હેમચંદ્રાચાર્ય ઉત્તર ગુજરાત યુનિવર્સિટી

NAAC A (3.02) State University

પો.બો.નં.–૨૧, યુનિવર્સિટી રોડ, પાટણ (ઉ.ગુ.) ૩૮૪૨૬૫

ફોનઃ(૦૨૭૬૬) ૨૨૭૪૫, ૨૩૦૫૨૯, ૨૩૦૭૪૩, ૨૩૩૬૪૮ ફેકસ : (૦૨૭૬૬) ૨૩૧૯૧૭

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પરિપત્ર ક્રમાંક – ૮૪/ ૨૦૧૮

વિષયઃ–એમ.એસસી. ફાર્માસ્યુટીકલ કેમેસ્ટ્રીનો અનુસ્નાતક કક્ષાના સેમેસ્ટર–૧ અને સેમેસ્ટર–૨ ના

આ યુનિવર્સિટીના કેમેસ્ટ્રી ડીપાર્ટમેન્ટના અધ્યક્ષશ્રી તથા સંલગ્ન વિજ્ઞાન કોલેજોના આચાર્યશ્રીઓને જણાવવાનું કે, રસાયણશાસ્ત્ર વિષયની અભ્યાસ સમિતિની તારીખ : ૦૪/૦૬/૨૦૧૮ ની સભાએ ભલામણ કર્યાનુસાર એમ.એસસી. ફાર્માસ્યુટીકલ કેમેસ્ટ્રીનો સેમેસ્ટર–૧ અને સેમેસ્ટર–૨ નો સામેલ પરિશિષ્ટ પ્રમાણેનો અભ્યાસક્રમ/સ્કીમ જૂન–૨૦૧૮ થી ક્રમશ : અમલમાં આવે તે રીતે એકેડેમીક કાઉન્સિલએ તેની તારીખઃ ૦૫/૦૬/૨૦૧૮ ની સભામાં ઠરાવ ક્રમાંક : ૬૨ થી મંજૂર કરેલ છે. જે સબંધિત સર્વેની જાણ તથા અમલ સારૂ આ સાથે મોકલવામાં આવે છે.

વધુમાં ઠરાવવામાં આવે છે કે, સદર અભ્યાસક્રમ મલ્ટીડીસીપ્લીનરી હોવાથી નીચેના વિષયોમાં અનુસ્નાતક માન્યતા ધરાવતાં અધ્યાપકો શૈક્ષણિક કાર્ય કરી શકશે.

૧. રસાયણશાસ્ત્ર ૨. ફાર્મસી ૩. બાયો–કેમેસ્ટ્રી અને ૪. ફાર્માસ્યુટીકલ કેમેસ્ટ્રી

આ બાબતની સબંધિત અધ્યાપકો તથા વિદ્યાર્થીઓને આપના સ્તરેથી જાણ કરવા વિનંતી છે.

નોંધ : (૧) વિદ્યાર્થીઓની જરૂરિયાત માટે આ અભ્યાસક્રમની એક નકલ આપના ડીપાર્ટમેન્ટ/કોલેજના ગ્રંથાલયમાં મૂકવાની રહેશે.

(૨) આ અભ્યાસક્રમ યુનિવર્સિટીની વેબસાઈટ www.ngu.ac.in પર પણ ઉપલબ્ધ કરવામાં આવેલ છે. આથી સબંધિત કોલેજોને ડાઉનલોડ કરી ઉપયોગ કરવા સારૂ જણાવવામાં આવે છે.

બિડાણ : ઉપર મુજબ

કુલસચિવવતી

નં.–એ કે / અ× સ / ૨૧૩૫ / ૨૦૧૮

તારીખઃ ૨૭ / ૦૬ / ૨૦૧૮

પ્રતિ,

૧. યુનિવર્સિટીના કેમેસ્ટ્રી ડીપાર્ટમેન્ટના અધ્યક્ષશ્રી
૨. સંલગ્ન સાયન્સ કોલેજોના આચાર્યશ્રીઓ
૨. ડા. એમ.બી.પ્રજાપતિ, (ડીનશ્રી–વિજ્ઞાન વિદ્યાશાખા)ગણિતશાસ્ત્ર ભવન, હેમચંદ્રાચાર્ય ઉત્તર ગુજરાત યુનિવર્સિટી, **પાટણ.**
૩. પરીક્ષા નિયામકશ્રી, હેમચંદ્રાચાર્ય ઉત્તર ગુજરાત યુનિવર્સિટી, **પાટણ.** (પાંચ નકલ)
૪. ગ્રંથપાલશ્રી, હેમ.ઉત્તર ગુજરાત યુનિવર્સિટી, **પાટણ.** (વિદ્યાર્થીઓના ઉપયોગ સારૂ રેકર્ડ ફાઈલ માટે)
૫. સિસ્ટમ એનાલીસ્ટશ્રી, કોમ્પ્યુટર (રીઝલ્ટ) સેન્ટર, હેમ.ઉ.ગુ.યુનિવર્સિટી, **પાટણ.** તરફ પરિણામ માટે તથા વેબસાઈટ પર મૂકવા સારૂ.
૬. માન.કુલપતિશ્રી / કુલસચિવશ્રીનું કાર્યાલય, હેમ.ઉત્તર ગુજરાત યુનિવર્સિટી, **પાટણ.**
૭. પ્રવેશ પ્રશાખા (એકેડેમિક), હેમચંદ્રાચાર્ય ઉત્તર ગુજરાત યુનિવર્સિટી, **પાટણ.**
૮. અનુસ્નાતક પ્રશાખા (એકેડેમિક), હેમચંદ્રાચાર્ય ઉત્તર ગુજરાત યુનિવર્સિટી, **પાટણ.**
૯. મુખ્ય હિસાબી અધિકારીશ્રી (મહેકમ), હેમચંદ્રાચાર્ય ઉત્તર ગુજરાત યુનિવર્સિટી, પાટણ તરફ → પરિપત્રની ફાઈલ અર્થે

Pharmaceutical Chemistry

CURRICULUM

Hemchandracharya

North Gujarat University, Patan.

General Information for

M.Sc. Pharmaceutical Chemistry

(With effect from June-2018)

1. **M.Sc. Pharmaceutical Chemistry is a two year (Four semester) program**
2. **The eligibility to enter this program is B.Voc. (Pharmaceutical Chemistry), B.Pharm., B.Sc. (Chemistry, Biotechnology, Biochemistry) pass out from a recognized University.**
3. **There will be 30% internal marks and 70% external marks in each core compulsory course. These marks will comprise of book review, project work, seminar, internal and external theory and practicals.**
4. **There will be following courses in each semester**
    a. **Core – I (4 credits)**
    b. **Core – II (4 credits)**
    c. **Core – III (4 credits)**
    d. **Core – IV (4 credits)**
    e. **Practical – I (3 credits)**
    f. **Practical – II (3 credits)**
    g. **Elective Course – I (2 credits)**
5. **Practical examinations will be conducted for three days (six hours each day)**
6. **Total of 96 credits in 4 semesters.**
7. **The table on the next page (page number - PCHN-2 OF 24) shows the overall pattern of marks, examination time, credit, teaching hours etc. for semester – I and semester – II.**

M.Sc. Semester – I

Course	Name of the course	Code of the course	Exam Duration	Ext. marks	Int. marks	Total marks	Teaching hours / week	Credit
Paper I	Core I	PCHN 401	2 : 30	70	30	100	4	4
Paper II	Core II	PCHN 402	2 : 30	70	30	100	4	4
Paper III	Core III	PCHN 403	2 : 30	70	30	100	4	4
Paper IV	Core IV	PCHN 404	2 : 30	70	30	100	4	4
Practical Paper I	Practical I	PCHN 405	3 / 4	75	---	75	6	3
Practical Paper II	Practical II	PCHN 406	3 / 4	75	---	75	6	3
Elective Course I		PCHN 407*	2 : 00	50	---	50	2	2
				480	120	600	30	24

*** Either PCHN-407-A or PCHN-407-B to be selected by the student.**

M.Sc. Semester – II

Course	Name of the course	Code of the course	Exam Duration	Ext. marks	Int. marks	Total marks	Teaching hours / week	Credit
Paper V	Core V	PCHN 501	2 : 30	70	30	100	4	4
Paper VI	Core VI	PCHN 502	2 : 30	70	30	100	4	4
Paper VII	Core VII	PCHN 503	2 : 30	70	30	100	4	4
Paper VIII	Core VIII	PCHN 504	2 : 30	70	30	100	4	4
Practical Paper III	Practical III	PCHN 505	3 / 4	75	---	75	6	3
Practical Paper IV	Practical IV	PCHN 506	3 / 4	75	---	75	6	3
Elective Course II		PCHN 507*	2 : 00	50	---	50	2	2
				480	120	600	30	24

*** Either PCHN-507-A or PCHN-507-B to be selected by the student.**

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M.Sc. Semester – II

(With effect from June-2018)

PCHN 501: PHARMACOLOGY **(4 CREDITS)**
60 Hours

Unit-I: Drug Action at Receptors **15 Hours**

Structure and classification of receptors, general mode of operation, Superfamily Type 1, 2, 3, 4, Ligand–receptor relationships, The chemical nature of the binding of ligands to receptors, Neurotransmitters, signaling process, Ion channels and their control, Membrane-bound enzymes-activation/deactivation, conformational changes in receptor, Binding groups, Position of binding, Size and shape, ligand concentration–response curves (Agonist concentration–response relationships, Antagonist concentration–receptor relationships), Ligand-receptor theories (Clark's occupancy theory, rate theory, two-state model), Citalopram, an antagonist antidepressant –case study, □-Blockers

Unit-II: ADME **15 Hours**

Scheme of fate of dosage form after its administration, definition and introduction to concept of absorption, distribution, biotransformation and elimination of drug, Introduction to bioavailability and various equivalence referring plasma time profile of drug, significance of metabolisms involved in the absorption and bio transformation of drugs, effects of physico-chemical, pharmaceutical and biological factors on ADME, renal and non-renal excretion, Concept of clearance, disintegration and dissolution studies

Unit-III: Barriers to Drug Exposure in Living Systems **15 Hours**

Introduction to Barriers, drug dosing, barriers in the mouth, stomach, gastrointestinal tract, kidney, permeation of the gastrointestinal cellular membrane, metabolism in the Intestine, enzymatic hydrolysis in the intestine, absorption enhancement in the Intestine, barriers in the blood stream, plasma enzyme hydrolysis, plasma protein binding, red blood cell binding, blood brain barrier

Unit-IV: Chemotherapy **15 Hours**

General principle of chemotherapy (various targets of chemotherapy covering pathology of infection and mechanism of actions of drugs, concept of resistance), Sulphonamides and co-trimoxazole, Antibiotics-Penicillins, Cephalosporins, Chloramphenicol, Macrolides, Quinolines and Fluoroquinolins, Quinolones, Tetracyclines, Aminoglycosides and miscellaneous antibiotics; Chemotherapy of tuberculosis, leprosy, fungal diseases, viral diseases, AIDS, protozoal diseases, worm infections, urinary tract infections and sexually transmitted diseases.

Reference Books

1. Graham L. Patrick: An Introduction to Medicinal Chemistry, Oxford University Press.

2. Gareth Thomas: Medicinal Chemistry, 2nd edition, John Wiley & Sons Ltd.

3. Donald Cairns: Essentials of Pharmaceutical Chemistry, third edn, Pharmaceutical Press.

4. Edward H. Kerns and Li Di: Drug Like Properties: Concepts, Structure Design and Methods: from ADME to Toxicity Optimization, Elsevier Publications.

5. Bertram G. Katzung (International edition): Basic and Clinical pharmacology, Lange Medical Book / Mc Graw Hill, USA 2001 8th edition.

6. Rang H. P, Dale M.M and Ritter J.M, Churchill Livingston: Pharmacology, London, 4th edn

7. Goodman and Gilman's the Pharmacological Basis of Therapeutics (International edition) Mc Graw Hill, USA 2001 10th edition.

8. Braunwald, Fauci, Kasper, Hauser and Longo Jameson: Harrison's Principles of Internal Medicine (two volumes), 2001, Mc Graw Hill, New York, 15th edition.

9. H. Gerhard Vogel: Drug Discovery and Evaluation-Pharmacological Assays, 2nd edition, Springer Verlag, Berlin, Heidelberg.

10. A. H. Becket and J. B. Stenlake: Practical Pharmaceutical Chemistry, 4th edition, the Athlone press.

11. Sara E. Rosenbaum: Basic Pharmacokinetics and Pharmacodynamics: An Integrated Text Book and Computer Simulations, Wiley publications.

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(With effect from June-2018)

PCHN 502: DRUG DISCOVERY AND DEVELOPMENT (4 CREDITS)
60 Hours

Unit-I: Drug Discovery-An Overview 15 Hours

Over view on drug discovery and drug development scenario; Statistics of drugs available; Overview on top selling drugs; neglected diseases; Sources of leads for drug development; Over view on drugs (with examples) obtained from ethnopharmaceutical sources, Plant sources, Marine sources, Microorganisms and Animal sources; Compound collections and data bases, merits and demerits of few natural leads quinine and curcumin

Unit-II: Pharmacokinetics and Drug Discovery 15 Hours

Introduction to Pharmacokinetics, PK Parameters (Volume of Distribution, Area Under the Curve, Clearance, Half-life, Bioavailability), General classification of pharmacokinetic properties, Drug regimens, Drug concentration analysis and its therapeutic significance, The importance of pharmacokinetics in drug discovery, Pharmacokinetic models, Intravascular administration and distribution, Extravascular administration, dissolution and absorption, Single oral dose, Binding on PK Parameters, Tissue Uptake, Drug distribution and 'survival', Drug design for pharmacokinetic problems (Variation of substituents, Stereoelectronic modifications etc)

Unit-III: Pharmacodynamics and Drug Discovery 15 Hours

Chemical stability, Metabolic stability and metabolic reactions; stereochemical, biological, and environmental factors effecting metabolism; species and metabolism; enzymes and metabolism; secondary implications of metabolism (Inactive metabolites, toxic metabolites, metabolites with similar activity, metabolites with different activity); sites of action; Hydrophilic/hydrophobic balance

Unit-IV: Drug-like Properties and Structural Modification in Drug Discovery 15 Hours

Leads and analogues, Bioavailability, Solubility, Structure and Stability, Drug-like Properties (Lipinski Rules, Veber Rules), Application of rules for compound assessment, Property Profiling in Discovery, general chemical properties of functional groups, Drug-like Property Optimization in Discovery through prodrugs. Binding role of hydroxyl, amino groups, aromatic rings, double bonds; Structure-activity relationships of synthetic analogues with variation of substituents, extension of the structure, chain extensions/contractions,degree of unsaturation, ring expansions/contractions, ring variations, simplification of the structure, changing size and shape, rigidification of the structure;

References

1. Drug like properties: concepts, structure design and methods, from ADME to toxicity optimization, by Edward H. Kerns and Li Di, Elsevier publications, ISBN: 978-0-1236-9520-8

2. An introduction to medicinal chemistry, Graham L. Patrick, Oxford University Press

3. Medicinal Chemistry, 2nd edition, Gareth Thomas, John Wiley and sons publishers, ISBN 978-0-470-02597-0 (HB), 978-0-470-02598-7 (PB)

4. The practice of medicinal chemistry, Camille Georges Wermuth, Elsevier Publications, ISBN 0-12-744481-5

5. Foye's principles of medicinal chemistry, Thomos L. Lemke, David A. Williams, Lippincott Williams and Wilkin publishers,

6. Transport processes in pharmaceutical systems, Gordon L. Amidon, Ping I. Lee, Elizabeth M. Topp, Marcel Dekker Inc, ISBN: 0-8247-6610-5

7. Goodman and Gilman's Manual of pharmacology and therapeutics, McGraw Hill publications

8. Basic principles of drug discovery and development, Benzamin E. Blass, Elsevier publications, ISBN: 978-0-12-411508-8

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(With effect from June-2018)

PCHN 503: Molecular Targets **(4 CREDITS)**

60 Hours

Unit-I: Receptors as Drug Targets **15 Hours**

Fundamentals of receptor action; ***GPCRs:*** Acetyl choline receptors (Muscarinic receptors), Adenosine receptors, Adrenoceptors, Purinergic receptors, dopamine receptors, angiotensin receptors; ***Direct ligand gated ion channel receptors:***GABAA receptors, Acetyl choline receptors (Nicotinic receptors), Glutamate receptors; ***Cytokine receptors:*** TNF-α receptors, Interleukin receptors; ***Receptors associated with tyrosine kinase:*** Insulin receptors; ***Nuclear receptors (steroid hormone receptors):*** progesterone receptors, Mineralocorticoid receptors; ***other nuclear receptors:*** Peroxisome proliferator-activated receptor (PPAR)

Unit-II: Enzymes as Drug Targets **15 Hours**

Fundamentals of enzyme action; ***Oxidoreductases:*** MAOs, COXs, LOXs, Aromatase, Dihydro folate reductase (DHFR), Xanthine Oxidase; ***Transferases:*** Protein Kinase-C, COMT, Reverse transcriptase, RNA Polymerase, DNA polymerase, Tyrosine kinases; ***Hydrolases (proteases):*** Aspartyl proteases; ***Hydrolases (metalloproteases):*** ACE, Human carboxy peptidase; ***Other hydrolases:*** Esterases (AChE, PDE, HDAC); ***Lyases:*** DOPA decarboxylase, carbonic anhydrase; Isomerases, DNA gyrase, topoisomerases; ***Ligases (Synthases):*** Thymidylate synthase

Unit-III: Ion Channels as Drug Targets: **15 Hours**

Introduction; Voltage-gated Ca2+ channels (L-Type channels, T-Type channels); K+ channels (Epithelial K+ Channels, Voltage gated K+ Channels); Na+ channels (Epithelial Na+channels (ENaC), Voltage-gated Na+channels); Direct ligand gated ion channels; Ryanodine-inositol 1,4,5-triphosphate receptor Ca2+ channel (RIR-CaC) family: Rynodyne receptors, Cl– channels, Acid sensing (Proton gated) Ion channels, Cyclic nucleotide gated (CNG) and hyperpolarization activated cyclic nucleotide gated (HCN) Channels, Transient receptor potential channels (Transient receptor potential Ca2+ channel (TRP-CC) family)

Unit-IV: Nucleic Acids, Ribosomes, Aquaporins as Drug Targets, Targets of Monoclonal Antibodies, Multi targeting Action of Drugs 15 Hours

Nucleic acids: DNA and RNA, Spindle as drug targets; ***Ribosome:*** 30S, 50S units as drug targets; ***Targets of monoclonal antibodies:*** TNF, Immunoglobulins, VEGF, EGFR; Aquaporins as drug targets; ***Multi targeting action of drugs:*** Introduction, Multi target pharmacology in Alzheimer's disease and cancer, basic considerations, its possibilities and limitations.

Reference Books

1. The handbook of receptor classification and signal transduction, Published by Sigma-Aldrich

2. Drug like properties: concepts, structure design and methods, from ADME to toxicity optimization, by Edward H. Kerns and Li Di, Elsevier publications, ISBN: 978-0-1236-9520-8

3. An introduction to medicinal chemistry, Graham L. Patrick, Oxford University Press

4. Drugs, their targets and the nature and number of drug targets, Peter Imming, Christian Sinning and Achim Meyer, Nature Reviews Drug Discovery, 5, 821-834, 2006, doi:10.1038/nrd2132

5. Drugs and their molecular targets: An updated overview, Yves Landry, Jean-Pierre Gies, Fundamental & Clinical Pharmacology 22 (2008) 1–18; doi:10.1111/j.1472-8206.2007.00548.x

6. Basic principles of drug discovery and development, Benzamin E. Blass, Elsevier publications, ISBN: 978-0-12-411508-8

7. www.animalsimulator.com

8. https://www.rcsb.org/

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(With effect from June-2018)

PCHN 504: CHROMATOGRAPHY **(4 CREDITS)**
60 Hours

Unit-I: COLUMN AND TLC **15 Hours**
Principle, Working, Apparatus, Rf values, Applications

Unit-II: HPLC UPLC CHROMATOGRAPHY **15 Hours**
Principle, Types of HPLC / UPLC, Working, Apparatus and construction, Applications

Unit-III: GAS CHROMATOGRAPHY, LIQUID CHROMATOGRAPHY **15 Hours**
Principle, Types of GC and LC, Working, Apparatus and construction, Applications

Unit-IV: BASIC PRINCIPLES, WORKING AND APPLICATIONS OF MASS SPECTROMETRY, GC-MS, LC-MS. **15 Hours**

Principle, Types of LC-MS, Working of GC-MS & LC-MS,
Construction of equipments, Applications

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(With effect from June-2018)

PCHN 505: PRACTICAL – 3 **(3 CREDITS)**

All the experiments are to be repeated for at least three times and data generated for every experiment has to be entered in Microsoft excel file.

1. Determination of % purity of sodium benzoate.
2. Determination of λmax of KMnO4
3. Determination of λmax of paracetamol
4. Preparation and standardization of iodine solution
5. Assay ferrous sulphate
6. Assay of norfloxacin tablets and chlorpromazine tablets
7. Experiment related to sampling of drugs from formulations
8. Experiment related to sampling of drugs from biological fluids
9. TLC profile of paracetamol and para aminophenol using various mobile phases
10. TLC profile of aspirin and salicylic acid using various mobile phases
11. Demonstration of column chromatography
12. Estimation of paracetamol using calibration curve method
13. Assay of paracetamol tablets and syrup
14. Estimation of effect of solvent, concentration on absorption of compounds
15. Demonstration of bathochromic shift and hypsochromic shift
16. Comparison of methods of assay of aspirin using titrimetry and spectroscopy

Reference Books

1. Gary D. Christian: Analytical Chemistry, 6th edition, John Wiley & sons Inc.
2. A. H. Becket and J. B. Stenlake: Practical Pharmaceutical Chemistry, 4th edn, the Athlone press
3. Henry P. Talbot: An introductory Course of Quantitative Chemical Analysis with Explanatory Notes, 6th edition.

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PCHN 506: PRACTICAL – 4 **(3 CREDITS)**

The following methods are to be applied in the preparation of the above mentioned compounds:
Purification: by crystallization/distillation
Purity check: by determination of melting point/boiling points and by TLC
Calculations: quantitative yields
Preparations:

(a) Bromination of Phenol/Aniline

(b) Benzoylation of amines/phenols

(c) Oxime and 2,4-dinitrophenylhydrazone of aldehyde/ketone

1. Potential drug databases
2. Potential protein databases
3. Various protein visualizing softwares
4. Visualizing protein structures in protein databank
5. Visualizing protein ligand interactions with co-crystallized structures
6. Simulations of animal experiments demonstrating role of various targets in activity of drugs

Reference Books

1. G. H. Jeffery, J. Bassett, J. Mendhan, R. C. Denny: Vogel's text book of Quantitative Chemical Analysis.
2. A.I. Vogel: Textbook of Practical Organic Chemistry, 5th edition, Prentice-Hall.
3. F. G. Mann & B. C. Saunders: Practical Organic Chemistry, Orient Longman (1960).

CURRICULUM

Hemchandracharya
North Gujarat University, Patan.
M.Sc. Pharmaceutical Chemistry
M.Sc. Semester – II

(With effect from June-2018)

PCHN 507: A) Subjective Elective II – Chemistry of Materials (2 Credits)

Unit - I

Glasses, Ceramics, Composites and Nanomaterials

Glassy state, glass formers and glass modifiers, applications. Ceramic structures, mechanical properties, clay products. Refractories, characterizations, properties and applications.

Microscopic composites; dispersion-strengthened and particle-reinforced, fibre-reinforced composites, macroscopic composites. Nanocrystalline phase, preparation procedures, special properties, applications.

Unit – II

Polymeric Materials

Molecular shape, structure and configuration, crystallinity, stress-strain behaviour, thermal behaviour, polymer types and their applications, conducting and ferro-electric polymers.

CURRICULUM

Hemchandracharya

North Gujarat University, Patan.

M.Sc. Pharmaceutical Chemistry

M.Sc. Semester – II

(With effect from June-2018)

PCHN 207: B) Subjective Elective II – Heterocyclic Chemistry (2 Credits)

Unit - I

Nomenclature of Heterocycles

Replacement and systematic nomenclature (Hantzsch-Widman system) for monocyclic, fused and bridged heterocycles.

Unit – II

Heterocyclic Synthesis

Principles of heterocyclic synthesis involving cyclization reactions and cycloaddition reactions

PHYSICS

Core theory course (Disciplinary)
CPH-501: ELECTRODYNEMICS AND MICROPROCESSOR

UNIT- I

(a) Maxwell's equations:

Maxwell's equation in matter, Boundary condition, Charge and energy **:** The Continuity equation, Poynting's Theorem, Momentum **:** Newton's Third Law, Maxwell's Stress Tensor, Conservation of Momentum, Angular Momentum.

(b) Potentials and Fields:

Continuous Distribution s **:** Retarded potentials, Point charges **:** Lienard Wiechert potentials .

Basic reference:

Introduction to Electrodynamics by D. J. Griffiths 1999. 3rd edition, PHI, EEE, New Delhi.

UNIT – II

Radiation and Relativity:

Dipole radiation, What is radiation ?, Electric dipole radiation, Magnetic dipole radiation, Radiation from an arbitrary source, Point charges : Power radiated by a point charge, Radiation reaction, The Physical basis of radiation reaction.

Dynamics, Relativistic electrodynamics, How the fields transform? , The field tensor, Electrodynamics in tensor notation.

Basic reference :

Introduction to Electrodynamics by D. J. Griffiths 1999. 3rd edition, PHI, EEE, New Delhi.

UNIT- III

Microprocessors, Advances in semiconductor technology, Organization of Microprocessor based system,

Microprocessors instruction set and computer Langugaes: Machine language, 8085-Machine language, 8085 - Assembly Language, Writing and Executing an assembly language program, High level language, Operting systems, Microprocessors architecture and its operational, M.I.O. and 8085 Bus organization, Internal data operations and the 8085 registers, Paripheral or externally intiated operations, Memory, Flip -Flop or latch as a storage element, Memory Map and addresses, Memory address range of a 1K memory chip, Memory classification, Logic Devices for interfacing : Tri-state Devices, Buffer, Decoder, Encoder, The 8085 MPU : The 8085 microprocessors(Pinout), Demultiplexing the bus AD7-- ADo , Generating control signals.

Basic reference :

Microprocessor Architecture, Programming and Applications with 8085 by Ramesh S. Gaonkar PIP Pub.

UNIT-IV

Introduction to 8085 Assembly Language Programming: Instruction classifications, Instruction word size, Opcode.format, Data Format, How to write assemble and execute simple programme, Overview of 8085 Instruction Set, Data Transfer Operations, Arithmatic Operations. Logical operations; OR, Exclusive-OR and NOT, Data Masking with logic AND, Examples, ORing data from two input ports, Branch Operations, Unconditional jump, Unconditionaljump to set up a continuous loop conditional jumps, Programming Techniques; Looping,Counting and Indexing, conditional loop, counter, Examples, Additional Data transfer and 16-bitArithmetic instructions, 16-bit data transfer to Registers pairs (LXI), Data transfer from Memory to Microprocessor, Examples, Data transfer from the Microprocessor to Memory or directly into Memory, Logic operations: Rotate-Left, Right with and without carry.

Basic reference :

Microprocessor Architecture, Programming and Applications with 8085 by Ramesh S. Gaonkar PIP Pub.

Other references :

(1) Classical electrodynamics by J. D. Jackson, 2nd edition 1964,- Jhon Wiley & Sons, Inc, and 3rd edition 2000.
(2) Electromagnetics by B. B. Laud. Willley Eastern Ltd.
(3) Electrodynamics by Kumar and Gupta, Pragati prakashan Meeruit, India.
(4) Introduction to microprocessor by R. Zalls B. P. B. Publication Delhi.
(5) An introduction to microprocessor and applications by Krishna Kant,Macmillan.

Core theory course (Disciplinary)
CPH-502: CLASSICAL MECHANICS AND PROGRAMMING IN C-I

UNIT - I

Canonical transformation : :

Gauge transformations, Canonical transformation, Condition for transformation to be canonical, Illustration of canonical transformations, Poission brackets, canonical equations in terms of Poisson brackets notation, Infinitesimal transformation, Relation between Infinitesimal transformation and Poission brackets, The Hamilton Jacobi equations, separation of variables.

Basic reference:

Introduction to classical mechanics by R. G. Takwale and P. S. Puranik 1979 TMH, New Delhi

UNIT - II

Small Oscillation and Rotating Frame:

Stable and unstable equilibriums, Small Oscillation in a system with one degree of freedom, Small Oscillation in a system with more than one degree of freedom, Normal coordinates and Normal frequencies of vibration.

Rotating Frame, Euler angles, Inertia tensor, Euler's equations of motion of a rigid body, Free motion of a rigid body, Motion of a symmetric top.

Basic reference :

Classical mechanics-A Text Book by Suresh Chandra, Narosa Publishing House New Delhi.

UNIT- III

Decision making and Looping:

Introduction, while statement, do statement, do while, for statement, jumps in loops – continue and break statements.

Arrays:

Introduction, One dimensional arrays, declaration and initialization of arrays one dimensional arrays, two dimensional arrays, initialization of two dimensional arrays , multidimensional arrays.

Basic reference :

Balagurusamy E., Programming in ANSI C (IIInd Ed.), TMH Pub.

UNIT- IV

Character Arrays and Strings :

Declaring and initializing string variables, reading and writing strings, arithmetic operations on characters, Putting Strings together, comparison of two Strings, String handaling functions, Table of strings, other features of strings.

Functions :

Need for user defined functions, A multi function program, Elements of user defind functions, Defination of functions, return values and their types, Functio Calls, Function Declaration, category of functions,No argument and no return values, Arguments but no return values, Arguments with return values, No arguments but returns avalue,Functions that returns multiple values, nesting of functions, recursion.

Basic reference :

Balagurusamy E., Programming in ANSI C (IIInd Ed.), TMH Pub.

Other references :

(1) Classical Mechanics by H. Goldstein, C. Poole, J. Safko 3rd edition, first india reprint (2002) Pub: Pearson Education.

(2) Classical mechanics by V. B. Bhatia 1997, Narosa Publishing House New Delhi

(3) Classical mechanics by N. C. Rana and P. S. Jog TMH, New Delhi.

(4) P. Day and M.Ghosh, Programming in C, Oxford Univ. Press, 2007

(5) Gottfried B.S.Programming with C

(6) Kochan S.G Programming in C, CBS Pub.

(7) Kenetker Y., Let us C, BPB Pub.

(8) Kernighan B.W. and Ritchie D.K., C Programming language, PH Pub.

(9) Stan Kelly - Bootle, Mastering Turbo C, BPB Pub.

Core theory course (Interdisciplinary)
CPH-503: NANO TECHNOLOGY

UNIT-I

INTRODUCTION: Pre- Nanotechnology, Origins of Concepts of Nano, Advances in Experimental Methods, Nanotechnology-Basics and Basis, Size of Nano, The Meaning of Nanotechnology, Four Generations of Nanotechnology Development, Technology of General Applicability, Multi-purpose Technology, Applications of Nanotechnology.

NANOCHEMISTRY: Introduction, Basic Concepts, Classification of Nanomaterials, Techniques of Production or Methodology, Size Concerns.

Fullerenes: Introduction, History of Discovery, Variations, Properties of Fullerenes.

Nanoparticles: Introduction, History, Properties of Nanoparticles, Classification, Characterization,, Production of Nanoparticles,Morphology of Nanoparticles, Safety Issues.

UNIT-II

Carbon Nanotube: Introduction, Discovery, Description, 'TYPes of Carbon Nanotubes and Related Structures,Single-walled Nanotubes, Multi-walled Nanotubes, Introduction, Structure, Research, Self-assembled Monolayars, Applications.

NANOPHYSICS: Quantum Dot, Description, Quantum Confinement in Semiconductors, Optical Properties, Fabrication, Mass Production, Applications, Computing Field ,Biology, Cellular Imaging, Quantum Dots tor Thmour Thrgeting, Toxicity, Photovoltaic Devices, Light-emitting Devices, Quantum Wire, Carbon Nanotubes as Quantum Wires, Quantum Well, Fabrication, Applications, Quantum Point Contact, Fabrication, Properties, Applications.Nanocrystals,Nanocrystal solar cell.

UNIT-III

NANOMEDICINE AND NANOBIOLOGY: Introduction, Bascic concepts and applications, Drug Delivery, Cancer Diagnosis and Therapy, Surgery, Invivo Therapy, Neuro-electronic Interfaces, Cell Repair Machines, Nanobiotechnological Devices: Nanoparticles , Dendrimers , Nanorobots, Nubot , Nanoshell , Other Applications of Nanobiotechnology

Biosensors : Definition , Principles of Detection , Optical (Photometric) Biosensor , Electrochemical Biosensor , Others , Applications , Nanobiosensors , Nanonose ,'Types of Nanosensors , Applications of Nanobiosensors Nanobiosensors and Cancer , Point-of-Care Testing , Nano- DNA Technology , Tile-based Arrays· , Applications.

Building Blocks of DNA , DNA Sensors , DNA Field-effect Transistor , Optical Biosensors , Nanosized Optical Biosensors, Nanopathology-, Interactions.

UNIT-IV

INSTRUMENTS AND METHODOLOGY

Introduction, Next Generation of Nanotechnological Techniques, Modern Developments, Techniques of Nanolithography, Scanning Probe Microscope, Types of Scanning Probe Microscopy, Advantages, Disadvantages

Atomic Force Microscope, Description, Parameters Measured by AFM, Image modes, Force Spectroscopy, Identification of individual surface atoms, Advantages, Disadvantages, Scanning Tunnelling Microscope(Introduction).

ENVIRONMENTAL AND SOCIAL ISSUES

Dangers of Molecular Manufacturing, Sudden and Unexpected Risks, Basis of Economic Disruption, Potential Economic Impact, Over-Pricing and Poverty, Terrorism, Solutions and Regulations. Environmental Damages, Regulation, Environmental and Social Issues, Pollution Prevention, Areas of Pollution Prevention, Water and Waste Water Treatment,Water Conservation, Water Purification, Water Management, \, Health Risks and Environmental Issues, Society Related Problems, Positive Aspects of Nano, Negative Aspects of Nano., Action Plan for Prevention of Disasters by Nano, Implications of Nano in the Society.

References:

(1) Nanotechnology by S.Shanmugam, MJP Publishers
(2) Nanobiotechnology by Subbiah Balaji, MJP Publishers
(3)Nanoscience and Technology by V S Muralidharan, A subramania, Ane Books Pvt Ltd

Elective course (Disciplinary)

EPH- 501: ENERGY TECHNOLOGY AND STORAGE SYSTEMS

UNIT- I:

ENERGY TECHNOLOGY:
Geothermal Energy: Introduction, Applications, Utilization of Geothermal Energy, Geothermal Energy Resources, Hydro Geothermal Resources, Hot Dry Rock Geothermal Resources.
Wind Energy: Introduction, Applications of Wind Energy and Historical Background, Merits and limitations of Wind energy Conversion, Nature and Origion of Wind, Wind Energy Quantom, Variables in Wind Energy Conversion systems, Wind power density, Power in wind Stream, Wind turbine Efficiency.
Ocean EnergyTechnologies: Introduction to energy from Ocean, Ocean Energy Resources, Off-shore and On-shore Ocean energy conversion Technologies, Advantages and limitations of Ocean energy conversion Technologies.

UNIT - II:
ENERGY STORAGE SYSTEMS:
Introduction, Energy storage systems for Electrical UTILITY Peak Shaving, Pumped Hydro Energy Storage Plants and Underground Pumped Hydro, Compressed Air Energy Storage, Battery Energy Storage Systems, Lead Acid Battery Cells Nickel-Cadmium Battery, Advanced Batteries, Supper Conducting Magnet Energy Storage, Advanced Flywheel Energy Storage, Thermal Energy Storage-thermal sensible heat storage and Latent heat energy storage, Chemical Energy Storage.

References:
(1) Energy Technology by S.Rao and Dr. B.B. Parulekar, Khanna Pub.-1995 1st edition
(2) Solar Energy conversion, An introductory course By A. E. Dikon and J. D. Loslie
(3) Principles of Energy Conversion By Archie W. Cupl Jr.

Elective course (Disciplinary)

EPH- 502: SYNTHESIS OF MATERIALS

UNIT-I

Physical Methods:
Solid State Reaction (Ceramic) Method: General Principles, Experimental Procedure: Reagents, Mixing, Container Material, HeatTreatment, Analysis, Kinetics of Solid State Reaction, Disadvantages.

Thin Film Synthesis:
Vacuum Evaporation, Sputtering, Spin Coating, Dip Coating, Pulsed Laser Deposition (PLD), Spray Pyrolysis, Chemical Vapour Deposition (CVD).

UNIT-II

Chemical Routes:
Sol-gel Method: Principle, Lithium Niobate ($LiNbO_3$), Doped Tin Dioxide, Silica for Optical Fiber

Growth of Single Crystals:
Czochralski Method, Bridgman and Stockbarger Methods, Zone Melting, Precipitation from Solution or Melt; Flux Method, Epitaxial Growth of Thin Layers.
Vapour Phase Transport Methods.

References:
(1) Solid State Chemistry and its Applications, Anthony R. West (John Wiley & Sons)
(2) Solid State Chemistry – An Introduction, Lesley Smart and Elaine Moore (Viva Books Pvt Limited)
(3) Hand Book of Thin Film Technology, K. L. Chopra (MacGrow Hill)
(4) Thin Film Fundamentals, Goswami A. (New Age International)
(5) Hand Book of Thin-Film Deposition Processes and Techniques, Krishna Seshan (Noyes Pub.)
(6) Crystal Growth – A Tutorial Approach,Eds. W. Bradsley, D.T.J. Hurle & J. B. Mullin (North Holland)
(7) Crystal Growth Processes & Methods, P. Santhana Raghavan, P. Ramasamy (KRU Publications)

Elective course (Interdisciplinary)

EPH- 503: EXPERIMENTAL TECHNIQUES

UNIT-I

X-ray: Introduction to production of X-ray & X-ray spectra, Instrumentation, X-ray generation,
collimators, filters, detectors, X-ray absorption methods, X-ray fluorescence methods, XF- Spectrometer (XFS),
Nuclear Magnetic Resonance (NMR) spectroscopy: basic principles, nuclear magnetic energy levels, magnetic resonance, NMR Spectrometer.
Electron Spin Resonance spectroscopy, ESR spectrometer, ESR spectra, Hyperfine interactions.

UNIT-II

Mass spectroscopy : principle, spectrometer, and its operation, resolution, Mass spectrum, applications.
Intrared Spectroscopy, correlation of IR spectra with molecular structure, Instrumentation.
Mosbauer Spectroscopy : Mosbauer effect, spectrometer, 57 Fe Mosbauer spectroscopy, nuclear hyperfine interactions.

References:
(1) Instrumentation Methods of analysis : VIIth Edition, Willard Meritt, Dean,,Settle,CBS publishers.
(2) Mosbauer Spectroscopy : Leopold May, Plenum Press, N.Y.
(3) Neutron Diffraction : G.C. Becon
(4) X-Ray diffraction : B.D. Culity, Edison Weisley
(5) Radiation Detection & Measurment : Glenn F. Knoll

PPH- 501: PRACTICALS

Group – I

1. Hysterisis by Magnatometer Method.
2. L by Rayleigh's method.
3. 'e' by Milicon's method
4. G.M. counter.
5. Microproccessor-arithmetic operations.
6. C Programming.
7. Ionic conductivity in Alkali Halides.
8. Determination of Band gap energy of given Thermister.

Group – II

1. Class-B Push-Pull Amplifier.
2. MOSFET Characteristics.
3. Amplitude modulation and demodulation.
4. Non-Inverting OP-AMP.
5. Voltage follower.
6. IC-723 Regulated Power Supply.
7. OP-AMP Parameters.
8. IC-555 Timer.

MATHEMATICS

HEMCHANDRACHARYA NORTH GUJARAT UNIVERSITY
PATAN- 384 265

Proposed details of CBCS PROGRAMME Pattern for M Sc Mathematics(Semester System)

With effect from June : 2014 NEW

FACULTY : SCIENCE

SUBJECT : MATHEMATICS

CLASS: Master of Science.

SEMESTER : I to IV

TOTAL PAGE 01 TO 33 (WITH COURSE STRUCTURE)

DATE : 15th September -2014

M Sc in Mathematics : PROGRAMME Structure Under CBCS

With effect from June : 2014

M. B. Prajapati, ***Department of Mathematics,***
Hemchandracharya North Gujarat University, Patan-384265.

(1) Department's VISION and Mission :

The Department of Mathematics is a premier academic institute in the North Gujarat region.
The Department was established in June-1993 to cater the need of this region for higher education in the mathematical field.
Mission : Our mission is to provide opportunities for developing high-quality mathematical skills and achievement for their betterment of life through scientific and technological development.
Learning outcomes: Logical Reasoning & Motivation ;Critical & Creative Thinking; Analysis & Problem solving; Information & Technology Proficiency.
Vision: To motivate Individuals to excel in the mathematical knowledge-driven environment of the 21st century through curriculum and train integrally human resources through teaching, research & extension to enhance and initiate human development and the quality of life.

We **Focus** on quality education and innovative research, activities reflecting the goals and objectives of the institution.

Presently, we teach and emphasize student's creativity, excellence, integrity through course work, extracurricular activities, advising and counseling, academic process and reach-as-we-practice.

(2) EDUCATIONAL AIMS :

Mathematics is one of the fundamental disciplines in science. It is the basic for all the disciplines. To make education more effective and learner centric, restructurisation of curriculum becomes essential. As a positive step in this direction and in order to respond to the emerging trends in the global scenario, it is decided to introduce the Choice Based Credit System (CBCS) from the academic year 2011-12. Under this system, the academic programme becomes student-oriented, relevant, interdisciplinary and flexible. Apart from the core subjects the student is at liberty to choose subjects of his/her choice offered by the department also. Besides, the student has an opportunity to learn extra subjects, for which classes will be conducted outside the regular working hours and he/she can earn extra credit in addition to the mandatory credits required of him/her to qualify for the degree, in accordance with the norm prescribed by the Department/University from time to time and availability of the academic infrastructures.

- General Objectives of Choice Based Credit System are as follows:

1. To enlarge and enrich the curriculum and to make education broad based, i.e., more knowledge and skill oriented.
2. To ensure flexibility in choosing intra and interdisciplinary subjects, according to the choice of the students.
3. To enable the interested students to earn extra credits.
4. To facilitate the students to learn at their own pace.

Besides all the above aspects, the MSc programme under CBCS in Mathematics is designed for B. Sc. Mathematics Students if he/she want to continue his/her studies by delving more deeply into particular aspects of pure , applied or applicable mathematics also.

(3) CONDITIONS FOR ADMISSION :

A candidate who has passed the B.Sc. Degree examination of this University with Mathematics or any other examinations accepted by the Syndicate as equivalent thereto shall be eligible for admission to this M Sc Programme in Mathematics on full-time basis of study.

INTAKE: 30 *students* but may vary from time to time with the permission from the university for the first semester. Other rules for admission are as per University notification from time to time.

Students are allowed to take admissions to successive semesters under carry over benefit facility.

(4) LEARNING OUTCOMES (Objectives and Aim)

The programme leading to this degree provides the opportunities to develop and demonstrate knowledge and understanding in the following areas:

- **Knowledge and understanding**

When one has completed this degree he/she will have knowledge and understanding of:

- the fundamental and advanced concepts, principles and techniques from a range of topic areas
- specific knowledge and understanding will be determined by his/her particular choice of courses, according to his/her particular needs and interests.

- **Cognitive skills**

When one has completed this degree he/she will be able to:

- understand how to solve some problems using the methods taught
- assimilate complex mathematical ideas and arguments
- develop abstract mathematical thinking
- develop mathematical and physical intuition.

- **Practical and/or professional skills and Key skills**

When you have completed this degree, you will be able to demonstrate the following skills:

- the ability to advance your own knowledge and understanding through independent learning
- communicate clearly knowledge, ideas and conclusions about mathematics
- develop problem-solving skills and apply them independently to problems in pure ,applied and applicable mathematics
- communicate effectively in writing about the subject
- improve his/her own learning and performance.

(5) DURATION OF THE COURSE:

The CBCS pattern M. Sc. programme with multidisciplinary approach in Mathematics is offered on a full-time basis. The duration of the course is of two academic years consisting of four semesters each of 15 weeks duration.

(6) TEACHING, LEARNING METHODS :

All relevant material is provided and taught in the course texts and through the study of set books. One will build up knowledge gradually, with sufficient in-text examples to support one's understanding. He/She will be able to assess his/her own progress and understanding by using the in-text problems and exercises at the end of each unit. Opportunity to engage with what is taught is provided by means of the assignment questions and understanding will be reinforced by personal feedback from the teacher in the form of comments based on the answers to one's assignments, seminars, unit-tests and project.

(7) COURSE OF STUDY :

The curriculum has seven major components:

1 Core / Principle / Fundamental Mathematical courses
2 Pure Mathematical Courses
3 Applied Mathematical Courses
4 Applicable / Application Oriented Mathematical Courses(disciplinary)
5 Soft Skill Based Courses (Inter-disciplinary)
6 Open Choice Based Courses (Disciplinary/Inter-disciplinary)
7 Cognitive Skill-Work Based Courses

There are at least total twenty COURSEs prescribed in the following classification, to be studied to acquire M.Sc. Degree in Mathematics.

(I) Principle/Core/Compulsory Courses (HARD CORE): (MTHP-1 to 8)

All Basic/Core courses carry 5 credits in 5 hours per week teaching and in each semester any two core courses to be selected from the list of MTHP_Group (various groups are listed on page number **10**)

with no repetitions i.e. there are total 8 Mathematical Core Courses to be selected from semester-I to semester-IV.

(II) Elective Disciplinary COURSEs (SOFT CORE): (MTHE-1 to 4)

All elective courses carry 4 credits in 4 Hours per week teaching. During the span of the programme, there are 4 Mathematical Elective Courses to be chosen from the lists of COURSEs of not more than Two groups : Three groups are *Group-A (Pure Mathematical Group) , Group-B(Applied Mathematical Group) and Group-C(Applicable Mathematical Group)*

(III) Choice Based Optional Courses: CB_Group (MCB-1 to 3)

All Choice based(disciplinary as well as inter-disciplinary) courses carry 2 credits in 2 hours per week teaching and there are 3 COURSEs to be chosen from the list of CB_Group.

(IV) Soft Skill Based Courses : SB_Group (SSB-1 to 4)

All Soft-skill based courses carry 2 credits in 2 hours per week teaching and 4 hours for practical. There are total 4 Courses to be chosen from the list of SSB_Group.

(V) Either Cognitive Skill-Work Project : MTHW_Group (MTHW)

OR

MTHE -5 ,MTHE-6 (selected from soft core subjects & MCB-4 (selected from CB group)

⇛ COURSE STRUCTURE ☒

SEMESTER-I Course	Courses	Credit /course	Teaching Hrs Total	Total Credits	Examination Internal Marks	Hours/ Course	External Marks	Total Marks
Principle/Core Courses: MTHP-1,2	2	5	10	10	70	3	180	250
Elective Opt. Disciplinary: MTHE-1	1	4	4	4	30	3	70	100
Choice Base Theory: MCB-1	1	2	2	2	15	2	35	50
Soft Skill Elective Theory: SSB-1	1	2	2	2	0	2	50	50
Soft Skill based Practical: SSB-2	1	2	Minimum:4	2	0	2	50	50
Total	**6**		**22**	**20**	**115**		**385**	**500**
SEMESTER-II								
Principle/Core : MTHP-3,4	2	5	10	10	70	3	180	250
Elective Opt. Disciplinary: MTHE-2	1	4	4	4	30	3	70	100
Choice Base Theory: MCB-2	1	2	2	2	15	2	35	50
Soft Skill Elective Theory: SSB-3	1	2	2	2	0	2	50	50
Soft Skill based Practical: SSB-4	1	2	Minimum:4	2	0	2	50	50
Total	**6**		**22**	**20**	**115**		**385**	**500**
SEMESTER-III								
Principle/Core : MTHP-5,6	2	5	10	10	70	3	180	250
Elective Opt. Disciplinary:MTHE-3,4	2	4	8	8	60	3	140	200
Choice Base Theory: MCB-3 (Research Methodology)	1	2	2	2	15	2	35	50
Total	**5**		**20**	**20**	**145**		**355**	**500**
SEMESTER-IV								
Principle/Core :MTHP-7,8	2	5	10	10	70	3	180	250
AND EITHER								
Cognitive Skill-Project: MTHW	1	10	Minimu:16	10	75	1/studt	175	250
OR								

Elective Opt. Disciplinary:MTHE-5,6	2	4	10	10	10	60	3	140	200
Choice Base Theory: MCB-4	1	2		2	2	15	2	35	50
Total	**3 or 5**			**26***	**20**	**145**		**355**	**500**
Total	***20***			***90****	***80***	***520***		***1480***	***2000***

N.B. *Work-load depends on the number of students and the number of Batches/Groups , for practical and Cognitive-skill based Course.*

(8) ***ASSESSMENT AND EXAMINATION METHOD :***

A candidate's understanding of principles and concepts will be assessed through CIA and UE pattern as follow:

- **CONTINUOUS INTERNAL ASSESSMENT (CIA):**

The CIA is done by the course teachers and this will evaluated any five/six from the following NINE academic components having equal weightage.

1. Assignments, Quiz (announced or unannounced)
2. Individual viva or group viva
3. Short duration objective types tests/snap tests
4. Short answer/problem solving(15 to 30 minutes for assessment of cognitive ability)
5. Seminar (once in a semester is compulsory)
6. Unit test (written or oral)/internal test
7. Laboratory/field/practical work
8. Group Discussion(Once in a semester to asses originality, creativity, initiative, communication skills …etc)
9. Class-room attendance/punctuality/sincerity

- **University Examination (UE):**

There shall be four semester examinations, one at the end of each semester in each academic year. A candidate who does not pass the examination in any course(s) in a semester will be permitted to appear in such failed course(s) also, with subsequent semester examinations: University Examination (UE) only.

There is no Continuous Internal Assessment for any SSB Theory/practical. Also External University Examination for SSB Theory/practical is of 50 Marks/practical (Practical including Viva :Examination-40 marks + Record/journal book: 10 marks)

(9) REQUIREMENTS FOR PROCEEDING TO SUBSEQUENT SEMESTER:

(i) Candidates shall register their name for the First Semester Examination after the admission in the M.Sc. Maths.

(ii) Candidates shall be permitted to proceed from the First Semester up to Final Semester irrespective of their failure in any of the Semester examinations subject to the condition that the candidates should register for all the arrear subjects of earlier semesters along with current (subsequent) semester subjects, in consultation with the Head of The Department and available faculties.

(iii) Candidates shall be eligible to go to subsequent semester, only if he/she earns sufficient attendance as prescribed thereof by the University from time to time. In the case of candidate earning less than the prescribed attendance in any one of the semesters due to any extraordinary circumstance, shall be permitted to proceed to the next semester and such candidate shall have to repeat the missed semester by

rejoining after completion of final semester of the course, after paying the higher-fee for the break of study as prescribed by the University from time to time.

(10) PASSING MINIMUM:

A candidate shall be declared to have successfully cleared in each course / Practical / Project , if he/she secures not less than 40 % of marks [in each of the continuous internal assessment (CIA) and the University examinations (External)], provided a minimum of 40% of marks secured in the University theory examination and a minimum of 40% marks in a Practical / Project / Viva-voce.

(11) GRADING SYSTEM and CLASSIFICATION OF SUCCESSFUL CANDIDATES:

The term grading system indicates a Ten (10) Point Scale of evaluation of the performances of students in terms of marks obtained in the CIA and External Examination, grade points and letter grade.

Procedure of awarding the grades : Marks and Award of Grades:

The following TABLE-I gives the marks, numerically grades, letter grades and classification to indicate the performance of the candidate.

Table 1 : Conversion of Marks to Numerical Grade and Letter Grade (Course Performance)

Sr no.	Letter Grade	Numerical Grade	Grade Points	Performance
1	O	90 - 100	9.0 to 10.0	Out standing
2	A	80 – 89	8.0 to 8.9	Excellent
3	B	70 - 79	7.0 to 7.9	Distinction
4	C	60 - 69	6.0 to 6.9	Very Good
5	D	50 – 59	5.0 to 5.9	Good
6	E	40 - 49	4.0 to 4.9	Satisfactory
7	F	0 – 39	Below 4.0	Unsatisfactory / Fail
8	AAA	--	0.00	Absent

The result of successful candidates at the end of each semester shall be declared in terms of GRADE POINT AVERAGE (GPA) and letter grade. The result at the end of fourth semester shall be classified on the basis of the Cumulative Grade Point Average (CGPA) obtained in all the four semester and the corresponding overall letter sign grade. The TEN point grading system with the Numerical as well as the letter grade as described as above and shall be recommended to be adopted. The Grade Point Average (GPA) and the Cumulative Grade Point Average(CGPA) at the end of fourth semester shall be computed as follows.

Computation of Grade Point Average(GPA):

The letter grade is assigned a numerical grade value according to the Grading Systems- as shown in the Table 1. Each letter grade has a numeric grade point value assigned which is used to calculate Grade Point Average (GPA) and cumulative grade point average (CGPA).

The numerical grade in a course shall be assigned on the basis of actual marks scored at the semester end examination including Internal Assessment in that course as per the above Table 1 provided he/she secures

a minimum of 40% marks in the semester examination. The candidate securing less than 40% of marks in the end of semester examination (including Internal marks) in any course (may be a theory / practical / project work /dissertation ,etc.) shall be declared to have failed OR to be re-appear in the next exam in that course.

The Grade Point (GP) for each course shall then be calculated as the product of the Numerical Grade earned in that course and the credits for that course. The Grade Point Average (GPA) for each semester is obtained by adding the GP of all the courses of the semester dividing by total Credits of the semester (in science faculty it is 20 credits for each semester).

Procedure for GPA calculation: If Ci = Credits of the i^{th} course, G_i = the numerical Grade obtained for the i^{th} course and n= the number of courses (credited) offered in the semester, then the Grade Point (GP_i) for the i^{th} course of the semester is calculate as : GRADE POINT (GPi) = Gi x Ci

GRADE POINT AVERAGE [GPA] $= (GP_1 + GP_2 + \ldots + GP_n) / (C_1 + C_2 + \ldots + C_n)$

$= (GP_1 + GP_2 + \ldots + GP_n) / 20$ (since total credit for each semester=20)

$= (C_1 \times G_1 + C_2 \times G_2 + \ldots + C_n \times G_n) / (C_1 + C_2 + \ldots + C_n)$

$$\textbf{GPA} = \frac{\text{Sum of the multiplication of numerical grade by the credits of the courses}}{\text{Sum of the credits of the courses in a semester}}$$

Note: The candidates who pass the subject at first appearance and within the prescribed semester of the PG Programme (Core, Elective, Non-major Electives and Extra-Disciplinary courses alone) only shall be eligible for the evaluation process of the Grade point of that subject. Those students who clear the examination at second or subsequent attempt or having skipped the first attempt in the subject shall be granted the numerical grade of only 4.0 (as the lowest one) instead of the higher numerical grade obtained by the candidate.

Calculation of CGPA for the entire programme : Cumulative GPA is a calculation of the average of all grades for all semesters and courses completed at the PG programme.

CUMULATIVE GRADE POINT AVERAGE [CGPA] =

$$= \frac{\text{Sum of the multiplication of GPA of the semester by the total credits of that semester}}{\text{Sum of the credits of the courses of the entire programme}}$$

Descriptions of each component described as follow:

Letter Grade	Numerical Grade	Grade Points	Performance	Letter Grade Description
A+	90 - 100	9.0 to 10.0	Out standing	Extra ordinary performance in the subject
A	80 – 89	8.0 to 9.0	Excellent	First Class Standing. Superior Performance showing comprehensive, in-depth understanding of subject matter. Demonstrates initiative and fluency of expression.
B+	70 - 79	7.0 to 8.0	Distinction	Basic understanding with knowledge of principles and facts at least adequate to communicate intelligently in the discipline.
B	60 - 69	6.0 to 7.0	Very Good	Clearly above average performance with knowledge of principles and facts generally complete and with no serious deficiencies.
C+	50 – 59	5.0 to 6.0	Good	Some understanding of principles and facts but with definite deficiencies.
C	40-49	4.0 to 5.0	Satisfactory	A passing grade indicating marginal performance. Student not likely to succeed in subsequent courses in the subject.
F	0 – 39	00.00	Unsatisfactory /	Knowledge of principles and facts is fragmentary;

			Fail	or student has failed to complete substantive course requirements.
AAA	--	0.00	Absent	Did not complete the course or less than 40% of course work completed.

(12). RANKING:

Candidates who pass all the examinations prescribed for the course in the first appearance itself alone are eligible for Ranking / division as shown as above. In the case of candidates who pass all the examinations prescribed for the course with a break in the First Appearance due to the reasons as furnished in the Regulations under Requirements for Proceeding to subsequent Semester are only eligible for Classification.

(13). PATTERN OF QUESTION PAPER:

Each COURSE possess four units having equal weightage . There should be five questions in a paper; each question should be from each unit and last one is of objective type from all units.

Two examiners , either both internal or one internal and one external can set the question paper. The internal examiner shall be the chairperson for the respective paper/COURSE.

(14). APPEARANCE FOR IMPROVEMENT:

Candidates who has already passed the semester-I,II&III Examination with seven optional COURSEs-MTHE-1,2,3,4& MCB-1,2,3 shell be allowed to reappear with another seven optional COURSEs (other than the previously ones) at semester-I , II & III examination to improve the result with the consent of the Head of The Department and the University. Such candidate shall have to get register for all the seven optional COURSEs in two additional terms; consecutive or alternative, and by paying the higher fees as prescribed by the university from time to time only after getting the prior permissions of the Department and the University. The result of such candidate will be declared on the basis of his/her mark sheet, in which the marks obtained by him/her in the other optional COURSEs have replaced the marks of old optional COURSEs. Such candidates are allowed to improve within a maximum period of 8 semesters counting from his/her first semester of his/her admission. If candidate improves his/her marks, then his improved marks will be taken into consideration for the award of Classification only. Such improved marks will not be counted for the award of Prizes / Medals, Rank and Distinction. No candidate will be allowed to improve marks in the Practical, Project, Viva-voce, Field work and any Core Subjects.

(15) Provisions for the Choice of Skill Based & Cognitive Work Subjects:

Faculty Advisor

To help the students to plan their optional COURSEs of the study and to offer general advice on the academic programmes, a student will be assigned to a member of the faculty (Major Dept) who will function as "Faculty Advisor" throughout his/her period of study.

The Faculty Advisor will counsel students on matters relating to the choice of subjects, withdrawal, etc. The student will meet his/her Faculty Advisor atleast three times during the semester.

Departmental Committee

Every major department will have a Departmental Committee consisting of

- The HOD - Convener
- The Faculty Advisors of the Department

- Student representative of each class

  The departmental committee is to meet at least thrice a semester to review all matters relevant to the academic programme. It is the responsibility of the faculty advisor to keep the records, Viz., the Agenda, Notes, Minutes, Diary etc.

Registration Procedure for Optional Subjects

Registration for the optional subjects should be done with the subject teacher in consultation with the HOD and Faculty Advisor. Students are expected to register for subjects intended to be credited during the next semester on specified dates.

(16). FORMAT FOR THE PREPARATION OF RECORD/PROJECT/COGNITIVE WORK:

The Rough Sketch of the Structure/Pattern provided herewith and are to be modified, time to time if needed.

(I) STRUCTURE FOR COMPUTER LABORATORY/PRACTICAL EXAMINATION.

Duration : 3 Hours Examination ,Maximum for Lab Course: 50 Marks. There is no Continuous Internal Assessment for any practical. University Exam. per practical : 50 Marks(Practical Examination: 40 marks + Journal: 10 marks)

(i) Record of Laboratory work for practical:

Title of the Course
Course Number --------- Year -------- Category ------- Semester ------- Credits ---- Course Code---Total Instructional Hours per week –

(a) Aim (b) Flowchart and Algorithm

(c) Source Code (d) Input/output specification

(e) Printout(s) (f) Remarks / Scope / Limitation of the Experiment.

(ii) FORMAT FOR THE COGNITIVE/PROJECT WORK.

Title of the Course
Paper Number --------- Year ----- Category ----- Semester ------- Credits ---- Course Code-------Total Instructional Hours per week –

(a) Title page : TITLE OF THE PROJECT

A project report Submitted for the partial fulfillment for the award of the Degree of Master of Science in Mathematics by Candidate's name (Register Number)
Under the guidance of Guide's name ----------
Name of the Department/College Name & Month and Year

(b) Bona fide Certificate

CERTIFICATE

This is to certify that the report entitled **"TITLE OF THE PROJECT"** *being submitted to the Hemchandracharya North Gujarat University of Patan* by Candidate's name for the partial fulfillment for the award of the Degree of **Master of Science in Mathematics** is a bona fide record of work carried out by him/her under my guidance and supervision

Date : Signature and Address of the Guide Signature of the HOD
Place:

Submitted for the viva-voce examination on…….…. at ----------Examiner-1 :
…….
(Signature and Name of the External Examiner)

Chairman of the examination:……. (Signature and Name of the External Examiner)

(c) Acknowledgement (d) Content

(e) Introduction (f) Chapters

(g) References (h) Appendices, if any.

(I) Principle/Core/Compulsory Courses: (MTHP-1 to 8)

All Basic/Core courses carry 5 credits in 5 hours per week teaching and in each semester any two core courses to be selected from the list of MTHP_Group with no repetitions i.e. there are total 8 following Mathematical Core Courses to be selected from semester-I to semester-IV.

(α) LIST OF COURSES FOR MTHP-GROUP (1 to 8) ANY TWO IN EACH SEMESTER

[MTHP-1]	Measure Theory	**[MTHP-2]**	Algebra-I
[**MTHP-3]**	Complex Analysis	**[MTHP-4]**	General Topology
[MTHP-5]	Advance Topology	**[MTHP-6]**	Functional Analysis-I
[MTHP-7]	Functional Analysis-II	**[MTHP-8]**	Field Theory

(II) ELECTIVE DISCIPLINARY COURSES: (MTHE-1 TO 4)

All elective courses carry 4 credits in 4 Hours per week teaching and there are 4 Mathematical Elective Courses to be chosen from the lists of COURSEs of not more than Two groups: three groups are Group-A, Group-B, Group-C ,

1. Group-A : Pure Mathematical Group

MTHE A-1	Differential Geometry
MTHE A-2	Techniques of Differential Equations
MTHE A-3	Number Theory
MTHE A-4	Algebraic Topology-I : Homotopy Theory
MTHE A-5	Algebraic Topology-II : Homology And Cohomology Theory
MTHE A-6	Functions of Several Variable
MTHE A-7	Differentiable Manifolds

2. Group-B : Applied Mathematical Group

MTHE B-1	Classical Mechanics-I	**MTHE B-2**	Classical Mechanics-II
MTHE B-3	Electrodynamics-I	**MTHE B-4**	Electrodynamics-II
MTHE B-5	Theory of Relativity	**MTHE B-6**	Relativity and Cosmology

Group – C: Applicable Mathematics Group

MTHE C-1	Mathematical Modelling
MTHE C-2	Mathematical Logic
MTHE C-3	Introduction To Artificial Intelligence
MTHE C-4	Operations Research
MTHE C-5	Advanced Operations Research
MTHE C-6	Statistical Methods
MTHE C-7	Mathematics Of Finance And Insurance PROBILITY AND STATICS
MTHE C-8	Computational Biology
MTHE C-9	Fuzzy Sets And Their Applications
MTHE C-10	BIO-MECHANICS
MTHE C-11	MATHEMATICS OF MONEY

(III) Choice Based Optional Courses: CB_Group (MCB- 1 to 3) ANY ONE

All Choice based (disciplinary as well as inter-disciplinary) courses carry 2 credits in 2 hours per week teaching and there are 3 COURSEs to be chosen from the list of CB_Group.

MCB-1	Special Functions
MCB-2	Advanced Linear Algebra
MCB-3	Research Methodology
MCB-4	Fuzzy sets, Fuzzy Logic and Fuzzy Control System
MCB-5	Integral Transforms
MCB-6	Mathematics Of Finance And Insurance
MCB-7	Industrial Mathematics

(IV) Soft Skill Based Courses : SB_Group (SSB-1 to 4) ANY TWO

All Soft-skill based courses carry 2 credits in 2 hours per week teaching and 4 hours for practical. There are total 4 Courses to be chosen from the list of SSB_Group.

SSB-1	Introduction to Computer C Language	**SSB-2**	Programming in C and applications (practical)
SSB-3	Introduction to Computer Graphics	**SSB-4**	Programming in Computer Graphics(practical)
SSB-5	Object oriented computer C++ language	**SSB-6**	Programming in C++ and applications (practical)
SSB-7	Introduction to MATLAB	**SSB-8**	Programming in MATLAB (practical)

DETAILS OF M Sc PROGRAMME

There are at least total twenty COURSEs prescribed in the following classification, to be studied to acquire M.Sc. Degree in Mathematics.

(I) Principle/Core/Compulsory Courses: (MTHP-1 to 8)

All Basic/Core courses carry 5 credits in 5 hours per week teaching and in each semester any two core courses to be selected from the list of MTHP_Group with no repetitions i.e. there are total 8 following Mathematical Core Courses to be selected from semester-I to semester-IV.

(α) LIST OF COURSES FOR MTHP-GROUP (1 to 8)

1 Measure Theory
2 Complex Analysis
3 General Topology
4 Advance Topology
5 Algebra-I
6 Field Theory
7 Functional Analysis-I
8 Functional Analysis-II

[MTHP-1] MEASURE THEORY

Revision: Standard topology on R, structure of open sets, cantor set, lim sup, lim inf.

Unit-1 Algebra and σ-algebra of sets, σ-algebra of Borel sets, Lebesgue outer measure on **R**, measurable sets, Lebesgue measure

Unit-2 Measurable function, Littelwood's three principles, Egoroff's theorem,Integral of a simple function, Lebesgue integral of bounded functions, bounded convergence theorem.

Unit-3 Integral of nonnegative functions, general Lebesgue (integral), Fatou's lemma, monotone convergence theorem, Lebesgue's convergence theorem, convergence in measure.

Unit-4 Differentiation of monotone functions, functions of bounded variation, differentiation of an integral, absolutely continuous functions and indefinite integrals.

The course is covered by "Real Analysis" by H. L. Ryoden, Macmillan Pub. Co. 3rd Ed.

Reference Books:

(1) "Theory of Functions of a Real Variable" – by I. N. Natansen, Fredrik Pub. Co., 1964.
(2) "Measure Theory" – by P. R. Halmos, East and West Press.
(3) "Introduction to Real Variable Theory" – by S. C. saxena and S. N. shah Prentice Hall of India, 1980.
(4) "Real and Complex Analysis", Rudin, W., 2nd Edition, Tata McGraw-Hill Publishing Co. Ltd., 1974.

[MTHP-2] ALGEBRA - I

Unit 1 [**Revision:** Group, Subgroup, Normal Subgroups, Quotient groups, Homomorphism of groups, Isomorphic groups, Permutation groups, Direct product of groups]
Cayley's theorem, Conjugacy relation on a group and its applications, Solvable groups.

Unit 2 Group actions, Sylow's theorem, , Finite abelian groups, Simple groups.

Unit 3 [**Revision:** Ring, subrings, ring homomorphisms, ideals and quotient rings, prime and maximal ideals, Polynomial rings]
Field of fractions of an integral domain, Divisibility in rings, Euclidean ring, Principal Ideal rings.

Unit 4 Polynomial ring over a rational field, irreducibility criteria, polynomial ring over a commutative ring, Unique factorization domain.

The course is indicated by "Topics in Algebra" by I. N. Herstain, John Wiley and Sons Inc., 2nd Edition.

Reference Books:

(1) "Basic Abstract Algebra" by Bhattacharya, Jain and Nagpal, 2nd Edition.
(2) "Algebra" by S. Mcclane and G. Birkhoff, 2nd Edition,
(3) "Basic Algebra" by N. Jacbson, Hind. Pub. Corp.1984.
(4) "A first course in Abstract Algebra" by John Fraleigh (3rd Edition), Narossa Publishing House, New Delhi.

[MTHP-3] COMPLEX ANALYSIS

Unit-1 [**Revision:** Complex numbers and its polar and exponential forms, powers and roots]
Regions in the complex plane, continuity and differentiability of complex functions, analytic functions, Cauchy-Riemann equations, harmonic Functions of two variables, Infinite series of complex numbers, power series functions.

Unit-2 The elementary Functions: exponential, trigonometric, hyperbolic functions, logarithmic functions and its branches, rectifiable arcs. Complex line integral, complex contour integral, Cauchy's theorem for triangular contours, anti-derivatives.

Unit-3 Cauchy's integral formula, derivative of analytic functions, Morera's theorem, Liouville's theorem, Fundamental theorem of algebra, Taylor expansions, Laurent expansions.

Unit-4 Singularities, zeros of analytic functions, poles, residues, Residue Theorem, residue at poles, evaluations of improper integrals.

The course is covered by the book: Complex Variables and Applications (Fourth edition) by Rule V Churchill and James W Brown, McGraw Hill, International Editions.

References:

1. John Duncan, The Elements of Complex Analysis, John Wiley & Sons Ltd, London. (1968)
2. L V Ahlfors, Complex Analysis, 3rd edition, McGraw Hill, International Editions, New York-1966
3. J B Conway, Functions of one complex variables, 2nd edition, Springer Verlag, New York (1973) (Indian edition: Narosa Publication House, New Delhi. (1982))
4. Serge Lang, Complex Analysis, Addison- Wesley, Publishing Co. (1997)
5. B Choudary, The Elements of Complex Analysis, 2nd edition, New Age International Ltd Publishers, New Delhi. (1992)
6.

[MTHP-4] GENERAL TOPOLOGY

Unit 1 **Topological Spaces:** Topological spaces, basis and sub-basis for a topology (definitions and examples only), The order topology, the product space Π Xi (for finitely many topological spaces ni), subspace topology , closed sets, limit points.

Unit 2 **Continuous Functions:** Continuous functions, Homeomorphisms, the pasting lemma, Map into products, the metric topology, the sequence lemma , Uniform limit theorem, The quotient topology.

Unit 3 **Connectedness :** connected spaces, path connected spaces, connected sets in the real line, components and path–components, locally connected spaces and path connected spaces.

Unit 4 **Compactness:** compact spaces, compact sets in the real line, limit–point compactness, locally compact spaces, one–point compactificaton.

Note: All results and examples are to be excluded which use the concept of the product topology of a collection of infinitely many topological spaces.

The course is covered by "Topology – A first course" – by J. R. Munkres, Prentice – Hall of India, 1992.

Reference Books

(1) "General Topology" – by S. Willard, Addison Wesley, 1970.
(2) "Topology" – by J. Dugundji, Prentice – Hall of India, 1975.
(3) "Aspects of Topology" – by C. O. Christonson and W. l. Voxman, Marcel Dekker Inc., 1977.
(4) "General Topology" – by J. L. Kelley, D. Van Nostraml, 1950.

[MTHP-5] ADVANCED TOPOLOGY

Unit 1 Countability Axioms: First countable space, second countable space, separable space, Lindeloff space

Unit 2 Separation axioms- Hausdorff space, regular space, normal space, Urysohn's lemma, Completely regular space, Tietze extension theorem.

Unit 3 **I**mbedding of Manifolds, Partition of unity, Tychonoff theorem (statement only), The Stone-cech Compactifications and uniqueness.

Unit 4 Complete metric space, Compactness in metric spaces, Ascoli's theorem, Bair spaces, Baire category theorem.

Note: All results and examples are to be excluded which use the concept of the product topology of a collection of infinitely many topological spaces.

The course is covered by "Topology – A first course" – by J. R. Munkres, Prentice Hall of India, 1992.

Reference Books

(1) "General Topology" – by S. Willard, Addison Wesley, 1970.
(2) "Topology" – by J. Dugundji, Prentice – Hall of India, 1975.
(3) "Aspects of Topology" – by C. O. Christonson and W. l. Voxman, Marcel Dekker Inc., 1977.
(4) "General Topology" – by J. L. Kelley, D. Van Nostraml, 1950.

(5)

[MTHP-6] FUNCTIONAL ANALYSIS-I

Unit 1 Normed linear space: definition and examples, continuous linear transformations, spaces BL(X,Y), BL(X) and BL(X,X), l^p & L^p (for $0 \leq p \leq \aleph$) Banach spaces.

Unit 2 Hahn-Banach theorem and its applications, open mapping theorem, Dual normed spaces, natural imbedding of normed space into double dual space of normed spaces.

Unit 3 Closed graph theorem, uniform boundedness principle, conjugate of an operator, bounded inverse mapping theorem.

Unit 4 Hilbert space: definition and examples, orthogonal complement, orthonormal set, Bessel's inequality, Projection theorem, Riesz Representation theorem.

Note: The course is roughly covered by the following books:

1. G. F. Simmons: Introduction to Topology and Modern Analysis, Tata McGraw,1963

2. B. V. Limaye: Functional Analysis, 2nd Edition, New Age International Ltd. Publishers.

Reference Books:

(1). S. K. Berberain: Lectures in Functional Analysis and Operator theory, Springer Verlag.
(2). Goffman and George Padre: First course in Functional Analysis, Prentice Hall of India.
(3) Martin Schechter: Principles of Functional Analysis (student edition) Academic Press, N York.

[MTHP-7] FUNCTIONAL ANALYSIS-II

Unit 1 Dual and transpose of a Hilbert spaces, adjoint of an operator, self-adjoint, normal, unitary operators, projections.

Unit 2 Finite dimensional spectral theorem, Weak and weak* convergence..

Unit 3 Banach algebra: definition and examples, regular and singular elements , topological divisiors of zero, spectral of an element and spectral radius, radical and simplicity..

Unit 4 Gelfand mapping, applications of the formula of the spectral radius, involutions in Banach algebra, Ideals in C(X), Banach-Stone theorem, Commutative C*-algebras, Stone-Weierstras theorem, Gelfand-Naimark theorem for commutative C*-algebra.

Note: The course is roughly covered by the following books:

1.G. F. Simmons:Introduction to Topology and Modern Analysis, McGraw Hill,1963.

2.B. V. Limaye: Functional Analysis, 2nd Edition, New Age International Limited, 2nd edition.

Reference Books:

(1). R Larson : Banach Algebra, Marcell Dekker,1973.
(2) H G Dales : Automatic Continuity, Cambridge, 2000
(3) S. K. Berberain: Lectures in Functional Analysis and Operator theory, Springer Verlag.
(4). Goffman and George Padre: First course in Functional Analysis, Prentice Hall of India.
(5) Martin Schechter: Principles of Functional Analysis (stud. ed.) Academic Press, New York.

[MTHP-8] ALGEBRA-II (FIELD THEORY)

Unit 1 Extensions of field, Finite, algebraic and simple field extensions, algebraic and transcendental numbers.

Unit 2 Roots of polynomials, the splitting field of a polynomial over a field, construction with straightedge and compass.

Unit 3 The fixed field of a group of automophisms, the theorem on symmetric polynomials, normal field extension, the Galois group of a polynomial.

Unit 4 The fundamental theorem of Galois theory, solvability by radicals, Galois group over the rationals, finite fields,

Note: The topics are roughly covered by chapter 5 (all articles) and chapter 7 (7.1 and 7.2 only) of the book, entitled “Topics in Algebra” by I. N. Herstein 2nd Edition. Wiley Eastern Ltd., 1975.

Reference Books:

1. "Basic Algebra" by Jacobson Vol. I & II Hindustan Publishing Co., 1984.
2. "Basic Abstract Algebra" by P B Bhattacharya, S K Jain, S R Nagpaul, 2nd Edition, Cambridge University Press, 1995.
3. "Algebra", by Lang S, Addison – Wesley, Reading, Mass, 1965.
4. "Algebra", by Artin M, Prentice Hall, Englewood Cliffs N J, 1991.
5. "Abstract Algebra" by David S. Dummit and Richard M – Foote, Prentice Hall, Englewood.
6. "University Algebra" by Vijay Krishnan.
7. "A first course in Abstract Algebra" by John Fraleigh, Nawsa Publishing 3rd Edition House.
8. A textbook of Modern Abstract Algebra" by Shantinaryan & Satpal, S. Chane & Company.

(II) ELECTIVE DISCIPLINARY COURSES: (MTHE-1 TO 4)

All elective courses carry 4 credits in 4 Hours per week teaching and there are 4 Mathematical Elective Courses to be chosen from the lists of COURSEs of not more than Two groups: three groups are Group-A, Group-B, Group-C ,

1. Group-A : Pure Mathematical Group

1. **Differential Geometry**
2. **Techniques of Differential Equations**
3. **Number Theory**
4. **Algebraic Topology-I : Homotopy Theory**
5. **Algebraic Topology-II : Homology And Cohomology Theory**
6. **Functions of Several Variable**
7. **Differentiable Manifolds**

(**β**) LIST OF COURSES FOR GROUP-A

[MTHE A-1] DIFFERENTIAL GEOMETRY

Unit 1 Velocity vector and tangent vector field, reparametrization, curvature, the Serret – Frenet apparatus and Serret – Frenet theorem.

Unit 2 The fundamental existence and uniqueness theorem for curves, non–unit speed curves. C^k coordinate patch, C^k coordinate transformation, tangent vectors to a simple surface, C^k surface in $\mathbf{R}^3$,

Unit 3 Metric coefficients, The first fundamental form and arc length, normal curvature, geodesic curvature and Gauss's formulas, second fundamental form and the Christoffel symbols,

Unit 4 Geodesics, generalizations of the properties of the straight lines to curves on surfaces. Parallel vector fields along a curve and parallelism, the second fundamental form and the Weingarten map, principal, Gaussian, mean and normal curvatures,

Note: The course is roughly covered by the book, entitled,
"Elements of Differential Geometry" by R. S. Millman and G. D. Parker, Prentice Hall, 1977.

Reference Books:

1."Elementary Differential Geometry" by B. O'Neill, Academic Press,1966
2. "Introduction to Differential Geometry" by A. Goetz, Addison – Wesley, 1970.
3. "Differential Geometry of Curves and Surfaces" by M. Do Carma, Prentice Hall, 1976.
4. "Differential Geometry" by J. Stocker, New York, Inter Science, 1969.
5. "Introduction to Differentiable Manifolds and Reimannian Geoemetry" by W. Boothby, Academic Press, .
6. "Notes on Differential Geometry" by N. Hicks, Van Nostrand, 1965.

[MTHE A-2] TECHNIQUES OF DIFFERENTIAL EQUATIONS

Unit 1 Simultaneous ordinary differential equations of first order and first degree, pfaffian method, total differential equations, partial differential equations of the first order.

Unit 2 Cauchy's Problem (Only Statement), Geometrical interpretation, linear equations, nonlinear equations,

Charpit's method, Jacobi's method.

Unit 3 Equation of second order, linear equations with constant and variable coefficients , the three canonical forms, method of separation of variables, Monge's method for Rr + Ss +Tt = V.

Unit 4 Laplace's Equations: Elementary solutions boundary value problems, separation of variables, solution with axial symmetry, the two dimensional equation.Wave Equations: One dimensional equation, three dimensional problems, general solutions of Kirchoff, diffusion equation, boundary value problems, elementary solutions, separation of variables.

The Syllabus is roughly covered by:

I. N. Snedden "Elements of Partial Differential Equations" (McGraw – Hill). Chapter – 1 (Omit 4, 7, 8), Chapter – 2 (Omit 8) Chapter – 3 (Omit 6, 7, 10), Chapter – 4 (Omit 7,8,9,10,13), Chapter – 5 (Omit 3,4,7,8,9,10), Chapter – 6 (Omit 5,6,7).

Reference Books

1. M D Raisinghania, Ordinary and Partial Differential Equations, S Chand & Co.
2. Gerald B Folland, Introduction to Partial Differential Equations, 2nd edition, Prentice-Hall of India.(2001)

[MTHE A-3] NUMBER THEORY

Unit 1 Divisibility, G.C.D., Primes, the fundamental theorem of arithmetic, the Euclidean algorithm, The greatest integer function, the Mobius function μ, the Euler function Φ, the divisor functions σ_k for $k \geq 0$ integer, properties of these functions, multiplicative functions, Mobius inversion formula.

Unit 2 Congruence, complete residue systems, Linear Congruence, reduced residue systems, Euler–Fermat theorem, the Chinese remainder theorem, The exponents of a number mod *m*, primitive roots.

Unit 3 Quadratic residues, Legendre Symbol and its properties, Gauss' Lemma, the quadratic reciprocity law, the Jacobi Symbol.

Unit 4 Diophantine Equations ax + by = c and its positive solutions, the equation $X^2 + Y^2 = Z^2$, the equation $X^4 + Y^4 = Z^2$ and the equation $X^4 + Y^4 = Z^4$, sum of squares, the Fermat's Last theorem.

Note: The course is roughly covered by the book, entitled "Elementary Number Theory", 2nd edition, by David M. Burton (Wm. C. Brown Publishers, 1989).

Reference Books:

1. I. Niven and H. Zukerman "An introduction to the theory of Numbers" 3rd edition, Wiley Eastern University Edition, New Delhi, 1985.
2. T. M. Apostol, "Introduction to Analytic Number Theorem", Springer studt edition, 1995.
3. Baker Alan, "A concise Introduction to the theory of Numbers", Cambridge, University, press, 1984.
4. Rose H. E., "A course in number theory", Oxford University Press, 1988.
5. Shapiro, Harold, "Introduction to the theory of Numbers", John Wiley and Sons, 1983.
6. Hardy, G. H. and E. M. Wright "An Introduction to the theory of Numbers", 5th edition, Oxford University Press, 1975.
7. T. Nagell "Introduction to Number Theory", 2nd edition, chelsea, 1984.

[MTHE A-4] ALGEBRAIC TOPOLOGY-I : HOMOTOPY THEORY

Unit I Homotopy theory: Homotopy of paths and loops , Product of two loops, Fundamental group, homomorphism induced by homotopy, retraction.

Unit II Covering spaces ,The fundamental groups of the circle , Lifting of a path, Path lifting theorem, Lifting correspondence, generator and order, Retractions and fixed points, no retraction theorem, Brouwer fixed-point theorem.

Unit III The fundamental theorem of algebra,The Borsuk-Ulam theorem, Deformation retracts and homotopy type, first fundamental group of doubly punctured plane and theta-space, homotoy equivalence, the fundamental group of the punctured plane, the n-sphere S^n .

Unit IV Fundamental group of some surfaces: figure eight, tourus and double torus, projective plane, The Jordan Separation Theorem and Nulhomotopy lemma for S^2.

Note: The course of unit-I to IV is roughly covered by the book, entitled: "Topology" by James R Munkres, second edition-Pearson education, 2004.

Reference Books:

1. Elements of Algebraic Topology" by James R. Munkres Addison – Wesley Pub. Co., 1984.

2. "Basic Concepts of Algebraic Topology" by Fred H. Croom Springer, Verlag, 1978.
3. "Algebraic Topology: An Introduction" by W. S. Massey Springer Verlag, 1977.
4. "Homology Theory" by S. T. Hu, Holden–Day, Inc. San Francisco, 1966.
5. Algebraic Topology" by C. R. F. Maunder Van Nostrand Reinhold Co., 1970.
6. "Algebraic Topology" by E.H. Spanier, McGraw – Hill Book Co., 1966.
7. "Aspects of Topology" by Charles O. Christenson and William L. Voxman, Marcel Dekker Inc.,
8. "Algebraic Topology: An Introduction" by W. S. Massey Harcourt Brace Jovanovich, 1967.
9. "Algebraic Topology" by E. H. Spanier, McGraw-Hill Book Co. 1966.

[MTHE A-5] ALGEBRAIC TOPOLOGY-II : HOMOLOGY AND COHOMOLOGY THEORY

Unit 1 Simplicial Homology Groups: Geometric complexes and polyhedra, orientation of complexes, Homology, groups, The structure of Homology groups.

Unit II The Euler–Poincare theorem, the computability of homology groups, pseudomanifolds and the Homology groups of S^n.

Unit III Simplicial Approximation and the Topological Invariance of the Homology Groups: Simplicial approximation, Barycentric subdivision, Simplicial approximation theorem, Induced homomorphisms on the homology groups.

Unit IV Topological invariance of the homology groups, the Brouwer fixed–point theorem and the related results, Developments in the Cohomology Theory: The Lefschtz fixed–point theorem, Relative homology and Exact homology.

Note: The course is roughly covered by the book, entitled. "Elements of Algebraic Topology" by James R. Munkres Addison – Wesley Publishing Co., 1984.

Reference Books:

1. "Basic Concepts of Algebraic Topology" by Fred H. Croom , Springer Verlag, 1978.
2. "Algebraic Topology: An Introduction" by W. S. Massey Springer Verlag, 1977.
3. "Homology Theory" by S. T. Hu, Holden–Day, Inc. San Francisco, 1966.
4. "Algebraic Topology" by C. R. F. Maunder Van Nostrand Reinhold Co., 1970.
5. "Algebraic Topology" by E.H. Spanier, McGraw – Hill Book Co., 1966.

[MTHE A-6] FUNCTIONS OF SEVERAL VARIABLES

Unit 1 **Mappings and their Differentials:** Continuous mapping, definition of a differential, differentiability implies continuity, special cases, functions of class **C**, mapping of Class C, compositions of differentiable mappings, higher differentials.

Unit 2 **Mapping into the Reals:** Taylor's theorem for one variable and for *n*-variables, absolute maxima and minima, location of maxima and minima.

Unit 3 Volume of a set, integral on a closed interval, condition for integrability, integral on an open set, iterated integral, volume of n–ball, interchange of order of integration with differentiation.

Unit 4 **Main theorems on Mappings:** Regular elements in L(E.F), inverse of a mapping, implicit function theorem, determinant, oriented volume, change of variables in integration, length and area.

Note: The course is covered by "Calculus of Several Variables" - by Casper Goffman, Jointly Pub: Harper & Row, New York and John Weatherhill, Inc., Tokyo, 1965.

Reference Books:

(1) "Calculus on Manifolds" – by M. Spivak.
(2) "Functions of Several Variables" – by W. H. Fleming, Addison Wesley Pub. Co.
(3) "Advanced Calculus" – by H. K. Nikerson, D. C. Spencer and N. E. Steenrod, Affiliated East and West Pvt. Ltd., New Delhi.
(4) "Calculus of Several Variables" – by S. Lang.

[MTHE A-7] DIFFERENTIABLE MANIFOLDS

Unit 1 **Introduction to Manifolds:** Topological manifolds, Cutting and Pasting, Abstract Manifolds and examples. **Functions of Several Variables and mappings: D**ifferentiability for functions of several variables.

Unit 2 **D**ifferentiability of mapping and Jacobians, The space of tangent vectors at a point of $\mathbf{R}^n$, another definition of $T_n(R^n)$, Vector fields on open subsets of $\mathbf{R}^n$.

Unit 3 The inverse function theorem. The rank of a mapping, Differentiable manifolds and submanifolds: Differentiable manifolds and examples, Differentiable functions and mappings.

Unit 4 Rank of a mapping, Immersions, Submanifolds , Lie Groups, the action of a lie group on a manifold.

Note: The syllabus is roughly indicated by "An Introduction to Differentiable Manifolds and Riemannian Geometry" William, M. Boothby, Academic press Chap. 1 to 3.

Reference Books:

1. "Introductions to Differentiable Manifolds" – Serge Lang, Interscience publishers.
2. "Differentiable Manifolds" – Matsushima, Marcel Dekker, Inc.
3. "Calculus on Manifolds" – M. Spivak, Benjamin.
4. "Differentiable Manifolds" – S. T. Hu. Holt, Rienhart and Winston, Inc.

2. Group-B : Applied Mathematical Group

1. **Classical Mechanics-I**
2. **Classical Mechanics-II**
3. **Electrodynamics-I**
4. **Electrodynamics-I**
5. **Theory of Relativity**
6. **Relativity and Cosmology**

(γ) LIST OF COURSES FOR GROUP-B

[MTHE B-1] CLASSICAL MECHANICS-I

Unit I Generalized co-ordinates, holonormic, non–holonormic, rheonomous and scleronomous constraints, derivation of Largrange's equations from D'Alembert's principle.

Unit II **V**elocity dependent potentials (electromagnetic case to be omitted); Rayeigh's dissipation function and applications, Hamilton's principle and derivation of Largrange's equations from Hamilton's principle.

Unit III Extensions of Hamilton's principle to non–conservative and non–holonomic dynamical systems.

Unit IV **C**yclic coordinates and Routa's properties, applications of LaGrange's formalism to two–body problem.

Note: The course is roughly covered by the book "Classical Mechanics' by H. Goldstein (2nd Edition), Narosa Publishing House, 1985.

Reference Books:

1. H. C. Corhen and P. Stechle: "Classical Mechanics", Wiley, New York, 1950.
2. J. B. Griffith: "The theory of Classical Dynamics", Cambridge Uni., Press, 1985.
3. L. D. Landan and E. M. Lifshiftz: "Mechanics", Pergenion Press, 1969.

[MTHE B-2] CLASSICAL MECHANICS-II

Unit I Derivation of Hamilton's canonical equations of motion from both differential and integral principles; canonical transformations and the four types of generating functions.

Unit II Poisson's brackets as canonical invariants, Hamilton's canonical equations in Poisson bracket notation and conservation theorems, the Hamilton's – Jacobi equation and it's solution.

Unit III The number of independent coordinates of a rigid body; Eulerian angles, rate of change of a vector and coriolis force. angular momentum and kinetic energy of a body about a point.

Unit IV inertia tensor and the moment of inertia, Euler's equations of motion for rigid body and their solution for torque free motion; motion of a heavy symmetrical top with one point fixed.

Note: The course is roughly covered by the book "Classical Mechanics' by H. Goldstein (2nd Edition), Narosa Publishing House, 1985.

Reference Books:

1 H. C. Corhen and P. Stechle: "Classical Mechanics", Wiley, New York, 1950.
2 J. B. Griffith: "The theory of Classical Dynamics", Cambridge Uni., Press, 1985.
3 L. D. Landan and E. M. Lifshiftz: "Mechanics", Pergenion Press, 1969.

[MTHE B-3] ELECTRODYNAMICS-I

Unit 1 Introduction to Electrostatics: Coulomb's Law, Gauss's Law, equations of electrostatics.

Unit II Green's theorem, electrostatic potential energy and energy density.

Unit III Boundary Value Problems in Electrostatics: Method of images, some illustrations of the method of images, boundary value problems with azimuthal symmetry.

Unit IV Electrostatics of Marocoscopic Media, Dielectrics: Elementary treatment of electrostatics with ponderable media, boundary value problems with dielectrics, electrostatic energy in dielectric media.

Note: The course is roughly covered by "Classical Electrodynamics" by J. D. Jackson, Wiley Eastern Ltd., 2nd Edition, 1978.

Reference Books:

(1) "Introduction to Electrodynamics" by David J. Griffith, Prentice Hall of India, 2nd Edition.

(2) "Classical Electrodynamics" by Wajedmiah

[MTHE B-4] ELECTRODYNAMICS-II

Unit I Magnetostatics: Biot and Savart Law, differential equations of magnetostatics. Ampere's law, magnetic fields, magnetic moment, macroscopic equations, boundary value problems in magnetostatics, time–varying fields, Maxwell's equations.

Unit II Faraday's law, energy in magnetic field, displacement current and Maxwell's equations, vector and scalar potentials, equations of macroscopic electromagnetism, Poynting theorem.

Unit III Special Theory of Relativity and Electromagnetic Fields: Einstein's two postulates, Lorentz transformations and basic kinematic results of special relativity, four-velocity, mathematical properties of space – time of special relativity.

UNIT IV Transformations of electromagnetic fields, the question of obtaining the magnetic field, magnetic force and Maxwell's equations from Coulomb's law and Special Relativity, Lagrangian for electromagnetic field, canonical and symmetric stress tensors and conservation laws, solution of the wave equation in covariant form.

Note: The course is roughly covered by of the book, entitled,"Classical Electrodynamics" by J. D. Jackson, Wiley Eastern Ltd., 2nd Edition, 1978.

Reference Books:

(1) "Introduction to Electrodynamics" by David J. Griffith, Prentice Hall of India, 2nd Edition.

(2) "Classical Electrodynamics" by Wajedmiah

[MTHE B-5] THEORY OF RELATIVITY

Unit 1 Space – Time Curvature: Geodesics, geodesic deviation, parallel transport along an extended curve, curvature tensor, the Ricci tensor, scalar curvature and Einstein tensor.

Unit II Space – Time symmetries, displacement of space–time, some properties of killing vectors, homogeneity and isotropy space – time of constant curvature, symmetric subspaces.

Unit III Energy Momentum Tensors, the action principle, the electromagnetic theory, Energy momentum tensors (general), conservation laws.

Unit IV Einstein Equations of Gravitation: Accelerated observers in Minkowski space–time, Einstein's equations: a heuristic derivation, Einstein's equations from an action principle, the Newtonian approximation, the principle of equivalence, gravitational waves.

Note: The course is roughly covered by the book, entitled "Lectures on General Relativity and Cosmology" by J. V. Narlikar, The Macmillan Company of India, N.Delhi, 1978.

Reference Books:

1. "A Papapetron Lectures on General Relativity", D. Reidel, Dordrecht, The Netherlands, 1974.
2. R. Alder, M – Bazine and M. Schiffer, "Introduction to General Relativity", McGraw Hill – Kogakusha,Tokyo, 1975.

[MTHE B-6] RELATIVITY AND COSMOLOGY

Unit I The Schwarzschild Solution: The spherically symmetric space–time, field equations, the Schwarzschild solution, particle orbits in Schwarzschild space–time, photon orbits.

Unit II Experimental Tests of General Relativity, the gravitational red–shift, planetary motion, the bending of light, the Radar echodelay.

Strong Gravitational Fields (I): Equilibrium of massive spherical objects, binding energy, gravitational Collapse of a dust ball.

Unit III Strong Gravitational Fields (II): The external Schwarzschild solution, The Kruskal – Szekers diagram, The Kerz – Newman solution.

Unit IV The Friedmean Models: The cosmological field equations, the dust models, Radiation models, cosmologies with a non–zero Λ.

Cosmology: The observational background the cosmological postulates, observable parameters in Robertson–Walker models.

Note: The course is roughly covered by the book, entitled "Lectures on General Relativity and Cosmology" by J. V. Narlikar, The Macmillan Company of India, N Delhi, 1978.

Reference Books:

1 "A Papapetron Lectures on General Relativity", D. Reidel, Dordrecht, The Netherlands, 1974.
2 R. Alder, M – Bazine and M. Schiffer, "Introduction to General Relativity", McGraw Hill – Kogakusha, Tokyo, 1975.

3. Group – C: Applicable Mathematics Group

1. Mathematical Modelling
2. Mathematical Logic
3. Introduction To Artificial Intelligence
4. Operations Research
5. Advanced Operations Research
6. Statistical Methods

7. Mathematics Of Finance And Insurance
8. Computational Biology
9. Fuzzy Sets And Their Applications
10. BIO-MECHANICS
11. MATHEMATICS OF MONEY

(δ) LIST OF COURSES FOR GROUP-C

[MTHE C-1] MATHEMATICAL MODELLING

Unit 1 Introduction to the subject, its scope and limitation, classification of models. Dimensional Homogeneity, Technique of dimensional analysis, an arithmetic model of Gravity, Simple population growth model, Logistic population growth model, Geometric interpretation of logistic growth function.

Unit 2 Two Species Population Models: Prey–Predator models for population dynamics, Geometric interpretation and stability of Prey-Predator model, competition model, Epidemic Models, Simple deterministic model, SIS Model, Epidemic Models with constant number of carriers, Epidemic model with removal.

Unit 3 Diffusion and Glucose in the Blood stream, Model for diabetes Mellitus, Genetics Models: Hardy-Weinberg law model for genetics, Genetics model for Blood groups.

Unit 4 Traffic Models: Macroscopic Highway traffic model, continuum hypotheses and the fundamental diagram, linear-car-following models.

Note: The course is roughly covered by the following two books:

1. J. N. Kapur, *Mathematical Modeling*, Wiley Eastern Ltd., 1988.
2. J. N. Kapur, *Mathematical Models in Biology and Medicine*, East–West press Pvt. Ltd., 1992.

Reference Books:

1. Braum, Colemem & Drew, *Differential Equation Models*, Springer–Verlag, 1983.
2. Martin Braun, *Differential Equation and their applications*, Springer-Verlag, 1977.
3. Dym & Ivey, *Principles of Mathematics Modeling*, , Academic press – 1980.
4. Lucas & Roberts, *Discrete and system models*, Springer Verlag, 1983.
5. Haberman, *Mathematical Model*, Prentice–Hall Inc., 1977.

[MTHE C-2] MATHEMATICAL LOGIC

Unit 1 PROPOSITIONAL LOGIC: Syntax: Atomic formulae; logical connectives: ¬ *and V*; formulae; defined logical connectives: *Λ,* ⇒, ⇔.Semantics: Truth valuation as a map ν from the set of all atomic formulae int {*T, F*}, Extension of ν to the set of all formulae, Truth table, Tautological consequences and Tautologies. Axioms and Rules of Inferences: Propositional Axioms; Extension, Contraction, Associative and cut rules; The notion of a proof and of a theorem of Propositional Logic.Tautological Equivalence and Conjunctive Normal Form of A Formula: Algorithm to find a conjunctive normal form of a formula.Post's Tautology Theorem (Completeness of Propositional Logic).

Unit 2 FIRST ORDER LOGIC: Sytax: Variables, propositional connectives: ¬ and V, Quantifier ∃, Equality symbol = ; Non–logical constant, function and predicate symbols; defined connective: ∀; Terms, Atomic formulae, formulae, subformulae of a formula, bound and free occurrence of a variable in a formula, closed formula, substitutability. Semantics: Structure of a first order language, The notion of truth of a formula in a structure (via name of each element of the universe). Axioms and Rules of Inferences: Logical axioms–propositional identity, equality and substitution axioms; Rules of inferences–Expansion, contraction, associative, cut and ∃-introduction rules; Non–logical axioms; Notion of a first order theory + some examples of first order theories. Models: The notion of a proof and theorem of first order theory, Model of a first order theories; validity (or soundness) Theorem.

Unit 3THEOREMS IN FIRST ORDER THEORIES: autology Theorem for First Order Theories:
[and few simple applications, Induction on theorems]. Results on Quantifiers: ∀-introduction rule, Generalization and Substitution Rules, Substitution Theorem,Distribution Rule and Closure Theorem. The Deduction Theorem: Deduction Theoremand Theorem on constants. The Equivalence and Equality Theorems: EquivalenceTheorem, Variant Theorem, Symmetry and Equality Theorems. The Prenex NormalForm: Including the Algorithm to reduce a formula in prenex normal form.

Unit 4 THE COMPLEMENTS THEOREM:
Reduction Theorem for Consistency: Consistent theories, Reduction Theorem for consistency, conservative extension, Equivalent Theories, statement of completeness theorem. Complete Theories: Complete Theories, Henkin theories, Henkin Model of a complete Henking theory.

Reference Books:

1. Shoenfield – "Mathematical Logic", Addison Wesley.2. Change, C. L. and Lee, R. T. C. – "Symbolic Logic and Mechanical Theorem Proving", Academic Press.

[MTHE C-3] INTRODUCTION TO ARTIFICIAL INTELLIGENCE

Unit 1 PROOF OF COMPLETENESS THEOREM: Henkin Extension of a consistent theory, Lindenbaum's theorem, the proof of completeness theorem.
Extensions by Definitions and Interpretations: Proof of Completeness Theorem, Compactness Theorem

Unit 2 RECURSIVE FUNCTIONS:
Initial functions composition and minimization; Definition of recursive function, Examples of recursive function and predicates; Sequence Numbers, Godel's β-function, Closure under primitive recursion, Recursively Enumerable predicates, Characterization of recursive predicates as recursively enumerable predicate whose negation is also recursively enumerable.

Unit 3 AN INTRODUCTION TO ARTIFICIAL INTELLIGENCE:
Resolution Method for Propositional Logic: Atoms, Literals, clauses. Resolvant of two clauses; Refutation of a set of clauses; Tree of a set of clauses, failure nodes, closed subtrees of semantic tree, Inference mode; Equivalence of unsatisfiability of a set of clauses and its refutation.
Skolemization and Herbrand Universe: Skolem normal form, Algorithm to reduce a formula in Skolen normal form; Herbrand universe and Herbrand interpretations; A set *S* of clauses is satisfiable iff a Herbrand interpretation of *S* is sastisfiable; Herbrand base of a set of clauses, ground instance.

Unit 4 Herbrand theorem showing that if a set *S* of clause is unsatisfiable then there is a finite unsatisfiable set of ground instance of clauses of *S*.

The Resolution Principle for Predicate Calculus: Substitution and instances of expressions; Refutation of a set *S* of clauses; Resolution procedure.

The Unification Algorithm: A unifier of a set of expressions – most general unifier; the unification Algorithm; the unification theorem.

Reference Books:

1. Shoenfield – "Mathematical Logic", Addison Wesley.
2. Change, C. L. and Lee, R. T. C. – "Symbolic Logic and Mechanical Theorem Proving", Academic Press.

[MTHE C-4] OPERATIONS RESEARCH

UNIT – I Development – Definition– Characteristics and Phases – Types of models – operation Research models – applications. ALLOCATION: Linear programming Problem Formulation – Graphical solution – Simplex method –Artificial variables techniques - Big-M method – Duality Principle.

UNIT – II TRANSPORTATION PROBLEM: Formulation – Optimal solution, unbalanced transportation problem – Degeneracy – Maximization case. ASSIGNMENT PROBLEM: Formulation – Optimal solution – Variants of Assignment Problem.

UNIT – III THEORY OF GAMES: Introduction – Minimax (maximin) – Criterion and optimal strategy – Solution of games with saddle points – Rectangular games without saddle points – dominance principle – m X 2 & 2 X n games -graphical method.

UNIT – IV PROJECT MANAGEMENT (CPM & PERT): Network concepts components– rules for network construction – critical path method (CPM) – Project evaluation and Review Techniques (PERT) PRODUCTION SCHEDULING (JOB SEQUENCING): Introduction, Johnson's algorithm for n jobs 2 machines, Johnson's algorithm for N jobs m machines, 2 jobs m machines using graphical method.

Books:

1. J. K. Sharma, "Operations Research – Theory and Application", 4th Edition, Macmillan Publishers India Ltd.
2. N H Shah, Ravi Gor, Hardik Soni, "Operations Research", PHI

[MTHE C-5] ADVANCE OPERATIONS RESEARCH (OPTIMIZATION TECHNIQUES)

UNIT – I Introduction to optimization - Statement of an Optimization Problem - Classification of Optimization Problems - Optimization Techniques Advance topic in LPP: Introduction - Revised Simplex Method- Sensitivity or Post optimality Analysis- Karmarkar's Interior Method-Quadratic Programming

UNIT – II Classical Optimization Techniques - Single-Variable Optimization - Multivariable Optimization with No Constraints - Multivariable Optimization with Equality Constraints - Multivariable Optimization with Inequality Constraints

UNIT – III INTEGER PROGRAMMING: Integer Linear Programming - Gomory's Cutting Plane Method – Integer Nonlinear Programming - Branch-and-Bound Method - Sequential Linear Discrete Programming

UNIT – IV DYNAMIC PROGRAMMING: Introduction - Multistage Decision Processes - Concept of Sub optimization and Principle of Optimality - Computational Procedure in Dynamic Programming – Example Illustrating the Calculus Method of Solution, the Tabular Method of Solution – Conversion of a Final Value Problem into an Initial Value Problem

Books:

1. Singiresu S. Rao, "Engineering Optimization: Theory and Practice," 4th Edition, John Wiley & Sons, Inc.
2. Stephen Boyd and Lieven Vandenberghe, "Convex Optimization", CAMBRIDGE UNIVERSITY PRESS

[MTHE C-6] STATISTICAL METHODS

Unit-1: Descriptive Statistics and Correlation

- Introduction to Statistics
- Applications in Business & Economics; Data: Summarizing Qualitative & Quantitative Data

- Exploratory Data Analysis: The Stem-and-leaf Display; Cross Tabulation & Scatter Diagrams
- Measures of location: Mean, Median, Mode, Percentiles, Quartiles; Measures of Variability: Range, Inter-quartile Range, Variance, Standard Deviation, Coefficient of Variation
- Measures of Distribution Shape, Relative Location and Detecting Outliers
- Measures of Association Between Two Variables; Covariance, Correlation

Unit-2: Probability & Probability Distribution

- Probability: Basic probability concepts (Experiment, sample space, events, exclusive events, exhaustive events, independent events, dependent events), methods for assigning probability (Classical method, relative frequency method, subjective method), events and their probability, addition rule (not to be proved or derived), conditional probability, multiplication rule (not to be proved or derived), Bayes' theorem (statement only, not to be proved or derived)
- Probability distribution: Random variable, Discrete and continuous random variable, expected value and variance of random variable, Probability distribution, Binomial distribution, Poisson distribution, Hypergeometric distribution, Uniform distribution, Normal distribution, Normal approximation of Binomial, exponential distribution, relationship between Poisson and Exponential distribution
- Note: Discuss pmf/pdf, properties and applications of all distribution

Unit-3: Statistical Inference

- Sampling methods, sampling distribution, central limit theorem (statement only), point and interval estimation, sampling distribution of sample mean, sampling distribution of sample proportion, Hypothesis tests: Null & alternative hypothesis, Type I & II errors, one and two tailed test, rejection rule using p-value and critical value approach, test of hypothesis about population mean (σ known, σ unknown and small sample), test of hypothesis about population proportion, Sampling distribution and test of hypothesis about difference between two population means (known and unknown σ_1 and σ_2) , sampling distribution and test of hypothesis about difference between two population proportions, analysis of variance (1-way, two-way).

Unit-4: Regression

- Introduction to Regression; Simple linear Regression Model; least Square Method; Coefficient of Determination; Correlation Coefficient;
- Model Assumptions; Residual Analysis: Validating Model Assumptions; Outliers and Influential Observations
- Using the Estimated Regression Equation for Estimation & Prediction

Main Reference Book:

1. Anderson, Sweeney, Williams, "Statistics for business and economics", 9th edition, Cengage Publication
2. Glyn Davis & Branko Pecar, "Business statistics using Excel", OXFORD University press (Indian Edition).

[MTHE C-7] Probability and statistics

Unit-I Combinatorial probability and urn models , Conditional probability, independence, Discrete and continuous sample spaces , Random variables.

Unit-II Distributions and density functions, mean and measures, Moment generating functions - probability laws (binomial, geometric, negative binomial, hypergeometric,Poisson, uniform, exponential, gamma)

Unit-III Standard discrete distributions uniform, binomial, Poisson, geometric, hypergeometric , Independence of random variables, joint and conditional discrete distributions , Densities: normal, exponential, gamma, Chi-square, beta, Cauchy

Unit-IV Expectation and moments of continuous random variables , Transformation of univariate random variables, Tchebychev's inequality and weak law of large numbers , Inferential statistics, estimation of parameters by method of moments and maximum likelihood.

References:

1. Harold J. Larson: Introduction to Probability Theory and Statistical Inference. Wiley 1982.
2. V. K. Rohatgi: An Introduction to Probability Theory and Mathematical Statistics. John Wiley & Sons 1976.
3. John Freund: Introduction to Probability. Dover Publications.
4. Marylees Miller, John E. Freund, Irwin Miller: John E. Freund's Mathematical Statistics: With Applications.

Prentice Hall, 2003.
5. William Feller: Introduction to Probability Theory and Its Application (Vol 1 and vol. 2). Wiley.
6. G. R. Grimmett, David R. Stirzaker: Probability and Random Processes. Oxford University Press, 2001.

[MTHE C-8] Computational Biology

Unit -1 Basic concepts of Molecular biology, DNA and Proteins, The Central Dogma, Gene and Genome Sequences.
Unit - 2- Restriction Maps - Graphs, Interval graphs. Measuring Fragment sizes, Algorithms for double digest problem ,(DDP) - Algorithms and complexity, Approaches to DDP.
Unit 3- Integer programming, Partition Problems, Traveling Salesman Problem (TSP) simulated annealing Sequence.
Unit 4- Assembly - Sequencing strategies, Assembly in practices, fragment overlap statistics.

Text Books:-

1- Introduction to Computational Biology by M.S, Waterman Chapman & Hall, 1995.
2- Bio informatics - A practical Guide to the analysis of Genes and Proteins by A. Baxevanis and B. Ouelette, WileyInterscience (1998).

Reference Books:-

1- Introduction to Bio informatics by Attwood.
2- Bioinformatics-Sequence and Genome analysis by David W.Mount.

[MTHE C-9] FUZZY SETS AND THEIR APPLICATIONS

Unit-1: Basics of Fuzzy Theory

(1) **Fuzzy Set:** Definition of Fuzzy set and set theoretic operations, Alpha-set, Normality, Extension Principle, Triangular norms (t-norms) and triangular conorms (t-conorms).
(2) **Fuzzy numbers and fuzzy arithmetic:** Interval arithmetic, Fuzzy numbers and their representation, Arithmetic of fuzzy numbers, Special types of fuzzy numbers and their arithmetic, Ranking of fuzzy numbers

Unit-2:

(1) **Classical relation and fuzzy relation:** Crisp relations, fuzzy relations, Tolerance and equivalence relations, fuzzy tolerance and equivalence relation.
(2) **Properties of Membership Functions, Fuzzification and Defuzzification:** Features of membership functions, fuzzification, defuzzification to crisp sets, lambda-cuts for fuzzy relations, defuzzification to scalars

Unit-3: Logic and Fuzzy System

Logic: Classical logic, Predicate Logic, Fuzzy Logic, Fuzzy Rule Based System
(1) **Development of Membership Functions:** Membership value assignments by intuition, inference, rank ordering, inductive reasoning
(2) **Automated Methods for Fuzzy Systems:** Definitions, Batch Least squares algorithm, recursive least squares algorithm, gradient method, clustering method, learning from example, modified learning from example
(3) **Rule-base Reduction Methods:** Fuzzy system theory and Rule Reduction, Singular Value Decomposition, Combs method.

Unit-4: Fuzzy Logic Control Systems

Introduction, Control System Design, Architecture and Operation of FLC System, FLC system models, Applications of FLC systems

Main Reference Book:

1. S.N. Sivanandam and S.N. Deepa, "Principles of Soft Computing", Wiley India (P) Ltd.
2. S. N. Sivanandam, S. Sumathi and S. N. Deepa, "Introduction to Fuzzy Logic using MATLAB", Springer.
3. Timothy J Ross, "Fuzzy Logic with Engineering Applications", John Wiley & Sons.
4. C. R. Bector and S. Chandra, "Fuzzy Mathematical Programming and Fuzzy Matrix Games", Springer.

[MTHE C-10] BIO-MECHANICS

Unit 1 Bio-physics of Human Cardio - vascular system: Types of Blood Vessels, Properties of Blood, Flow in Tubes, Poiseuibles law, Erythrocyte Sedimentation Rate , Stroke's law , Palatial flow in elastic vessels.

Unit 2- Bio - physics of Human Thermo- Regulation Head Flow in Human Dermal and Subdermal parts; Derivation of Governing partial differential equations Incorporating Microcirculation and perspiration.

Unit 3- Solution of steady state and Unsteady - state flow problems in one dimesion, application of finite element method and exact solutions.

Unit 4- Diffusion processes in biology ; diffusion in Tissue Fick's principle, One, two and three Dimensional diffusion problems and their solution, Water Transport, Diffusion through membranes.

Text books:

1- Introduction to Mathematical Biology by S.I. Rubinow, J. Wiley & Sons.
2- Biomechanics by Y.C, Fung, Springer - Verlag.
3- Introduction to Biomathematics by V.P. Saxena, Vishwa Prakashan (Wiley eastern)

Reference Book :-

1- Bio-fluid Dynamics by Mazumdar.

[MTHE C-11] MATHEMATICS OF MONEY

Unit-I The Simple Interest Theorem, Consesequenceis of the theorem, Financial Digression, Ambiguities when interest period is meseared in days, Number of days calulations, The Compound Interest Theorem, Consesequenceis of the theorem, The annual effective rate, time diagram and cash flows, interest rate of return (IRR), Financial Digression, The IRR uniquness theorem and its consequencies, the rule of 72,Inflation, The purchasing power theorem, consumer price index(CPI), personal taxes, the tax theorem.

Unit-II An ordinary annuity, the future value of an ordinary annuity theorem(OAT), consequences of OAT, the interest value of an OAT and its appications, An annuity due, the future value of an annuity due theorem(ADT), the present value of an ADT, perpetuities, loans and risks, examples of loans(bond, zero coupon bond, creditcard load)

Unit-III Amortization tables, the amortization theorem, periodic payments, the periodic payment theorem(PPT), consequencies of PPT, linear interpolations, credit cards payments, the credit card theorem and its appications, credit card numbers.

Unit-IV Bonds, noncallable bonds, the bond theorem, the price-yield theorem, accrued interest, duration, modified duration, convexity, portfolio, buying and selling stocks, the dollar cost averaging theorem, the long sale maintence level theorem, the short sale maintencence level theorem and its examples.

Books: Course covered by the book: An Introduction to the Mathematics of Money:Savings and Investing, David,Mendel and Wright,Springer,2000.

Reference books:

1. Investments, Bodie,Kane and Marcus, McGraw Hill, 2005, 6th ed.
2. Black-Scholes and Beyond:Option Pricing Models, McGraw Hill, 1997.
3. The Banker's Secret, Eisenson, Villard Books, New York, 1990.
4. The Handbook of Fixed Income Securities, Fabozzi and Mann, McGraw Hill, NY(2005), 7th ed.
5. Options, Futures and Other Derivatives, Hull, Prentice Hall,Upper Saddle River,New Jersey,2006,6th ed.
6. Interest Rate Modelling, Jemes and Webber, John Wiley and sons, NY,2000.
7. Investment Science, Luenberger, Oxford Uni. Press,NY,1997.

(III) Choice Based Optional Courses: CB_Group (MCB- 1 to 3)

All Choice based(disciplinary as well as inter-disciplinary) courses carry 2 credits in 2 hours per week teaching and there are 3 COURSEs to be chosen from the list of CB_Group.

1. Special Functions
2. Advanced Linear Algebra
3. Research Methodology
4. Fuzzy sets, Fuzzy Logic and Fuzzy Control System
5. Integral Transforms
6. Mathematics Of Finance And Insurance
7. Industrial Mathematics

(μ) LIST OF COURSES FOR MCB GROUP

[MCB-1] SPECIAL FUNCTIONS

Unit 1: Power series solutions, Gauss's Hypergeometric function.

Unit 2 Hermite Polynomials., Chebyshev Polynomials.

Unit 3: Legendre Polynomials.

Unit 4: Bessel Functions.

The Syllabus is roughly indicated by George F. Simmons: "Differential equations with applications and historical notes". Tata McGraw-Hill, Publishing Co. Ltd., New Delhi, 1974.

Reference Books:

1. An Introduction to Ordinary Differential Equations – E. A. Coddington, Prentice-Hall of India Private Ltd., New Delhi, 2001 .
2. Elementary Differential Equations (3rd Edition) – W. T. Martain and E. Relssner, Addison Wesley Publishing Company, inc., 1995.
3. Theory of Ordinary Differential Equations – E. A. Codington and N. Levinson, Tata McGraw hill Publishing co. Ltd. New Delhi, 1999.

[MCB-2] ADVANCED LINEAR ALGEBRA

Revision: Vector spaces, subspaces, bases and dimensions, dual spaces, linear transformations.

Unit-1 The algebra of linear transformations, characteristic roots, matrices.

Unit-2 Triangular canonical forms, nilpotent linear transformations.

Unit-3 Trace and transpose, a decomposition theorem, Jordan canonical forms,

Unit-4 Rational canonical forms., Determinants.

The course is roughly covered by the book entitled "Topics in Algebra", 2nd edition, by I N Herstein, John Wiley & Sons, Student Edition, New York. (2004)

References:

1. Kenneth Hoffman, Ray Kunze, Linear Algebra, 2nd edition, Prentice Hall of India, New Delhi. (1971)
2. P.B. Bhattacharya, Phani Bhushan Bhattacharya, S. K Jain, S. R. Nagpaul , First course in linear algebra, , New Age International Ltd Publishers, New Delhi. (2008)
3. Steven Roman, Advanced linear algebra, 3rd edition, Springer. (2008)

[MCB-3] RESEARCH METHODOLOGY

Unit 1 What is research? Science and research, Basic and applied research, Essential steps in research. Characteristic of scientific research. Research and experimental design.

Unit 2 Statistics: Definition and scope, data collection, classification, tabulation of data and its graphical and diagrammatic presentation. Measures of central tendency, dispersion and standard error, Probability, distributions, binomial, Poisson and normal distribution.

Unit 3 Statistical significance: Hypothesis testing, types of error, level of significance, various test and Chi-square goodness of fit, Simple linear regression and correlation analysis.

Unit 4 Scientific Writing , Research Proposal, Research Paper, Review Paper, Thesis, Conference Report, Book Review and Project Report (any two), Reference Writing, Scientific Abbreviations. Preparation and Delivery of Scientific Presentations, Research Report / Thesis Formatting and Typing (Computing),Title page, Certificate, Declaration, Acknowledgement, List of Table, Figures, Abbreviations and Symbols, Chapters Quotations, Table, Figures, Summary, Appendices, References etc.

References

1 How to write and publish a scientific paper by Day, R.A.
2 Guide to write scientific papers by Garson, G.D.
3 Developing Bioinformatics computer skill by Gibas.
4 Instrumental methods of analysis by D.A. Skoog

[MCB-4] FUZZY SETS, FUZZY LOGIC AND FUZZY CONTROL SYSTEM

Unit-1: Fuzzy Set Theory

Fuzzy versus Crisp, Crisp Sets, Fuzzy Sets, Crisp Relations, Fuzzy Relations

Unit-2: Fuzzy Systems

Crisp Logic, Predicate Logic, Fuzzy Logic, Fuzzy Rule Based System, Defuzzification Methods, Applications

Unit-3: Fuzzy Logic Control Systems

Introduction, Control System Design, Architecture and Operation of FLC System

Unit-4: FLC system models, Applications of FLC systems

Main Reference Book:

1. S.N. Sivanandam and S.N. Deepa, "Principles of Soft Computing", Wiley India (P) Ltd.
2. S. N. Sivanandam, S. Sumathi and S. N. Deepa, "Introduction to Fuzzy Logic using MATLAB", Springer.
3. Timothy J Ross, "Fuzzy Logic with Engineering Applications", John Wiley & Sons.

[MCB-5] INTEGRAL TRANSFORMS

Unit 1 Laplace transform- Definition and its properties. Rules of manipulation. Laplace transform of derivatives and integrals.

Unit 2 Properties of inverse Laplace transform. Convolution theorem. Complex inversion formula.

Unit 3 Fourier transform - Definition and properties of Fourier sine, cosine and complex transforms.

Unit 4 Convolution theorem. Inversion theorems. Fourier transform of derivatives.Mellin transform-Definition and elementary properties. Mellin transforms of derivatives and integrals. Inversion theorem. Convolution theorem.

List of books:

- The Fourier Transforms and its applications, by Ronald Bracewell
- Schaum's outline of Fourier analysis with applications to Boundary value problems, by Murray Spiegel
- The Laplace Transform: Theory and applications, by Joel L. Schiff
- Schaum's outline of Laplace Transforms, by Murray Spiegel
-

[MCB-6] MATHEMATICS OF FINANCE AND INSURANCE

Unit-1 Elements of Theory of Interest
Unit-2 Flow Valuation Annuities
Unit-3 Amortization and Sinking Funds, brief review of probability theory.
Unit-4 Survival Distributions , Life Tables, Valuing Contingent Payment Life insurance,

Text Books:

1 Options, Futures and other Drivatives by Jhon C. Hull Prentice –Hall of India Pvt. Ltd.
2 An introduction to Mathematic Finance by Cheldon M. Ross, Cambridge University Press

Reference Books:

1 An Introduction to Mathematics of Financial Derivatives by Salih N.Neftci, Academic Press.
2 Mathematics of Financial markets by Ribert J. Elliot & P.E. Kopp Springer Verlag, New York.

[MCB-7] INDUSTRIAL MATHEMATICS

Unit 1 Application to problems of industry with Partial differential equations and techniques of solution. Finite difference methods for solving PDE,

Unit 2 Linear Programming problems. Computational procedure of Simplex method, Two-phase Simplex method, Big-M-method, Revised Simplex method, Duality in linear programming, Duality and Simplex method.

Unit 3 Application to problems of industry with Assignment models. Mathematical formulation, Hungarian method. Travelling Salesman problem. Transportation models. Mathematical formulation. Initial basic feasible solution. Degeneracy and unbalanced transportation problems

Unit 4 Inventory Models. EOQ models with and without shortages. EOQ models with constraints. Replacement and Reliability models.

List of Books:

1. Nonlinear Ordinary Differential Equations : An Introduction For Scientist And Engineers, Jordan D. W. , Oxford University Press
2. Textbook Of Ordinary Differential Equations, Mondal C.R., Prentice Hall Of India Pvt. Ltd.
3. Elements Of Partial Differential Equations, Sneddon I N, Tata Macgraw Hill
4. Advanced Partial Differential Equations : With Boundary Value Problems, Pundir Sudhir K., Tata Macgraw Hill
5. Partial Differential Equations, Evans Lawrence, American Mathematical Society
6. Operations Research : Methods And Applications, Sharma J. K, Macmillan Press Ltd.
7. Operations Research : Problems And Solutions, Sharma J. K, Macmillan Press Ltd.
8. Optimization Methods In Operations Research And Systems Analysis, Mittal K. V., New Age International Pvt Ltd

(IV) Soft Skill Based Courses : SB_Group (SSB-1 to 4)

All Soft-skill based courses carry 2 credits in 2 hours per week teaching and 4 hours for practical. There are total 4 Courses to be chosen from the list of SSB_Group.

1 Introduction to Computer C Language
2 Programming in C and applications (practical)
3 Object oriented computer C++ language
4 Programming in C++ and applications (practical)
5 Introduction to MATLAB
6 Programming in MATLAB (practical)
7 Introduction to Computer Graphics
8 Programming in Computer Graphics(practical)

(σ) LIST OF COURSES FOR SSB GROUP

[SSB-1] INTRODUCTION TO COMPUTER "C" LANGUAGE

Unit 1 Constants, variables and data types, operators and expressions, managing input and output operators

Unit 2 Conditional statements, Decision making and branching , Decision making and looping.

Unit 3 Defining and manipulating Arrays, Logical expression and more control statements, handling of character strings

Unit 4 User-defined functions , Some mathematical C- programs.

The course is roughly covered by the book, entitled "Programming in ANSI C" by E. Balagurusamy, The McGraw-Hill Pub. Co. Ltd., 1992.

Reference Books:

1. **C**omputer programming in C, V Rajaraman, PHI-2002

2 "The C Programming Language" by B. W. Kernighan and B. M. Ritchie. Prentice-Hall, 1977.

3 "The C Primer" by L. Hancock and M. Krieger, McGraw-Hill, 1987.

[SSB-2] PROGRAMMING IN 'C' AND APPLICATIONS (PRACTICAL)

The following programs are to be practised:

1. Largest among the numbers, Sum of individual digits of a given number
2. Reverse order of a given number, evaluations of operators,

3 . Determination of roots of quadratic equations, $Ax^2+Bx+C=0$,

4 . Arranging given set of numbers in increasing/decreasing order, calculation of Mean.

5 . Evaluation of sum of power series eg. e^x, sin x, cos x, log (1 + x).

6. Calculation of GCD/LCM of two integers, sum of given numbers, Fibonacci numbers

7. Evaluation of factorial of a positive integer and evaluation of binomial coefficients.

8. Evaluation of Prime and Armstrong numbers, Generation of twin primes, automorphic numbers

9. Addition, subtraction and multiplication of matrices, Transpose, determinant…etc

10 Writing a given number in words using function, Arranging a set of names in alphabetical order.

11. Operations with strings and sorting. ….etc

Reference Books:

1. "Programming in ANSI C" by E. Balagurusamy, The McGraw-Hill Pub. Co. Ltd., 1992.

2 **"C**omputer programming in C", V Rajaraman, PHI-2002

3 "The C Programming Language" by B. W. Kernighan and B. M. Ritchie. Prentice-Hall, 1977.

4 "The C Primer" by L. Hancock and M. Krieger, McGraw-Hill, 1987.

[SSB-3] COMPUTER GRAPHICS

Unit 1 Introduction to Computer Graphics and 2-D computer graphics-line, introduction, DBplay devices, DBplay-File interpreter, structure and algorithms, DBplay control, frame butter, normalized device coordinates.

Unit 2 Two- Dimensional Graphics: 2-D geometry, line generation, antialiasing of lines, character generation.

Unit 3 Polygons, transformations, segments, windowing, clipping and iteration.
Basics of Polygons, polygon filling, scaling and rotation transformations, segment creation, closing and deleting segments, concepts of window and view-port, viewing transformation, line and polygon clipping, intersection.

Unit 4 Three dimensional graphics, 3-D geometry, primitive transformations, rotation and scaling, parallel and perspective projection, viewing parameter, clipping in three dimensions, 3-D viewing transformations.

Reference Books:

1. "Computer Graphics' (2nd Ed.) by Steven Harington McGraw-Hill ,International Edition, 1988.
2. "Computer Graphics" by Plastock and Kelley, McGraw-Hill, 1986.

[SSB-4] PROGRAMMING IN COMPUTER GRAPHICS (PRACTICAL)

The students are expected to write and run the computer programs on the following topics:

1. Implication of line and circle algorithm
2. Modification in line algorithm to generate dashech line.
3. Character-display.
4. Polygon filling.
5. Transformation of objects.
6. Use of segments in forming pictures from given objects.
7. Zooming the portion of windows and display in view ports.
8. Line clipping and polygon clipping.
9. Displaying 3-D objects on 2-D surfaces.

Reference Books:

1 "Computer Graphics' (2nd Ed.) by Steven Harington McGraw-Hill ,International Edition, 1988.
2 "Computer Graphics" by Plastock and Kelley, McGraw-Hill, 1986.

[SSB-5] OBJECT ORIENTED "C" LANGUAGE

Unit 1 Array-declaration/initialization, array structure, Classes-objects, array as class members data, array of objects, string as a class members, user defined string type.

Unit 2 **F**unction-declaration/initialization, variables and storage classes, calling function, passing arguments (constants, variables, array , structure variables, objects) to function, passing arguments (simple data type, structure variables, objects) by reference.

Unit 3 processing character strings, character data type, manipulating of characters, string processing , input and output of strings, enumerated data type and stacks.

Unit 4 Structures, use of structure in arrays and arrays in structures, Pointer data type and its applications, pointers and functions , file management in C, Developing a C program.

Reference Books:

1 "The C Programming Language" by B. W. Kernighan and B. M. Ritchie. Prentice-Hall, 1977.
2 Computer programming in C, V Rajaraman, PHI-2002
3 "Programming in ANSI C" by E. Balagurusamy, The McGraw-Hill Pub. Co. Ltd., 1992.
4 "The C Primer" by L. Hancock and M. Krieger, McGraw-Hill, 1987.
5 Mahpatra P B, Thinking in C:Including Object Oriented Programming with C, Wheeler Pub.

[SSB-6] PROGRAMMING IN OBJECT ORIENTED "C" AND APPLICATIONS (PRACTICAL)

List of practical to be performed on computers:

1. Statistical data processing programs
2. Functions programs to calculate interest …etc
3. Operations on Matrices, Gauss elimination method and its applications.
4. Sequences-sorting, searching and merging, program related to functions
5. Function to read a line and store in buffer , find length and so on..
6. String processing programs, programs related to enumerated data tpes and stacks

7. Programs related to structures , pointers and functions
8. Netwon's form of polynomial, interpolation polynomial, divided difference table
9. Numerical integration, numerical solutions of differential equations.

Reference Books:

1 "The C Programming Language" by B. W. Kernighan and B. M. Ritchie. Prentice-Hall, 1977.
2 Computer programming in C, V Rajaraman, PHI-2002
3 "Programming in ANSI C" by E. Balagurusamy, The McGraw-Hill Pub. Co. Ltd., 1992.
4 "The C Primer" by L. Hancock and M. Krieger, McGraw-Hill, 1987.
5 Mahpatra P B, Thinking in C:Including Object Oriented Programming with C, Wheeler Pub.

[SSB-7] INTRODUCTION TO MATLAB

Unit-I & II Introduction to Matlab

1. Matlab Interface 2. Menus and the toolbar
3. Computing with Matlab 4. Script files and the Editor Debugger
5. Matlab Help System

Arrays and Matrices

1. Arrays 2. Multidimensional Arrays
3. Element by Element Operations 4. Polynomial Operations Using Arrays
5. Cell Arrays 6. Structure Arrays 7. Matrices
8. Referencing Individual Entries 9. Matrix Operations
10. Submatrices and Colon Notation

Functions & Files

1. Elementary Mathematical Functions 2. User Defined Functions
3. Advanced Function Programming 4. Working with Data Files

Unit-III & IV Programming Techniques

1. Program Design and Development 2. Relational Operators and Logical Variables
3. Logical Operators and Functions 4. Conditional Statements
5. Loops 6. The Switch Structure 7. Debugging Mat Lab Programs

Plotting

1. XY- plotting functions 2. Subplots and Overlay plots
3. Special Plot types 4. Interactive plotting
5. Function Discovery 6. 3-D plots

Polynomials

1. Roots 2. Multiplication 3. Addition 4. Division
5. Derivatives and Integrals 6. Evaluation

7. Rational Polynomials 8. Curve Fitting

Integration and Differentiation

1. Integration 2. Differentiation

Main Book :

1. Introduction to Matlab 7 for Engineers, by William J. Palm III, McGraw Hill 2005.
2. Mastering Matlab 7, by Duane Hanselman, Bruce Littlefield, Pearson Education 2005.
3. Learning Matlab-7, Oxford,2008

[SSB-8] Programming in MATLAB (Practicals)

Practical related to the followings:

1. Mat lab Environment: MATLAB user interface, commands and variables
2. Built in Mat lab Functions
3. Vector and matrix data, data types
4. Plotting
5. User Defined Functions
6. Mathematical/Engineering case studies

Main Book :

1. Introduction to Mat lab-7 for Engineers, by William J. Palm III, McGraw Hill 2005.
2. Mastering Mat lab-7, by Duane Hanselman, Bruce Littlefield, Pearson Education 2005.
3. Learning Matlab-7, Oxford,2008

(V) Cognitive Skill-Work Project : MTHW_Group (MTHW-I)

COURSE: MTHW-I Cognitive Skill-Work Project

AIM : *To develop student's cognitive abilities to solve assignment/problem …….etc, problems in a longer time frame than in usual in other courses. Students will learn how to search for known results and techniques related the project work. On completion of the project work, each student is expected to Submit a written document describing the results, mathematical developments, background material, bibliographical search etc. Present orally in a seminar setting of the work done in the project work. The students will meet regularly with the project guide to work out problems that appear and adjust the goals and time frame accordingly. The project should be carried out individually/ jointly are acceptable only with prior permission of the Guide.*

Cognitive skill-work based Project carries 10 credits in at least 16 hours depending on the number of students and the number of Batches/Groups) per week teaching and two work-Project to be chosen from the list of MTHW Group.

MTHW Group: Any TWO from the followings.

1 BOOK REVIEW
2 PROJECT WORK/FIELD WOR
3 PROBLEM SOLVING WORK
4 FOUNDATION OF MATHEMATICS
5 HISTORY OF MATHEMATICS
6 MATHEMATICS EDUCATION
7 MINI DISSERTATION ON SPECIAL TOPICS OF MATHEMATICAL SUBJECTS (to be suggested by the faculty)

8 *Any Special Topics to be selected by the faculty which may includes: supportive courses, life oriented education, personality development activities, leisure hour activity ….etc.*

Scheme of Evalution :

A project/cognitive report will be the outcome of the assignment given by the faculty in the fourth semester. The project work should be an individual one. The final semester project work will be evaluated by any two examiners : The Subject teacher, The Chairman of the Examination and an external examiner (appointed by the University) .

Project Report/cognitive work : 250 Marks, Passing Minimum for the Project: 45% marks

Total 250 marks divided as :

75 marks for Internal &

175 marks of External Exam separated as

75 marks for Presentation + 100 marks for Viva-voce Examination.

N.B.: More Elective/Soft Skill based courses can be added from time to time as and when needed, subject to the availability of the faculties , GOVT./UNIVERSITY's policy matter and demand/requirement of the students.

BIO-
TECHNOLOGY

Principle paper BT 201 Bioprocess and biochemical engineering

Section I

Unit 1

1.1. Introduction to bioprocess technology; Screening, preservation and improvement of industrially important microorganisms, Inoculation development for fermentation process for different types of microorganisms. .

1.2. Raw material and media formulation for fermentation process; Influence of environmental factors on growth and product formation;

1.3. ,Bioreactor design and different types of bioreactors , Batch, fed batch and continuous cultivation. Solid state cultivation ,Sterilization kinetics, sterilization of media and fermentor.

1.4. Microbial growth kinetics.

Unit 2

2.1. Agitation, aeration and mass transfer of oxygen.

2.2. Control of process parameters: Measurement of process parameters like pH , temperature, DO, foam

2.3. Instrumental process control, two position and proportionate control

2.4. Biosensor and enzyme probe, microprocessor based control systems.

2.5.

Section II

Unit 3

3.1. Scale up of bioprocess.

3.2. Down stream processing-cell separation, cell disintegration and product purification.

3.3. Immobilization of enzyme, cell and their applications.

3.4. Production of secondary metabolites.

Unit 4

4.1. Industrial production of penicillin, streptomycin.,amylase, lipase and protease.

4.2. Industrial production of citric acid, acetic acid, alcohol based liquors, acid Vitamins, Glutamic acid, lysine, alkaloids.,

4.3. Production and applications of SINGLE CELL PROTEINS., mushroom cultivation, steroid transformation, Flavones.

4.4. Industrial production of dairy products- Cheese. Production and application of biopolymers.

References:

1. Biotechnology: Rehm and Reid
2. Comprehensive Biotechnology: Murray Moo Young
3. Economic Microbiology (series): A.H. Rose
4. Microbial Physiology: Moat and Foster

Principle paper BT 202 Molecular Biology

Section I

Unit 1

- **1.1.** DNA super coiling: Linking number, positive and negative and negative supercoiling, role of topoisomerase and its catalytic mechanism. .
- **1.2.** Organization of genome in eukaryotes and prokaryotes.
- **1.3.** DNA replication: Historical prospective, catalytic mechanism of DNA polymerase Replication in bacteria
- **1.4.** Replication in eukaryotes.

Unit 2

- **2.1.** DNA repair mechanisms in bacteria and eukaryotes.
- **2.2.** Recombination and its types.
- **2.3.** Transcription in bacteria.
- **2.4.** Transcription in eukaryotes, post transcription mechanisms.

Section II

Unit 3

- **3.1.** Genetic code and its historical perspective.
- **3.1.** Translation in bacteria.
- **3.2.** Translation in eukaryotes.
- **3.3.** Post translation mechanisms.

Unit 4

- **4.1.** Gene regulation in bacteria. Lac operon, ttrp operon and arabinose operon. Immunity operon of bacteriophage.
- **4.2.** Gene regulation in eukaryotes.
- **4.3.** Mode of gene transfer in bacteria - Role of natural plamsmids, -transformation, conjugation and transduction. Transposable elements.
- **4.4.** Genetic disorders.

References

1. **Strickberger,** *Genetics*.
2. **Benjamin Lewin**, *Genes viii*
3. **R. M. Twymen**, *Advances in Molecular Biology*
4. **Syndeer and Champness.** *Molecular genetics of bacteria*
5. **Maloy,** *Microbial genetics*
6. **Malacinski,** *Essential of molecular biology*
7. **J. D. Watson**, Molecular Biology of the Genes.

Principle paper BT 203 Instrumentation and analytical techniques

Section I

Unit 1

1.1. Electrochyemistry : pH and buffers, potentiometric and conductometric titration.
1.2. Principle and application of light, phase contrast, fluorescence microscopy.
1.3. Principle and application of scanning and transmission electron microscopy, scanning tunneling microscopy,
1.4. Principle and application of , atomic force microscopy and confocal microscopy; Cytophotometry and flow cytometry.

Unit 2

2.1. Principle and application of gel- filtration, ion-exchange, affinity chromatography, Thin layer chromatography.
2.2. Principle and application of GC,HPLC, FPLC.
2.3. Principle and application of Centrifugation: Basic principle and application; Differential, density and Ultracentrifugation
2.4. Principle and application of X ray diffraction, fluorescence, UV-Visible,IR, NMR and ESR.

Section II

Unit 3

3.1. Principle and application of Atomic absorption and plasma emission spectroscopy;
3.2. Principle of MALDI.
3.3. Principle of electorphoresis- agarose and PAGE ,SDS-PAGE.
3.4. Pulse gel and 2D gel electrophoresis.

Unit 4

4.1. Principle and applications of tracer technique in biology
4.2. ; Radioactive isotopes and half life of isotopes; Effect of radiation on biological system;
4.3. Autoradiography; Cerenkov radiation; liquid scintillat ion spectrometry Cell cycle regulation and cancer
4.4. Biosensors and their applications.

References

1. **Sharma B K,** *Instrumental method of chemical analysis*
2. **D.A. Skoog**, *Instrumental methods of analysis*
3. **Plumner,** *An introduction to practical Biochemistry*
4. **Chatwal and Anand,** *Instrumentation*
5. **Boyer,** Modern experimental Biology

Elective paper. BT 204 Environmental Management.

Section I

Unit 1

- **1.1.** Introduction and scope of environmental management
- **1.2.** Basic concepts of sustainable development
- **1.3.** Industrial ecology and recycling industry
- **1.4.** Recycling of domestic waste.

Unit 2

- **2.1.** Role of natural products and bio-diversity in international trade
- **2.2.** Fundamentals of fossil fuels use
- **2.3.** Energy production and trade
- **2.4.** Energy balance and energy audit

Section II

Unit 3

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- **3.1.** Eco-marketing Environmental Impact Assessment (EIA),
- **3.2.** General guidelines for the preparation of environmental impact statement (EIS),
- **3.3.** Scope and types of environmental audit,
- **3.4.** Cost benefit analysis, environmental management plan (EMP)

Unit 4

- **4.1.** International organization for standardization (ISO) , ISO 14000 standards and certification
- **4.2.** Environmental clearance for establishing industry
- **4.3.** Environmental safety, risk management and emergency preparedness,
- **4.4.** International summit and treaties, important dates dedicated to environmental management

Elective paper BT 204 Pharmaceutical Microbiology

Section I

Unit 1

1.1. Antibiotics and synthetic antimicrobial agents .Antifungal antibiotics,
1.2. Antitumor substances, Peptide antibiotics
1.3. Chloramphenicol, Sulphonamides and Quinolinone antimicrobial agents.
1.4. Chemical disinfectants, antiseptics and preservatives.

Unit 2

2.1. Mechanism of action of antibiotics (inhibitors of cell wall synthesis, nucleic acid and protein synthesis)
2.2. Molecular principles of drug targeting
2.3. Mode of action of quinolinones
2.4. Drug resistance in pathogens.

Section II

Unit 3

3.1. Microbial contamination and spoilage of pharmaceutical products
3.2. Concept of sterilization in pharmaceutical industry.
3.3. Manufacturing procedures and in process control of pharmaceuticals
3.4. Financing R&D capital and market outlook. IP, BP, USP

Unit 4

4.1. Good Manufacturing Practices (GMP and good laboratory practices (GLP). ;
4.2. Regulatory aspects of quality control.
4.3. Quality assurance and quality management in pharmaceutical industy.
4.4. ISO,WHO and US certifications.

References

1 . Pharmaceutical Microbiology – Edt. by W.B.Hugo & A.D.Russell Sixth edition. Blackwell scientific Publications.
2. Analytical Microbiology –Edt by Frederick Kavanagh Volume I & II. Academic Press New York.
3. Quinolinone antimicrobial agents – Edt. by David C. Hooper, John S.Wolfson .ASM Washington DC.
4. Quality control in the Pharmaceutical Industry - Edt. by Murray S.Cooper Vol.2. Academic Press New York.

Practical module 1

1. Titration of monoacid- determination of pKa values.
2. Determination of PH
3. Separation of plant pigments, amino acids by Paper and TLC.
4. Study of affinity and ion exchange chromatography.
5. Study of differential centrifugation.
6. Determination of lamda max.
7. Electrophoresis of nucleic acid by agarose gel electrophoresis.
8. Electrophoresis of proteins by PAGE
9. Electrophoresis of proteins by SDS PAGE
10. To determine MIC, LD 50 of Beta-lactum
11. Sterility testing by Bacillus stearothermophilus
12. Determination of D value, Z value for heat sterilization in pharmaceuticals
13. Determination of antimicrobial activity of a chemical compound.(phenol,resorcinol)

Practical module 2

1. Measurement of Kla
2. Fermentation of gluconic acid, ethanol, citric acid.ss
3. Fermentation of antibiotic =penicillin
4. Estimation of penicillin. By chemical method.
5. Bioassay of penicillin.
6. Production of amylase, protease and lipase.
7. Microbial analysis of milk and food.
8. Production of beer and wine.
9. Production of PHB.
10. Conjugation in *E. coli*
11. Transduction
12. Plasmid curring
13. Phage titration
14. Isolation of DNA from bacteria,
15. Isolation of antibiotic resistant mutant by direct and indirect method.
16. Find out uv and temperature survival curve of bacteria.
17. Isolation of auxotrophic mutant.
18. Isolation of respiratory deficient mutant.

ZOOLOGY

Z 406C – BIOCHEMISTRY

UNIT-I CARBOHYDRATES

1. Monosaccharides: Isomerism, Havarth and Fisher formula and classification
2. Oligosaccharides/Disaccharides: Maltose, Lectose, Sucrose, Cellobiose; General structure and their importance
3. Polysachharides: Homopolysac charides-Starch, Glycogen, Cellulose,
4. Heteropolysaccharides

UNIT-II PROTEIN

1. Classification of amino acids by different methods
2. Peptide formation and protein formation
3. Structure of protein molecule
4. Secondary bond of Protein and Protein metabolism

UNIT-III LIPID

1. Fatty acids
2. Lipid formation
3. Classification of lipids
4. Principles and pathways of lipid metabolism

UNIT-IV NUCLEIC ACIDS

1. Structure of Nitrogen base
2. Replication and Repair of DNA
3. RNA: Structure, types and synthesis
4. Nucleic acid Synthesis and Metab olism

Z 407C – ANIMAL BEHAVIOR

UNIT-I

1. Introduction to Ethology: A Science of Animal Behaviour
2. Classification of behavioral patterns
3. Ethogram
4. Concept and Application of Behavioral Ecology

UNIT-II

1. Perception of environment: Mechanical; Electrical; Chemical; Olfactory; Visual; Auditory;
2. Instinctive and Learning Behaviour
3. Physiological and Hormonal basis of behavior
4. Human ethology and Psychosomatic disorders

UNIT-III

1. Communication: Chemical; Visual; Light; Auditory
2. Camouflage and Mimicry in Animals
3. Methods to study communications
4. Animal behavior and adaptation

UNIT-IV

1. Ecological aspects: Habitat and food selection; optimal foraging theory
2. Territoriality; social behavior-schooling and Movement patterns
3. Effect of environment on Animal Behaviour
4. Advanced techniques to study animal behaviour

Z 408C – RESEARCH METHODOLOGY AND BIOSTATISTICS

UNIT I INTRODUCTION TO SCIENTIFIC RESEARCH

1. Characteristics and types of scientific research
2. Basics of research methodology
3. Research and Experimental design
4. Method of Data collection

UNIT II STATISTICAL METHODS AND DATA ANALYSIS

1. Definition and scope, Organizing a statistical survey and presentation of statistically analysed information
2. Basic statistical methods: Measures of central tendency, dispersion and standard error; Probability distributions: binomia l, poisson and normal distribution
3. Statistical significance: Hypothesis testing, types of error, level of significance, Student's t test, ANOVA and Chi square goodness of fit
4. Simple linear regression and correlation analysis

UNIT III NON PARAMETRIC STATISTICS AND COMPUTING

1. Comparing Parametric and Non parametric statistics, Rank test, F -max test, Mann –Whitney (U) test, and Sign test
2. Applications of non parametric statistics in biological research
3. Basic computing: MS Office ®, Internet
4. Data base management, Use of computers in statistical analysis

UNIT IV SCIENTIFIC PRESENTATIONS AND PRACTICES

1. Scientific Deliveries and Communications: Writing Research proposal, Paper, Thesis, Report and Citations
2. Fundraising in the field of Animal sciences
3. Presenting scientific research: Power point presentations, Posters, Flyers, etc.
4. Publication processes, Review Processes and Significance of scientific communications

BOTANY

CBO-404 ANGIOSPERM TAXONOMY AND PLANT REPRODUCTION

Unit-I Taxonomy

Salient features of the International Code of Botanical Nomenclature.

Taxonomic evidence: morphology, anatomy, palynology, embryology, cytology.

Taxonomic tools: Herbarium; floras; histological, cytological, phytochemical, serological, biochemical and molecular techniques; computers and GIS.

Systems of angiosperm classification: Phenetic versus phylogenetic systems; cladistics in Taxonomy; relative merits and demerits of major systems of classification: Takhtajan, Bassaey, Hutchinson.

Main Reference(s):

Singh V and Jain D K **(1999)** ***Taxonomy of Angiosperms*****,** Rastogi Publications, Meerut (2nd Edition's Reprint).

Sambamurty A V S S (2005) ***Taxonomy of Angiosperms***, I K International P Ltd, New Delhi (1st Edition)

Pandey B P (2004) ***A Text Book of Botany: Angiosperms****,* S Chand & Company Ltd., New Delhi (1st Edition's Reprint)

Other Reference(s):

Reddy S M, Madhusudana Rao M, Reddy S A, Reddy M M and Chary J S **(2004)** ***University Botany-3*****,** New Age International (P) Ltd, Publishers, New Delhi (1st Edition).

Subrahmanyam N S **(1999)** ***Modern Plant Taxonomy*****,** Vikas Publishing House Pvt. Ltd,,New Delhi (1st Edition's Reprint.

Unit-II Families

Taxonomical studies of the following families with references to their geographical distribution, systematic position, floral variations and economic importance.

DICOTYLEDONS :

Polypetalae: Menispermaceae, Capparaceae, Sterculiaceae, Anacardiaceae, Rutaceae, Meliaceae, Molluginaceae, Cactaceae.

Gamopetalae: Oleaceae, Convolvulaceae, Salvadoraceae, Lamiaceae.

Apetalae: Nyctaginaceae, Amaranthaceae, Chenopodiaceae, Euphorbiaceae.

MONOCOTYLEDONS: Lamnaceae, Typhaceae, Cyperaceae, Poaceae.

Main Reference(s):

Lawrence G H M **(1967)** ***Taxonomy of Vascular Plants*****,** Oxford & IBH Publishing Co.Pvt Ltd., New Delhi (1st Indian Edition).

Singh V Pande P C and Jain D K **(1995)** ***A Text Book of Botany-Angiosperms*****,** Rastogi Publications, Meerut (1st Edition's Reprint).

Singh V and Jain D K **(1999)** ***Taxonomy of Angiosperms*****,** Rastogi Publications, Meerut (2nd Edition's Reprint).

Unit-III Plant Reproduction

Microsporangium: Anther wall, Sporogenous tissue, Microsporogenesis.

Male gametophyte-development: Formation of vegetative and generative cells, pollen wall.

Male gametophyte-morphology: Introduction, pollen wall features, Scope of Palynology, preparation of pollen grains,

Megasporangium: Types of ovules, integuments, megasporogenesis.

Unit-IV Plant Reproduction

Female gametophyte: General, types of embryo sacs, Mature embryo sac, Haustorial behaviour of embryo sac, nutrition of embryo sac

Fertilization: pollen germination, pollen tube growth and guidance, *in-vitro* pollen germination, pollen viability test, double fertilization.

Endosperm development during early, maturation and desiccation stages.

Embryogenesis, ultra structure and nuclear cytology, polyembryony.

Main Reference(s):

Reddy S M, Madhusudana Rao M, Reddy S A, Reddy M M and Chary J S **(2004)** ***University Botany-3*****,** New Age International (P) Ltd, Publishers, New Delhi (1st Edition).

Pandey B P **(2003) Simplified Course in *Botany –B Sc-II,*** S Chand & Company Ltd., New Delhi (1st Edition's Reprint)

Other Reference(s):

Bhojwani S S and Bhatnagar S P **(2001)** ***The Embryology of Angiosperms*****,** Vikas Publishing House Pvt Ltd., New Delhi (4th Revised Edition's Reprint).

Maheshwari P (**1989**) ***An Introduction to the Embryology of Angiosperms,*** Tata McGraw-Hill Publishing Company Ltd., New Delhi (10th Edition's Reprint).

CBO-405 PLANT ANATOMY AND ECOLOGY

Unit-I Plant Anatomy

Meristems: Classification of Meristems; Apical Meristems: Theories of Shoot Apical Meristems: Apical Cell Theory, Histogenic layer theory, Anneau initial & meristem d'attente theory.

Root Apex: Theories of Root apex organization: Apical Cell Theory, Korper-Kappe theory, Concept of quiescent centre, development of lateral roots and root hairs.

Transition of vegetative shoot apex into reproductive shoot apex.

Development of Plant Tissues: Simple and Complex tissues.

Vascular Elements: Functional Differentiation.

Wood Anatomy: Ontogeny of secondary vascular tissues, Growth rings, Heart wood & Sap wood, Porous & non-porous wood, wood parenchyma.

Unit-II Plant Anatomy

Vascular Cambium: origin, structure, seasonal changes in cambium activity, cambium in wound healing and grafting, cambium in monocotyledons.

Anomalous Secondary Growth in *Aristolochia* stem, *Mirabilis* stem, *Bougainvillea* stem and *Chenopodium* stem.

Structural variability in Leaves of *Helianthus*, *Aloe*, *Calotropis*, *Typha*, *Nymphaea* and Maize.

Systematic Plant Anatomy: with special references to trichomes, stomata, leaf anatomy, nodal anatomy, cellular contents, wood anatomy and flower anatomy.

Main Reference(s):

Singh V, Pande P C and Jain D K **(1998)** ***Anatomy of Seed Plants*****,** Rastogi Publications, Meerut (1st Edition's Reprint).

Pandey B P **(1997)** ***Plant Anatomy*****,** S Chand & Co. Ltd, New Delhi. (1st Edition's Reprint).

E John Jothi Prakash **(2000)** ***A Text Book of Plant Anatomy*****,** Emkay Publications, Delhi. (2nd Revised Edition).

Tayal M S **(2001)** ***Plant Anatomy*****,** Rastogi Publications, Meerut (5th Edition's Reprint).

Unit-III Plant Ecology

Physociological characters and methods of plant community

Ecosystem - Structure and Function, Types-terrestrial (forest and grass land) and aquatic (fresh water, marine and estuarine), Energy flow, Productivity, Biogeochemical cycle (Carbon and Sulphur), Homeostasis, Optimization and Evolution

Environmental problems- Biodiversity, Biopiracy, Eco-terrorism, Desertification and Sustainable development

Environment pollution – Kinds, Sources, Effects on plants and ecosystem, Conventional and Non-Conventional energy sources.

Unit-IV Plant Ecology

Phytogeography – Plant community of the world (terrestrial and aquatic biomes), Phyto-geographical region of world (vegetation belt), Bio-geographical zones (soil, climate, flora and vegetation) of India

Bioremediation and Environment clean up-Bioremediation, Need and Scope, Application, Future outlook and Phyto-remediation.

Conservation - Introduction, Forest conservation (Resources and importance), National Parks and Biosphere Reserve conservation.

Main Reference(s):

Sharma P D **(2003)** ***Ecology and Environment*****,** Rastogi Publications, Meerut. (7th Edition's Reprint).

Agrawal K C **(2001) Fundamentals of Environmental Bio*logy*,** Nidhi Publishers (India), Bikaner. (1st Edition).

Other Reference(s):

Subrahmanyam N S and Sambamurty A V S S **(2000)** ***Ecology*****,** Narosa Publishing House, New Delhi. (1st Edition).

Kormondy E J **(2002)** ***Concept of Ecology*****,** Prentice-Hall of India Pvt Ltd., New Delhi (12th Indian Edition Reprint).

CBO 406 BIOPHYSICS, INSTRUMENTATION AND BIOCHEMISTRY

Unit-I Biophysics

1. pH and Buffers.
2. Free radicals, charge transfer complex (CTC) and Redox potentials.
3. Laws of Thermodynamics.
4. Radiations and Isotopes and their role/application in plant science.

References:

(1) Biophysics by Vasantha Pattabhi and N. Gautham, Narosa Pub.
(2) Introduction to Biophysics byPranabkumar Banerjee, S.Chand.

Unit-II Instrumentation

1. Principles and application of light, phase contrast, fluorescence, scanning and transmission electron microscopy.
2. Photometry, colorimetry and spectrophotometry, their application.
3. Principles and application of gel-filtration, ion exchange and affinity chromatography. Paper chromatography, thin layer and gas chromatography, HPLC.
4. Electrophoresis: PAGE, Agarose gel electro-phoresis and electro-focusing, Ultra-centrifugation: Principles and types.

Reference:

Research Methodology for biological sciences, N Gurumani, MJP Publishers, Chennai, 2007

Unit-III Biochemistry-I

1. Behaviour of biological compounds: Dissociation, Solubility, Isomerism, Adsorption and Chemical bonds.
2. Carbohydrates: Occurrence, classification, structure and function of Monosaccharides (Triose, Pentose and Hexose), Disaccharides (Maltose, Lactose and Sucrose) and Polysaccharides (Starch and Cellulose).
3. Lipids: Occurrence, classification, structure and function of Simple lipids (Triglycerides and Waxes) and Complex lipids (Phospholipids) and Role of Polyunsaturated fatty acids.
4. Amino acids: Structure, properties and classification of amino acids. Amino acid metabolism, non-oxidative de-amination. Biosynthesis and breakdown of amino acids.

Unit-IV Biochemistry-II

1. Proteins: Classification of proteins, Biological functions, Conformation of proteins (primary, secondary, tertiary and quarternary), Ramachandran plot, Lectins (Glycoproteins) and their importance.
2. Enzymes: Definition, nomenclature and classification of Enzymes, Apo-enzymes, coenzymes, cofactors and prosthetic groups, properties of Enzymes, Mechanism of enzyme action, Kinetics of an enzyme-catalyzed reaction, Various kinds of Inhibition, Factors affecting the enzyme action.
3. Vitamins: Occurrence, classification, structure and function of various vitamins and their deficiency diseases.
4. Nucleic acids: Introduction, components, structure of DNA and various RNAs.

Main Reference(s):

Deb A C **(2008)** ***Fundamentals of Biochemistry,*** New Central Book (P) Ltd., Kolkata (9th Edition Revised).
Jain J L, Jain Sanjaya and Jain Nitin **(2005)** ***Fundamentals of Biochemistry,*** S Chand & Co. Ltd., New Delhi (6th Revised Edition).

References

Lehnigar A C ( ), ***Biochemistry***
Jain J.L., Fundamentals in Biochemistry,
Deb A C (2008), ***Fundamentals of Biochemistry*** **(9th edition),**
Satyanarayana U (1999), ***Biochemistry*** **(edition),**
Rama Rao A V S S () ***Text Book of Biochemistry*** **(5th edition),**
Verma S K and Verma Mohit ( ), ***Plant Physiology, Biochemistry and Biotechnology*** **( ),**

PBO-404 PRACTICAL BASED ON TOPICS COVERED IN CBO-404

TAXONOMY

- Study of genera from listed families as per theory syllabus.
- Identify the genus and species of given plant specimen with the help of flora(s).

PLANT REPRODUCTION

- To study the young and matured anther T.S.
- *in-vitro* pollen germination by hanging drop and suspension method.
- To dissect out endosperm haustoria with embryo of cucumber seed.
- To dissect out Embryo with suspensor and basal cell from *Brassica* seed.
- Study the poly embryo from citrus seeds.

PBO-405 PRACTICAL BASED ON TOPIC COVERED IN CBO-405

Plant Anatomy

- To study the vegetative/reproductive shoot apices of *Hydrilla, Ceratophyllum*, Grass.
- To study the root apices of *Eichhornia, Lemna, Allium*.
- To study the Plant Tissues from fresh material and permanent slides: Parenchyma, Aerenchyma, Chlorenchyma, Collenchyma, Sclerenchyma, Xylem, Phloem, Transfusion tissue.
- To study the Wood Anatomy from locally available wood specimens.
- To study the Anomalous Secondary Growth from *Aristolochia* stem, *Mirabilis* stem, *Bougainvillea* stem and *Chenopodium* stem.
- To study the Structural variability in the Leaves of *Helianthus, Aloe, Calotropis, Typha, Nymphaea* and Maize.
- To study the comparative examples of Systematic Plant Anatomy with special references to trichomes, stomata, leaf anatomy, nodal anatomy, cellular contents, wood anatomy and flower anatomy.

Plant Ecology

- **Ecological apparatus**
  - Soil thermometer, Sling psychrometer, Abney's meter, Minimum and Maximum thermometer, Cup-anemometer, Flame photometer
- **Phytosociological study**
  - Determine the minimum size of quadrate.
  - Determine the minimum number of quadrate.
  - Determine the quantitative characters of plant community by random quadrate method (Density, Abundance, Frequency and Basal cover).
  - Preparation of frequency diagram of plant community.
  - Evaluation of life form classes of local flora and preparation of Biological spectrum.
- **Biomass and Productivity**
  - Estimation of above and below ground biomass in a grass land area.
- **Soil analysis** (Physical and Chemical characters)
  - Determine the soil moisture content by oven drying method.
  - Estimation of texture of soil by sieve method.
  - Determine the water holding capacity of different type of soil.
  - Electro conductivity of soil.
  - Estimation the buffering action of soil (0.1N Ammonium acetate and 0.1N NaCl).
  - Calculation of Phosphorus, Potassium and pH from the soil.
  - Determine the Sodium, Potassium, Calcium and Phosphorus in plant ash material.
- **Water analysis** (Physical and Chemical characters)
  - Determine the Calcium, Chloride, Total hardness and pH from water.
  - Determine the Biological Oxygen Demand (BOD) and Chemical Oxygen Demand(COD) from water.

PBO-406 PRACTICAL BASED ON TOPIC COVERED IN CBO-406

Major practicals

1. Standard curve of Glucose (Reducing sugar) by Nelson-Somogyi/Di-Nitro Salicylic Acid (DNSA) method.
2. Standard curve of Starch by Anthrone/Iodine reagent.
3. Standard curve of Proteins by Biuret/Lowry's method.
4. Standard curve of Animo acids by Ninhydrin method.
5. Extraction and estimation of reducing sugar by Nelson-Somogyi/Di-Nitro Salicylic Acid (DNSA) method.
6. Extraction and estimation of Starch by Anthrone/Iodine reagent.
7. Estimation of protein by Micro-Kjeldahl's/Biuret/Lowry's method.
8. Extraction and estimation of amino acids by Ninhydrin method.
9. Determination of Amylase/Peroxidase activity.

Minor practicals

10. Separation and identification of Sugars/Amino acids/Plant pigments by Paper/Thin layer Chromatography.
11. Identification of different sugars (spot tests).
12. Estimation of free fatty acids by titration.
13. Extraction of seed proteins depending upon the solubility.
14. Determination of Isoelectric point of Casein.

General practicals

15. pH determination of plant tissues.
16. Preparation of Buffers and buffering action.

Spot-'A'

17. Principle and working of:
    1. Colorimeter/Spectrophotometer.
    2. Chromatography technique.
    3. Electrophoresis.
    4. Centrifugation.
    5. Microscopy
    6. pH meter

EBO-404 PHYTOCHEMISTRY AND PHARMACOLOGY OF HERBAL DRUGS

Unit-I Phytochemistry

- Carbohydrates: mono and disaccharides, sugar alcohols, sugar acids, sugar amines.
- Polysaccharides: dextrins, inulin, matrix polysaccharides, gums and mucilages.
- Proteins: peptides, lectins.
- Lipids: volatile oils fatty acids and fatty oils, sesquiterpenes, di_, tri_ and tetraterpenes.
- Glycosides: anthraquinones, isothiocynates, flavonols, lactones, phenols, saponins and cardiac glycosides
- Alkaloids, indoles, isoquinolines, tropanes, pyridine and piperidine, steroidal alkaloids.
- Bitter principle, phenols and tannins, antibiotics, phyto-inorganic chemistry.

Unit-II Pharmacological study of herbal drugs

- Need for phyto-pharmacological evaluation
- Evaluation of anti diabetic agents
- Evaluation of anti microbial agents
- Evaluation of anti diarrheal agents

EBO-405 PLANT TISSUE CULTURE

Unit-I

- Plant cell and tissue culture: Introduction, History, Scope, Concept of Cellular differenciation, Totipotency and Applications.
- Laboratory organization, Media Preparation and sterilization techniques.
- Types of culture, Callus and its Types, micropropagation.
- Somatic Hybridization, protoplast isolation, fusion and culture, Hybrid selection regeneration.

Unit-II

- Clonal propagation, Artificial seed production and Biotechnological production of plant Secondary metabolites.
- Transgenic plants and Crop Protection: Pathogen and Herbicide Resistant plants, Oxidative stress and Salt stress resistant plants
- Molecular farming: Production of Antibodies, Vaccines, Polymers and Bioplastic.
- Germplasm storage and Cryopreservation

EBO-406 MARINE BOTANY

UNIT-I

Marine environment: History of oceanography, oceans of the world, continental drift, sea as a biological environment, main divisions and zones of marine environment.

Physical factors: Temperature, light, pressure, sound velocity, sedimentation, dynamic factors, waves, tides, currents, their effects on marine flora, fauna and microorganisms.

Chemistry of sea water: Chemical composition, chlorinity, salinity, pH, dissolved gases, minerals, nutrients and organic matter.

Pollution: Major pollutants (sewage, agricultural discharges, industrial wastes, dredging, oils, radioactive elements) and their effects on marine biota, bioremediation.

UNIT-II

Marine Phytoplankton: Types, distribution, biomass, productivity and factors affecting productivity.

Marine algae: Salient features-(morphology, structure, reproduction, classification) of marine **Chlorophyta, Phaeophyta** and **Rhodophyta,** algae of Saurashtra.

Marine Angiosperms: Sea grasses, halophytes, mangroves, coastal flora of India.

Physiology of Marine Angiosperms: Seed germination, salt uptake and translocation, nitrogen metabolism and photosynthesis.

Economic utility: Uses of marine algae, algal products and uses of mangroves.

MICRO-
BIOLOGY

MB 201 Molecular Genetics of Bacteria and Bacteriophages

Section - I

Unit - 1 DNA Damage, Repair, Recombination and Gene Regulation **15 hours**

1.1. **Mutations and Mutagenesis:** Biochemical Basis of Mutation, Spontaneous Mutation, Fluctuation Test, Useful Phenotypes in bacterial genetics, Mutation Rate, Expression and Selection of Mutant Cell, Types of Mutation, Mutagens, Reversion and suppression of mutation

1.2. **DNA Repair** Evidences of DNA Repair, Specific repair pathway, General repair mechanisms, Repair pathway in *E. coli*, Bacteria phage repair pathway

1.3. **Recombination:** Overview of recombination**,** Molecular Model Recombination, Molecular basis for recombination in *E. coli,* Phage recombination , illegimate recombination, Genetic and Functional Analysis of Recombination

1.4. **Regulation of gene expression: Overview of gene regulation,** Transcriptional regulation in bacteria, Negative regulation, Positive regulation, Regulation by attenuation, Feedback inhibition, Translational control.

Unit-2 Plasmid, Transposition and Conjugation **15 hours**

2.1. **Plasmid Molecular Biology:** What is plasmid, Types and properties of plasmid: Replication, Control of Copy Number, Partitioning, Incompatibility, Maintaining Plasmid belonging to the same incompatibility group. Conjugal Functions, Pilus Production, Transfer DNA Replication

2.2. **Properties of Particular Plasmids :**Major Chromosome-Mobilizing other than F, Bacteriocins, Resistance Plasmids, Agrobacatrium plasmid Ti, Broad Host Range Plasmids

2.3. **Conjugation:** Discovery of Conjugation, Mechanism of DNA transfer during conjugation in Gram Negative Bacteria, Chromosome transfer by Plasmid, Genetic mapping with Hfr crosses, Chromosome mobilization, Prime factors, Transfer systems of gram Positive bacteria.

2.4. **Transposition and site specific recombination :** Insertion sequences, Detection of transposition in bacteria, Types of bacterial Transposon, Transposition, Transposon Mutagenesis, Site specific recombination, Phage Mu

Section - II

Unit-3 Bacteriophage Genetics and Transformation **15 hours**

3.1. **Genetics of intemperate bacteriophages:**T_4 Bacteriophage as a Model Genetic System**,**Morphology and Composition, Experimental Methods Used to Study Phage Infection, Genetic Organization of T_4, DNA Replication, Molecular Biology of T4 Phage Infection, Morphogenesis and Maturation;Properties of some other common intemperate bacteriophages.

3.2. **Genetics of Temperate Bacteriophages:**Overview of various temperate bacteriophages, General Nature of the Temperate Response, Bacteriophage Lambda as the Archetypal Temperate Phage, Genetic Map of Lambda. Lytic Cycle, Lysogeny Cycle, Lysogenic phage and bacatrial pathogenesis.

3.3. **Transduction**: Bacteriophage Lambda: A Specialized Transducing Phage, Production of Transducing Particles, Physiology and Genetic Consequences of Transduction, Specialized Transducing Phages Other than Lambda, Generalized Transduction, Cotransduction.

3.4. **Genetic Transformation:**Standard Genetic Transformation Systems¸ Discovery of Genetic Transformation, Competent Cells, DNA Uptake and Entry, Establishment of Donor DNA in the Recipient Cell, Other Transformation Systems, Transfection, Genetic Mapping Using Transformation

Unit- 4 Advances in Microbial Genetics **15 hours**

4.1. Bacterial and Bacteriophage Evolution : What Is Evolution, Expression of Evolutionary Relationships, Specific Examples of Evolution, Genetic Structure of the Chromosome, Bacteria, Bacteriophage ;

4.2. Advanced Regulatory Topics : Global Regulatory Mechanism: Catabolic sensitive Operon, Regulation of Nitrogen assimilation, Porin synthesis, Heat shock protein, Virulence genes, Endospore formation, Ribosome and t RNA synthesis; Two component regulation system; Inteins, Small RNA Molecules

4.3. Strain Construction: Construction of Bacterial strains, Operon and Gene fusion, Construction of Phage Mutants

4.4. Genetic Methods for Investigating Bacteria: Metabolic pathways, Microbial physiology¸ Bacterial virulence, Specific mutagenesis, Taxonomy, evolution and epidemiology

List of Experiments

1. Ultraviolet irradiation survival curve
2. Fluctuation test, rapid - plate technology.
3. Isolation of auxotrophic mutant
4. Isolation Respiratory deficient mutant
5. Isolation of temperature sensitive mutant
6. Isolation of streptomycin resistant mutant by gradient plate technique
7. Ames test
8. Conjugation in *E. coli*
9. Transduction
10. Plasmid curring
11. Phage titration

List of Reference Books

1. **Trun and Trempy,** *Fundamental Bacterial genetics*
2. **Syndeer and Champness,** *Molecular genetics of bacteria*
3. **Maloy,** *Microbial genetics.*
4. **Edward,***Bacterialand Bacteriophage Genetics.*
5. ***Dale,*** *Molecular Genetics of Bacteria.*
6. **Streips***, Modern Microbial genetics.*
7. **Alan,** *Principles of Molecular Virology*

MB - 202 Research Methodology and Professional Practices

Section - I

Unit -1 Introduction to Scientific Research **15 hours**

1.1. Characteristics and types of scientific research, Basics of research methodology, Research and Experimental design, Method of Data collection
1.2. Scientific Deliveries and Communications: Writing Research proposal, Paper, Thesis, Report and Citations, Presenting scientific research: Power point presentations, Posters, Flyers, etc.
1.3. Publication processes, Review Processes and Significance of scientific communications
1.4. Study of Critical review and scientific Paper in Microbiology

Unit-2 Statistical Methods and Data analysis **15 hours**

2.1. Definition and scope, Organizing a statistical survey and presentation of statistically analyzed information, Basic statistical methods: Measures of central tendency, dispersion and standard error; Probability distributions: binomial, poisson and normal distribution
2.2. Statistical significance: Hypothesis testing, types of error, level of significance, Student's t test, F test and Chi square goodness of fit
2.3. Comparing Parametric and Non parametric statistics, Rank test, F-max test, Mann –Whitney (U) test, and Sign test, Applications of non parametric statistics in biological research
2.4. Simple linear regression and correlation analysis,

Section – II

Unit -3 Computer Science and Bioinformatics **15 hours**

3.1. Basic computing: MS Office ®, Internet, , Use of computers in statistical analysis, Database and Data base management system, Biological database : Sequence, Structure and classification
3.2. Sequence Analysis : concepts of sequence similarity, identity and homology, Global and Local alignment, Scoring matrices, BLAST, FASTA
3.3. Multiple Sequence Alignments (MSA): The need for MSA, basic concepts of various approaches for MSA (e.g. progressive, hierarchical etc.); Introduction to CLUSTALW and PileUp ; concept of dendrogram and its interpretation.
3.4. Application of Bioinformatics: Gene finding, PCR Primer designing, Microbial identification, Comparative genomics, Secondary and tertiary protein structure prediction

Unit - 4 Professional Practices **15 hours**

4.1. Concept of Quality Control and Assurance in life science research and industry, Concept of GMP, GLP, ISO, WHO
4.2. The Business of biotechnology: Sciences and Business, Biotechnology company fundamentals, funding, research development and marketing
4.3. Legal and regulatory issues for Biotechnology based business
4.4. Survey on Microbiology and Biotech Industry in State and Nation

List of Experiments

1. Standard operation procedure and validation of autoclave, pH meter, UV visible spectrophotometer and laminar air flow
2. Computation of Mean, Mode and Median
3. Computation of Standard deviation and Co-efficient of variation.
4. Calculation of confidence limit for the population mean.
5. Student's 't' test. (Paired and unpaired)
6. ANOVA.
7. regression and correlation analysis
8. *Chi* square goodness of fit
9. perform non parametric tests

10. Application statistical software (SPSS/ minitab/ metlab)
11. Use of Word, Excel, Power Point, Access and internet
12. Submission of scientific Review in relevant topics
13. Internet gene bank search and SRS
14. BLAST and FASTA
15. Local Global and Multiple sequence alignment
16. Protein structure visualization
17. Primer designing

List of Reference Books

1. **Yali Friedman,** *Building Biotechnology*
2. **David Hoyle,** *ISO 9000 Quality Systems Handbook*
3. **Denyer,** *Handbook of Microbiological Quality Control*
4. **The North Carolina Association for Biomedical Research**, *Mapping your future: Exploring Careers In biomanufacturing*
5. **Chap**, *Introductory Biostatistics*
6. **Zar**, *Biostatistical Analysis*.
7. **Gibas,** *Developing Bioinformatics computer skill*
8. **Ghosh,** *Bioinformatics Principle and application*
9. **Selzer,** *Applied Bioinformatics*
10. **Baxevanis,** *Bioinformatics*
11. **Claverie,** *Bioinformatics for dummies*
12. **Mount,** *Bioinformatics: sequence and genome analysis*
13. **Oren,** *Bioinformatics, Gene, Proteins and Computers.*
14. **Rastogi,** *Bioinformatics*
15. **Twyman,** *Instant notes on Bioinformatics,*
16. **Jin,** Essential Bioinformatics

MB – 203 Bioprocess and Biochemical Engineering 4 Credits

Section - I

Unit -1 Bioprocess Microbiology – I 15 hours

1.1. Introduction: Scope of Biotechnology and Industrial Microbiology : Nature of Biotechnology and Industrial Microbiology; Characteristics of Industrial Microbiology; Patents and Intellectual Property Rights in Industrial Microbiology and Biotechnology; The Use of the Word 'Fermentation' in Industrial Microbiology; Organizational Set-up in an Industrial Microbiology Establishment

1.2. Screening for Productive Strains and Strain Improvement in Biotechnological Organisms: Sources of Microorganisms used in Biotechnology; Selection from naturally occurring variants; Manipulation of the genome of industrial organisms in strain improvement

1.3. Metabolic Pathways for the Biosynthesis of Industrial Microbiology Products: The Nature of Metabolic Pathways; Industrial Microbiological Products as Primary and Secondary Metabolites; Trophophase-idiophase Relationships in the Production of Secondary Products; Role of Secondary Metabolites in the Physiology of Organisms Producing Them; Pathways for the Synthesis of Primary and Secondary Metabolites of Industrial Importance; Carbon Pathways for the Formation of Some Industrial Products Derived from Primary Metabolism; Carbon Pathways for the Formation of Some Products of Microbial Secondary Metabolism of Industrial Importance.

1.4. Overproduction of Metabolites of Industrial Microorganisms: Mechanisms Enabling Microorganisms to Avoid Overproduction of Primary Metabolic Products Through Enzyme Regulation; Derangement or Bypassing of Regulatory Mechanisms for the Over-production of Primary Metabolites; Regulation of Overproduction in Secondary Metabolites; Empirical Methods Employed to Disorganize Regulatory Mechanisms in Secondary Metabolite Production

Unit -2 Bioprocess Microbiology – II 15 hours

2.1. Growth Kinetics : Introduction; Kinetics of batch culture; Disadvantages of batch culture ; Advantages of continuous culture ; Growth kinetics for continuous culture; Material balance for CSTR: Rate of product formation, Growth kinetics, biomass and product yields, YX/S and YP/S, Biomass balances (cells) in a bioreactor, Material balance in terms of substrate in a chemostat, Modified chemostat, Fed batch culture

2.2. Industrial Media and the Nutrition of Industrial Organisms : The Basic Nutrient Requirements of Industrial Media; Criteria for the Choice of Raw Materials Used in Industrial Media; Some Raw Materials Used in Compounding Industrial media; Growth Factors; Water; Some Potential Sources of Components of Industrial media, Carbohydrate sources, Protein sources; The use of plant waste materials in Industrial Microbiology media: Saccharification of Polysaccharides, Starch, Cellulose, hemi-celluloses and lignin in plant materials

2.3. Sterility in Industrial Microbiology : Introduction; The basis of loss by contaminants; Physical and Chemical Methods of Achieving Sterility : Hot plates; High temperature sterilization; Dry heat sterilization; Sterilisation with filtration; Microwave sterilization; Electron beam sterilization; Chemical sterilization; Batch sterilization; Continuous sterilization; The sterilization of the fermentor and its accessories; Media sterilization; Viruses (Phages) in Industrial Microbiology

2.4. Bioprocess Scale-up: Introduction; Scale-up procedure from laboratory scale to plant scale(Scale-up for constant KLa, for shear forces, constant mixing time); Bioreactor design criteria ; CSTR chemostat versus tubular plug flow; Dynamic model and oxygen transfer rate in activated sludge; Aerobic wastewater treatment; Fermentation economics

Section II

Unit- 3 Biochemical Engineering 15 hours

3.1. Bioreactor : Introduction; Background; Bioreactor for batch type fermentation : The Aerated Stirred Tank, Anerobic Batch, Airlift bioreactors, Bubble column, Surface or Solid State; Bioreactor Configurations for Fed-batch Cultivation and Continuous fermentations; Calculation for bioreactor: Heat transfer; Design equations for CSTR fermenter; Monod model for a chemostat ; Temperature effect on rate constant; Scale-up of stirred-tank bioreactor

3.2. Dissolved Oxygen Measurement and Mixing: Introduction; Measurement of dissolved oxygen concentrations; Oxygen transfer rate (OTR); Respiration quotient (RQ); Agitation rate studies ; **Gas and Liquid System (Aeration and Agitation):** Introduction; Aeration and agitation; Effect of agitation on dissolved oxygen; Air sparger; Oxygen transfer rate in a fermenter; Mass transfer in a gas–liquid system; Gas hold-up; Agitated system

and mixing phenomena; Characterisation of agitation; Types of agitator; Gas–liquid phase mass transfer (Oxygen transport, Diameter of gas bubble formed D0)

3.3. Material and Elemental Balance: Introduction; Growth of stoichiometry and elemental balances; Energy balance with example of continuous ethanol fermentation; Conservation of mass principle with example of Acetic acid fermentation process

3.4. Fermentation Process Control: Introduction; Bioreactor controlling probes; Characteristics of bioreactor sensors; Temperature measurement and control; DO measurement and control; pH/Redox measurement and control; Detection and prevention of the foam; Biosensors

Unit - 4 Downstream Processing, Scale up and Economics 15 hours

4.1. Extraction of Fermentation Products: Solids (Insolubles) Removal: Filtration, Centrifugation, Coagulation and flocculation, Foam fractionation, Whole-broth treatment; Primary Product Isolation: Cell disruption, Liquid extraction (Continuous extraction column process, rotating disk contactors), Dissociation extraction, Adsorption (Ion-exchange, Langmuir isotherm, Freundlich isotherm and Fixed-bed), Precipitation; Purification: Chromatography, Carbon decolorization, Crystallization; Product Isolation: Crystalline processing, Drying

4.2. Membrane Separation Processes: Introduction; Types of membrane; Membrane processes; Nature of synthetic membranes; General membrane equation; Cross-flow microfiltration; Ultrafiltration; Reverse osmosis; Membrane modules.

4.3. Advanced Downstream Processing in Biotechnology: Introduction; Protein products; Cell disruption; Protein purification; General problems associated with conventional techniques; Fluidised bed adsorption; Design and operation of liquid fluidised beds; Interfaced and integrated fluidised bed/expanded bed system

4.4. Immobilized Enzymes and Immobilized Cells: Advantages of immobilized biocatalysts in general; Methods of immobilizing enzymes; Methods for the immobilization of cells; Practical Application of Immobilized Biological Catalyst Systems; Bioreactors Designs for Usage in Biocatalysis ; Immobilised cell reactor(ICR) experiments and ICR rate model

List of Experiments

1. Amylase Production: Screening, Optimization, production and Purification (affinity chromatography)
2. Protease Production: Screening, Optimization, Production and Purification (Salt precipitation, ion exchange chromatography)
3. Immobilization of enzyme
4. Estimation aeration efficiency
5. Reverse micelle formation
6. Screening of Organic acid producer microorganism
7. Screening of Antibiotic producer microorganism
8. Operation of fermentation
9. Sterility testing

List of Reference Books

1. **Okafor,** *Modern Industrial Microbiology and biotechnology.*
2. **Najafpour,** *Biochemical Engineering and Biotechnology.*
3. **Shigeo**, *Biochemical engineering.*
4. **Whittaker,** *Principles of fermentation technology*.
5. **Alexander,** *Microbial Biotechnology.*
6. **Sikyta,** *Techniques in Applied Microbiology.*
7. **Vogel,** *Fermentation and Biochemical Engineering Handbook.*
8. **Mcneil,** *Practical Fermentation Technology.*
9. **Doran,** *Bioprocess engineering Principle.*
10. **Nathan,** *Modern Biotechnology.*
11. **Mansi,** *Fermentation microbiology and Biotechnology*, Taylor and Francis
12. **Waites**, *Industrial Microbiology: An Introduction*, Blackwell publication
13. **Michal,** *Bioprocess Engineering Basic Concept*, Prentica Hall of India
14. **Crueger,** *A text book of Industrial microbiology.*
15. **Volkmar**, *Microbial Fundamentals of Biotechnology*

Peppler, *Microbial technology: fermentation technology*

HOME-SCIENCE

CURRENT TRENDS AND ISSUES IN RESOURCE MANAGEMENT

Paper no. -HSRM - 201

CC –4

Credits – 4 +0=4 **Sem. – 2 (M.Sc. R. M.)** **Marks- 100 +0 =100**

Objectives

- To create awareness regarding currect treads, issues and res earches in varios aspects of resource management, consumer studies, interior design, environment and management of families and organization.
- To debate on various emerging areas of studies and research needs for Resource managements.

Unit-1

- Socio-economics environment impact on families and organization.
- Consumer issues-Foreign direct investment privatization

Unit-2

- Equipment Design –standards-Quality Control.
- Environment issues-Women and Environment.

Unit-3

- Fuel Technology-New thrusts.
- Quality management

Unit-4

- Entrepreneurship Management
- Human Resource Planning and Audit.

ADVANCE INTERIOR DESIGNING

Paper no. -HSRM - 202

CC –5

Credits – 3 +1=4 **Sem. – 2 (M.Sc. R. M.)** **Marks- 100 +35 =135**

OBJECTIVES:

1. To develop skill in creative environment suitable to the home.
2. To develop art of judging functional home furnishing.
3. To better understanding the principles of designing.

UNIT – 1

i. Residental Planning.

Aspects, prospects, privacy, groupiness, romminess, ventilation, circulation, flexibility, furniture requirement and sanitation.

i. Planning of rooms.

ii. Essentials for room Arrangements.

UNIT – 2

General Building Materials.

i. Bricks,stones, cement, lime, plastic, glass, metal and wood.

ii. Materials used in Interior Decoration.

iii. A coustic materials.

UNIT -3

Furniture Arrangement.

i. Design, Style and materials used in modern furniture.

ii. Rules for furniture arrangement selection of furniture.

iii. Different types of furniture.

i. **Treatment of Individual room.**

- Drawing room.
- Kitchen.
- Bedroom.
- Children.

ii. Accessories for Home Decoration.

UNIT – 4

i. Current Trends in Interior Design.

ii. Possiblities in Decoeration.

iii. Consideration ergonomically aspects of human -body,posture in different activities while planning space of Interior designing.

PRACTICAL :

1. Rendering techniques.
2. To study about colour schemes.
3. Model making of interior schemes.
4. Market survey of building materials.

5. Visit to inside/outside fare.
6. To study about modern furniture.
7. To draw 3 D Plan – one room.
8. To make a scrapebook of space – management of residential planning/small residential space planning and comme rcialspace planning.

REFERENCE :

1. Housing for family living by Veena gandotra and Sanjev patel
2. Nanavati R.M. (1990) professional practiceer book depot, Bombay.
3. Bhatt P.D.and goenlca S. (1990) “foundation of art and design” Lakhani Book Depot, Bombay
4. Rangwala N. (1996) “Building Materials”
5. Craig and Rush “Home with characters”
6. Donmericeri K.S. (1993) “Interior Decoration in India.”
7. Inside out side magazine.

THEORIES OF MANAGEMENT AND RESOURCE ENCHANCEMENT

Paper no. -HSRM - 203

CC -6

Credits – 4 +0 = 4 **Sem. – 2 (M.Sc. R. M.)** **Marks- 100 +0 =100**

OBJECTIVES:

1. To understand the significance of management in the micro an d macro level organization.
2. To know the conceptual human & scientific aspects of management function.
3. To develop the ability to evaluate the management efficiency of effectives in the family and organizations.
4. To enhance the understanding of the similarly among all areas of management education & research the dissemination of the professional knowledge, skill & attitude.

UNIT – 1

1. History & development of management in India & elsewhere.

   - Industrial ,Farm & agricultural Institutional, Household and educational.

2. Management as a system-

   - Definition, elements, types, advantages & disadvantages of system.

   - Application in family resources management.

UNIT – 2

(A) Management Abilities.

- Conceptnal
- Human
- technical

(B) Decision making.

- Meaning,types of decisions.
- Modes of decision making
- Techniques & tools for decision making, decision tree.

UNIT – 3

(A) Planning – Objectives, principles, strategies.

(B) Organization–Objectives, Principles, Types, Authorities & responsibilities.

(C) Guiding,Directing,Leadership,motivation & communication.

(D) Controlling- tools for management control & feedback.

UNIT – 4

Human behavior organization.

- Personality, attitude, motivating factors.
- Group behavior & dynamics.
- Team management.
- Stress & conflict management.
- Management of change.
- Stress management.

REFERENCES :-

1. Kapur S.K. (1996) : Professional Management,S.K.Publishers,New Delhi.
2. Deacon R.E. and fire Baugh,F.M. (1975): Home Manage ment context and concept, Hougmen Miffen, Boston.
3. Deacon R.E. and Fire Baugh F.M. (1981) Resource Management Principles and Appliances,Allyn and Bacon and Bacon Boston.
4. Sheman A.W. et.al. (1988) : Managing Human Resources, South -Weston Publication Co; Cincinnati.
5. Ivancevich,J.M. et.al.(1980) Managing for performance Business Publications INC.TEXAS.
6. Dwivedi,R.S. (1981): Dynamics of Human Behaviour of Work,Oxford and 9BH, New Delhi.
7. Saiyadain M.S. (1988): Human R esources Management,Tata McGraw Hill,New Delhi.
8. Dayal R (1996): Dynamic of Human Resources Development,Mittal Publications,New Delhi.

HOSPITALITY ADMINISTRATION

Paper no. -HSRM - 204

ES – 2

Credits – 3 +1=4 **Sem. – 2 (M.Sc. R. M.)** **Marks- 100 +35 =135**

Objectives :

1. To orient the students with the functions of front office department in the ho spitality department.
2. To acquire the students with the housekeeping department and it's administration.
3. To enable the students to manage resourses in the house keeping departments of fulfill the hospitality function.

UNIT – 1

Types of Institutions offering hospitality services.

a) Functions/services of the front office.

b) Various section of the front office.

c) Front office organisation and the duties of the front office staff.

d) The role and the essential qualities of front office staff.

e) Personnel hygine of the front office staff.

UNIT – 2

1. Role of housekeeping in the hospitality industry.
2. Layout of housekeeping department.
3. Organisation of housekeeping department.

4. Qualities of the housekeeping staff.
5. Departments that housekeeping co-ordinates with.

UNIT – 3

1. Personnel management
   - Recruitment
   - Selection
   - Training
   - Job Analysis and job Description
2. Housekeeping procedures of rooms and floor.
3. House keeping procedures of Linen & uniform wearing.

UNIT – 4

1. Safety and security

   Fire preperation, sanitation, post control, con trol of o-dours/firstaid.
2. Flower arrangement.
3. The basic style/types of food service – self, tray and waiter.
4. Top off table items – table linen, dinner work, table work and glass work.
5. Table setting.

PRACTICAL :

1. Folding of nepkins.
2. Floor arrangement for din ning room and dinning table.

3. Salad description
4. Table setting for various meal.
5. Menu planning for various groups of people for various occassions.
6. A short duration training in planning and organisation, a catering project.
7. Market survey of different food c ommodities and their costs.
8. Models of records to be maintained in a food service institution.
9. Hospitality administration project.

RFERENCES:

1. Andrews Snoher (1978) : Hotel Housekeeping Training Manual, Tata McGraw Hill Publication Co.Ltd., New Delhi.
2. Dix ,C (1979) Accommodation Operations: MacDonald and Evans.
3. Ursula Jones and Newtonons; Hospitality and Catering.
4. Sethi ,M.and Malhan.S. (1993) Catering Management ,Wiley Eastern Ltd.,New Delhi.

HOUSEHOLD EQUIPMENTS

Paper no. -HSRM - 204

ES – 2

Credits – 3 +1=4 **Sem. – 2 (M.Sc. R. M.)** **Marks- 100 +35 =135**

Objectives:

1. To understand the students and innovative technology in household equipments.
2. To understand the students about market of the household equipments.
3. To enable the students about conservation of time and energy saving.

UNIT - 1

Household equipments

- History
- Importance
- Changing trends in equipments in manufacturing materials and assembling and finishes.

Kitchen equipments

- Electrical and non electrical it's use and opereting system.
- Surface cooking equipments
- Oven and bakery equipments
- Tools for preparing and serving the foods.

UNIT – 2

A. Equipments for cleaning

- Importance
- Housing machine, Vacume cleaner, Dish washer, Moper

B. Equipments for Confort

- Air conditioner , Fan
- Room heater
- Exhaust fan, Air Cooler
- Water purifier

UNIT – 3

Equipment Designs

- Criteria kept in mind while designing product.
- Convenient features
- Types of design testing of it’ s method

UNIT – 4

Consumer and household equipments

- Market trends
- Consumer protection related to household equipment
- Advertisement
- Label and specification
- I.S.I., B.I.S. and others

PRACTICAL

1. To study judging various brands of equipments and types of e quipments
2. Market survey of household equipment
3. Consumer survey for household equipment
4. To study various finishers of Equipments
5. Designing of an Equipments
6. Visit to a Equipped station

REFERENCES

1. Avery, M. (1955): Household Physics, MacMillan Co, New York.
2. Allison, A. (1966): Running Your Home and Equipment:Design for Living, Series No.6, Mills and Boon Ltd., London.
3. Varghese, M.A. et al (1985) : Household Equipment Manual, S.N.D.T. Women's University, Mumbai.
4. Jonson B.J.(1970):Equipment for Modern Li ving, MacMillan Co, New York.
5. Beveridge, E.(1965): Choosing and Using your Home Equipment, Lowa State University Press, Ames.

COMPUTER APPLICATION

Paper no. HSG- 205

ID – 2

Credits – 2+2=4 **Sem. – 2 M.Sc. R.M.** **Marks- 50 +50 =100**

OBJECTIVES

1. To introduce the students to theoretical constructs related to computer & Information technology.
2. To expose student to the application of computer & I.T.
3. To be able to appreciate and understand importance of writing scientifically.
4. To develop competence in writing and abstracting skills.
5. To develop skill to write either a draft research proposal or a chapter of dissertation

UNIT :1

- Introduction of computer
  - Various part of computer.
  - Structure and Functions of various part of computer.
  - Application of computer.

UNIT :2

- Window based programme.
  - Word : Introduction & Application.
  - Excel : Introduction & Application.

UNIT :3

- Network cabling.
- Power Point : Introduction & Application.

UNIT : 4

- Internet : Introduction & Application.
- Accessing websites : Use of Internet to access & discriminate information.

1. **PRACTICAL:**
    1. Use of Microsoft Word.
    2. Use of Excel.
    3. Use of Fox Pro.
    4. Use of Power Point.
    5. Use of Internet

REFERENCES :-

1. HURMAN e & Montagnes,1 (Eds.)(1997). The Thesis and the Book. New Delhi Vistar.
2. APAC (1984) Publication manual of American Psychological Association (3 rd Edition), Washington : APA.
3. Cooper,H.M. (1990) Intergrating Research : A guide for literature Review (2 nd Edition) California : sage.
4. Sternberg, R.J. (1991). The Psychologist's companion : A guide to scientific writing for students & Researchers,Cambridge C.U.P.
5. Wolcott,H.F. (1990) Writing up Qualitative Research,Newbury Park,S age.

CURRENT TRENDS AND ISSUES IN HUMAN DEVELOPMENT

Paper no. –HSHD - 201

CC - 4

Credits – 4+0=4 **Sem. – 2 M.Sc. H.D.** **Marks- 100 +0 =100**

Objectives

- To create awareness regarding current trends, issues and researches relate d to various aspects of human development, early childhood education, family studies and disabilliting.
- To understand the importance of innovative/new programmes in the field.
- To develop an understanding of the role of advocacy in promoting issues and concerns related to human development.

Unit -1

1. Trends and issues related to processes of development
    - Psycho-motor development.
    - Perceptual development.
    - Congnitive development.
    - Socio-emotional development.
    - Language development.
    - Moral development.

Unit-2

1. Trends and issues related to early child development and early childhood care and education
    - Demographic status, attrition in early preschool/and primary years, gender equality and equity.

- Issues and concerns related to children in difficult circumstances; street children, adopted children, girl child, single parent children, refugee and migrant children, children with disability and other vulnerable groups.
- Issues and concerns related to quality in early childhood and primary curriculum.
- Issues and concerns related to training of ECCE personnel and accreditation processes.

Unit-3

1. Trends and issues related to life span development
    - Infancy
    - Early childhood
    - Young adulthood
    - Adulthood
    - Old age

Unit-4

1. Trends and issues related to family studies.

MEASUREMENT AND EVALUATION.

Paper no. –HSHD - 202

CC - 5

Credits – 3+1=4 **Sem. – 2 M.Sc. H.D.** **Marks- 100 +35 =135**

Objectives

1. To acquaint the students with the various method of studing human behavior and development across the age span.
2. To train students to administer various standardized test.
3. To expose the students to the relevance of the standardized tools to the Indian setting.

UNIT : 1.

Functions & origins Of Psychological Testing.

- Introduction uses and varities of psychological tests, control the use of tests.
- Test administration, Examiner and situational variables,sources of information about tests.
- Overview of the historical antecendents and origins of psychological testing.

Anthropometric measurement and visiting method.

- Types and measures of motor developments.
- Observation and Interview methods,Rating of behavior & development of rating scale.
- Measurement & Inter pretation of Reliability and validy,Item Analysis.

UNIT : 2.

Measurement of Intelligence.

- Definition & concept of intelligence I.Q.,Nature & Factors affecting to intelligence.
- Individual & group Test,Verbal & Non verbal tests, and other standized test for to measure intelligence.
- Test for special population.

UNIT : 3.

Measurement of personality.

- Definition, concept & factors affecting to personality test.
- Self-Report personality test.
- projective techniques.

UNIT : 4.

Applications of testing.

- Educational and occupational testing.
- Test use in clinical and counseling psychology.
- Ethical and social considerations in Testing.

PRACTICAL :-

1. Case practice across age span using various psychological test.
2. Interviews/observation of children/adolescents/youth/women.
3. Case study of children : Normal and children with special needs.
4. To study Anthropometric measurement.

REFERENCES :-

1. Dr. Desai,Krishnakant G; 2000,Psychological Testing; The University Book production Board,Gujarat State.
2. Anastasi;Anne;1988;Psychological Testing,Macmillan publishing company,New York.
3. Anastasi Anne;Urbing Susana;1997;Psy chological Testing,7th Edition,person Education(Singapore)Ptc.Ltd; Indian branch Patparganj,Delhi.
4. Panda K. C;1981;Elements of child development,Kalyani publis hers.

ADVANCE HUMAN DEVELOPMENT – I

Paper no. –HSHD-203

CC -6

Credits – 4 + 0 =4 **Sem. – 2 (M.Sc. H.D.)** **Marks-100 +0 =100**

OBJECTIVES

1. To undertake an advances study of the stages in human development with special focus on stages from parental development to childhood.
2. To understand the principles and factors influencing human development in these stages.

UNIT : 1

Research methods to study development.

- Introduction,classification.
- Methods of data collection.
    - Cross-sectional studies.
    - Longitudinal studies.
    - Sequential studies.
- Nonexperimental methods :

  Case study, Observation,Intervies,Correctional studies.
- Experimental methods.:

  Types of experiments : Laboratory,Field & Natural.
- Prenatal development
- Recapitulation of stages in prenatal development.

- Genetic & environmental factors.
- Significance of the genome project for understanding human development.
- Birth process : Stages of birth process

  -Types of delivery.

UNIT : 2

Infancy : (birth – 2 years)

- The new born
- Developmental tasks.
- Physical and motor development.
- Sensory capacities and reflexes.
- Imitation,object permanence and other cognitive accomplishments.
- Early language development.
- Social relationships during infancy.
- Emotional development.

UNIT :3

Early childhood (2-6 years)

- Transition from infancy to childhood (Characteristis and developmental tasks.)
- Physical and motor development.
- Cognitive development.
- Language development.
- Emotional development

- Social & personality development.
- Factors affecting on Early childh ood development.

UNIT : 4

Middle childhood (6-12 years)

- Physical and motor development.
- Cognitive development.
- Language development.
- Social relationships.
- Personality developments.
- Emotional development.
- The experience of schooling academic achievement.

REFERENCES :-

1. Rice F.P. (1995),Human Development,NewJersey:Prentice Hall.
2. Berk L.E. (1995) Child development,London: Allyn & Bacon.
3. Harlock Allizabath “Developmental Psychology.”
4. Mussen P.H. conger J.J.,Kagan,J & Huston,A.C.(1996).Child development & personality,New York:Harper & Row.

FAMILY STUDIES & EDUCATION

Paper no. -HSHD- 204

ES – 2

Credits – 3+1=4 **Sem. – 2 (M.Sc.H.D.)** **Marks-100 +35 =135**

OBJECTIVES:

1. To understand family as a component of socio -cultural millien and context.
2. To familiarize students with developmental perspectives in family & life cycle.
3. To realize and appreciate universals and variations in family life patterns across cultures sub-cultures.
4. To create awareness regarding philosophy ,structure, function,need and stren gths of families with specific reference to the Indian Family.
5. To understand the various crisis,its effects and preventive measures for its in family.

UNIT – 1

- Family as component of social structure and context.
- Family as an involving and dynamic insti tution.
- Socio –cultural studies of family pattern in India.
- Types of family.
  - Nuclearer,Joint.
- Functions of family.
  - Alternative families
  - Single parent families.
- Childless
- Adoptive families

- Contract system
- Dual carrier families.

UNIT – 2

- Marital and family relationship.
- Marital adjustment and satisfaction.
- Inter action pattern throughout the family life cycle.
- Approaches and theories in family studies.

  Developmental, Interreactional, Institutional systemic, Family life cycle and cyclical, progressive and structural functional theory.

UNIT – 3

Family stress & crisis.

Introduction,definition.

Types of crisis

Causes of crisis.

- Divorce as crisis : reasons,effects.
- Widowhood as crisis.
- Aging as a crisis.

UNIT – 4

- Dual career of women as a crisis.
- Pre and post marital affairs as a family crisis.
- Desertion as a crisis.

- Mechanism for resolution of family crisis.
    - Adjustment of new values.
    - Changeover of responsibilities.
    - Planning for the future.
    - Family guidance and counseling.

PRACTICAL :-

1. Study of various family crisis by Interview method.
2. Study of family structures,its effect etc.

REFERENCES:-

1. Ahuja R (1997).India Social System (2nd Edition)Jaipur,Rawat.
2. Bharat S & Desai M (1995) India Bibliographies on the family: Bombay : Tata Institute of Social Sciences.
3. Bharat S (1996) Family measurement in India,New Delhi sage.
4. Shriram R (1993). Family Studies in India Appraisal and New Directions.
5. T.S.saraswati & B Kaur (Eds.)Human development & family studies in India. An agenda or Research & Policy,New Delhi sage.
6. 'KUTUMBKALYAN'-A.G.Shah & J.K. Dave.
7. 'SAMAJ SHASTRA NA MUL TATVO' -Tara Patel.

REPRODUCTIVE HEALTH, CARE AND EDUCATION

Paper no. -HSHD- 204

ES – 2

Sem. – 2 (M.Sc. H.D.) **Marks-100 +35 =135**

OBJECTIVES:

1. To creative awareness of the basic concepts of reproductive health.
2. To create awareness of the ba sic concepts in counseling of person with STD/HIV/AIDS.
3. To make them understand psychosocial aspects of HIV/AIDS in relation to family and community life.
4. To develop the skills for counseling for behavior change in person living with HIV/AIDS.
5. To develop skills for home based care and counseling for family members.

UNIT – 1

- Basic concept of reproductive health.
- Importance of reproductive health.
- Reproductive system: Reproductive organ,structure functions.
- Forms of sexual practice,sexual abuse. Sexually Tra nsmitted diseases.
- Various sexually transmitted diseases ,prevalence/characteristics or symptoms ,causes and prevention of S.T.D.
- Basic concepts and facts about HIV/AIDS.
- Introduction to HIV virus.

- Prevalence rate of HIV/AIDS in India & World.
- Transmission of HIV infection.

UNIT – 2

- Diagnosis of HIV infection.
- Sign & symptoms of AIDS.
- Prevention of HIV infection.
- Mis conception about HIV/AIDS disease.
- Need of reproductive Health education,Methods of reproductive Health education.

UNIT – 3

- Psychosocial aspects of HIV/AIDS.
- Coping strategies HIV/AIDS person.
- Legal issues, rights and ethics.
- HIV/AIDS patients in school and family.
- Attitude towards HIV/AIDS patient.
- Role of various agencies in prevention.

UNIT – 4

HIV/AIDS counseling.

- The principles of counselling, Goals of counseling.
- The prerequisites of counseling, stage of counseling, specific counseling skills.
- Characteristics & attitude of a counselor.
- Content of communication about HIV/AIDS.

- Some specific counseling situations.

  Post-test and pre-test counseling.

PRACTICAL :

1. Visit of HIV/AIDS counseling centers.
2. Study of psychosocial problems of HIV/AIDS patient.
3. Study of socio economic & family problems of HIV/AIDS patient.
4. Planning of STD awareness programme.
5. Study of awareness belief/Attitude forwar ds sexuality, S.T.D./Reproductive Health etc.

REFERENCES :-

1. Panthaki,Dhun(1997) Education in Human Sexuality,Delhi: FamilyPlanning Association of India.
2. Bharat S (1996) Facing the challenge -house hold and community response to HIV/ AIDS in mobai,Bombay TISS.
3. Ahmed,P.I. (1992) Living and dying with AIDS, New York:Plenum.
4. Sonawat R & Mathur S (1999); HIV/AIDS persons coping strategies,Mumbai: Multi Tech Publishing Co;.
5. HIV/AIDS counseling Training Manual, AIDS Control Programme. Ministry of Health, Malaw.

COMPUTER APPLICATION

Paper no. -HSG- 205

ID – 2

Sem. – 2(M.Sc. H.D.) **Marks- 50 +50 =100**

OBJECTIVES

1. To introduce the students to theoretical constructs related to computer & Information technology.
2. To expose student to the application of computer & I.T.
3. To be able to appreciate and understand importance of writing scientifically.
4. To develop competence in writing and abstracting skills.
5. To develop skill to write either a draft research proposal or a chapter of dissertation.

UNIT :1

- Introduction of computer
  - Various part of computer.
  - Structure and Functions of various part of computer.
  - Application of computer.

UNIT :2

- Window based programme.
  - Word : Introduction & Application.
  - Excel : Introduction & Application.

UNIT :3

- Network cabling.
- Power Point : Introduction & Application.

UNIT : 4

- Internet : Introduction & Application.
- Accessing websites : Use of Internet to access & discriminate information.

PRACTICAL:

1. Use of Microsoft Word.
2. Use of Excel.
3. Use of Fox Pro.
4. Use of Power Point.
5. Use of Internet.

REFERENCES :-

1. HURMAN e & Montagnes,1 (Eds.)(1997). The Thesis and the Book. New Delhi Vistar.
2. APAC (1984) Publication manual of American Psychological Association (3 rd Edition), Washington : APA.
3. Cooper,H.M. (1990) Intergrating Research : A guide for literature Review (2 nd Edition) California : sage.
4. Sternberg, R.J. (1991). The Psychologist's companion : A guide to scientific writing for students & Researchers,Cambridge C.U.P.
5. Wolcott,H.F. (1990) Writing up Qualitative Research,Newbury Park, Sage.

CURRENT TRENDS AND ISSUES IN CLOTHING & TEXTILE

Paper No HSCT (201)

CC-4

Credits : 4+0=4 **SEM – II (M.Sc. C.T.)** **Marks : 100**

Unit -1

- Principale of Art and design
- Principale of fullness

Unit -2

- Fashion Trends

Unit -3

- Textile & their uses
- Eco-friendly textile

Unit -4

- Garments & Textile industry

FABRIC CONSTRUCTION AND WOVEN FABRIC ANALYSIS

Paper No HSCT (202)

CC-5

Credits : 3+1=4 **SEM – II (M.Sc. C.T.)** **Marks : 100 + 35= 135**

Objective

- To enable students to understand and learn methods of developing fabrics u sing different fibers, yarn and fabric making techniques.
- To gain knowledge and understanding of fundamentals of weaving machinery and processes.
- To analyse different weave patterns and learn principles of creating design through weaving.

Unit - 1

principles of yarn manufacture – yarn processing

- For natural fibers - cotton, wool & worsteds, jute, lilen by conventional systems and recent developments like:
  a. OE Spining – Rotar, Vortex, Friction, Airjet Electrostatic, Twistless (Bobbtex, cover, signal twilo).
  b. Self twisting
  c. Fasicated
  d. Yarn from fibers
  e. Laminated yarns
- Yarn nomenclature and measurement – Yarn numbering systems
- Geometry of different classes of yarns and its relationship to fabric properties.

Unit - 2

Modern developments in yarns and at their manu facture

- Modern yarn production – principles of spinning in production of man made fiber; hot & cold drawing; spun yarn; blend yarn and bicomponent yarn
- Textured yarn technology – principles methods and process variable in texturing & their effect on properties of textured yarns : morphological changes induced by texturing.
- Core yarns, network and film yarns and laminated yarns.
- Designing through variable in yarns.

Unit - 3

Principles of fabric manufacture – basic principles, characteristics and significanc e of different processes – woven, knitted, non woven, laces, braids.

a. Weaving
   - Parts and functions of handloom
   - Types of weave – basic & decorative

b. Knitting
   - Knitting machines, types of knitting
   - Properties

c. Felts & Non wowens
   - Knitting, braiding and lace making
   - Types of weave – basic & decorative

d. Introduction to Technical Textiles – geo textiles.
   - Parts and functions of handloom
   - Types of weave – basic & decorative
   - Types of weave – basic & decorative

Unit -4

Fabric faults – fiber, yarn and fabric defects and their remedies.

Woven: Sequence of operations in warp and weft preparations:

- Various types of looms and their drive.
- Fabric classification and analysis of fabrics for its construction weaves.

- Basic and decorative weaves plain, twill and stain derivatives. Dobby and jacquard shedding and weaving terrypile.
- Principle of colour and design in weaving: preparation of pattern for dobby and jacquard looms; brocade, damask, tapestry, warp and weft pile weaving.
- New developments in woven fabrics – new looms and loom developments. Triaxial weaving, knit and weave construction.
- Textile design through weaving.

Practicals

1. Setting up of a simple loom – calculation of raw materials.
2. Weaving on simple loom, plain, rib, matt and twill structures.
3. Fabric analysis for design, repeat, draft, peg plan and other details.
4. Creating designs for stripes, checks, dobby and jacquards.
5. Visit to weaving mills.
6. Survey - Various fabrics available.

References

1. Spun Yarn Technology – Eric Oxtoby Butterworth Publication
2. American Cotton Handbook - Merrill
3. Subodh Kumar Aggarwal (1980): Textile Processing And Auxiliaries.
4. Textiles – Burker – (1988) Abhishek Publication.
5. Essentials Of Textiles – M. Joseph, Holf Rinechants, Winston Publication.
6. Irene Waller: Designing With Threads.
7. Edward Miller (1992) Textiles.
8. Corbman B.: Fiber To Fabric.
9. Book – Textiles – Prop & Behaviour in Clothing Use – Year (1992).
    a. What is Textiles, page 10-13.
        - Wowen Fabrics
        - Knitted Fabrics
    f. Fabric structure (86-94)

- Woven fabric, fabric width, fabric weight, woven fabric structur e, weaves, weave variety, plains, twill, stains weave.

10. Book – Textiles
    - Year 1998
    - Chapter 7, Principles of Weaving
    - Pg. 154 - 171
11. Book – From Fibers to Fibrics, Gale, E., 1968, p.54.
12. Colour and Weave – Margret & Thomas, Winderkuechd.
13. Grociki, Z.J.: Watsons Textiles Design and Colour, London, Newness Butter Worths.
14. William Watson: Advanced Textiles Design, London, Longmans Green and Co. Ltd.
15. Nisbet, H.: Grammar of Textile Design, Taraporewale Sons and Co. Ltd., London.
16. Aswani, K.T.: Weaving Mechainsms – Mahajan Book Destributors, Ahmedabad.
17. Sengupta, R.: Weaving Calculations – Taraporewale Sons and Co., Bombay.
18. Robinson and Mark: Woven Cloth Construction – Butter Worth and Co. Ltd., London.
19. Thorpe, Azaba: Elements of Weaving – Doubleday and Co. Inc. New York.
20. Singh, R.B.: Modern Weaving, Mahajan Book Distributors, Ahmedabad.
21. Kulkarni, M.M.: Weaving Technology; Virinda Publication, Jalgaon.
22. Amalsar, D.M.: Yarn and Cloth Calculation.
23. Amalsar, D.M.: Handloom Weaving.
24. Amalsar, D.M.; Fabric Structure and Cloth Analys is.
25. Ajgaonkar, D.B.: Knitting technology, Universal Publishing Crop., Mumbai.
26. Ingold, T.S. & Miller, K.S.: Geotextiles Handbook – Thomas Telford, London.

COLOUR SCIENCE AND INSTRUMENTATION

Paper No HSCT (203)

CC-6

Credits : 4+0=4 **SEM – II (M.Sc. C.T.)** **Marks : 100**

Objectives

1. To develop an understanding of the scientific aspects of colour, difference betwee n day and colour compound.
2. Understanding of colour formulation, assessment of colour differences, colour, sorting techniques and colour perception.
3. To understand theory of colour measurements in solution and on textiles and the instruments used for colour measurement.
4. To acquaint students with the recent developments regarding eco -regulation and banned dyes.

Unit -1

- Electromagnetic Radiation, Electromagnetic Spectrum and its uses in
- Physical/organic chemistry, sources of natural and artificial light, properties of artificial light sources, absorption and scattering of light, spectro - photometric curves and their relationship to perceived colour.

Unit -2

Relation between colour and chemical constitution of days, to acquaint

With colour index.

- Instruments for the measurement of colour, principal of spectrophotometry, early colorimeter, absorption spectroscopy, Beer -Lambents Law ,single beam and double beam spectrophotometer.

Unit -3

Colour mixing system, colour order system, CIE colour specifications, lluminant, yellowness index and whiteness index, reflectance spectrophotometer , kubelka munk Theory, Relation between K-S and concentration of colourant, understanding colour difference, hue, chroma etc.

Unit -4

Introduction to chromatography and basic instrumentation; Application of Thin layer chromatography, HPLC and GC in day analysis.

Practicals

1. Identification of dyes, direct, reactive, vat, acid, azo, disperse and natural day.
2. Demonstration of reflectance spectrophotometer for colour data measurements, whiteness and yellowness index.

References

1. Colour physics for industry, Ed., by Roderick McDonald, Published by the Society of dyers and colourists.
2. Instrumental methods of Chemical Analysis, Galen W.E. Wing, McG raw –Hill Book Company.
3. Instrumental Methods of Chemical Analysis – G.R. Chatwal and S. Anand, Himalaya, Publishing House, Mumbai.
4. Dyeing and Chemical Technology of Fibers, S.R. Trotman, Charles Gribbin & company limited.
5. Chemistry of Synthetic Dyes Part i & ii – K. Venkatraman.

ADVANCED APPAREL CONSTRUCTION

Paper No HCT (204)

ES - 2

Credits : 3 + 1= 4 **SEM – II (M.Sc. C.T.)** **Marks : 100 +35 = 135**

Objective

- To help develop skills in pattern making and construction.
- To create awareness of quality assurance norms and evaluating of quality in apparel

Unit -1

Fitting – factors affecting good fit, common problems encountered and remedies for fitting defects (upper and lower garments).

Unit -2

Clothing for people with special needs

- Maternity and lactation period
- Old age
- Physically challenged
- Physically challenged

Unit -3

Evaluating the quality of apparel

- Identification of the components of apparel
- Fiber content, Shaping devices, underlying fabrics, pockets, necklines, hem treatments, decorative details and alteration potential.

Unit - 4.

Standards for evaluating the various components.

Practicals

1. Developmentof slopers for skirt variations
   - Low and high waist.
   - A line, flared, circular, pleated, yoked with godet/peplum
   - Skirt band – separate band, faced waist line
1. Pockets
   - Slashed pockets – welt, bound flaps
   - Inseam pockets : closed and open
3. Placket
   - Fly front opening
   - Zipper in seam, without seam
4. Designing, drafting and construction of skirts
5. Fashion sketching
6. Term garments

References

1. Slampler, Sharp & Donnell: Evaluating Apparel, Quality – Fairchild Publications, New York.
2. Natalle Bray Dress Fitting Published By Blackwell Science Ltd.
3. Margolis Design Your Own Dress Pattern Published By Double Day And Co. Inc New York.

KNITTING TECHNOLOGY

Paper No HSCT (204)

ES - 2

Credits : 3 + 1 = 4 **SEM – II (M.Sc. C.T.)** **Marks : 100 +35=135**

OBJECTIVES

- To gain experience in hand knitting and machine knitting]
- To know about Indian knitting industry.
- To develop an understanding of the various knitting structure.
- To understand stitching of knitted garments.

Unit-1

- Introduction to Knitting-definition of knitting, basic structural terns and principle of knitting technology, Difference between knits and woven.
- Development of knitting from hand knitting to machine knitting and further developments.
- Indian knitting industry-past, present and future

Unit-2

- Basic mechanical principles of knitting technology, elements of knitted loop structure, four primary base structures(pain, rib, interlock,purl),
- Weft knitting and warp knitting-terms and definition used related and warp knitting comparison of weft and warp knitting, classification of weft knitting machines and warp knitting machines.
- Weft knitting-Basic structure, stitches, designing of weft-knit structures, needles and yam selection for weft knitting .Quality control of weft knit fabrics, general calculation for weft knits.

Unit-3

- Warp knitting –development of warp knitting machines, basic warp knit str uctures and their representation, patterning mechanisms for warp knit designs, yams for warp knits, general calculations for warp knits. Tricot and Raschel knits - Principle,machines and production methods.
- (a) The structure of a flat knitting machine:

  Needle bed assembly.

  The carriage.

  Yam feeding

  Needle brushes

  Fabric take-down
- (b) Manual operation of a flat knitting machine and circular knitting machine

Unit-4

- Knitted structures, structured knits, Jac quard knitting, intarsia knitting-Basic principle and stitches and their application.
- Electronics in knitting.
- Knitted garments-Cutting, stitching &Quality control of knitted garments.

Practicals

1. Learning to operate the flat knitting machine and circular knitting machine,
2. Making knitting samples with the 4 basic stitches (pain,rib,purl and interlock)
3. Analysis and testing of knitted samples.
4. Yarn calculations for weft and warp knits.
5. Visits to different knitting units

References

- David J.Spencer-Knitting Technology,Pergeman Press,U.K

- Prof. D.B. Ajgaonkar- knitting Technology,university publishing co-operation,Bombay.
- Dr.Samuel Raz – Flat knitting Technology,Germany.
- Terry Brackenbury-knitted clothing Technology-Blackwell science.

COMPUTER APPLICATION

Paper no. -HSG- 205

ID – 2

Sem. – II (M.Sc. C.T.) **Marks- 50 +50 =100**

OBJECTIVES

To introduce the students to theoretical constructs related to computer & Information technology.

To expose student to the application of computer & I.T.

To be able to appreciate and understand importance of writing scientifically.

To develop competence in writing and abstracting skills.

To develop skill to write either a draft research proposal or a chapter o f dissertation.

UNIT :1

Introduction of computer

- Various part of computer.
- Structure and Functions of various part of computer.
- Application of computer.

UNIT :2

Window based programme.

- Word : Introduction & Application.
- Excel : Introduction & Application.

UNIT :3

- Network cabling.
- Power Point : Introduction & Application.

UNIT : 4

- Internet : Introduction & Application.
- Accessing websites : Use of Internet to access & discriminate information.

PRACTICAL:

Fundamentals of computer.

Use of Microsoft Word.

Use of Excel.

Use of Power Point.

Use of Internet

REFERENCES :-

1. HURMAN e & Montagnes,1 (Eds.)(1997). The Thesis and the Book. New Delhi Vistar.
2. APAC (1984) Publication manual of American Psychological Association (3 rd Edition), Washington : APA.
3. Cooper,H.M. (1990) Intergrating Research : A guide for literature Review (2 nd Edition) California : sage.
4. Sternberg, R.J. (1991). The Psychologist's companion : A guide to scientific writing for students & Researchers,Cambridge C.U.P.
5. Wolcott,H.F. (1990) Writing up Qualitative Research,Newbury Park,Sage.

CHEMISTRY

Paper-VII CHN 501 Inorganic Chemistry

I Electronic Spectra and Magnetic Properties of Transition Metal Complexes — **20 Hrs**

Spectroscopic ground states, correlation, Orgel and Tanabe-Sugano diagrams for transition metal complexes (d^1-d^9 states), calculations of Dq, B and β parameters, charge transfer spectra, spectroscopic method of assignment of absolute configuration in optically active metal chelates and their stereochemical information, anomalous magnetic moments, magnetic exchange coupling and spin crossover

II Metal π-Complexes — **12 Hrs**

Metal carbonyls, structure and bonding, vibrational spectra of metal carbonyls for bonding and structural elucidation, important reactions of metal carbonyls; preparation, bonding, structure and important reactions of transition metal nitrosyl, dinitrogen and dioxygen complexes; tertiary phosphine as ligand

III Metal Clusters — **14 Hrs**

Higher boranes, carboranes, metalloboranes and metallocarboranes. Metal carbonyl and halide clusters, compounds with metal-metal multiple bonds.

IV A Isopoly and Heteropoly Acids and Salts — **3 Hrs**

B Sigma bonded organo metallic compounds of transition metals classification synthesis structure , properties and applications — **12 Hrs**

Paper-VIII CHN502 Organic Chemistry

I Free Radical Reactions 12Hrs

Types of free radical reactions, free radical substitution mechanism, mechanism at an aromatic substrate, neighbouring group assistance. Reactivity for aliphatic and aromatic substrates at a bridgehead. Reactvity in the attacking radicals. The effect of solvents on reactivity.

Allylic halogenation (NBS), oxidation of aldehydes to carboxylic acids, auto-oxidation, coupling of alkynes and arylation of aromatic compounds by diazonium salts. Sandmeyer reaction. Free radical rearrangement. Hunsdiecker reaction.

II Addition to Carbon- Hetero Multiple Bonds 15 Hrs

Mechanism of metal hydride reduction of saturated and unsaturated carbonyl compounds, acids, esters and nitriles. Addition of Grignard reagents, organozinc and organolithium reagents to carbonyl and unsaturated carbonyl compounds. Wittig reaction.

Mechanism of condensation reactions involving enolates — Aldol,. Knoevenagel, Claisen, Mannich, Benzoin, Perkin and Stobbe reactions.

Hydrolysis of esters and amides, ammonolysis of esters.

III Pericyclic Reactions 20 Hrs

Molecular orbital symmetry, Frontier orbitals of ethylene, 1,3- butadiene, 1,3,5-hexatriene and allyl system. Classification of pericyclic reactions. Woodward—Hoffmann correlation diagrams. FMO and PMO approach. Electrocyclic reactions — conrotatory and disrotatory motions, 4n, 4n+2 and allyl systems. Cycloaddditions — antarafacial and suprafacial additions, 4n and 4n+2 systems, 2+2 addition of ketenes, 1,3 dipolar cycloadditions and cheleotropic reactions.

IV A Sigmatropic rearrangements 5Hrs

Sigmatropic rearrangements — suprafacial and antarafacial shifts of H, sigmatropic shifts involving carbon moieties, 3,3- and 5,5- sigmatropic rearrangements. Claisen, Cope and aza-Cope rearrangements. Fluxional tautomerism. Ene reaction.

B Elimination Reactions 8 Hrs

The E2, E1 and E1cB mechanisms and their spectrum. Orientation of the double bond. Reactivity - effects of substrate structures, attacking base, the leaving group and the medium.

Mechanism and orientation in pyrolytic elimination.

Paper-IX (CHN503) Physical Chemistry

Unit I Chemical Dynamics 18Hrs

Methods of determining rate laws, collision theory of reaction rates, steric factor, activated complex theory, Arrhenius equation and the activated complex theory; ionic reactions, kinetic salt effects, steady state kinetics, kinetic and thermodynamic control of reactions, treatment of unimolecular reactions.

Dynamic chain (pyrolysis of acetaldehyde, decomposition of ethane), photochemical (hydrogen-chlorine reactions) and oscillatory reactions (belousov-Zhabotinsky reaction), homogeneous catalysis, kinetics of enzyme reactions, general features of fast reactions, study of fast reactions by flow method, relaxation method, flash photolysis and the nuclear magnetic resonance method. Dynamics of barrier less chemical reactions in solution, dynamics of unimolecular reactions. (Lindemann and Hinshelwood theories of unimolecular reactions.)

Unit II Surface Chemistry 18Hrs

Adsorption

Surface tension, capillary action, pressure deference across curved surface (Laplace equation), vapour pressure of droplets (Kelvin equation), Gibbs adsorption isotherm, estimation of surface area (BET equation), surface films on liquids. Surface active agents, classification of surface active agents, micellization, hydrophobic interaction, critical micellar concentration (CMS), factors affecting the CMC of surfactants, counter ion binding to micelles.

Macromolecules

Polymer – definition, types of polymers, electrically conductiong, fire resistant, liquid crystal polymers, kinetics of free radical chain polymerzation, mechanism of polymerization.

Molecular mass, number and mass average molecular mass, molecular mass determinations (osmometry, viscometry, diffusion and light scaffering methods), size of macromolecules

Unit III Electro Chemistry- I 12Hrs

Electrochemistry of solutions, Debye-Huckel – Onsager treatment and its extension, ion solvent interactions, Debye-Huckel-Jerum mode. Thermodynamics of electrified interface equations. Derivation of electro-capillarity, Lippmann equations (Surface excess)) methods of determination, Structure of electrified interfaces. Guoy-Chapman, Stern, Bockris model.

Over potentials, exchange current density, derivation of Buller-Volmer equation, Tafel plot.

Unit IV Electro Chemistry-II

Quantum aspects of charge transfer at electrodes-solution interfaces, tunneling,

Semiconductor interfaces – theory of double layer at semiconductor, electrolyte solution interfaces, Effect of light at semiconductor solution interface.

Electrocatalysis – influence of various parameters, Hydrogen electrode. Bioelectrochemistry thereshold membrane phenomena, Nernst-planck equation, Hodges.

Huxley equations, electrocardiography, Polarogrophy – theory instrumentation, haf – wave potential and its significance. Polarography theory(No Derivation), half wave potential and its significance.

Paper-X CHN504 – A Spectroscopy

I Vibrational Spectroscopy 8 Hrs

Review of linear harmonic oscillator, vibrational energies of diatomic molecules, zero point energy, force constant and bond strengths; anharmonicity, Morse potential energy diagram, vibration-rotation spectroscopy, P,Q,R branches. Breakdown of Oppenheimer approximation; vibrations of polyatomic molecules. Selection rules, normal modes of vibration, group frequencies, overtones, hot bands, factors affecting the band positions and intensities, far IR region, metal-ligand vibrations, normal co-ordinate analysis.

II A Raman Spectroscopy 12Hrs

Classical and quantum theories of Raman effect. Pure rotational, vibrational and vibrational-rotational Raman spectra, selection rules, mutual exclusion principle. Resonance Raman spectroscopy, coherent anti Stokes Raman spectroscopy (CARS).

B Microwave Spectroscopy

Classification of molecules, rigid rotor model, effect of isotopic substitution on the transition frequencies, intensities, non-rigid rotor. Stark effect, nuclear and electron spin interaction and effect of external field. Applications.

III Magnetic Resonance Spectroscopy Part-I 16 Hrs

^{1}H NMR Nuclear spin, nuclear resonance, saturation, shielding of magnetic nuclei, chemical shift and its measurements, factors influencing chemical shift, deshielding, spin-spin interactions, factors influencing coupling constant 'j'. Classification (ABX, AMX, ABC, A2B2 etc.) spin decoupling; basic ideas about instrument. advantages of FT NMR use of NMR in medical diagnostics.

IV Magnetic Resonance Spectroscopy Part-II 12 Hrs

NMR studies, of nuclei other than proton – ^{13}C, ^{19}F and ^{31}P, FT NMR, ^{1}H NMR

Paper-XI CHN504 - B Computers for Chemists

I Introduction to Computers and Computing — 8 Hrs

Basic structure and functioning of computers with a PC as an illustrative example. Memory, I/O devices. Secondary storage. Computer languages. Operating systems with DOS as an example. Introduction to UNIX and WINDOWS. Data Processing, principles of programming. Algorithms and flow-charts.

II Computer Programming in FORTRAN/C/BASIC — 12 Hrs

(The language features are listed here with reference to FORTRAN. The instructor may choose another language such as BASIC or C and the features may be replaced appropriately). Elements of the computer language. Constants and variables. Operations and symbols. Expressions. Arithmatic assignment statement. Input and Output. Format statement. Termination statements. Branching statements such as IF or GO TO statement. LOGICAL variables. Double precision variables. Subscripted variables and DIMENSION. DO statement. FUNCTION and SUBROUTINE. COMMON and DATA statements. (Students learn the programming logic and these language features by 'hands on' experience on a personal computer from the very beginning of this topic).

III Programming in Chemistry — 15 Hrs

Development of small computer codes involving simple formulae in chemistry, such as van der Waals equation, pH titration, kinetics, radioactive decay. Evaluation of lattice energy and ionic radii from experimental data. Linear simultaneous equations to solve secular equations within the Hückel theory. Elementary structural features such as bond lengths, bond angles, dihedral angles etc. of molecules extracted from a database such as Cambridge data base.

IV Use of Computer Programmes — 25 Hrs

The students will learn how to operate a PC and how to run standard programmes and packages. Execution of linear regression, X-Y plot, numerical integration and differentiation as well as differential equation solution programmes. Monte Carlo and Molecular dynamics. Programmes with data preferably from physical chemistry laboratory. Further, the students will operate one or two or the packages such as MATLAB, EASYPLOT, LOTUS, FOXPRO and Word Processing software such as WORDSTAR/MS-WORD.

Paper-XII (CHN505) Laboratory Course

270 Hours (18 Hours/week)

INORGANIC CHEMISTRY

I Qualitative (A mixture containing total Eight radicals) (Minimum 4)

(a) Less common metal ions – TI, Mo, W, Ti, Zr, Th, V, U (two metal ions in cationic/ anionic form)

(b) Insoluble – oxides, sulphates and halides

II Separation and determination of two metal ions Cu-Ni, Ni-Zn, Cu-Fe etc. involving volumetric and gravimetric methods (Minimum 2)

III Chromatography

Column chromatography – ion exchange

ORGANIC CHEMISTRY

Qualitative Analysis

Separation, purification and identification of compounds of three component mixture (solid mixed with liquid) use of TLC and column chromatography, chemical tests. IR spectra to be used for functional group identification etc. preferred.

Organic Preparation (Minimum 3)

(i) Sandmeyer reaction: p-Chlorotoluene from p-toluidine

(ii) Acetoacetic ester Condensation: Synthesis of ethyl-n-butylaceto -acetate by A.E.E. condensation.

(iii) Cannizzaro reaction : 4-Chlorobenzaldehyde as substrate

(iv) Friedel Crafts Reaction : β-Benzoyl propionic acid from succinic anhydride and benzene

(v) Aromatic electrophilic substitutions: Synthesis of p-nitroaniline and p-bromoaniline

Quantitative Analysis (Minimum 3)

(i) Determination of the percentage or number of hydroxyl groups in an organic compound by acetylation method

(ii) Estimation of amines/phenols using bromate bromide solution/or acetylation method

(iii) Determination of Iodine and Specification values of an oil sample.

(iv) Determination of DO, COD of water sample

Physical Chemistry

Semester II

Physical Chemistry

Students are required to perform at least 08 experiments

Section I

Adsorption and phase equilibria **(Minimum one)**

(i) To study surface tension- concentration relationship for solutions (Gibbs equation).

(ii) To construct the phase diagram for three component system (e.g. chloroform-acetic acid-water)

Partition coefficient **(Minimum one)**

(1) To determine equilibrium constant of the reaction $KI+I_2 \rightarrow KI_3$ by distribution method.

(2) To determine the formula of the complex formed between the cupric ion and ammonia by distribution method.

Chemical Kinetics **(Minimum Two)**

(i) Determine the temperature coefficient and energy of activation of the reaction between $HBrO_3$ and HI.

(ii) Flowing clock reactions (Ref: Experiments in Physical Chemistry by Show maker)

(iii) Determination of the primary salt effect on the kinetics of ionic reactions and testing of the Bronsted relationship (iodide ion is oxidized by persulphate ion)

(iv) Determination of the rate constant for the oxidation of iodide ions by hydrogen peroxide studying the kinetics as an iodine clock reaction.

Section II

Conductometry (Minimum two)

(i) Determination of the velocity constant, order of the reaction and energy of activation for sponificification of ethyl acetate by sodium hydroxide conductometrically.

(i) To determine the amount of acetic acid and hydrochloric acid in given mixture of HAC + HCl conductometrically.

(ii) To study the effect of solvent on the conductance of $AgNO_3$/acetic acid and to determine the degree of dissociation and equilibrium constant in different solvents and in their mixtures (DMSO, DMF, dioxane, acetone, water) and to test the validity of Debye-Huckel- Onsager theory.

(iii) Determination of the activity coefficient of zinc ions in the solution of 0.002 M zinc sulphate using Debye Huckel's limiting law.

Potentiometry/pH metry **(Minimum Two)**

(i) Determination of the concentration of NaOH and NH_4OH in the given mixture using 0.1N HCl / conductometrically.

(ii) Determination of the dissociation constant of monobasic/ dibasic acid by Albert-Serjeant method.

(iii) Determination of the valency of mercurous ions potentiometrically.

(iv) Determination of activity and activity coefficient of electrolytes.

(v) Determination of the dissociation constant of acetic acid in DMSO /DMF /acetone or dioxane by titrating it with KOH

(vi) Determine of thermodynamic constants, ΔG, ΔS and ΔH for the reaction by e.m.f. method.

$Zn+H_2SO_4 \qquad ZnSO_4 + 2H$

Polarimetry **(Minimum one)**

(i) Determination of rate constant for hydrolysis / inversion of sugar using a Polari meter.

(ii) Enzyme kinetics – inversion of sucrose.

Semester –I
Practical Examination Schedule
[Total 150 marks 3 days]

[A] Inorganic Chemistry Practicals (40 marks, 5Hrs)

(i) Preparation of complexes and their analysis and chromatography.

OR

(ii) Qualitative Analysis

[B] Organic Chemistry Practicals (40 marks, 5 Hrs)

(i) Organic Preparations

OR

(ii) Qualitative Analysis

[C] Experiments of Physical Chemistry (40 marks, 5 Hrs)

(i) Any one statistical 05 marks
(ii) Instrument / Kinetics / Adsorption 35 marks
[D] Viva voce 30 marks

Semester –II

Practical Examination Schedule
[Total 150 marks 3 days]

[A] Inorganic Chemistry Practicals (40 Marks, 5Hours)
(i) Qualitative Analysis 25 Marks
(ii) Admixture (Gravimetry, Volumetry)
OR Chromatographic Analysis 15 Marks
[B] Organic Chemistry Practicals (40 marks, 5 Hrs)
(i) Organic Qualitative Analysis including derivatives and crystallization 40 Marks

OR

(i) Organic Preparation, Characterization 20 Marks

And

(ii) Organic Estimation 20 Marks
[C] Experiments of Physical Chemistry (40 marks, 5 Hrs)
Any one experiment
[D] Viva voce 30 marks

ENVIRONMENTAL SCIENCE

M.Sc. Environmental Science Crriculum

W.E.F. June -2011

Semester III

11. Environmental Monitoring Techniques	**70 Marks**
12. Environmental Management System and Risk Assessment	**70 Marks**
13. Environmental Laws. Policies and Public Participation	**70 Marks**
14. Elective Paper (From EES 09-12)	**70 Marks**
15*. Pratical :III & Industrial Tour*	**120 Marks**

Semester IV

16. Major Project (Master's Thesis)	**400 Marks**

The students will carry out this project work in the Department of Life Science under the guidance of any faculties of the department or in collaboration with any Institute of State/National level repute,any Industry or Govt. Orgation.

However one faculty member of the Department of Life Sciences shall remain as a co-guide.

List of elective papers :

EES-01	**Conservation Biology and Wildlife Management (CBEM)**
EES-02	**Environmentally Sustainable Technologies (EST)**
EES-03	**Conservation and Restoration of Degraded Ecosystems (CRD)**
EES-04	**Conservation and Management of Marine Environment (CMM)**
EES-05	**Water and Waste Water Management (WRM)**
EES-06	**Solid waste Wastes and their management (SWM)**
EES-07	**Biodiversity Research, Monitoring and Management (BRM)**
EES-08	**Applied eco-informatics (AEI)**
EES-09	**Industrial Safety and Management (ISM)**
EES-10	**Conventional Energy and Carbon Offset Management (CEC)**
EES-11	**Eco-tourism and Conservation (ETC)**
EES-12	**Environmental Communication and Conflict Resolution(ECC)**

Semester III

ES 301 Environmental monitoring Techniques

Section: I

Unit 1 Monitoring of Abiotic Environment

- **Standards for environmental quality assessment and monitoring**
- **Monitoring Protocols for Soil, Water and Air according to Indian Standards**
- **Monitoring ambient environment of industrial and domestic zones**
- **Monitoring non degradable elements in the environment**

Unit 2 Monitoring and Assessment of Biotic Environment

- **Monitoring ecosystems and biological diversity: Birds and Mammalian diversity**
- **Indicator species in the ecosystem and their monitoring**
- **Monitoring streams, wetland, rangeland and other man made ecosystems**
- **Monitoring marine environment**

Section: II

Unit 3 Monitoring Toxicity in the Environment

- **Basics of Toxicology: Introduction, Scope and Significance**
- **Toxic elements and their fate in the environment**
- **Toxicity measurement techniques (Toxicological Analysis)**
- **Detoxification: Methods, Applications and Significance**

Unit 4 Advanced Monitoring Techniques and Documentation

- **Monitoring and managing domestic and industrial Wastes**
- **Applying RS and GIS in environmental monitoring**
- **Bio-degradation and bio-deterioration of recalcitrant compounds**
- **Preparation of Environment Monitoring Report**

ES 302 Environmental Management Systems and Risk Assessment Core Paper

Section: I

Unit 1 Introduction of EMS

- **Overview of Environmental Management System (EMS)**
- **EMS Audits and its significance**
- **Cleaner production (CP) management and its significance in EMS**
- **Planning and Preparing an EMS report**

Unit 2 Environmental Impact Assessment and Auditing

- **Concept, Process and Evaluation methodology**
- **Methods for EIA**
- **Preparation of EIA statements**
- **Concept of environmental audit**
- **Setting up an audit programme and Carrying out environmental audits**

Section: II

Unit 3 Environmental Risks

- **Basics, Definitions, Scope and significance of Studying Environmental Risks**
- **Evaluation of Risks, Risk Assessments and Risk Communication**
- **Hazard identification, Assessment and Control Techniques**
- **Legislations on safety and health in India**

Unit 4 Environment and Disasters: Management and mitigation

- **Definition, types of disasters, and their impact on man and environment**
- **Natural disasters and their management**
- **Man made disasters, their impact and solutions.**

- **Disaster management, relief operations, role of administration and NGO, emergency supply and rehabilitation**

ES 303 Environmental Laws, Policies and Public Participation Core Paper

Section: I

Unit 1 Environmental Laws

- **Factory Act (1948)**
- **Environmental Protection Act (1986)**
- **Air pollution and prevention Act (1981)**
- **Forest Act (1927) and Wildlife (Protection) Act (1972)**

Unit 2 Environmental Case Laws

- **Bhopal Gas case**
- **Shri Ram Food and Fertilizer case**
- **M.C. Mehta Vs Union of India case (Ganga pollution case)**
- **Narmada Bachao case**

Section: II

Unit 3 Communication techniques for Environment Conservation and Management

- **Communication basics and Concept of Environment Communication**
- **Fund raising protocols and Grant writing process for environmental issues**
- **Stakeholder consultation process, Messaging, Advocacy and behavioral change**
- **Rio Earth Summit: Convention on Nation's Biodiversity, UN convention on climatic change**

Unit 4 Environmental Education

- **Background, goals, objectives, guided principles of Environmental Education**
- **Strategies for development: authorization, EE methodologies, and EE modeling**
- **Environmental movements in India, Eco-tourism, Eco-development and environmental ethics**

- **Nature Education Camps and their impact evaluation on environment**

ES 304 ***Elective Paper (From EES 09-12)***

EES-09 **Industrial Safety and Management (ISM)**
EES-10 **Conventional Energy and Carbon Offset Management (CEC)**
EES-11 **Eco-tourism and Conservation (ETC)**
EES-12 **Environmental Communication and Conflict Resolution (ECC)**

Semester IV Project Work (Masters' Thesis)

The student will carry out this project work in the Department of Life Science under the guidance of any faculty of the department OR in collaboration with any Institute of State/ National repute, any Industry, Govt. or Non Govt. Organization. However in such case, one faculty member of the Department of Life Sciences shall remain as a co-guide.

Student shall have to carry out Original Research Work OR Undergo industrial training with a specific Project/ Task for minimum of three months without break and submit a master's Thesis. He/She also need to give a presentation (Open house oral presentation of the work) during the Viva Voce examination to be conducted at the university campus only.

The Thesis shall be evaluated by the panel of three examiners as follow:

1. **External Examiner**
2. **Thesis supervisor or Co-Guide of Internal Examiner**

Same panel will also remain present at the time of presentation.

The distribution of Marks for M.Sc. Dissertation

1.	Masters' Thesis	150
	a. Internal Evaluation : 75	
	b. External Evaluation : 75	
2.	Viva- voce	050
3.	Presentation	050
	Total	300

Distribution of Marks in Sem IV :

1. **Project work 300**

2.	**General Viva**	**050**
3.	**Regularity and Performance**	**050**