically the reaction rate of decomposition of iodide by peroxydisulphate.
- (iv) To study the hydrolysis of an ester in presence of a base.
- (iv) To determine the relative strength of two acids using ester hydrolysis.

Phase Equilibrium

- (i) To study the effect of a solute (e. g. NaCl, succinic acid) on the critical solution temperature of two

partially miscible liquids (e.g. Phenol-water system) and to determine the concentration of that solute in the given phenol-water system.

- (ii) To construct the phase diagram of two component (e. g. diphenylamine- benzophenone) system by cooling curve method.

Adsorption:

- (i) To study the adsorption of acetic acid by activated charcoal and test the validity of Freundlich or Langmuir adsorption isotherm.
- (ii) To study the adsorption of oxalic acid by activated charcoal and test the validity of Freundlich or Langmuir adsorption isotherm.

Books Recommended:

- 1 Practical chemistry - Giri, Bajpai and Pandey, S. Chand & Co. Ltd. New Delhi
- 2 Laboratory Manual in Organic Chemistry, R.K. Bansal, Wiley Eastern
- 3 Experimental Organic Chemistry Vol.I & II, P.R. Singh, D.S. Gupta & K.S. Bajpai, Tata Mc Graw Hill.
- 4 Experiments in Physical Chemistry- J.C. Ghose, Bharti Bhawan
- 5 Experiments in General Chemistry, C.N.R. Rao & U.C. Agarwal, Eastern Press
- 6 Practical Chemistry- Suresh Ameta & P.B. Punjabi, Himanshu Publication.

B.Sc. SECOND YEAR SCIENCE
2005-2006
GEOLOGY

The examination shall consist of three theory papers and one practical.

	Hr/ Week	Exam. Hr.	M. Marks
A. Theory Papers			
Paper I : Structural Geology	2	3	50
Paper II : Petrology	2	3	50
Paper III : Stratigraphy	2	3	50
B. Practical	4	4	75
Total Marks			225

Note:

Time: 3 hr

MM 50

Note: Each paper will be divided into THREE parts.

Part I – Ten questions (short type answer) two from each Unit will be asked. Each question will be of half a mark and the candidates are required to attempt **ALL** questions. **Total - 05 marks**

Part II – Five questions (answer not exceeding 250 words) one from each Unit with internal choice will be asked and the candidates are required to attempt **ALL** questions. Each question will be of 05 marks.

Total 25 marks

Part III – Four questions may be in parts covering all five Units (answer not exceeding 500 words) will be asked. The candidates are required to attempt any **TWO** questions. Each question will be of 10 marks.

Total 20 marks

PAPER-I STRUCTURAL GEOLOGY

Time: 3 hr

MM 50

UNIT-I

Basic concept of structural geology. Concept of strike and dip. Effects of topography on outcrops. Description and applications of clinometer compass. Primary sedimentary structures, their use in determination of top and bottom of beds.

UNIT-II

Folds-Characteristics and their types - Elementary ideas of mechanism of folding; outcrop pattern of non-plunging, plunging, and doubly plunging folds.

UNIT-III

Faults - Characteristics and classification, effects of faults on outcrop, criteria of their recognition in field.

UNIT-IV

Mechanical principles; Stress and strain. Geological examples of strain in rocks. Types of unconformity; their recognition, significance and distinction from faults. Outliers, inliers, overlap and offlap.

UNIT-V

Preliminary ideas of foliation, lineation, and joints. Structures of igneous rocks.

PAPER-II PETROLOGY

Time: 3 hr

MM 50

UNIT-I

Introduction to Petrology. Igneous rocks: Forms, structures, textures and microstructures. Composition of magma, Classification of igneous rocks.

UNIT-II

Processes of differentiation, gaseous transfer within liquid; immiscibility, and assimilation. Description of the following rock forming families : granite - granodiorite, syenite, diorite, gabbro, feldspathoidal - syenite, ultrabasic and ultramafic rocks.

UNIT-III

Metamorphic rocks: Definitions, controls of metamorphism. Metamorphic processes and reactions. Types of metamorphism - contact, cataclastic, regional and ocean floor metamorphism.

UNIT-IV

Texture and structure of metamorphic rocks. Nomenclature and description of important metamorphic rocks. Metasomatism, anatexis, and migmatization. Sedimentary rocks: Processes of formation of sediments, diagenesis. Textures of sedimentary rocks.

UNIT-V

Major sedimentary structures - primary, secondary and biogenetic and their significance. Classification of sedimentary rocks. Type of arenites, carbonate rocks, and argillites.

**PAPER-III
STRATIGRAPHY**

Time: 3 hr

MM 50

UNIT-I

Principles of stratigraphy. Stratigraphic classification. Stratigraphic correlation. Problems of Early Precambrian stratigraphy. Brief idea about the process of early crustal evolution. Major Precambrian Provinces of India. Physical division of India and their characteristics.

UNIT-II

Geological Time Scale and its equivalent formations in India. Precambrian stratigraphy of Rajasthan, Central India, Jharkhand, Bihar, Orissa, Eastern Ghat and Southern India.

UNIT-III

Middle and Late Proterozoic platforms; Cuddapah, Vindhyan and their equivalents. Precambrian belts of extra -Peninsular region.

UNIT-IV

Geology of Gondwana Supergroup and Palaeozoic stratigraphy of India, their distribution, division, lithology, fossil content and economic importance.

UNIT-V

Mesozoic and Cenozoic geology of India, their distribution, division, lithology and fossil content.

**B. Sc. SECOND YEAR GEOLOGY
PRACTICAL 2005-2006**

The Examination will be of four hours' duration.

Maximum Marks 75

Petrology

- | | |
|-------------------------------------|----|
| 1. Study of rocks in hand specimens | 08 |
| 2. Microscopic study of rocks | 07 |

Structural Geology

- | | |
|---|----|
| 3. Interpretation and drawing of section of simple geological map | 10 |
| 4. Problem of true and apparent dips | 05 |

Stratigraphy

- | | |
|---|----|
| 5. Stratigraphic rocks | 10 |
| 6. Sketch map of Indian formations and palaeographic period | 05 |
| 7. Field report | 15 |
| 8. Viva-Voce | 05 |
| 9. Record | 10 |

Total

75

STRUCTURAL GEOLOGY :

1. Study of topographic maps. Interpretation of topography from contour maps.
2. Orientation of planes and lines; dip, strike, pitch and plunge. Use of clinometer compass.
3. Study and interpretation of outcrop patterns. True and apparent thickness of beds, study of simple geological maps and drawing of sections.
4. Basic principles of stereographic and orthographic projections.

PETROLOGY :

- (1) Identification of igneous, metamorphic and sedimentary rocks in hand specimens as per list given below:

Igneous Rocks: -

Granite, granodiorite, syenite, diorite, anorthosite, norite, gabbro, pyroxenite, peridotite, nepheline syenite, pegmatite, dolerite, basalt and rhyolite.

Metamorphic Rocks: -

Quartzite, marble, granite gneiss, mica schist, phyllite, slate, amphibolite, charnockite, mylonite and migmatitic gneiss.

Sedimentary Rocks: -

Sandstone, limestone, shale, conglomerate, arkose, grit, greywacke, and breccia.

- (2) Petrographic study of the following rocks under microscope: granite, syenite, diorite, gabbro, dolerite, rhyolite, basalt, mica schist, granite gneiss, amphibolite, marble, sandstone and limestone.

STRATIGRAPHY :

Identification and description of important stratigraphic rocks of India and their assignment to respective stratigraphic position. Plotting of following stratigraphic units and their equivalents in the outline map of India. Delhi-Aravalli fold belts, Main Vindhyan Basin, Gondwana Supergroup, Deccan Traps and Siwalik Group. Preparation of palaeogeographic maps of Permocarboniferous and Cretaceous periods.

FIELD WORK :

Field work for seven days for training in geological mapping of rock units and measurement of dip and strike of beds.

Fieldwork is compulsory. Students not taking part in the fieldwork shall not be allowed to appear in the examination.

Books suggested, besides the Internet:

B.Sc. Part-II

Billings M. P.: Structural Geology, Prentice Hall of India Pvt. Ltd., New Delhi.

Bolton T.: Geological Maps their solution and interpretation, Cambridge University Press

Haung G. N.: Petrology

Kirshnan M. S.: Geology of India and Burma, CBS Publishers & Distributors, Delhi.

Lemon R. R.: Principles of Stratigraphy, Merrill Publishing Company, London

Mukerjee P. K.: A Textbook of Geology, The world Press Pvt. Ltd., Calcutta.

Naqvi S.M. & Rogers J. J.W.: Precambrian Geology of India. Oxford University Press.

Parbin Singh: Engineering & General Geology, S. K. Kataria & Sons, New Delhi.

Pettijohn F. J.: Sedimentary Rocks, CBS Publishers & Distributors, Delhi.

Ravindra Kumar: Fundamentals of Historical Geology and Stratigraphy of India, Wiley Eastern Ltd., New Delhi.

Sinha Roy, S., Malhotra, G., & Mohanty, M., 1998: Geology of Rajasthan, Geological Society of India, Bangalore, pp278.

Tyrrell G. W.: The principles of Petrology, B. I. Publications Pvt. Ltd., Delhi.

Weller J. M.: Stratigraphic Principles and Practice, Universal Book Stall, Delhi.

SECOND YEAR T.D.C. SCIENCE, 2005-06

ZOOLOGY

The second year TDC examination shall consist of three theory papers, each of three hours duration and a practical examination of five hours duration.

Marks

Paper-I : Life and Diversity of Animals-II (Vertebrates)	50
Paper-II : Genetics and Biotechnology	50
Paper-III : Applied Zoology and Microbiology	50
Practical :	75

Pattern of question paper in the annual examination and distribution of marks:

Each theory paper in the annual examination shall have three sections i.e. A,B, and C. **In section A**, total 10 questions will be set in the paper, selecting at least two from each unit. These questions to be answered in a word or so. All questions are compulsory. Each question carries 0.5 mark, total 05 marks.

In section B, there shall be total 10 questions, selecting two questions from each unit, five questions to be answered by the student selecting at least one from each unit. Answer should be given in approximately 250 words. Each question carries 05 marks, total 25 marks.

In section C, 04 descriptive type questions will be set in the examination paper from five units of the syllabus of the paper, selecting not more than one question from a unit. Each question may have two sub divisions. Students are required to answer any two questions approximately in 500 words. Each question is of 10 marks, total 20 marks.

**SECOND YEAR T.D.C. SCIENCE,
2005-06**

ZOOLOGY

**PAPER-I
LIFE AND DIVERSITY OF ANIMALS-II
(VERTEBRATES)**

Duration : 3 hours

M.M. : 50

UNIT-I

- 1 Characteristics and classification of Protochordates and Agnatha upto orders with examples emphasizing their biodiversity, economic importance and conservation.
- 2 Type study- *Amphioxus*, *Herdmania*, general biology of *Petromyzon*
- 3 Affinities of *Amphioxus* and importance of ammocoete larva.

UNIT-II

- 4 Characteristics and classification of Pisces (after Berg) and Amphibia upto orders with examples emphasizing their biodiversity, economic importance and conservation.
- 5 Type study- *Scoliodon*, *Rana*, types of scales and fins, fish migration: parental care in Amphibia.

UNIT-III

- 6 Characteristics and classification of Reptiles upto orders with examples emphasizing their bio-diversity, economic importance and conservation.
- 7 Type study- *Calotes*. Identification of poisonous and non-poisonous snakes, venom, antivenom, medicinal significance of venom.
- 8 *Sphenodon*: Characteristics and affinities.

UNIT-IV

- 9 Characteristics and classification of Aves upto orders with examples emphasizing their bio-diversity, economic importance and conservation.
- 10 Type study - *Columba*, flight adaptations, perching mechanism, types of feathers.
- 11 *Archaeopteryx*, bird migration.

UNIT-V

- 12 Characteristics and classification of Mammalia upto orders with examples emphasizing their bio-diversity, economic importance and conservation.
- 13 Type study - *Rattus*, (Digestive, respiratory and urinogenital systems only).
- 14 Dentition, hair and thermoregulation; integumentary derivatives.

SECOND YEAR T.D.C. SCIENCE, 2005-06

ZOOLOGY

PAPER-II GENETICS AND BIOTECHNOLOGY

Duration : 3 hours

M.M.: 50

UNIT-I

- 1 Brief history of genetics. Mendelian laws and their significance.
- 2 Genetic interaction: Supplementary and complementary genes, duplicate genes, epistasis, inhibitory and polymorphic genes, multiple gene inheritance, ABO blood groups, Rh factor.
- 3 Extra-chromosomal inheritance.

UNIT-II

- 4 Linkage and crossing over: Kinds of linkage- complete and incomplete linkage, linkage groups, significance of linkage.
- 5 Sex-linked inheritance, sex limited and sex-influenced genes.
- 6 Chromosomal theory of sex determination, hormonal theory of sex determination, X and Y chromosomes, gynandromorphs.

UNIT-III

- 7 Light and electron microscopic structure of chromosome (from nucleosome to organization of chromatids).
- 8 Genetic code: triplet, initiation and termination codons, palindromes.
- 9 Genetic engineering: Restriction enzymes, cloning vehicle, C-DNA, applications of genetic engineering. Hybridoma technology.
- 10 Concept of gene, muon, recon, cistron, gene expression, lac-operon, trp-operon.

UNIT-IV

- 11 Mutations: Definition, gene mutation, chromosomal mutation, chromosomal aberrations, somatic and germ mutations, numerical alterations of chromosomes, molecular basis of mutation, mutagenic agents
- 12 Polytene and lamp-brush chromosomes.
- 13 Eugenics and genetic counselling.

UNIT-V

- 14 Medicines and biotechnology: Microbes in medicine, antibiotics, vaccines, enzymes and antigens.
- 15 Food and dairy microbiology: Fermented food production, dairy products, food preservation, microbial spoilage, alcoholic beverages, vinegar.
- 16 Role of Biotechnology in health care.

SECOND YEAR T.D.C. SCIENCE, 2005-06

ZOOLOGY

PAPER-III APPLIED ZOOLOGY AND MICROBIOLOGY

Duration: 3 hours

M.M.: 50

UNIT - I

- 1 History, general account and scope of sericulture. Distribution of mulberry and non- mulberry silk-worm.
- 2 Life history of *Bombyx mori*.
- 3 Rearing techniques of silkworm
- (a) Brief account of environmental conditions of rearing and programming of mulberry cultivation.
- (b) Rearing of silk worm.
- 4 Reeling of silk yarn.
- 5 Brief idea of diseases of silk worm.

UNIT-II

- 6 History, scope and general practices of apiculture in India.
- 7 Life history of honey bee.

8 Rearing of honey bee:

- (a) Indigenous methods of bee keeping
- (b) Tools of bee keeping
- (c) Modern methods of bee keeping

9 Economic Importance of bees wax and honey.

10 Brief idea of diseases and enemies of honey bee.

UNIT-III

11 Shell-fish culture:

- (a) Culture of fresh water prawns.
- (b) Prawn seed procurement and rearing.
- (c) General idea of lobsters, clams, mussels and pearl culture.

12 Fin fish culture and fisheries :

- (a) Culturable fresh water fishes of India.
- (b) Inland, marine, and estuarine fisheries
- (c) Preservation of fishes
- (d) Economic importance of fishing industry.

UNIT-IV

13 Concepts of basic microbiology and its significance, work of Anton von Leeuwenhoek, theory of spontaneous generation, gram theory of fermentation and disease, work of Louis Pasteur.

14 General account of classification, structural organisation, physiology and multiplication of bacteria.

15 Brief idea of bacteria and human welfare.

UNIT-V

16 DNA and RNA viruses

17 AIDS

- (i) The causal agents: HIV subtypes and their structures.
- (ii) Transmission of HIV
- (iii) Pathogenicity of HIV
- (iv) Prevention of HIV
- (v) Laboratory diagnosis of HIV infections and treatment

**SECOND YEAR T.D.C. SCIENCE,
2005-06**

ZOOLOGY - PRACTICAL

Duration : 5 Hrs.

M.M. :75

S.No.	Exercise	Regular	Ex-Students
1	Major dissection	18	25
2	Minor dissection	09	12
3	Mounting/Applied Zoology exercise	08	08
4	Spots	20	20
5	Viva-voce	10	10
6	Record	10	—
Total :-		75	75

General survey of Vertebrates (Museum specimens)

- A Urochordata : *Ciona, Pyrosoma, Doliolum, Salpa, Herdmania*
- B Cephalochordata : *Amphioxus*
- C Agnatha : *Petromyzon, Ammocoete larva*
- D Pisces : *Echeneis, Sphyrna, Torpedo, Pristis, Labeo, Clarias, Anabas, Hippocampus* (male and female), *Chimaera, Anguilla, Protopterus, Lepidosiren, Neoceratodus*.

- E Amphibia : *Ichthyophis, Axolotl larva, Salamander, Bufo, Rana, Hyla, Pipa, Amphiuma, Alytes*.
- F Reptilia : *Testudo, Trionyx, Hemidactylus, Draco, Calotes, Chamaeleon, Varanus, Phrynosoma, Crocodilus, Gavialis, Uromastix, Heloderma, Naja, Vipera, Typhlops, Bungarus, Hydrophis, Natrix, Eryx, Python, models of Dinosaurs*.
- G Aves : *Columba, Psittacula, Passer, Bubo, model of Archaeopteryx*
- H Mammalia : *Pteropus, Rhinopoma, Felis, Erinaceous, Hystrix, Crocedura, Manis*.

PREPARED SLIDES :

- 1 Cephalochordata : *Amphioxus*: T.S. through buccal region, T.S. through pharynx showing gonads, T.S. through caudal region.
- 2 Pisces : Placoid, cycloid and Ctenoid scales, V.S. of skin.
- 3 Amphibia : V.S. of skin, T.S. of testis, T.S. of kidney and T.S. of liver.

- | | | |
|---|----------|--|
| 4 | Reptilia | : V.S. of skin and T.S. of stomach. |
| 5 | Aves | : T.S. of intestine, T.S. of liver, T.S. of ovary, filoplume W.M. |
| 6 | Mammalia | : T.S. of pancreas, T.S. of thyroid gland, L.S. of pituitary gland, T.S. of stomach, T.S. of intestine, L.S. of kidney, T.S. of testis and ovary, V.S. of skin and T.S. of lung. |

PERMANENT PREPARATIONS : Unstained placoid scales, spicules of *Herdmania*.

DISSECTION :

- | | |
|-------------------------|--|
| <i>Herdmania</i> | : Neural complex. |
| <i>Scoliodon</i> | : Alimentary canal, scroll valve <i>in situ</i> , afferent and efferent branchial arteries, eye muscles, internal ear. |
| <i>Rattus</i> | : Arterial, venous and urino-genital systems. |

OSTEOLOGY :

Identification of disarticulated skeleton of *Rana*, *Varanus*, *Gallus* and *Oryctolagus*. Palates of birds.

GENETICS :

Drosophila : Life cycle and its culture. Identification of wild and mutant *Drosophila*.

APPLIED ZOOLOGY:

- 1 Identification of different stages (from egg to adult) of silkworm.
- 2 Dissection of silk worm to study the internal anatomy and silk glands.
- 3 Tools used in silk worm rearing.
- 4 Visit to a rearing and reeling unit.
- 5 Identification of bee colony and honey bee castes.
- 6 Mounting of mouth parts and sting apparatus of honey bee.
- 7 Identification of tools used in Apary.
- 8 Identification of cultivable varieties of shell fish and fin fish.
- 9 Preparation of media and culture of microorganisms.
- 10 Gram staining of microbes.

REFERENCE BOOKS (LATEST EDITIONS) :

LIFE AND DIVERSITY OF ANIMALS (VERTEBRATES)

- 1 Ayyar, E.K. and T.N. Ananthakrishnan, Manual of Zoology, Vol.II (Chordata), S.Viswanathan (Printers and Publishers) Pvt. Ltd., Madras.

- 2 Jordan, E.L. and P.S.Verma, Chordate Zoology and Elements of Animal Physiology, S. Chand & Co. Ltd., Ram Nagar, New Delhi (English and Hindi Editions).
- 3 Parker, T.J. and Haswell, W.A.: Text Book of Zoology, Vol.II (Chordata), A.Z.T.B.S. Publishers and Distri-butors, New Delhi- 110051.
- 4 Waterman, Allyn J. et.al., Chordate Structure and Function, Mac Millan and Co., New York.
- 5 Kotpal, RL, Modern Text Book of Zoology-Vertebrates, Rastogi Publications, Meerut (English and Hindi Editions).
- 6 Ganguly, BB, Sinha, AK and Adhikari, S : Biology of Animals, Vol.II, New Central Book Agency (P) Ltd. Kolkatta.
- 7 Alexander, R.M.: The Chordates (Cambridge University Press).
- 8 Monielth, A.R: The Chordates (Cambridge University Press).
- 9 Young, J.Z : Life of Vertebrates (Oxford University Press)
- 10 Waterman, A.J: Chrodta - Structure and Function (Macmillan Co.).

GENETICS AND BIOTECHNOLOGY:

- 11 Verma, P.S. and V.K.Agarwal, Genetics, S.Chand & Co.

- 12 Lewis, C.D. and Lewin, R., Biology of Gene, McGraw Hill, Toppan Co. Ltd.
- 13 Gunther S. Stent, Molecular Genetics, macmillan Publishing Co. Inc.
- 14 Goodenough, V., Genetics, New York Holt, Rinchart and Winston.
- 15 Gardner, E.J. et al. Principles of Genetics, Wiley Eastern Pvt., Ltd.
- 16 Winchester, Genetics, Oxford IBH Publications
- 17 Stickberger, Genetics, MacMillan Publications.
- 18 Pai, A.C., Foundations of Genetics, McGraw Hill Publications.
- 19 R.A.Meyers (Endocrinology.): Molecular Biology and Biotechnology, VCH Publishers.
- 20 Glick : Molecular Biotechnology.
- 21 R.W.Old and S.B. Primrose : Principles of Gene Manipulation and Introduction to Genetic Engineering.
- 22 Gupta PK : Elements of Biotechnology, Rastogi Publications, Meerut.

APPLIED ZOOLOGY AND MICROBIOLOGY :

- 23 Jhingran, VG, Fish and Fisheries of India. Hindustan Publishing Corporation, New Delhi.

- 24 Kovaleve, PA, Silkworm Breeding Stocks, Central Silk Board, Marine Drive, Bombay.
- 25 Roger, A. Morse, The ABC and XYZ of Bee Culture, A.I. Root and Co., Medina, Ohio 44256.
- 26 Metcalf CL and WP Flint, Destructive and Useful Insects, Tata McGraw Hill publishing Co. Ltd., New Delhi- 110051
- 27 Sharma PD, Microbiology, Rastogi Publications Meerut.
- 28 Shukla, G.S. and Upadhyaya, V.B. : Economic Zoology (Rastogi Publishers)
- 29 Venkitaraman : Economic Zoology (Sudarshana Publishers)

PRACTICAL:

- 30 Verma, PS, A manual of practical Zoology Vertebrates S.Chand and Co. Ltd., Ram Nagar, New Delhi (English and Hindi Editions).
- 31 Lal, SS : Practical Zoology Vertebrates, Rastogi Publication, Meerut (English and Hindi Editions)..

SECOND YEAR T.D.C. SCIENCE, 2004-05

ENVIRONMENTAL SCIENCES

The second year TDC examination shall consist of three theory papers, each of three hours duration and a practical examination of five hours duration.

	<u>Marks</u>
Paper-I : Ecological Factors, Adaptations and Distribution	50
Paper-II : Aquatic Ecology	50
Paper-III : Terrestrial Ecology	50
Practical :	75

Pattern of question paper in the annual examination and distribution of marks:

Each theory paper in the annual examination shall have three sections i.e. A, B and C. **In Section A**, total 10 questions will be set in the paper, selecting at least two from each unit. These questions to be answered in a word or so. All questions are compulsory. Each question carries 0.5 mark, total 05 marks.

In Section B, there shall be total 10 questions, selecting two questions from each unit, five questions to be answered by the student selecting at least one

from each unit. Answer should be given in approximately 250 words. Each question carries 05 marks, total 25 marks.

In section C, 04 descriptive type questions will be set in the examination paper from five units of the syllabus of the paper, selecting not more than one question from a unit. Each question may have two sub divisions. Students are required to answer any two questions approximately in 500 words. Each question is of 10 marks, total 20 marks.

SECOND YEAR T.D.C. SCIENCE, 2005-06

ENVIRONMENTAL SCIENCES

PAPER-I

ECOLOGICAL FACTORS, ADAPTATIONS & DISTRIBUTION

Duration : 3 Hrs.

M.M.: 50

UNIT-I

Ecological factors in relation to plants and animals :

1. Edaphic 2. Light
3. Temperature 4. Precipitation
5. Topography

Laws of limiting factors – Leibig and Shelford's.

UNIT-II

Ecological adaptation- Xerophytes, hydrophytes, halophytes, adaptations and ecotypes; Plant indicator; animal fitness to habitats; fossorial, arboreal, aquatic, volant adaptations.

UNIT-III

Patterns in vegetation – brief idea of morphological, environmental and sociological patterns. Measurement of non-randomness in vegetation, continuous and discontinuous distribution, interpretive phytogeography. Endemic areas and theories of endemism; Endemic flora of India.

UNIT-IV

Major biomes of the world : Forest, savannah, grass-land, desert and tundra biomes. Flora and vegetation of India; vegetation of Rajasthan.

UNIT-V

Zoogeographical regions – Palaearctic, Nearctic, Neotropical, Ethiopian, Oriental, Australian region, Dynamic biogeography – Dispersal dynamics, barriers, dispersal pathways, continental drift theory, land bridge, centre of origin, age and area hypothesis; Migration.

SECOND YEAR T.D.C. SCIENCE, 2005-06

ENVIRONMENTAL SCIENCES

PAPER - II AQUATIC ECOLOGY

Duration : 3 Hrs.

M.M.: 50

UNIT-I

Physico-chemical characteristics of aquatic habitats (light, temperature, pH, nitrate and phosphate); lentic and lotic habitats; Lakes and Ponds; ecological zonation in the lake environment.

UNIT-II

Definition and general account of lakes; origin of lakes, classification of lakes; Productivity of lakes; Lake fertility and fish production; Eutrophication.

UNIT-III

Biotic communities of lakes: Plankton, Benthos, Nekton and Neuston, Diversity and Biomass of plankton and benthos in time and space, aquaculture.

UNIT-IV

Features of marine environment, zonation of marine environment, biotic communities of marine environment; Brief account of pelagic, coastal, deep sea, coral reefs and mangrove communities; Marine resources.

UNIT-V

Estuarine ecology, Definition and types, biota and productivity, Ecological adaptation in estuarine environment. Eco- characteristics of Chilka lake.

SECOND YEAR T.D.C. SCIENCE, 2005-06

ENVIRONMENTAL SCIENCES

PAPER-III TERRESTRIAL ECOLOGY

Duration : 3 Hrs.

M.M.: 50

UNIT-I

Physico-chemical characteristics of terrestrial ecosystem, Grassland ecosystem – Grassland environment; food chain and trophic levels, energetics of grasslands, productivity of grassland, biogeo-chemical cycles operating in grasslands; grass-legume association; Grasslands in relation to soil and water conservation.

UNIT-II

Basis of grassland classification, Major grassland types in the world, grasslands in India with special reference to Rajasthan; Range management.

UNIT-III

Forest ecosystem – Major forest types of the world and of India; forest ecosystem, forest environment, food chains, energetics and biogeochemical cycles operating in forests. Forest biota.

UNIT-IV

Desert ecosystem – Introduction to world deserts, causes of desertification and control, climate of desert; Ecological adaptations to desert in plants and animals.

UNIT-V

Flora and fauna of Indian desert, Dryland farming, sylvipastoral agroforestry, solar energy utilization, arid horticulture and resource management activities with special reference to Rajasthan. Aims and activities of CAZRI, Desert Development Board and Arid-Forestry Research Institute (AFRI).

SECOND YEAR T.D.C. SCIENCE, 2005-06

ENVIRONMENTAL SCIENCES

PRACTICALS

Duration : 5 Hrs.

M.M.:75

	Regular	Ex-Students
1. Major Exercise	15	25
2. Major Exercise	15	15
3. Minor Exercise	10	08
4. Spots	20	20
5. Viva – Voce	10	10
6. Record	05	—
Total :	75	75

SECOND YEAR T.D.C. SCIENCE, 2005-06

ENVIRONMENTAL SCIENCES

PRACTICALS

Duration : 5 Hrs.

M.M.: 75

1. Measurement of depth of visibility in a lake or pond with the help of a Secchi disk.
2. Studies of water samples for :
 - i) pH
 - ii) Dissolved oxygen
 - iii) Alkalinity
 - iv) Total hardness
 - v) Chlorides
 - vi) Dissolved organic matter
 - vii) Suspended particulates
3. Observation of zooplanktons and phytoplankton, benthos, nektons and macrophytes.
4. Estimation of primary productivity with the help of dark and light bottle experiment.
5. Sampling equipments.
6. Analysis of vegetation by line transect method.

7. Determination of cover in a grassland community with the help of chart quadrat method.
8. Determination of DBH of the tree species in a forest and calculation of the basal area.
9. Characteristic adaptation of animals of ecological significance.
10. Morpho-anatomical characteristics of hydrophytes and xerophytes.
11. Study of primary productivity (in terms of chlorophyll) in relation to light.
12. Study of animal communities in a terrestrial ecosystem.

SECOND YEAR T.D.C. SCIENCE, 2005-06
ENVIRONMENTAL SCIENCES

BOOKS RECOMMENDED :

- 1 P.D.Sharma : Ecology and Environment, Rastogi Publications, Meerut.
- 2 R.S.Ambasht : Ecology
- 3 Verma and Agarwal: Environmental Biology. S.Chand and Co. Ram Nagar, New Delhi.
- 4 V.B. Rastogi : Animal Ecology, Kedarnath Ramnath, Meerut.

PRACTICAL :

- 5 J. Pandey and M.S.Sharma : Environmental Science: Practical and Field Manual, Yash Publications, Bikaner.

COURSE CURRICULAM AND SYLLABII OF
THREE YEAR DEGREE COURSE 2004-2007
PHYSICS

COURSE CURRICULAM

Paper- code	Paper Nomenclature	Lect- ures	Dura- tion of Exam	Max. Marks	Min. Marks
2161	I Kinetic Theory, Thermodynamics and Statistical Physics	60 hrs	3hrs	50	18
2162	II Optics	60 hrs	3 hrs	50	18
2163	III Electronics	60 hrs	3 hrs	50	18
2164	IV Practical	120 hrs	6 hrs	75	27

Each theory paper in the annual examination shall have three sections.

Section A shall contain one compulsory question of 5 marks having 10 parts. Two parts shall be set from each unit. The candidate is required to answer each part in about 20 words.

Section B shall contain five compulsory questions of 5 marks each with internal choice .One question with internal choice will be set from each unit .The answer may be given in approximately 250 words.

Section C shall contain four descriptive questions covering all units and candidate has to answer any two questions of ten marks each. The answer may be given in approximately 500 words. There can be two parts in a question from this section.

In total the candidate has to answer eight questions in each theory paper.

**SECOND YEAR T.D.C. SCIENCE
2005-2006**

**PAPER-I
KINETIC THEORY, THERMODYNAMICS AND
STATISTICAL PHYSICS**

UNIT - I

Ideal Gas: Kinetic Model, Deduction of Boyle's law, Review of the kinetic model of an ideal gas, Interpretation of temperature, Brownian motion, Estimate of the Avogadro number, Equipartition of energy, specific heat of monatomic gas, extension to di and triatomic gases, Behaviour at low temperatures, Adiabatic expansion of an ideal gas. Application to atmospheric physics (derivation of barometric equation)

Real Gas: Van der Waals model; equation of state, nature of Van der Waals forces, comparison with experimental P-V curves. The critical constants, gas and vapour. Joule-Thomson expansion of an Ideal gas and Van der Waals gas; Constancy of $U+pV$, Joule coefficients, Estimates of J-T cooling, adiabatic expansion of an ideal gas.

Liquification of gases : Joule Expansion, Joule-Thomson and adiabatic cooling, Boyle temperature and inversion temperature, principles of regenerative cooling and cascade cooling, Liquification of hydrogen and helium, meaning of efficiency.

UNIT - II

Transport phenomena in gases: Molecular collisions, mean free path and collision cross-sections, Estimates of molecular diameter and mean free path, Experimental determination of mean free path. Transport of mass, momentum and energy and interrelationship, dependence on temperature and pressure.

Maxwellian distribution of speeds in gas: Derivation of distribution of speeds and velocities, experimental verification, distinction between mean, rms and the most probable speed values. Doppler broadening of spectral lines.

UNIT - III

The laws of thermodynamics: The Zeroth law, Various indicator diagrams, work done by and on the system, First law of thermodynamics, internal energy as a state function. Carnot cycle and its efficiency, Carnot theorem and the second law of thermodynamics, Different versions of the second law, Reversible and irreversible changes. Practical cycles used in internal combustion engines. Entropy, principle of increase of entropy. Thermodynamic scale of temperature; its identity with the perfect gas scale. Impossibility of attaining absolute zero; third law of thermodynamics.

Thermodynamic relationships: Thermodynamic variables; extensive and intensive, Maxwell's general relationships; applications to J-T cooling and adiabatic

cooling in a general system, Van der Waals gas, and the Clausius-Clapeyron heat equation.

Thermodynamic Potentials: Relation to the thermodynamic variables, Equilibrium of thermodynamic systems, Cooling due to adiabatic demagnetization.

UNIT - IV

Statistical basis of the thermodynamics:

Probability and thermodynamic probability, principle of equal *a priori* probabilities, probability distribution and its narrowing with the increasing n , average properties, Accessible and inaccessible states, distribution of particles with a given total energy into a discrete set of energy states.

Phase space representation: The μ space; its division into sheets of energy, phase cells of arbitrary size, one-dimensional oscillator, free particles, the functions $F(E)$ and $W(E)$, definition of probability.

Black Body Radiation: Spectral distribution of BB radiation; pure temperature dependence, Stefan-Boltzmann law, Wien's displacement law, Rayleigh-Jeans law and the ultraviolet catastrophe, Pressure of radiation, Planck's hypothesis, mean energy of an oscillator and the Planck's law, complete fit with the experiment. Interpretation of specific heats of gases at low temperature.

UNIT-V

The bridge of Statistical physics with thermodynamics: Thermal equilibrium between two

subsystems, beta parameter and its identity with $(kT)^{-1}$, probability and entropy, Boltzmann entropy relation, statistical interpretation of the second law of thermo-dynamics. Boltzmann canonical distribution law; rigorous form of equipartition of energy.

Transition to quantum statistics: 'h' as a natural constant and its implications, cases of particles in a box and simple harmonic oscillator, Setting phase-cell size as nature's constant (Planck's constant h); quantization of energy. Indistinguishability of particles and its consequences. Bose-Einstein and Fermi-Dirac conditions, applications to liquid helium, free electrons in a metal, and photons in blackbody chamber, Fermi level and Fermi energy.

Text and Reference Books :

1. B.B. Laud, "Introduction to Statistical Mechanics" (Macmillan 1981)
2. F. Reif, "Statistical Physics" (McGraw-Hill, 1988)
3. K. Huang, "Statistical Physics" (Wiley Eastern, 1988)

PAPER-II OPTICS

UNIT-I

Format's Principle : Principle of experiments path, the applanatic points of a sphere and other applications.

General theory of image formation : Cardinal points of an system; general relationship; thick lenses and lens combinations, telephoto lenses.

Aberration in images : Chromatic aberration ; achromatic combination of lenses in contact and separated lenses. Monochromatic aberrations and their reduction; spherical mirrors and schmidt corrector plates; oil immersion objective, meniscus lenses.

Optical instruments : Entrance and exit pupils, need for a multiple lens eye pieces. Common type eye pieces.

UNIT - II

Interference of Light

The principle of superposition ; two slit interference, coherence requirement for the sources, localized fringes in thin films, transition from fringes of equal thickness to those of equal inclination, Newton's rings, Michelson interferometer its uses for determination of wavelength, wavelength difference and standardization of meter. Intensity distribution in multiple beam interference, Fabry-Perot interferometer and etalon. Lummer Gehrke plate, Lloyd's mirror.

UNIT - III

Diffraction of light

Fresnel diffraction : Half period zones, circular aperture and obstacles; straight edge, explanation of rectilinear propagation, Zone plate with multiple foci

Fraunhofer diffraction : Diffraction at a slit, a circular aperture and a circular disc, resolution of images; Rayleigh criterion. Resolving power of a telescope and microscope, outline of phase contrast microscopy.

Diffraction grating : Diffraction at N parallel slits, plane diffraction grating, concave grating resolving power of grating and prisms.

UNIT - IV

Polarization of light

Double refraction and optical rotations : Double refraction in uniaxial crystals, explanation in terms of electromagnetic theory, Malus Law, Phase retardation plates, rotation of plane of polarization, origin of optical rotation in liquids and in crystals. Babinet Compensator, Polarimeters and their applications in measurement of specific rotation.

Dispersion and Scattering : Theory of dispersion of light, absorption band and anomalous dispersion theory of Rayleigh Scattering.

UNIT - V

LASER

Laser System : Purity of spectral line; Coherence length and coherence time, spatial coherence of a source; Einstein's A and B coefficients; Coherence of induced emissions, conditions for laser action, existence of a metastable state, population inversion by pumping and cavity. He-Ne and Ruby Laser

Application of lasers : Spatial coherence and directionality, estimates of Laser and non linear optics : Polarization P including higher order terms in E and generation of harmonics. Momentum mismatch and choice of right crystal and direction for compensation.

Recommended Books

1. Principle of Optics : B. K. Mathur (IIIrd edition)
2. Text book of Optics : Subrahmanyam and Brijlal (S.Chand and Co.)
3. Optics : Jankins and White (McGraw Hill)
4. Text book of Optics : D. P. Khandelwal
5. Universities Optics Vol. I & II : Whittkar and Yarwood
6. Optics : Ajay Ghatak (Tata McGraw Hill)

PAPER-III ELECTRONICS

UNIT-I

Basic circuit analysis:

Voltage and current sources, Open and Short Circuits, Kirchoff's laws, Voltage and current divider rules, Mesh and node analysis, Principle of superposition, Thevenin's and Norton's theorem, Maximum Power transfer theorem.

Semiconductor diodes:

p-n junction diodes, I-V characteristics, diode as a rectifier, half wave, full wave and bridge rectifiers, clippers and clampers, Zener, varactor diode and their applications, Optoelectronic diodes: LED and Photodiodes.

Bipolar Junction Transistors (BJT) :

Basic construction of pnp and npn transistors and their operation, Input and output characteristics of CB, CE and CC configurations, Biasing methods, active, saturation and cutoff regions, load line concepts, Graphical analysis of CE configuration and phase relationship.

Field effect transistors:

Basic constructions of JFET and MOSFET, Drain characteristics of JFET, biasing of JFET, operating regions, pinch-off voltage.

UNIT-II

Small signal amplifiers:

General amplifier characteristics, Two port analysis of a transistor, definition of h- parameters, current gain, voltage gain and power gain of an amplifier, Input and output resistances, Analysis of CB, CE and CC amplifiers for current gain, voltage gain, input and output impedances using h – parameters, Decibel power, Classifications of amplifiers, class A, B, AB and C amplifiers (graphical treatment only), RC coupled transistor amplifier, Gain frequency response, and high frequency limitations. Transformer coupled amplifier.

UNIT III

Feed back amplifiers:

Basics of Negative feedback, Merits and demerits of negative feedback and its applications, Voltage series amplifier (Emitter follower) and Current series amplifier (CE amplifier with and without bypass capacitor).

Oscillators:

Positive feedback, Barkhausen criterion, Phase shift oscillator, Colpitt's and Hartley oscillators, and Crystal oscillator.

Operational Amplifiers:

Characteristics of Operational amplifiers, circuit symbols, ideal and practical op-amp, Inverting and

noninverting configurations, Applications of OP-AMP as an adder, subtractor, inverter, scale changer, phase shifter, differentiator and integrator.

UNIT-IV

Digital Electronics:

Binary, Octal, decimal and hexadecimal numbers and their inter conversions, 1's and 2's complements of binary numbers, addition and subtraction of binary numbers, OR, AND, NOT, NAND, NOR and XOR gates and their symbols and truth tables, Boolean algebra, DeMorgan's theorem, minterms and maxterms, sum of minterms and product of maxterms forms of Boolean functions, simplifications of Boolean function using Karnaugh's map (up to 4-variables).

UNIT-V

Modulation:

Basics of modulation, amplitude and frequency modulation, sidebands, Comparison between AM and FM, power of amplitude modulation and spectrum, AM and FM transmitters (Block diagram and principle of operation only).

Demodulation:

Demodulation of AM and FM waves, linear envelope detector, Heterodyne and superheterodyne receiver (Block diagram and principle of operation only).

Cathode Ray Oscilloscope:

Cathode ray tube-theory and construction, Cathode Ray Oscilloscope (Block diagram and operation), Application of CRO, wave form display, frequency, phase and amplitude determination, Lissajous figures.

Recommended Books:

1. Electronic Devices and Circuit theory by R. Boylestead and L. Nashelsky (Prentice Hall of India).
2. Foundations of Electronics by D. Chattopadhyaya, P.C. Rakshit, B. Saha and N.N. Purkait (New Age International (P) Limited Publishers).
3. Electronic Devices by Allan Mottershed (Prentice Hall of India).
4. Digital fundamentals by Thomas L Floyd (Unuited Book Stall, New Delhi).
5. Electronic fundamentals and applications by John D. Ryder (Prentice Hall of India).
6. Electricity and Magnetism by K.K. Tewari (S. Chand & Company Limited).

PAPER-IV PHYSICS PRACTICAL

The distribution of marks in the practical examination will be as follows:

(i) Two experiments 48 Marks

For each experiment, distribution of marks will be as follows:

Figure :	3
Formula/Theory :	3
Observation :	10
Calculation and Result :	6
Precautions :	2

(ii) Viva voce 12

(iii) Records 15

Total 75 Marks

MAX. MARKS :75

Students are expected to perform sixteen experiments in all taking eight from each section.. One experiment from Section A and one from Section B shall be set in the examination paper.

LIST OF EXPERIMENTS

Section-A

1. Determination of the size of the Lycopodium grains using Cornu's method.
2. Determination of wavelength of Mercury light using grating
3. Determination of resolving power of grating
4. Determination of dispersive power of the glass prism
5. Determination of wavelength of sodium light using Fresnel's biprism
6. Determination of wavelength of sodium light using Newton's rings
7. Determination of specific rotation of cane sugar solution using polarimeter.
8. Determination of wavelength of ultra sonic wave.
9. Determination of focal length of a high power microscope objective.
10. Measurement of absorption by a solution.
11. Study of aberrations of a thick lens.
12. Study of interference fringes in thin films of the following (not all)
 - (a) Thermal expansion of a crystal using interference fringes.

- (b) Bending of a glass plate under load.
- (c) Bending of a rod under load.
- (d) Use of Newton's ring to determine the radii of curvature of surfaces.
- (e) Use of fringes in wedge film .
13. Resolving limit of the eye and of a telescope with a variable aperture.
14. Fresnel diffraction at a straight edge and a slit.
15. Fraunhofer diffraction at a single slit.
16. Resolving limits of grating and prism.
17. Study of polarization of the light by simple reflection.
18. Verification of Cauchy's relation using Prism and Grating.

Section-B

1. To draw characteristic curves of Common emitter transistor and calculate its hybrid parameters.
2. To study gain and frequency response of a single stage Common emitter amplifier.
3. To determine varactor diode characteristics.
4. To draw characteristics of Zener diode and calculate voltage regulation factor.
5. To study ripple factor and internal resistance of a solid state power supply using LR,CR and Pi filter using a CRO

6. To find barrier height of a given solid state diode.
7. Use of p-n junction for the measurement of temperature.
8. Design and construction of phase shift oscillator.
9. Design, build and test of a logarithmic amplifier.
10. Study of a function generator using Operational Amplifier.
11. Study of NAND and NOR circuits (discrete and IC) XOR and De Morgans Theorem.
12. Study of multiplexers and demultiplexers.
13. Study of half adder and full adder circuit.
14. Study RS, D and JK flip - flops.
15. Study of Modulo- 3 , Modulo-5 and Modulo-7 binary counter circuits.
16. Study of characteristics of a thermistor.
17. Determination of solar constant or temperature of an oven through radiation measurement.
18. Resistance thermometry: temperature of a torch bulb filaments from R value, platinum resistance thermometry.

SECOND YEAR SCIENCE, 2005-2006

COMPUTER SCIENCE

PAPER-I

COMPUTER SYSTEM ARCHITECTURE

Max. Marks : 50

UNIT-I

Processor Design : Processor organization, Instruction set, Instruction formats, Instruction types, Addressing modes - Direct, Indirect, Immediate, Relative & Indexed. Organization of 8085, 8085 signals, demultiplexing of bus, generation of control signals, ALU, timing and control unit.

UNIT-II

Assembly language programming : Instruction of 8085. Writing assembly language program, looping counter and indexing, counter and timing delay, stack and sub routine.

UNIT-III

Control Design and arithmetic procedure : Instruction sequencing, Instruction interpretation, hardwired v/s micro programmed control. Micro programmed computers. Comparison of Intel and Motorola family 8-bit, 16-bit, 32-bit processors. Fixed point, floating point arithmetic - addition, subtraction, multiplication and division.

UNIT-IV

Memory organization : Basic memory cell - linear, two dimensional, three dimensional memory organization. Random and serial access memory, associative memory, virtual memory, cache memory, interleaved memory.

UNIT-V

I/O Systems : Programmed I/O, DMA and interrupts, I/O processor, Pipeline processor, RS232-C, IEEE-488 communication protocol.

Suggested Books

1. Mano M.M.: Computer System architecture, Third Edition, Prentice Hall of India Private Limited, New Delhi.
2. Gaonkar R.: Micro processor architecture, programming and application, Second Edition, New Age International Private Limited, New Delhi..
3. Mathur A.P.: Introduction to Micro processor, Third Edition, Tata McGraw Hill Publishing Company Limited, New Delhi.
4. Ram B.: Fundamentals of Micro processor and Micro computers, Dhanpat Rai & Sons, New Delhi.
5. Tanenbaum Andrew S.: Structured computer organization, Prentice Hall of India Private Limited, New Delhi.
6. Hayes J.P.: Computer organization and architecture, Second Edition, Tata McGraw Hill Publishing Company Limited, New Delhi.

PAPER-II

FILE ORGANIZATION TECHNIQUES AND FILE MANAGEMENT

Max. Marks : 50

UNIT-I

Elements of COBOL programming language : File concept: Field, record, layout coding format of COBOL, structure of COBOL programs, COBOL coding format, character set, COBOL words, identifiers, literals, figurative constants, syntax diagram, punctuation in COBOL, data description, PIC clause, VALUE clause, USAGE clause, JUSTIFIED clause, BLANK WHEN ZERO clause, SELECT and FD entry formats, DATA DIVISION, input and output files, WORKING STORAGE SECTION and problems based on these clauses.

UNIT-II

Procedure division : File oriented input and output - OPEN, CLOSE, READ, WRITE verbs. Data oriented input and output - ACCEPT and DISPLAY. Data movement - MOVE, MOVE CORRESPONDING, Arithmetic verbs - ADD, SUBTRACT, MULTIPLY, DIVIDE and COMPUTE verbs, ROUNDED and ON SIZE ERROR option, GOTO verb. Writing complete programs.

UNIT-III

Procedure Division : GOTO depending verbs, conditional statements i.e. relation condition, logical, nested condition. More about data division - REDEFINE and RENAMES clause, PERFORM verb and programs based on these statements.

UNIT-IV

Table Handling : OCCURS clause, SEARCH verb and its application, programs based on these statements.

File processing : The organization and processing of sequential files, non sequential files and indexed sequential files, direct access files.

UNIT-V

Sorting and merging of sequential files : Files sorting - COBOL Sort features, syntax and use of SORT statement, Input-Output procedures in SORT statement, File merging - COBOL merge features, syntax and use of MERGE statement. Sorting transactions for file processing and problems based on SORT and MERGE verb.

Structured programming : Objectives and methodologies of structured and modular programming.

Suggested Books

1. Roy and Dastidar : COBOL programming, Second Edition, Tata McGraw Hill Publishing Company Limited, New Delhi.
2. Sharadkant : A practical approach to COBOL programming, Wiley Eastern Limited.
3. Philipakis and Kajmier : Information system through COBOL, Tata McGraw Hill Publishing Company Limited, New Delhi.
4. Programming with structured COBOL, Schaum series, Tata McGraw Hill Publishing Company Limited, New Delhi.

PAPER-III

DATA STRUCTURE USING PASCAL

Max. Marks : 50

UNIT-I

Linear Structure : Arrays, records, stack, operation on stack, implementation of stack as an array, queue, operations on queue, implementation of queue.

UNIT-II

Linked Structure : List representation, operations on linked list - get node and free node operation, implementing the list operation, inserting into an ordered linked list, deleting, circular linked list, doubly linked list.

UNIT-III

Tree Structure : Binary search tree, inserting, deleting and searching into binary search tree, implementing the insert, search and delete algorithms, tree traversals.

UNIT-IV

Graph Structure : Graph representation - Adjacency matrix, adjacency list, adjacency multilist representation. Orthogonal representation of graph. Graph traversals - bfs and dfs. Shortest path, all pairs of shortest paths, transitive closure, reflexive transitive closure.

UNIT-V

Searching and Sorting : Searching - Sequential searching, binary searching, hashing. Sorting - Selection sort, bubble sort, quick sort, heap sort, merge sort and insertion sort, efficiency considerations.

Books Suggested

1. Horowitz E., Sartaj Sahni : Fundamentals of data structure, Galgotia Publication Private Limited., New Delhi.
2. Dale & Lily : PASCAL + data structure, algorithms and advanced programming, Third Edition, Galgotia Publications Private Limited, New Delhi.
3. Trembley & Sorenson : An introduction to data structure with applications, Tata McGraw Hill Publishing Company Limited, New Delhi.

COMPUTER SCIENCE

PRACTICALS

M.M.: 75

Note : Students are required to perform all the experiments. In the examination three exercises selecting one from each part, will be set.

Marks Distribution

Part A :	16
Algorithm and flowchart	: 5
Program coding	: 5
Program execution, result and documentation	: 6
Part B :	16
Algorithm and flowchart	: 5
Program coding	: 5
Program execution, result and documentation	: 6
Part C :	16
Mnemonic code generation	: 5
Conversion to machine language	: 5
Program Execution	: 6
Viva	: 12
Record	: 15

PART-A

Data structure programming using PASCAL

1. Programs using array-one dimensional, two dimensional
2. Programs on matrix addition, subtraction, multiplication, transpose.
3. Programs on records, variant records, array of records.
4. Program for creation of simple linked list using pointers write procedure to:
 - a) Insert cell in middle of list
 - b) Delete cell from middle of list
 - c) Printing elements of list
5. Program for creation/maintaining binary search tree. Procedures to perform following operations on binary search tree :
 - a) Search an element
 - b) Insert an element
 - c) Delete an element
 - d) Print elements in pre-order, post-order and in-order form.

6. Programs for performing basic operations on stacks and queues.
7. Programs using procedure and functions (recursive and non-recursive).
8. Programs on sorting array using -
 - a) selection sort
 - b) insertion sort
 - c) bubble sort
 - d) quick sort
 - e) heap sort
9. Program for searching an element in array using linear and binary search.
10. Simple file processing program on sequential file of records.

PART-B

COBOL programming

1. Simple exercise using identification, environment, data and procedure division.
2. Programs on file processing — exercises based on file.
3. Programs on file sorting and merging.

PART-C

8085 micro processor assembly language programming

1. Addition and subtraction of 8-bit numbers.
2. Find 1's and 2's complement of 8 and 16-bit numbers.
3. Shifting left/right of 8/16 bit numbers.
4. Logical operation such as - masking and setting of specific bits.
5. To find larger/smaller of two numbers.
6. Sum of series of 8-bit numbers.
7. To arrange a series of numbers in ascending/descending order.
8. To multiply, divide two 8-bit numbers.
9. Multi byte addition, subtraction.

B.A./B.Sc. SECOND YEAR EXAMINATION, 2005 - 2006

MATHEMATICS

(Common for the faculties of Arts & Science)

Papers	Teaching	Examination	Maximum Marks	
	hours/ week	Hours	B.A.	B.Sc.
Theory Papers :				
Paper I	3	3	70	75
Paper II	3	3	65	75
Paper III	3	3	65	75
Total Marks			200	225

N.B.

1. Common papers will be set for both the faculties of Arts & Science.
2. Students are allowed to use simple electronic desk calculators (as per University guidelines)
3. Mathematical Table/log tables may be used (as per University guidelines).

B.A./B.Sc. SECOND YEAR 2005 - 2006

MATHEMATICS

PAPER - I ADVANCED CALCULUS

Note : The question paper will be divided into three section A, B and C as follows:

Section A : In this section, ten questions will be set taking two questions from each unit. Each question will be of short answer type not exceeding 20 words and will carry $3/4$ mark. The candidate will be required to attempt all the questions (aggregating 7.5 marks).

Section B : In this section, ten questions will be set taking two questions from each unit. The answer of each will not exceed 250 words or two and a half page. Each question will be of 7.5 marks. The candidate will be required to attempt five questions in all taking one question from each unit (aggregating 37.5 marks).

Section C : In this section, four questions will be set covering all the five units and whose answers shall not exceed 500 words or five pages each. Each question may have sub parts in it and will carry 15 marks. The candidate will be required to attempt any two questions (aggregating 30 marks).

UNIT-I

Continuity. Cauchy and Heine's definition of continuity of a function and their equivalence, discontinuous

functions and their kinds, Properties of continuous functions, properties of functions continuous in closed intervals.

Derivability: Differentiable functions and their properties including Darboux theorem, Examples of continuous and differentiable functions. Roll's theorem, Mean value theorems, Taylor's theorem, their proofs, verifications and applications.

UNIT - II

Partial differentiations, envelopes, Maxima and Minima of two variables and more than two variables including Lagrange's method of undetermined multipliers.

UNIT - III

Beta and Gamma functions and their properties, Evaluation of double and triple integrals, Dirichlet's theorem and Liouville's extension, change of order of integration.

UNIT - IV

Jacobians, change of independent variables.

Vector Calculus: Direction of derivatives, gradient of scalar functions, irrotational Vectors, definition of gradient, divergence of a vector, curl of a vector, curl of the product of a scalar and vector, divergence of a vector product.

UNIT - V

Vector Integration: Gauss's theorem, divergence of the product of a scalar and a vector, Stoke's theorem, surface integral of the curl of a vector, Green's theorem.

References :

1. Differential calculus, by Gorakh Prasad, Pothishala Pvt. Ltd., Allahabad.
2. Integral calculus by Gorakh Prashad, Pothishala Pvt. Ltd., Allahabad.
3. Mathematical Analysis by S.C. Malik, Wiley Eastern Ltd., New Delhi
4. A Course of Mathematical Analysis by Shanti Narayan, S.Chand and Company, New Delhi.
5. An Introduction to Real Analysis by P.K. Jain and S.K.Kaushik, S.Chand and Company, New Delhi.
6. Principles of Mathematical Analysis by Walter Rudin.
7. A first course in Real Analysis by Ranjit Singh Arora.
8. Elements of Real Analysis by Sharma Purohit.
9. Real Analysis by Bhargava, Goyal.
10. Real Analysis by Sharma, Gokhroo.
11. Vector Analysis by B. Spain.
12. Sadish Phalan by Bhargava, Banwari Lal.
13. Sadish Phalan by Gokhroo, Saini.

PAPER - II DIFFERENTIAL EQUATIONS

Note : The question paper will be divided into three section A, B and C as follows:

Section A : In this section, ten questions will be set taking two questions from each unit. Each question will be of short answer type not exceeding 20 words and will carry 3/4 mark. The candidate will be required to attempt all the questions (aggregating 7.5 marks).

Section B : In this section, ten questions will be set taking two questions from each unit. The answer of each will not exceed 250 words or two and a half page. Each question will be of 7.5 marks. The candidate will be required to attempt five questions in all taking one question from each unit (aggregating 37.5 marks).

Section C : In this section, four questions will be set covering all the five units and whose answers shall not exceed 500 words or five pages each. Each question may have sub parts in it and will carry 15 marks. The candidate will be required to attempt any two questions (aggregating 30 marks).

UNIT - I

Exact differential equations and equations of special forms. Simultaneous differential equations. Total differential equations.

UNIT - II

Linear differential equations of second order and their solutions by :

- (i) The method of finding an integral of the C.F. by Inspection,
- (ii) Changing of independent variables,
- (iii) Removal of the first derivative,
- (iv) Operational factors,
- (v) Undetermined coefficients and
- (vi) Variation of parameters.

UNIT - III

Linear partial differential equations of first order : Lagrange's method, Integral surfaces passing through a given curve, orthogonal surfaces, Geometric description of $Pp+Qq=R$. Linear equations involving more than two variables. Non-linear partial differential equations of order one : Special methods of solution applicable to certain standard forms.

UNIT - IV

Charpit's method of solving non linear partial differential equations of first order, Monge's method for the integration of equations $Rr + Ss + Tt = V$.

Linear partial differential equations with constant coefficients, homogeneous equations with constant coefficients and non homogeneous equations with constant coefficients.

UNIT - V

Series solutions of linear differential equations : Power series method, Bessel, Legendre and Hypergeometric equations.

References :

1. Differential equation by Ray and Sharma
2. Differential equation (Vol. II) by Bansal, Dharmi
3. Advanced differential equations by M.D. Raisinghanian.
4. Differential equation by Murray A. Daniel
5. A Treatise on Differential equation by A.R. Forsyth.
6. Elements of Partial differential equations. by Ian N. Sneddon, Mc Graw - Hill Book Company.
7. Avkal Samikaran by Gokhroo, Saini, Kumbhat
8. Partial differential equations by Gokhroo, Saini, Ojha
9. An introduction to ordinary differential equation by E.A. Codrington, Prenticehall of India.

PAPER - III MECHANICS

Note : The question paper will be divided into three section A, B and C as follows:

Section A : In this section, questions will be set taking two questions from each unit. Each question will be of short answer type not exceeding 20 words and will carry $3/4$ mark. The candidate will be required to attempt all the questions (aggregating 7.5 marks).

Section B : In this section, ten questions will be set taking two questions from each unit. The answer of each will not exceed 250 words or two and a half page~. Each question will be of 7.5 marks. The, candidate will be required to attempt five questions, in all taking one question from each unit (aggregating 37.5 marks).

Section C : In this section, four questions will be set covering all the five units and whose answers shall not exceed 500 words or five pages each. Each question may have sub-parts in it and will carry 15 marks. The candidate will be required to, attempt any two questions (aggregating 30 marks).

UNIT - I

Equilibrium of. bodies under three or more forces, Friction, common catenary.

UNIT - II

Virtual work, Projectile on inclined plane and Impact.

UNIT - III

Velocity and Accelerations (Tangential, normal, radial, transversal), Rectilinear motion, Hooke's law and motion of horizontal and vertical strings.

UNIT - IV

Constrained motion (circular and cycloidal), motion under resisting medium (resistance varies as velocity and square of velocity).

UNIT - V

Fluid pressure and thrust on immersed plane surfaces. Center of pressure.

References :

1. S. L. Loney : Statics, Macmillan and Company, London.
2. R.S. Verma : A Text book of Statics (Pothishala)
3. Ray & Sharma : A Text book of Hydrostatics
4. N.Sharma : A Text book of Dynamics.
5. M Ray : A Text book of Dynamics.
6. Bhargava & Agrawal : Gati Vigyan
7. Gokhroo, Saini : Uchch Gati Vigyan
8. Gokhroo & Others : Hydrostatics(Hindi Ed.)
9. ---,--- : Statics (Hindi Ed.)
10. Bhargava & Others : Hydrostatics (Hindi Ed.)
11. Bhargava & Others : Statics (Hindi Ed.)

**B.A./B.Sc. SECOND YEAR
EXAMINATIONS, 2005-2006**

STATISTICS

(Common for the Faculties of Arts & Science)

Papers	Periods* per week	Examination Hours	Maximum B.A.	Marks B.Sc.
Theory Papers				
Paper-I	2	3	45	50
Paper II	2	3	45	50
Paper.III	2	3	45	50
Practicals**	4	4	65	75
Total Marks			200	225

*1 Period= 1 hours **Per batch

N.B.

1. Common papers will be set for both the Faculties of Arts & Science.
2. Students are allowed to use simple electronic desk calculators (as per University guidelines).
3. Statistical Tables may be used (as per University guidelines).
4. Visit to Local Governments/ Organizations, Semi Governments Departments/Organizations, Govern-ment Undertaking Organizations, Statistical Institute of repute, Private sector Statistical Organization and Research Stations within Udaipur Division may be organized to familiarize students with the practical work done at these centers.

**PAPER - I
PROBABILITY DISTRIBUTIONS**

Note : The question paper will be divided into three sections A, B and C as follows:

Section A : In this section, ten questions will be set taking two questions from each unit. Each question will be of short answer type not exceeding 20 words and will carry 1/2 mark. The candidate will be required to attempt all the questions (aggregating 5 marks).

Section B : In this section, ten questions will be set taking two questions from each unit. The answer of each will not exceed 250 words or two and a half page. Each question will be of 5 marks. The candidate will be required to attempt five questions in all taking one question from each unit (aggregating 25 marks).

Section C : In this section, four questions will be set covering all the five units and whose answers not shall not exceed 500 words or five pages each. Each question may have sub parts in it and will carry 10 marks. The candidate will be required to attempt any two questions (aggregating 20 marks).

UNIT I

Chebyshev's inequality, Weak law of large numbers, Central limit theorem for i.i.d. random variables and simple problems on them.

UNIT II

Uni-variate Discrete Probability Distributions: Bernoulli, Binomial and Poisson distributions with

their derivations, properties and simple applications.
Fitting of Binomial and Poisson distributions.

UNIT III

Negative-Binomial and Hyper-geometric distributions with their derivations, properties and simple applications. Elementary idea of Geometric and Multinomial distributions.

UNIT IV

Univariate Continuous Probability Distributions: Rectangular, Normal and Cauchy distributions, with their derivations, properties and simple applications. Fitting of normal distribution.

UNIT V

Exponential, Beta type I, Beta type II and Gamma distributions with their derivations, properties and simple applications.

Recommended Books:

1. Gupta S.C. & Kapoor V.K. : Fundamentals of and Mathematical Statistics, Sultan Chand & Sons, New Delhi
2. Kapur, J.N. and Saxena H.C. : Mathematical Statistics, S. Chand & Company Ltd New Delhi.
3. Goon A.M., Gupta M.K. & Das Gupta B : An outlines of Statistical Theory Vol. I & II, World Press, Calcutta

PAPER - II SAMPLING DISTRIBUTIONS AND ELEMENTS OF ESTIMATION

Note : The question paper will be divided into three sections A, B and C as follows

Section A : In this section, ten questions will be set taking two questions from each unit. Each question will be of short answer type not exceeding 20 words and will carry 1/2 mark. The candidate will be required to attempt all the questions (aggregating 5 marks).

Section B : In this section, ten questions will be set taking two questions from each unit. The answer of each will not exceed 250 words or two and a half page-Each question will be of 5 marks. The candidate will be required to attempt five questions in all taking one question from each unit (aggregating 25 marks).

Section C : In this section, four questions will be set covering all the five units and whose answers not shall not exceed 500 words or five pages each. Each question may have sub parts in it and will carry 10 marks. The candidate will be required to attempt any two questions (aggregating 20 marks).

UNIT I

Uni-variate Sampling Distributions: Concept of random sampling, statistic and sampling distribution. Concept of standard error of an estimate. Standard errors of sample mean, sample proportions. Sampling distri-

bution of sum of Binomial, Poisson and mean of Normal distribution, Chi-square distribution its derivation, properties and problems.

UNIT II

t, F, and Z sampling distributions with their derivations, properties and inter- relationships with Chi-square distribution.

UNIT III

Elements of Point Estimation: Concept of point estimation, properties of point estimators such as consistency, unbiased-ness, efficiency and simple notion of sufficiency, Factorization theorem (without proof).

UNIT IV

Bias, Mean Square error, variance and relation among them of an estimator, Minimum variance unbiased estimator and its properties (excluding, Cramer-Rao inequality) and problems on them.

UNIT V

Interval Estimation: Concept of interval estimation, confidence interval and confidence coefficient. Confidence interval for mean and variance in case of normal population.

Definition of order Statistic and sampling distributions of median and range from any uni-variate population.

Recommended Books:

1. Gupta.S.C. & Kapoor, V.K. : Fundamentals of Mathematical and Statistics, Sultan Chand & Sons, New Delhi
2. Kapur J.N. & Saxena H.C. : Mathematical Statistics S. Chand & Company Ltd., New Delhi.

Reference Books:

1. Singh, J. : Statistical Inference (Hindi edition) Madhya Pradesh Hindi Granth Academy, Bhopal.
2. Freund J.E. : Mathematical Statistics (2001) Prentice Hall of India
3. Goon A.M. : An out lines of Statistical Theory Vol. I & II, World and Das Gupta Press, Calcutta B. (1991)

PAPER - III

APPLIED STATISTICS

Note The question paper will be divided into three sections A, B and C as follows:

Section A In this section, ten questions will be set taking two questions, from each unit. Each question will be of short answer type not exceeding 20 words and will carry 1/2 mark. The candidate will be required to attempt all the questions (aggregating 5 marks).

Section B: In this section, ten questions will be set taking two questions from each unit. The answer of each will not exceed 250 words or two and a half page. Each question will be of 5 marks. The candidate will be required to attempt five questions in all taking one question from each unit (aggregating 25 marks).

Section C: In this section, four questions will be set covering all the five units and whose answers shall not exceed 500 words or five pages each. Each question may have sub parts in It and will carry 10 marks. The candidate will be required to attempt any two questions (aggregating 20 marks).

UNIT-I

Theory of curve Fitting: Method of least squares, fitting of straight line, parabola, Kth degree polynomial, exponential and logarithmic curves (reducible to linear forms). Most plausible solution of linear equations.

UNIT-II

Linear correlation and regression, concept of intraclass correlation, Spearman's rank correlation.

UNIT-III

Partial Correlation coefficient Multiple correlation coefficient and multiple regression for three variables only.

UNIT-IV

Time series and its components, methods of determining trend and seasonal components.

UNIT-V

Index Numbers: Problems involved in the construction of Index numbers, types of index numbers, construction of index numbers by aggregate methods and price relative methods, chain indices.

Requisites of an ideal index number. Uses and limitation of the index numbers. Errors in index numbers. Base shifting, splicing and deflating concepts, cost of living and wholesale price index numbers.

Recommended Books:

1. Gupta S.C. and : Fundamentals of Mathematical
Kapoor V.K. Statistics, Sultan Chand &
Sons, New Delhi.
2. Gupta S.C. and : Fundamentals of Applied
Kapoor V.K. Statistics, Sultan Chand &
Sons, New Delhi
3. Kapur, J.N.and : Mathematical Statistics,
Saxena H.C. S.Chand & Company Ltd., New
Delhi.
4. Goon, A.M., : Fundamentals of Statistics
Gupta, M.K. Vol. I & II World Press, Calcutta
and Das Gupta
B. (1991)

STATISTICS PRACTICAL

Duration of Examination: Four Hours

Max. Marks : Arts - 65
Science - 75

The distribution of marks will be as follows:

	B.A.	B.Sc.
(a) Practicals	39 Marks	45 Marks
(b) Practical Record	13 Marks	15 Marks
(c) Viva- voce	13 Marks	15 Marks
Total :	65 Marks	75 Marks

The following topics are prescribed for practical work:

1. Fitting of (i) Binomial distribution when (a) p-known (b) p-unknown, (ii) Poisson distribution (iii) Normal distribution.
2. Exercise based on area property of Normal distribution.
3. Fitting of curves: (i) Straight line (ii) Parabola (iii) Exponential and Power curves.
4. Calculation of correlation coefficient by (i) Karl Pearson's method and (ii) Spearman's rank method.
5. Construction of regression line.

6. Preparation of bivariate frequency distribution, calculation of correlation coefficient and construction of regression lines.
7. Calculation of Multiple and Partial correlation coefficients and construction of multiple regression equations (For three variables only)
8. Time Series : Determination of trend by (i) Least square method (ii) Moving average method (including weighted averages).
9. Determination of seasonal variation by (1) Simple average method (ii) Ratio to trend method (iii) Ratio to moving average method and (iv) Link relative method.
10. Construction of Index Numbers by - (i) Laspeyre's (ii) Paasche's (iii) Fisher's (iv) Dorbish-Bowley's and, (v) Marshall Edgeworth's formulas.
11. Tests of Ideal Index numbers.
- 12 (i) Fixed base and chain base Index numbers (ii) Whole sale price Index number (iii) Cost of living Index number (iv) Base shifting, splicing & deflating.

Note : “Students may be tried to familiarize and utilize statistical packages in solving the relevant statistical practical exercises on Computers”.