

PHYSICS

Core theory course (Disciplinary)

CPH-601: STATISTICAL MECHANICS AND NUCLEAR PHYSICS

UNIT-I

Some concept in statistical mechanics and Quantum statistics :

Ergodic Hypothesis, Density distribution in phase space, The Liouville Theorem, Principle of conservation of density in phase space and principle of conservation of extension in phase space, Condition for statistical equilibrium, Density matrix, Liouville Theorem in quantum statistical mechanics, Condition for statistical equilibrium (in quantum statistics), Ensembles in quantum mechanics.

UNIT-II

Ideal Bose and Fermi system and Transport phenomena ;

Photon gas, Einstein derivation of Planck's law, Bose-Einstein condensation, Fermi energy, An alternate derivation of Fermi energy, Mean energy of fermions at absolute zero, Fermi gas in metals, Fermi energy as a function of temperature, White dwarfs, Compressibility of a Fermi gas, Mean collision time, Thermionic emission, Photoelectric effect, Molecular collisions, Einstein relation for mobility, Distribution function, Boltzmann transport equation, Boltzmann H-theorem in Q.M. , Maxwell-Boltzmann distribution from Boltzmann equation.

Basic reference :

Fundamentals of statistical mechanics by B. B. Laud, 1998, New age international (P) LTD, (For III&IV)

Publishers, New Delhi.

Other reference:

1. Statistical Mechanics by S.K. Sinha, Tata McGraw Hills.
2. Statistical Mechanics and Properties of Matter by E.S. Raja Gopal, Mc Millan Company of India Limited.

UNIT – III

.Two-body problem in nuclear physics :

Introduction , The ground state of the Deuteron, Excited states of the Deuteron, Neutron-Proton scattering at low energy, Scattering length , Spin-dependence of Neutron-Proton scattering, Singlet n-p system, Effective range theory in n-p scattering, Significance of the sign of the scattering length, Tensor force and the Deuteron problem, Proton-Proton scattering at low energy, Analysis of n-p and p-p scattering, Interpretation of p-p and n-n scattering. .

Nuclear Reactions:

Nuclear reactions and cross section, Resonance: Breit-Wigner dispersion formula for $l = 0$, The compound nucleus, The continuum theory of cross section σ_c , Statistical theory of Nuclear reactions.

Basic referenc : Nuclear Physics by Roy and Nigam : Pub : New age International Ltd. New Delhi

UNIT – IV

Elementary Particles:

Classification of elementary particles, type of interaction, Baryon number, lepton number, parity, charge conjugation and time reversal, CPT theorem, charge independence nuclear forces, Isospin consequences of Isospin, G-Parity, Strange particles, associated prediction, Gell-mann Nishijima scheme, Neutral K- meson, strangeness, oscillations (?) hypercharge, CP-violation in K- decay, Isospin and SU(2) and SU(3) , Baryon and meson multiplets, Gell-mann Okubo mass formula. Quark model flavour and colour.

Basic refernce:

Introduction to high energy physics by D. H. Perkins 3rd edition Cambridge Uni. Press Elementary particles by I. H. Hughes, Cambridge Uni. Press

Other references:

1. Nuclear Physics by I Kaplan, Narosa Pub.
2. Introduction to Nuclear Physics by H.A. Enge, Addison-Wesley

Core theory course (Disciplinary)

CPH-602: DIGITAL ELECTRONICS AND PROGRAMMING IN C-II

UNIT- I

Digital Electronic:

A-bit memory(R-S Flip flop), Flip Flops, J-KFlip Flop, D Flip Flop; T-type FlipFlop , shift-register, seriato parallel converter, series-in rif.s out register, paraller to series converter, parallel in parallel out, right-shift, left-shift register, digital delay line, sequence generator.

Basic Reffrence:

Electronics and Radio engineering (9/e Reprint-2002) By M.L.Gupta (D.R. Sons New Delhi)

UNIT- II

Counters:

Shift register ring counter, Johnson counter, Basic clocks, Ripple (asynchrpnus)counters, Rip'ple center, Updown counter, Divided by -N counter, Sychronus counter, Series carry, Parrel carry, Up down Sychronus counter with Parrel carry, Sychronus decade counter, Application of counters, Digital to Analog conversion, Variable resistor network, Binery adder, D/A converter, D/A accuracy and resolution, A/D converter counter rmethod, A/D converter simultaneous conversion.

Basic Reffrence:

Electronics and Radio engineering (9/e Reprint-2002) By M.L.Gupta (D.R. Sons New Delhi)

UNIT- III

Structures and Unions :

Introduction, Defining a structure, Declaring structure variables, Accessing structure members, Structure initialization, copying and comparing structure variables, Operation on individual members, Arrays of structure, Arrays within structure, Structures within structures, Structures and functions, Unions, Size of structures, Bit fields

Pointers : Concept, accessing the address of variables, declaring and initializing pointers, accessing variables through pointers, pointer expressions, pointer increments and scale factor, pointers and arrays, pointer and character strings, pointers and functions, pointers and structures

UNIT- IV

File management in C:

Defining and Opening a File, Closing a File, I/O operations on Files, Error handuling during I/O operations, Random Access to Files, Command Line Arguments.

Developing a C program:

Program Design, Program Coding, Common Programming Errors, Program Testing and Debugging, Program Efficiency.

Basic reference :

Balagurusamy E., Programming in ANSI C (IIIInd Ed.), TMH Pub.(For U-III&IV)

Core theory course (Interdisciplinary)

CPH-603: BIOPHYSICS

UNIT-I

Separation Techniques:

Introduction, Chromatography, Column chromatography, Thin layer chromatography, Paper chromatography, Adsorption chromatography, Partition chromatography, Gas liquid chromatography (GLC) , Ion exchange chromatography, Molecular exclusion chromatography, Affinity chromatography

Electrophoresis: Moving boundary electrophoresis, Zone electrophoresis, Low voltage electrophoresis, High voltage electrophoresis, Gel electrophoresis, Sodium dodecyl sulphate poly acrylamide gel electrophoresis (SDS-PAGE), Iso electric focusing, Continuous flow electrophoresis.

Physico-Chemical Techniques to Study Biomolecules:

Introduction, Hydration of Macromolecules, Role of Friction, Diffusion, Sedimentation, The Ultracentrifuge, Viscosity, Rotational Diffusion: Flow birefringence measurements, Electric birefringence, Light Scattering, Small Angle X-ray Scattering.

UNIT-II

Spectroscopy:

Introduction, Ultraviolet/Visible Spectroscopy, Circular Dichroism (CD) and Optical Rotatory Dispersion (ORD), Fluorescence Spectroscopy, Infrared Spectroscopy, Raman Spectroscopy, Electron Spin Resonance.

Light Microscopy:

Introduction , Elementary Geometrical Optics, The Limits of Resolution, Different Types of Microscopy, Bright field microscopy, Dark field microscopy, Phase contrast microscopy, Fluorescence microscopy, Polarising microscopy.

UNIT-III

Electron Microscopy:

Introduction, Electron Optics, The Transmission Electron Microscope (TEM) The Scanning Electron Microscope (SEM), Preparation of the Specimen for Electron Microscopy, Image Reconstruction, Electron Diffraction, The Tunnelling Electron Microscope, Atomic Force Microscope.

NMR Spectroscopy:

Introduction, Basic Principles of NMR, NMR Theory and Experiment, Classical Description of NMR, NMR Parameters, Chemical shift Intensity, Line width, Relaxation parameters, Spin-spin coupling, The Nuclear Overhauser Effect, NMR Applications in Chemistry Chemical shift, Spin-spin coupling, ¹³C NMR , NMR Applications in Biochemistry and Biophysics, Concentration measurement

Two-Dimensional NMR, Determination of macromolecular structure, NMR in Medicine.

UNIT-IV

Biomechanics:

Striated Muscles , Contractile proteins, Mechanical Properties of Muscles, Contraction mechanism, Biomechanics of the Cardiovascular System , Blood pressure, Electrical activity during the heartbeat, Electrocardiography.

Neurobiophysics:

Introduction, The Nervous System, Synapse, Voltage Clamp, Resting potential, Action potential, Electrical activity and visual generator potentials, Optical defects of the eye, Neural aspects of vision, Visual communications, bioluminescence, Physical Aspects of Hearing, The Ear, Elementary acoustics, Theories of hearing, Signal Transduction, Mode of transport, Signal transduction in the cell.

References:

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

Elective course (Disciplinary)

EPH- 601: LINEAR IC's APPLICATIONS

UNIT – I

Signal processing circuits: Active Filters - First/second order low pass, high pass Butterworth filter, higher order filter, band pass filter (wide/narrow), Bandreject filter (Wide/narrow), All pass filter. Electronic Analog computation using OpAmps. Simulation of transfer function, squareroot, as Rectifier, RMS and phase shift detectors.

UNIT- II

Special Purpose Amplifiers: Opamps using FET input stages, tone controls and graphic equalizers, Isolation Amplifiers, Video Amplifiers LM 733 and RCA 3040, Wide band operational amplifiers. Norton's OpAmp-LM 3900, Norton OpAmp in inverting and Non inverting configuration, FET input OpAmp.

References:

- (1) Gayakwad, OpAmp. and Linear Integrated circuits, PHI. (3rd Ed.)
- (2) K.R.Botkar, Integrated circuits, Khanna Prakashan, (8th Ed).
- (3) Coughlin and Driscoll, Operational Amplifiers and Linear integrated circuits, PHI

Elective course (Disciplinary)

EPH- 602: PULSE AND MICROWAVE ELECTRONICS

UNIT-I

Characteristic of Pulse waveforms, rise time, fall time, duty cycle concept, tilt, R-C circuits, constant rate charging, relationship between rise time and upper cutoff frequency, relationship between fall time and tilt.

Schmitt trigger and Ramp generator : Circuit operation, designing for a given upper trigger point (UTP) and lower trigger point (LTP), speed-up capacitor, input and out put characteristics, RC ramp generators.

UNIT-II

Fundamentals of microwave technology, limitations of vacuum tubes. Klystrons, Two cavity Klystron, Multi-cavity and Reflex Klystrons, Traveling wave tube, Magnetron.

Antennas: Terms and definition, Antenna gain, resistance, beamwidth and polarization, resonant & non resonant antenna, effect of ground on antennas, antenna height, directional high frequency antennas, dipole arrays, Yagi-Uda antenna, Parabolic reflector.

References :

- (1) Solid State Pulse Circuits, David A Bell PHI
- (2) Electronic Communication Systems : George Kennedy TMH
- (3) Microwave Devices & Circuits, III Edition, Samuel Y. Liao, PHI
- (4) Electronic communications systems, Wayne Tomasi, Pearson Education

Elective course (Interdisciplinary)

EPH- 603: RESEARCH METHODOLOGY

UNIT –I

What is research?, Science and research, Basic and applied research, Essential steps in Research.

Literature collection: Need for review of literature, Review process, Research reading, Reference cards, Literature citation, Different systems.

UNIT-II

Components of research report/Thesis: Field work and laboratory work, photography, Preparation of tables, Preparation of figures.

Research report/Thesis –formatting and typing (computing): Title page, certificate, declaration, acknowledgement, list of table, figures, abbreviations and symbols, chapter quotations, table, figures, summary, appendices, references etc.

References:

1. Research Methodology with statistical package for social sciences by Dr. A. Safeevan Rao & Dr. Dipak Tyagi, Shree Nivas Pub. - Jaypur
2. Research Methodology by G.R Basotia and K.K. Sharma, Mangal Deep Pub., Jaypur
3. Research Methodology Modern methods and New techniques by M.N. Borse, Shree Nivas Pub. - Jaypur
4. Research Methodology Modern methods and techniques by Anil Tandon, Anmol Pub. - New Delhi

PPH- 601: PRACTICALS

Group – I

1. An optical method for determining dielectric constant, dipole moment and polarizability of a polar liquid by Hollow Prism.
2. Young's modulus by optical method
3. G.M. Counter
4. Microwave
5. Fiberless optical communication using Laser
6. Fiber optics
7. Ultrasonic Interferometer-Determination of Velocity of Ultrasonic waves in a liquid/solid
8. C Programming

Group – II

1. Frequency Modulation and Demodulation.
2. Phase shift Oscillator using IC-741.
3. Astable Multivibrator with IC -555
4. TRIAC characteristics
5. Biastable Multivibrator
6. R-S FLIP-FLOP
7. SCR as a Triangular wave generator
8. Scmitt trigger using transistor.

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	Courses	Credit /course	Teaching Hrs Total	Total Credits	Examination			Total Marks
Course					Internal Marks	Hours/ Course	External 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 be 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 assess 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 C_i = 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 (GP_i) = $G_i \times C_i$

$$\begin{aligned} \text{GRADE POINT AVERAGE [GPA]} &= (GP_1 + GP_2 + \dots + GP_n) / (C_1 + C_2 + \dots + C_n) \\ &= (GP_1 + GP_2 + \dots + GP_n) / 20 \quad (\text{since total credit for each semester}=20) \\ &= (C_1 \times G_1 + C_2 \times G_2 + \dots + C_n \times G_n) / (C_1 + C_2 + \dots + C_n) \end{aligned}$$

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

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.

$$\begin{aligned} \text{CUMULATIVE GRADE POINT AVERAGE [CGPA]} &= \\ &= \frac{\text{Sum of the multiplication of GPA of the semester by the total credits of that semester}}{\text{Sum of the credits of the courses of the entire programme}} \end{aligned}$$

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 shall 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 \mathbb{R} , structure of open sets, cantor set, \limsup , \liminf .

Unit-1 Algebra and σ -algebra of sets, σ -algebra of Borel sets, Lebesgue outer measure on \mathbb{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. Herstein, 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. Jacobson, Hind. Pub. Corp. 1984.

(4) "A first course in Abstract Algebra" by John Fraleigh (3rd Edition), Narosa 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 R. 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 $\prod X_i$ (for finitely many topological spaces X_i), 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 compactification.

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. I. 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 Imbedding 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. I. 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 divisors 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 automorphisms, 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 Riemannian Geometry” 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. Zuckerman "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, homotopy equivalence, the fundamental group of the punctured plane, the n-sphere S^n .

Unit IV Fundamental group of some surfaces: figure eight, torus 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 Lefschitz 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:** Differentiability for functions of several variables.

Unit 2 Differentiability of mapping and Jacobians, The space of tangent vectors at a point of \mathbf{R}^n , another definition of $T_n(\mathbf{R}^n)$, 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-II
5. Theory of Relativity
6. Relativity and Cosmology

(y) LIST OF COURSES FOR GROUP-B

[MTHE B-1] CLASSICAL MECHANICS-I

- Unit I** Generalized co-ordinates, holonomic, non-holonomic, rheonomous and scleronomous constraints, derivation of Lagrange's equations from D'Alembert's principle.
- Unit II** Velocity dependent potentials (electromagnetic case to be omitted); Rayleigh's dissipation function and applications, Hamilton's principle and derivation of Lagrange's equations from Hamilton's principle.
- Unit III** Extensions of Hamilton's principle to non-conservative and non-holonomic dynamical systems.
- Unit IV** Cyclic coordinates and Routh'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. Lifshitz: "Mechanics", Pergamon 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 its 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. Lifshitz: "Mechanics", Pergamon Press, 1969.

[MTHE B-3] ELECTRODYNAMICS-I

Unit I	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 Macroscopic 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., 2 nd 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., 2 nd 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.
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- 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

(8) 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: \neg and \vee ; formulae; defined logical connectives: \wedge , \Rightarrow , \Leftrightarrow . Semantics: Truth valuation as a map v from the set of all atomic formulae into $\{T, F\}$, Extension of v 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: Syntax: Variables, propositional connectives: \neg and \vee , Quantifier \exists , Equality symbol $=$; Non-logical constant, function and predicate symbols; defined connective: \forall ; 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 \exists -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 3 THEOREMS IN FIRST ORDER THEORIES: autology Theorem for First Order Theories: [and few simple applications, Induction on theorems]. Results on Quantifiers: \forall -introduction rule, Generalization and Substitution Rules, Substitution Theorem, Distribution Rule and Closure Theorem. The Deduction Theorem: Deduction Theorem and Theorem on constants. The Equivalence and Equality Theorems: Equivalence Theorem, Variant Theorem, Symmetry and Equality Theorems. The Prenex Normal Form: 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 Henkin theory.

Reference Books:

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

[MTC-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. Resolvent 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 Skolem normal form; Herbrand universe and Herbrand interpretations; A set S of clauses is satisfiable iff a Herbrand interpretation of S is satisfiable; 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 – $m \times 2$ & $2 \times n$ 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 uniqueness theorem and its consequences, 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), consequences 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 maintence 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, James 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. Martin and E. Reissner, Addison Wesley Publishing Company, inc., 1995.
3. Theory of Ordinary Differential Equations – E. A. Coddington 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 Derivatives 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. Computer 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 “Computer 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 dashed 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** Function-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 types and stacks

7. Programs related to structures , pointers and functions
8. Newton'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 Mahapatra 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/problemetc, 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 activityetc.*

Scheme of Evaluation :

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 301 Genetic engineering and Bioinformatics.

Unit 1

- 1.1. Fundamentals of rDNA technology.
- 1.2. Enzymes and proteins used in rDNA technology.
- 1.3. Cloning vectors and expression vectors: plasmid based, bacteriophage based, cosmid, phagemid., vectors for cloning and expression in plant cell and animal cell.
- 1.4. Advance special purpose high capacity cloning and expression vectors.

Unit 2

- 2.1. Construction and uses of genomic and cDNA library.
- 2.2. Methods of gene transfer.
- 2.3. Expression of cloned gene: Monitoring gene expression, strategies for stability of foreign protein, Purification and characterization
- 2.4. Hybridization and blotting processes and their applications. In situ hybridization techniques

Section II

Unit 3

- 3.1. DNA sequencing: different methods, advancement in DNA sequencing and their applications. PCR and its variations and their applications
- 3.2. Chemical Synthesis of DNA, Protein sequencing
- 3.3. Applications of rDNA technology in healthcare, forensic science
- 3.4. Commercial possibilities of rDNA technology

Unit 4

- 4.1. Database and Data base management system, Biological database : Sequence, Structure and classification
- 4.2. Sequence Analysis : concepts of sequence similarity, identity and homology, Global and Local alignment, Scoring matrices, BLAST, FASTA
- 4.3. 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
- 4.4. Application of Bioinformatics: Gene finding, PCR Primer designing, Microbial identification, Comparative genomics, Secondary and tertiary protein structure prediction

References:

1. Gibas and Jamback: Developing bioinformatics computer skills. O'Reilly Associates.
2. J. Peek, G. Todino & J. Straug: Learning unix operating system. O'Reilly Asso.
3. Bioinformatics : A. V. Subramanian
4. P. Baldi & S. Brunak. Bioinformatics: A machine learning approach. M. I. T. Press
5. A.D. Bzxevanis and B.F. F. Onellette Bioinformatics: A Practical guide to the analysis of lienes and Proteins.
6. Gene cloning : T. A. Brown
7. Principles of gene manipulation : Old & Primrose
8. Genetic engineering : Sandya Mitra

Principal paper BT302 Research Methodology and animal biotechnology

Section: I

Unit 1

- 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

- 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

- 3.1. Equipments and materials for animal cell culture technology. Introduction to the balanced salt solutions and simple growth medium
- 3.2. Brief discussion on the chemical, physical and metabolic functions of different constituents of culture medium Role of carbon dioxide ,serum and supplements, Serum and protein free defined media and their applications
- 3.3. Primary and established cell line cultures, Measurement of viability and cytotoxicity
- 3.4. Basic techniques of mammalian cell culture; Cell cloning and cell separation. Cell synchronization, cell transformation..

Unit 4

- 4.1. Scaling up animal cell culture. Industrial applications of animal cell culture.
- 4.2. Stem cells: somatic stem cells and embryonic stem cells and their applications.
- 4.3. Methods for generation of transgenic animals.
- 4.4. Applications of transgenic animals.

.References:

1. Gibas Developing Bioinformatics computer skill.
2. Freshney, R. I.: Culture of Animal Cells. Wiley - Liss
3. Masters, J.R. E. (ed): Animal Cell Culture – Practical Approach, Oxford Univ. Press.
4. Basega, R. (ed): Cell Growth and Division: A Practical Approach. IRL Press.
5. Butler, M. and Dawson, M. (eds.): Cell Culture Lab Fax, Eds., Bios Sci. Publ.
6. Clynes, M. (ed): Animal Cell Culture Techniques, Springer

Principal paper BT303 Plant Biotechnology

Section: I

Unit 1

- 1.1. Conventional plant breeding, Introduction to cell and tissue culture
- 1.2. Tissue culture as a technique to produce novel plants and hybrids
- 1.3. Callus and suspension cultures
- 1.4. Tissue culture media (Composition and preparation), Initiation and maintenance of callus and suspension cultures Single cells clones.

Unit 2

- 2.1. Organogenesis; Somatic embryogenesis Transfer and establishment of whole plants in soil
- 2.2. Rapid clonal propagation and production of virus -free plants; Embryo culture and embryo rescue Protoplast isolation, culture and fusion; Selection of hybrid cells and regeneration of hybrid plants;
- 2.3. Plants; Symmetric and asymmetric hybrids, cybrids Anther, pollen and ovary culture for production of haploid plants and homozygous lines. Cryopreservation; Slow growth and DNA banking for germplasm conservation.
- 2.4. Cryopreservation; Slow growth and DNA banking for germplasm conservation.

Section: II

Unit 3

- 3.1. Somaclonal variation; In vitro mutation
- 3.2. Sexual incompatibility and male sterility
- 3.3. Plant Trans genesis Generation of transgenic plants and production of recombinant products using rDNA technology.
- 3.4. Crop improvement: insect resistance, herbicide resistance, stress resistance, improvement of quality of plant Golden rise,. protease inhibitors, alpha amylase inhibitor, virus resistance, coat protein mediated disease resistance .

Unit 4

- 4.1. Molecular marker aided breeding – RFLP maps, linkage analysis
- 4.1. RAPD markers, microsatellites, SCAR (Sequence Characterized Amplified Regions), SSCP (Single Stranded Conformational Polymorphism),
- 4.2. AFLP, QTL, map based cloning, and molecular marker assisted selection
- 4.3. Metabolic engineering and industrial products – Plant secondary metabolites, control mechanisms and manipulation of phenyl propanoid pathway, shikimate pathway; alkaloids.

References:

1. Plant Biotechnology – J. Hammond, *et al.* Springer Verlag.
2. Plant cell and tissue culture for production of food ingredients – T.J. Fu, G. Singh *et al.*
3. Biotechnology in crop improvement – H.S. Chawla
4. Practical application of plant molecular biology – R.J. Henry, Chapman & Hall.
5. Elements of biotechnology – P.K .Gupta
6. An Introduction to plant tissue culture – M.K. Razdan

Elective paper BT 304 Clinical Biochemistry.

Section I

Unit 1

- 1.1. Disorders of carbohydrate metabolism: Diabetes mellitus,
- 1.2. Glucose and galactose tolerance tests, sugar levels in blood, renal threshold for glucose.
- 1.3. Factors influencing blood glucose
- 1.4. Glycogen storage diseases

Unit 2

- 2.1. Disorders of lipids: Plasma lipoproteins, cholesterol, triglycerides & phospholipids in health and disease
- 2.1. Hyperlipidemia, hyperlipoproteinemia .
- 2.2. Gaucher's disease, Tay-Sach's and Niemann-Pick. disease
- 2.3. Ketone bodies and Abetalipoproteinemia

Section II

Unit 3

- 3.1. Digestive diseases : Maldigestion
- 3.2. Malabsorption
- 3.3. Creatorrhoea
- 3.4. Diarrhoea and steatorrhoea.

Unit 4

- 4.1. Disorders of liver and kidney – Jaundice
- 4.2. fatty liver
- 4.3. normal and abnormal functions of liver and kidney
- 4.4. urea clearance

Elective paper BT 304 Microbial ecology

Section I

Unit 1

- 1.1. Microorganisms in extreme environments
- 1.2. Environmental Determinants that Govern Extreme environments
- 1.3. Extremes of pH & temperature, salinity
- 1.4. Hydrostatic pressure, nutrient limitation

Unit 2

- 2.1. Physiology, Morphology of Microbial Biofilms
- 2.2. Microbial biofilm formed in natural environment.
- 2.3. Mechanism of microbial adherence.
- 2.4. Beneficial & harmful role of biofilms

Section II

Unit 3

- 3.1. Techniques to study microbial ecology: Insitu and advance microscopy use of physiological methods including measurement of microbia
- 3.2. carbon respiration, use of radio labeled tracers , enzyme assays and immunoassys
- 3.3. Enzyme assays and immunoassays. Analysis on the basis of nuclic acid based techniques.
- 3.4. Metagenomics : study of uncul tivable microorganisms.

Unit 4

- 4.1. Methods for studying soil organisms: Direct microscopy of soil population (counting by direct microscopy
- 4.2. Calculation of Bio-volume and Biomass Measurement by chemical techniques
- 4.3. ATP measurement of Respiration
- 4.4. Soil enzymes- measurement

Practical module 1

1. Isolation of DNA from Gram negative and Gram positive bacteria.
2. Isolation of DNA from different plant tissues.
3. Isolation of DNA from animal tissues.
4. Isolation of DNA from blood.
5. Isolation of DNA from yeast/fungi.
6. Isolation of DNA from soil.
7. Isolation of plasmid.
8. Preparation of competent cells and transformation with plasmid.
9. Cloning and selection of mutant.
10. Transposome study
11. Demonstration of PCR reaction.
12. Sequence alignment using BLAST
13. Demonstrate use of RASMOL
14. Demonstrate application of NCBI
15. Applications of gene bank.

Practical module 2

1. Nutrient composition of Murashige & Skoog's (MS) medium and its composition
2. Preparation of stock solutions of MS medium
3. Requirements and preparation of medium for initiation of callus from different explants
4. Subculturing of callus and initiation of multiple shoots/organs (Organogenesis
5. Somatic embryogenesis induction and development of somatic embryos from callus
6. Study of anther culture.
7. Demonstration of mitosis
8. Short term leucocyte culture and its requirements
9. Metaphase chromosome preparation
10. Demonstration of banding pattern in metaphase chromosomes
11. Polytene chromosome preparation
12. Sex chromosome detection in buccal smear
13. Histochemical localization of enzymes
14. localization of mitochondria, lysosomes and nucleic acids

ZOOLOGY

Z 501C - ECONOMIC ZOOLOGY

UNIT-I PARASITOLOGY

1. Protozoans pathogens and their diseases;
2. Phytoparasitic Nematodes and their control;
3. Helminthes parasites and their control
4. Recent development in diagnosis and treating parasitic infections

UNIT-II INSECT CULTURE

1. Economic importance of insect culture
2. Apiculture, Sericulture and Lac culture
3. Insects as a pest
4. Insect Pests and pest control

UNIT-III ECONOMIC INDUSTRY

1. Poultry and Aquatic
2. Dairy Industry
3. Challenges and opportunities in Animal related industries
4. Entrepreneurship development in Animal Sciences

UNIT-IV PRODUCTS

1. Transgenic animals
2. Animal cell science and stem cell cultures
3. Pharmaceuticals products from Animals
4. Important animal product related to mankind

Z 502C – FISHERIES SCIENCE

UNIT-I

1. Introduction and Scope of Fishery Science
2. Structure of fishes : Morphology, General anatomy
3. Taxonomy of fishes
4. Various systems of fish

UNIT-II

1. Fresh water fisheries of India and Gujarat
2. Fresh water fish culture
3. Induced breeding
4. Fisheries of Pond, Lake and River

UNIT-III

1. Marine fisheries of India and Gujarat
2. Different groups of fishes with reference to fisheries
3. Economic importance of marine fishes
4. Preservation and processing of fishes

UNIT-IV

1. Prawn fisheries
2. Pearl fisheries
3. Promfret fisheries
4. Scenario of fisheries in Gujarat and India

Z 503C Avian Biology

UNIT-I

1. Morphology of birds
2. Classification of birds up to species
3. General anatomy and related physiology of birds
4. Thermoregulation in birds

UNIT-II IMPORTANT TOPICS

1. Aerodynamics
2. Perching mechanism
3. Flight muscles of birds
4. Migration of birds

UNIT-III BEHAVIORAL STUDY

1. Reproductive behaviour
2. Call, song and vocalization of birds
3. Territorial behaviour
4. Complex behaviour

UNIT-IV ECONOMIC VALUE AND CONSERVATION

1. Useful and harmful birds
2. Birds conservation strategy / programs
3. Ramsar convention
4. Important bird areas (IBAs) in India

BOTANY

CBO-501 PLANT PHYSIOLOGY

Unit -I Growth and Development

Latent Life-Dormancy: Introduction and types of Dormancy; Causes and overcoming of Seed Dormancy; Bud Dormancy, factors affecting dormancy.

Seed Germination: Physiological aspects of Seed germination, Seedling emergence.

Senescence and Programmed Cell Death (PCD) :Basic Concepts , Mechanisms and Types Cell Death , PCD in life cycle of plants , metabolic Changes associated with senescence and its regulation , Influence of Hormones and Environmental Factors on Senescence.

Unit -II Physiology of Mineral Transport and Stress

Mechanism, regulation and transport of Macronutrients (K, P) and Micronutrients (Zn, Fe) in Plants

Physiological effects, mechanism and theories to explain:

Stress and stressful environments, Water and Salt stress, Light and Temperature stress, Biotic stress.

Development of stress resistant plants: Oxidative stress, Salt stress, Senescence tolerance.

Unit -III Photo-physiology

Photochemistry and Photosynthesis: General Concepts, Historical background, Photosynthetic Pigments systems and Light harvesting Complexes, Photo oxidation of water, Photophosphorylation and mechanisms of electron transport, C₃ Cycle, C₄ Cycle, CAM Pathway .

Respiration: Definition and types of Respiration, Glycolysis, The TCA Cycle, Electron Transport and ATP Synthesis, Pentose Phosphate Pathway, Gluconeogenesis, Glyoxylate Cycle. Chemiosmotic regeneration of ATP during respiration, model of Fo-F1 ATPase and its role in ATP synthesis.

Sensory Photobiology: History and discovery of Phytochromes and Cryptochromes and their Photochemical and Biochemical Properties.

Unit -IV Plant hormones and flowering

Plant Growth Regulators and Elicitors : Physiological Effects and Mechanisms of Action of Auxins , Gibberellins, Cytokinins, Ethylene , Abscisic Acid, Brassinosteroide, Polyamines, Jasmonic Acid and Salicylic Acid, Hormone Receptors, Signal Transduction and Gene Expression.

The Flowering Process: Photoperiodism and its significance, Floral Induction and Development-Genetic and Molecular analysis; Role of Vernalization.

Main Reference(s):

Mukherji S and Ghosh A K (2005) *Plant Physiology*, New Central Book Agency (P) Ltd., Kolkata (1st Central Edition).

Devlin Robert M and Witham Francis H (1986) *Plant Physiology*, CBS Publishers and Distributors, Delhi (4th Edition/ 1st Indian Edition).

References

Delvin R.M., Plant Physiology

Gill P S (), Plant Physiology (1st edition)

Mukherji S and Ghosh A K (), Plant Physiology (1st edition)

Ross Salisbury (), Plant Physiology (4th edition)

Srivastava H S (2004), Plant Physiology (2nd edition)

Sundara Rajan S (), Plant Physiology (edition),

Sornathai Annie, Rajakumar K, Jayakumar M and Rajarathinam K (), Plant Physiology (edition),

Verma S K and Verma Mohit (), Plant Physiology, Biochemistry and Biotechnology (),

Verma V (), A Text Book of Plant Physiology (), Emkay Publication, New Delhi.

Sundara Rajan S (2001), Practical Manual of Plant Ecology and Plant Physiology (1st edition),

Jain V.K., Fundamentals of Plant Physiology

Pandey S.N. and B.K. Sinha, Plant Physiology

Verma P.S. and P.K. Agarwal, Plant Physiology

CBO 502 PLANT RESOURCE UTILIZATION, CONSERVATION AND BIOMETRY

Unit-I Plant resources-I

Adulteration in plant products: Introduction, detection of adulteration in the flowering: oils-groundnut and sunflower, species and condiments: pepper, caraway, cardamoms, saffron and clove. Cereals and pulses-Bajara, Rice, Tur and Gram.

Origin, evolution, botany, cultivation and use of:

- (i) Food (Wheat, chickpea, potato, groundnut),
- (ii) Forage/fodder crops (bajara, guarbean).

Plant fibers: Textile fibers (cotton, jute, linen, sun hemp, cannabis); Cordage (coir); Fibers for stuffing (silk cotton).

Unit-II Plant resources-II

Dyes (Turmeric, Indigo, *Butea monosperma*, *Lawsonia alba*).

Important fire-wood and timber-yielding plants: *Acacia nilotica*, *Tectona grandis*, *Dalbergia sissoo*, *Terminalia arjuna* (Arjun sadar), *Mangifera indica*.

Rubber: Introduction, chemical composition of rubber, hevea rubber, plantation and production of rubber in the world and India, processing. Uses of rubber and synthetic rubber.

Medicinal Plants: *Atropa belladonna*, *Catharanthus roseus*, *Adhatoda vasica*, *Allium sativum*, *Rauvolfia serpentina*, *Papaver somniferum*, *Phyllanthus amarus*, *Aloe barbadense*.

References

Kochhar S L (), *Economic Botany in the Tropics* (2nd edition),

Verma V (), *A Text Book of Economic Botany* (edition),

Bendre and Kumar (), *Economic Botany* (4th edition),

Unit-III Conservation

Principles of conservation, Strategies for conservation *in situ* conservation: International efforts and Indian initiatives; protected areas in India-sanctuaries, national parks, biosphere reserves, mangroves and coral reefs for conservation of wild biodiversity.

Strategies for conservation *ex situ* conservation: Principles and practices; botanical gardens, field gene banks, seed banks, general account of the activities of Botanical Survey of India (BSI), National Bureau of Plant Genetic Resources (NBPGR), Indian Council of Agricultural Research (ICAR), Council of Scientific Industrial Research (CSIR) and the Department of Biotechnology (DBT) for conservation.

Unit-IV Biometry

Sampling: Sample characters, sampling techniques.

Probability distribution: Normal, Poisson and Binomial.

Level of significance, Degree of freedom, Chi-square, Homogeneity Chi-square, Binomial expansion, Testing hypotheses using binomial distribution, level of significance, Student's t test, F test. Analysis of variance.

Correlation: Measures of relationship between continuous variables, Types of correlation, Calculation of correlation, coefficient from ungrouped series and grouped series.

Regression, Calculation of regression coefficient.

Non parametric tests: Rank test, F-max test, Mann-Whitney (U) test, and Sign test.

Main Reference(s):

Banerjee P K (2004) *Introduction to Biostatistics [A Textbook of Biometry]*, S Chand & Company Ltd., New Delhi (1st Edition).

Prasad S (2001) *Elements of Biostatistics*, Rastogi Publications, Meerut (1st Edition).

Chandel S R S (2006) *A Hand Book of Agricultural Statistics*, Achal Prakashan Mandir, Kanpur (1st Edition).

CBO-503 MOLECULAR BIOLOGY AND BIOTECHNOLOGY

Unit-I Molecular biology-I

1. Molecular organization of Eukaryotic DNA: Double helical form of DNA and RNA, Alternate forms of DNA-B, C & Z.
2. Replication of DNA and enzymes involved in replication.
3. Transcription: RNA polymerases, regulation of transcription in prokaryotes and eukaryotes.
4. Genetic code: Deciphering genetic code, properties of genetic code, initiation and termination codons, mutation and genetic code, wobble hypothesis, new genetic codes, second genetic code, overlapping and split genes.

Unit-II Molecular biology-II

1. Translation: Process of protein synthesis.
2. Gene structure and expression: Gene vs allele, a new concept of Allelomorphism, fine structure of gene, cistron, recon and muton, regulation of gene expression in prokaryotes and eukaryotes.
3. Genetic control of cell division: Regulation of the mitotic cell cycle in eukaryotes, cancerous cells, tumor inducing viruses (viral oncogenes), protooncogenes and cellular oncogenes, cancer as the end product of the multistep process.
4. Brief account of human genome project.

Main Reference(s):

Verma P S and Agarwal (2006) *Cell Biology, Genetics, Molecular Biology, Evolution and Ecology*. S Chand & Company Ltd., New Delhi (1st Multicolour Edition-Reprint).

Unit-III Biotechnology-I

Recombinant DNA technology:

- a. Gene cloning principles and technique
- b. Construction of Genomic/c DNA Libraries
- c. Choice of vectors
- d. DNA synthesis and sequencing
- e. Restriction enzymes
- f. Polymerase chain reaction (PCR)
- g. DNA finger printing

Unit-IV Biotechnology-II

1. Transgenic plants for crop improvement in Wheat, Rice and resistance to herbicides, insecticides, virus and other diseases and hybridoma technology.
2. Transformation of chloroplast (Cp) genome in higher plants (using *Agrobacterium* and particle gun).
3. Embryo culture, bud culture and pollen culture, Clonal propagation, artificial seeds, germ plasm storage and cryo preservation,
4. Production of hybrids and somatocloning, production of secondary metabolites and natural products, applications.

Main Reference(s):

Chawla H S (2002) *Introduction to Plant Biotechnology*, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi (2nd Edition).

PBO-501 PRACTICAL BASED ON TOPICS COVERED IN CBO-501

MAJOR EXPERIMENTS

- Determination of IAA/IAA Oxidase activity.
- Determination of Amylase and Peroxidase activity from control and stressed seeds.
- Estimation of Sugar, Protein, Amino acid content from control and stressed seeds.
- Separation of Plant pigments by using separating funnel.

MINOR EXPERIMENTS

- Seed germination under different light, temperature and hormone treatments.
- Extraction and estimation of plant pigments in young and old leaves.
- Estimation of chlorophyll a and b from C₃ and C₄ plants
- Separation of chlorophyll pigments from the leaves by chromatographic method.
- Demonstration of seed survival under salinity.
- Seed germination studies using different mineral ions.

GENERAL EXPERIMENTS

- Seed viability, seed vigor study and seed leachate study.
- Study Growth indices: RGR, NAR, LWR and LAL.
- Effect of Seed soaking with different PGRs on seed germination and seedling growth.
- Demonstration of Leaf senescence by ABA and Kinetin.

SPECIMENS 'A' and 'B'

- Promotion and inhibition of seed germination as affected by Red and Far-red irradiation.
- Bioassay of hormones: Auxin, GA and Kinetin.
- A model of dormancy and germination showing selective functions of hormones.
- *Avena* Coleoptile section test
- *Avena* Coleoptile curvature test
- Effect of apical bud removal and auxin on lateral bud growth.
- Translocation of floral hormone.
- Corn leaf showing Kranz anatomy.

PBO 502 PRACTICAL BASED ON TOPIC COVERED IN CBO-502

Plant resource Utilization and Conservation

1. Perform the tests of Adulteration in plant products:
Oils: groundnut and sunflower,
Spices and condiments: pepper, carawax, cardemonas, saffron and clove,
Cereals and pulses: Bajara, Rice, Tur and Gram.
2. Scientific name, local name, family, useful organ, morphology and uses of :
 - (i) Food crops (Wheat, chicken pea, potato, groundnut)
 - (ii) Forage/fodder crops (bajara, guarbean)
 - (iii) Plant fibers: (cotton, jute, linen, sun hemp, cannabis, coir, silk cotton).
 - (iv) Medicinal Plants: *Atropa belladona*, *Catheranthus roseus*, *Adhatoda vasica*, *Allium sativum*, *Rauvolffia serpentina*, *Papaver somniferum*, *Phyllanthus amaaratus* and *Aloe barbadense*.
 - (v) Dyes: (Turmeric, Indigo, *Butea monosperma*, *Lowsonia alba*)
 - (vi) Important fire-wood and timber-yielding plants: *Acacia nilotica*, *Tectona grandis*, *Dalbergia sissoo*, *Terminalia arjuna* (Arjun sadar), *Mangifera indica*.
3. Rubber: Introduction, chemical composition, plantation, production, processing and Uses of rubber.
4. A visit to protected areas of India – sanctuaries, national parks, biosphere reserves, mangroves and coral reefs for conservation of wild biodiversity, BSI, NBPGR, ICAR, CSIR, DBT and prepare the general account.

Biometry

1. Various examples of Sampling.
2. Various examples of Probability.
3. Chi-square analysis and 2 x 2 contingency.
4. Various examples on coefficient of correlation and regression.
5. Analysis of variance.

PBO 503 PRACTICAL BASED ON TOPIC COVERED IN CBO-503

Molecular biology Practicals

1. Models / Charts of DNA and RNA and its types.
2. Chart of Replication of DNA.
3. Charts of Transcription and Translation, RNA polymerases, regulation of transcription in prokaryotes and eukaryotes.
4. Models / Charts of Genetic code.
5. Charts of mutation wobble hypothesis, new genetic codes, overlapping and split genes.
6. Standard curve of DNA.
7. Isolation of plant DNA and its quantitation by spectrophotometric method.
8. Standard curve of RNA.
9. Isolation of plant RNA and its quantitation by spectrophotometric method.
10. Method of induction of polyploidy in onion root tip.
11. Study of various stages of cell divisions (Mitosis/Meiosis) in Plant cells.

Biotechnology Practicals

1. Models / Charts of DNA sequencing method, PCR, DNA finger printing, terminator technology, hybridoma technology, etc and topics covered in theory syllabus.
2. Plant tissue culture: Embryo culture, bud culture and pollen culture

EBO-501 Biofertilizer Technology

Unit-I

1. Biofertilizers: Definition and types, importance of biofertilizers in agriculture
2. Characteristics of biofertilizers: *Rhizobium*, *Azotobacter*, *Azospirillum*, Phosphate solubilizing microorganisms, cyanobacteria, *Azolla*, Mycorrhizae
3. Symbiosis: Physiology, biochemistry and molecular genetics of symbiosis
4. Enzymes and their regulation: Nitrogenase, hydrogenase

Unit-II

1. Production technology: Strain selection, sterilization, growth and fermentation, mass production of various biofertilizers
2. Application technology: Standards and quality control, application for field and tree crops, nursery plants and seedlings
3. Extension, promotion and marketing: Extension strategies, diagnosis for the effectiveness of inoculation, improvement in distribution system

EBO-502 Air Pollution and Climate Change

Unit-I

1. Atmospheric composition and climate; Gaseous and particulate pollutants, emission trends and scenarios; climate change, drivers of climate change, greenhouse gas emission scenarios.
2. Sulphur derivatives: Sources and cycling of sulphur, effects on plants, human health and ecosystems, mechanism of toxicity, resistance and buffering, sulphur metabolism, threshold and injury
3. Nitrogen derivatives: Formation and sources; deposition, uptake, metabolism, critical load; effects on plants, human health and ecosystems
4. Fluoride derivatives: Sources and cycling, bioaccumulation, threshold and injury; effects on plants, human health and ecosystems

Unit-II

1. Oxidants: Formation and sources, photochemical smog; effects on plants and human health, mechanism of toxicity, resistance, critical load
2. Stratospheric ozone depletion: Phenomenon, causes, irradiation scenarios; effects of enhanced UV-B on plants, microbes and human health, biological action spectra
3. Greenhouse effects: Process; consequences, global warming, sea level rise, albedo, oceanic influences agriculture, natural vegetation; effects of increased CO₂ on plants; human implications
4. Acid rain: Formation, dispersion and deposition, trends; consequences on soil fertility, rivers and lakes; effects on plants, leaf injury, buffering, reproduction; forest decline.

EBO 503 Research Methodology and Scientific Presentations

Unit-I Research Methodology and Scientific Presentation-I

1. Science and Research: Definition of Science and Research, Basic and applied Research, Essential steps in Research.
2. Characteristic and type of scientific research: Characteristics of the Scientific Method, Research Procedures (only 8 steps). Sectors of Research: Academic and Private.
3. Research and Experimental design:
Introduction, Pre-Experimental Design, The One-Shot Case Study, One Group Pretest Posttest Study, The Static Group Comparison Study, Quasi-Experimental Design, Pretest Posttest Nonequivalent Group, Time Series Designs, Nonequivalent Before-After Design, True Experimental Design, Posttest Equivalent Groups Study, Pretest Posttest Equivalent Groups Study.

Unit-II Research Methodology and Scientific Presentation-II

1. Method of Data collection and Data analysis
2. Scientific Writing: Research proposal, Research Paper, Review paper, Thesis, Conference report, Book review and Project report; Reference writing, scientific abbreviations, Findings.
3. Preparation and delivery of scientific presentations

MICRO-
BIOLOGY

MB-301 Genetic Engineering and Protein Engineering

Section – I

Unit - 1 Concepts and tools and technique for genetic engineering

15 hours

- 1.1. Concepts and application: Introduction to gene cloning; Application of Recombinant microorganisms; Application of transgenic Plant Technology; Application of animal cloning and Transgenic animal technology
- 1.2. Enzyme used in genetic engineering: Restriction endonuclease; DNA Polymerase: Reverse transcriptase; RNA polymerase; Alkaline Phosphatase; Polynucleotide Kinase; DNA ligase; Deoxyribonuclease; Ribonuclease; Phosphodiesterase; β Agarase; Uracil – DNA Glycoylase; Proteinase K; Lysosome; Topoisomerase
- 1.3. Cutting of DNA: Host Controlled Restriction Modification system; Nomenclature of Restriction Endonuclease; Types of Restriction Endonuclease; Recognition sites; Cleavage by Restriction endonuclease; variants of Restriction Endonuclease; Application of Restriction Endonuclease
- 1.4. Joining of DNA Fragments: Introduction; Ligation of DNA fragment using DNA ligase; ligation using homopolymer Tailing; Increasing versatility and Efficiency of ligation by modification of the Ends of Restriction Fragments; Ligation of PCR products

Unit - 2 Vectors

15 hours

- 2.1 Plasmid as a vector: pSC101; pSF124; Col E1; pBR 322 series; pUCSeries; pGEM series; pET, pBAD,
- 2.2 Bacteriophage as a vector: lambda phage; M13; Cosmid; Phagemids; Phasmids; Fosmid;
- 2.3 Advanced vector: Shuttle vector; Expression vector; Advanced gene trapping vector; Specialized vector for making SS DNA; facilitate Purification of cloned product; promotes solubilization of expressed product; promotes export of cloned product; PAC, YAC, BAC, HAC;
- 2.4 Other vectors : Chimeric vector; Gram negative bacteria other than E. coli as cloning vector; Gram positive bacteria as cloning vector; Plant and Animal Vectors; Fungi system other than yeast.

Section - II

Unit - 3

15 hours

1. Introduction of DNA in to Host : Introduction; Introduction of DNA in to bacterial cells; Introduction of DNA in to yeast cells; Genetic transformation of Plants; Introduction DNA in to insects
2. Construction of Genomic and c DNA Libraries: Introduction; Genomic Library ; cDNA Library; PCR as an alternative to library Construction; Functional cloning; Positional cloning; Differential cloning
3. Techniques for Selection, Screening and characterization of trans formants: Introduction; Selectable Marker gene; Reporter genes; Screening of clone(s) of interest; Nucleic Acid Blotting and Hybridization; Protein structure/ Function Fusion- based techniques
4. Safety regulation related to genetic engineering: Introduction; National regulatory Mechanism for implementation of biosafety guideline for handling GMOs; Salient features , revised Guidelines for Research in transgenic Plant and risk assessment; regulation of Gm Plant; Regulation of stem Cell research and human cloning; Patenting for Molecular Biotechnology; Ethical issues

Unit – 4

15 hours

1. Site directed mutagenesis; Concept tools, technique of and application
2. Concept of protein engineering; Evolutionary Methods for Protein Engineering; Phage Display Systems for Protein Engineering; Cell Surface Display Systems for Protein Engineering; Cell-Free Display Systems for Protein Engineering;
3. Protein engineering in basic and applied biotechnology; Enhanced recovery and folding of recombinant proteins using Fusion protein strategies; Protein engineering for affinity purification; Stabilization of industrial enzymes by protein engineering; Engineering of Therapeutic Proteins
4. DNA Microarray technology: Concepts, tools and techniques, data generation and analysis, application; Microarrays for Bacterial Typing; Overview of protein Microarray technology

List of Experiments

1. Isolation of genomic DNA from Bacteria
2. Isolation of genomic DNA from Plant
3. Isolation of genomic DNA from Blood
4. Isolation of genomic from fungi
5. Agarose gel electrophoresis and recovery of DNA from gel
6. Isolation of plasmid
7. RFLP
8. RAPD
9. PCR amplification
10. Cloning in bacteria
11. Transformation of plants
12. Protein denaturation and in vitro Protein folding
13. BT cotton testing

List of Reference Books

1. **Nicholl**, *An Introduction to Genetic Engineering*
2. **Reece**, *Analysis of Genes and Genomes*
3. **Primrose**, *Principle of gene Manipulation*
4. **Brown**, *Gene cloning and DNA Analysis*
5. **Howe** , *Gene Cloning and Manipulation*
6. **Wong** , *The ABC of gene cloning*
7. **Watson** , *Recombinant DNA genes and genomics*
8. **Budisa**, *Engineering the Genetic Code*
9. **Sheldon J. Park**, *Protein Engineering and Design*
10. **Allan Svendsen** *Enzyme Functionality Design, Engineering, and Screening*
11. **Lilia Alberghina** *Protein engineering in industrial Biotechnology* by Lilia Alberghina
12. **Joanna S. Albala**, *Protein Arrays, Biochips, and Proteomics The Next Phase of Genomic*
13. **Isaac**, *Discovery by Microarrays for an Integrative Genomics*

MB - 302 Pharmaceutical Microbiology and Fermentation Technology

Section - I

Unit - 1 Pharmaceutical Microbiology

15 hours

1. Microbial aspect of Pharmaceutical processing : Microbial spoilage and prevention of pharmaceutical product; Principle and practice of sterilization, Sterile pharmaceutical product , Factory and hospital hygeny and good Manufacturing practice
2. Drug Discovery: Targets and Receptors; Drug Discovery: Small Molecule Drugs; Drug Discovery: Large Molecule Drugs: Enzymes, Vaccines (Attenuated, DNA, Subunit, vector), Antibodies(Monoclonal antibodies) , Cytokines, Hormones, Gene Therapy, Stem Cells;
3. Drug Development and Preclinical Studies; Clinical Trial : Overview, Role of microbiologist in CRO;
4. Bio safety: Principle of bio safety , Laboratory Bio safety Level Criteria; Bioterrorism; Biomedical waste management

Unit - 2 Novel Microbial products

15 hours

1. Probiotics and Prebiotic : Concept, methods and application
2. Production of Antibiotics and Anti-Tumor Agents: Classification and Nomenclature of Antibiotics; General production methods; Penicillin, Cephalosporins, Tetracycline, Bacitracin production; Problem of Antibiotic Resistance; The Search for New Antibiotics; Combating Resistance and Expanding the Effectiveness of Existing Antibiotics; Anti-Tumor Antibiotics; Newer Methods for Searching for Antibiotic and Anti-tumor Drugs; Synthesis of commercial products by recombinant microorganism: Small Biological molecules, Antibiotics, Biopolymers;
3. Biocatalysis in Organic Chemistry: Nature and Use of Steroids and Sterols, Uses of Steroids and Sterols, Types of microbial transformations in steroids and sterols, Fermentation conditions used in steroid transformation, Asymmetric Catalysis in the Pharmaceutical and Agrochemical Industries
4. Production of Microbial Insecticides: Alternatives to Chemical Insecticides; Biological Control of Insects; *Bacillus thuringiensis* Insecticidal toxin ; Production of Biological Insecticides; Bioassay of Biological Insecticides; Formulation and Use of Bioinsecticides; Safety Testing of Bioinsecticides; Search and Development of New Bioinsecticides

Section - II

Unit - 3 Primary metabolites production

15 hours

1. Amino Acids: Introduction, Microbial strain employed in aminoacid production, process control in amino acid fermentation, Production of Glutamic Acid by Wild Type Bacteria, Production of Amino Acids by Mutants, Improvements in the Production of Amino Acids Using Metabolically Engineered Organisms; Vitamin: Vitamin B12, Riboflavin, Carotenodis
2. Production of Organic Acids: Citric, acetic lactic, Gluconic and Itaconic acid
3. Production of Microbial enzyme: Introduction, Development of new enzymes, Fermentation process, Recovery and finishing, Regulations and specification, Survey of enzyme and application
4. Production of Fermented Foods: Introduction; Fermented Food from Wheat: Bread; Fermented Foods Made from Milk; Fermented Foods from Corn; Fermented Vegetables; Fermentations for the Production of the Stimulant Beverages: Tea, Coffee, and Cocoa; Fermented Foods Derived from Legumes and Oil Seeds; Production of Beer, Wines and Spirits

Unit - 4 Production of Secondary metabolites and other

15 hours

1. Microbial Polysaccharides and Polyesters : Polysaccharides, Xanthan Gum, Polyesters
2. Production of Ergot Alkaloids: Nature of Ergot Alkaloids, Uses of Ergot Alkaloids and their Derivates, Production of Ergot Alkaloids, Physiology of Alkaloid Production
3. Microbial Production of Nucleocide and Nucleotides: Introduction, Methods for production
4. Single Cell Protein (SCP): Substrates for Single Cell Protein Production; Microorganisms Used in SCP Production; Use of Autotrophic Microorganisms in SCP Production; Safety of Single Cell Protein; Nutritional Value of Single Cell Protein; Yeast Production: Production of Baker's Yeast; Food Yeasts; Feed Yeasts; Alcohol Yeasts; Alcohol Yeasts

List of Experiments

1. Production of Amino acid (Glutamic acid)
2. Production of Vitamins (Vitamin B₂ /Vitamin B₁₂)
3. Production of Solvents (Ethanol, Acetone/ Butanol)
4. Production of Organic acid (Citric acid/ Gluconic acid)
5. Production of extra-cellular polysaccharide
6. Production of Antibiotics (Penicillin/ Tetracycline/ Chloramphenicol/ Streptomycin)
7. Effectiveness of antimicrobial preservatives
8. Microbial limit test
9. Physicochemical test of extracts: Preparation of extract, appearance, light absorption, pH, nonvolatile matter, residues on ignition, heavy metal, buffering capacity, oxidizable substances
10. Lal test for bacterial endotoxins

List of Reference Books

1. **Mansi**, *Fermentation microbiology and Biotechnology*, Taylor and Francis
2. **Waites**, *Industrial Microbiology: An Introduction*, Blackwell publication
3. **Michal**, *Bioprocess Engineering Basic Concept*, Prentice Hall of India
4. **Biotol series**, *Operational Models for Bioreactor*,
5. **Biotol series**, *Product recovery in Bioprocess technology*,
6. **Whittaker**, *Principles of fermentation technology*.
7. **Crueger**, *A text book of Industrial microbiology*.
8. **Okafor**, *Modern Industrial Microbiology and biotechnology*
9. **Najafpour**, *Biochemical Engineering And Biotechnology*
10. **Alexander**, *Microbial Biotechnology*
11. **Volkmar**, *Microbial Fundamentals of Biotechnology*
12. **Sikyta**, *Techniques in Applied Microbiology*
13. **Laskin**, *Applied Microbiology, Volume 56*
14. **Laskin**, *Advances in Applied Microbiology Volume 59*
15. **Laskin**, *Advances in Applied Microbiology Volume 62*
16. **Walker**, *Microbial Processes and Products*
17. **Demain**, *Manual of Industrial and Biotechnology*
18. **Peppler**, *Microbial technology: fermentation technology*
19. **Waites**, *Industrial Microbiology: An Introduction*
20. **Michal**, *Bioprocess Engineering Basic Concept*
21. **Rehm**, *A multivolume Comprehensive Treatises: Biotechnology*

MB - 303 Omics, Inter Phase Microbiology and Recent Advances in Microbiology

Section - I

- Unit 1 Proteomics: Microbiology** **15 hours**
1. Holistic Biology of Microorganisms: Genomics, Transcriptomics and Proteomics; Understanding genes, genomes, "otheromes"; Introduction and basic concept of systems biology
 2. Tools and technique for proteomics
 3. Exploring and Exploiting Bacterial Proteomes; Strategies for Measuring Dynamics: The Temporal Component of Proteomics; Quest for Complete Proteome Coverage
 4. Proteomics of *Corynebacterium glutamicum*: Essential Industrial Bacterium; Analyzing Bacterial Pathogenesis at Level of Proteome; Structural Proteomics and Computational Analysis of a Deadly Pathogen: Combating *Mycobacterium tuberculosis* from Multiple Fronts

- Unit 2 Genomics: Microbiology** **15 hours**
1. Tools and technique for Genomics
 2. Bacterial Genomes for the Masses
 3. Comparative Genomics for Microorganisms; Microbial Genome Sequencing and Annotation
 4. Pharmacogenomics : Overview, concept and application of Individualized Therapy; RNA Interference: Targeted Medicine

Section - II

- Unit 3 Metagenomics** **15 hours**
1. Metagenomics: What and Why for metagenomics
 2. Metagenomics: a new light on biology
 3. Metagenomics: From Genomics to Metagenomics
 4. Designing a successful metagenomics project
- Unit 4 Recent Advances in Microbiology** **15 hours**
1. Overview of clinical laboratory diagnosis (Hematology, Cardiac, Renal, Liver testing's) ; Culturing of pathogens; Immunological Diagnostic Procedure; Monoclonal Antibodies; DNA diagnosis systems; Molecular Diagnosis of genetic disease.
 2. Overview and Current status of Anti HIV, Anti Malaria, Anti Tuberculosis and Anti Cancer treatment; Multidrug resistance : Introduction, development, detection and treatment
 3. Discovering New Pathogens; New disease: SARS, bird flu , swine flu etc.; Pharmacogenomics : Overview, concept and application of Individualized Therapy; RNA Interference: Targeted Medicine; Introduction to synthetic biology; Overview of Artificial Cells
 4. Study of Selected recent review/ research paper in field of Microbiology (Minimum four)

List of Experiments

1. DNA extraction from Soil
2. DNA extraction from water
3. Library creation from metagenome
4. Isolation of m RNA
5. RT PCR
6. Immunological testing : Widal test; VDRL test; Enzyme Linked Immuno Sorbent assay (ELISA)
7. Hematology : RBC Count; Total WBC Count; Differential WBC Count; E.S.R. determination; Hb estimation;
8. Bleeding time and clotting time
9. Blood Grouping: Slide technique; Tube technique; Reverse and forward grouping/ Cross matching: Major and Minor/Coombs test: Direct coomb's; Indirect coomb's
10. Isolation and identification of Pathogens
11. Biochemistry : Cardiac Profile testing; Live Profile testing; Renal Profile testing
12. Study of genome database and tools
13. Study of Metagenomics database and tools
14. Study of proteomics database and tools

List of Reference Books

1. **Woodford**, *Genomics, Proteomics and clinical bacteriology*
2. **Andreas**, *Computing for Comparative Microbial Genomics*
3. **Humphery-Smith**, *Microbial Proteomics*
4. **Rehm**, *Protein Biochemistry and Proteomics*
5. **Daniel**, *Introduction to Proteomics*
6. **Heinrich**, *Industrial Pharmaceutical Biotechnology*
7. **Richmond**, *Bio safety in Microbiological and Biomedical Laboratories*
8. **Rick**, *Drugs: From Discovery to Approval*
9. **Gad**, *Handbook of Pharmaceutical Biotechnology*
10. **Walsh**, *Biopharmaceuticals Biochemistry and Biotechnology*
11. **Hugo**, *Pharmaceutical Microbiology, Blackwell scientific Publications*
12. **Glick**, *Molecular Biotechnology*

HOME-SCIENCE

ORGANISATIONAL THEORIES, STRUCTURES AND DESIGN

Paper no.- HSRM – 301

CC - 7

Credits -4 +0=4

Sem. – 3 (M.Sc. R.M.)

Marks – 100 +0= 100

Objectives

- To understand the different organizational theories.
- To understand the role of organization structure in changing business environment.

Unit-1

- Organisation structure and their impacts
- Assessing the exiting organization structure and its effectiveness in selected organization determinants of structure

Unit-2

- Structure-Technology and environment, Inter-relationship and Adjustment
- Human Relationship and Dynamics in Organisation systems.

Unit-3

- Organisational Theories and their critical evaluation
- Understanding of organization structure and design

Unit-4

- Power and Authority
- Designing of organisation in changing economic/business environment.

Reference

- Nilakanth,V.and Ramnarayan,s.(1998):managing Organisationl Change, Response Book, New Delhi.

- Ansciem, M.(1985):Organisationl behavior: Toward an Integrated Organisatio n, Himalaya, Bombay.
- Husse, D.E.(1986): How to manage Organisation Change,Kogan page New Delhi.
- Pareek,U,(1987): Motivating Organisationl Roles:Role Effency Approach,Rawat,Jaipur.
- Diwan,P.(1998):Management Principle and practices, Excel Books, New Delhi.
- Moshal,B.S.(1998): Organisation and management:Text and cases,Galgotia Publishers, New Delhi.
- Basu, C.R.(1985): organisation and management,S.Chand and Co,New Delhi.
- Narayanan,B.(1998):HRM VEWD,APH publisher.
- Milkovich, G.T.C. (1997):HRM,Irwin Publisher, Ch icago.

CONSUMER EDUCATION AND REDRESAL MECANISIUM

Paper no.- HSRM– 302

CC - 8

Credits -3 +1=4

Sem. – 3 (M.Sc.R.M.)

Marks – 100 +50= 150

OBJECTIVES

- To equip and impact knowledge on consumer related facts and issues.
- To provide an understanding of the significance of consumer information.
- To develop and acquire skills in consumerism and utilizing the provisions in redressal mechanism.

UNIT : 1

- Importance of consumer Education.
- Need for consumer Education.
- Objectives of consumer Education.
 - Basic concepts.
 - Kinds of Goods.
- Consumer movement.
- Origin and growth.
- Philosophy, objectives.
- Consumer movement in developed countries and global experience – a brief overview.
- Indian experience, reasons for slack in consumer movement.

UNIT : 2

- Consumer protection.
- Legal problems in buying and paying for good and services.
- Consumer representation – Govt. agencies, consumer organizations, legal cells in industries, public interest legislation.

- Problem faced by consumer in the Market.

UNIT : 3

- Consumer information.
- Need and significance, Sources.
- Consumer services – public and private. Merits and limitations.
- Institutional support – corporate accountability, Government policies and responsibilities.
- Do's and Dont's towards better consumerism.

UNIT : 4

- Consumer Redressal.
- Consumer protection Act, 1986
- Definitions of consumer, Complaint, Complaint service, unfair trade practices as given in CPA.
- Procedure for filling a complaint appeal to district, state and national commissions.
- Some tips for ensuring redressal.

PRACTICALS

- 1) Visit to a consumer redressal forum.
- 2) To study about consumer club objectives.
- 3) Detection of food adulteration.
- 4) To study about type of certification marks.
- 5) To prepare consumer awareness programme .

REFERANCES

- 1) D.N.Saraf (1990) : Law of consumer protection in India, Tripathy private limited, N.M. New Delhi.

- 2) Gurjeet Singh (1996) : The law of consumer protection in india, Deep and Deep publications, New Delhi.
- 3) Himachalam, D. (1998) : Consumer protection and the law, APH publishing corporation, New Delhi.
- 4) Seetharaman, P. and Sethi, m. (2001) : Consumerism : Strategies and Tactics, CBS publishers, New Delhi.
- 5) Sethi, M. and Seetharaman, P. (1994) : Consumerism : A Growing concept, phoenix publishers, New Delhi.
- 6) Sherlikar, S.A. : Trade practice and consumer protection. Himalaya publishing House, Mumbai.
- 7) Gulshan, S.S. : (1994) : Consumer protection and satisfaction, wiley eastern lmt, Mumbai

PROFESSIONAL MANAGEMENT.

Paper no.- HSRM – 303

CC -9

Credits -4 +0=4

Sem. – 3 (M.Sc. R.M.)

Marks – 100 +0= 100

OBJECTIVES

- ❖ To understand the professional code of management in interior design.
- ❖ To maintain internal and cost aspects of professional management.

UNIT : 1 Introduction to professional Management.

- Management concept.
- Internal aspect of professional management.
- Office management.
- Some of accounting terms.
- Code / conduct
- Scale of professional fees and charges.
- Structure of an Interior Designer's office .

UNIT : 2 Estimating cost

- Definition.
- Importance of estimating.
- Types of estimating.
 - Rough order of magnitude of cost
 - Area basis.
 - Cybic content basis
 - Detailed item wise estimation
 - Unit basis

UNIT : 3 Tenders.

- Definitions.
- Tender notice
- Tender document
- Types of Tender
- Earnest money
- Security Deposit
- Retention amount.

UNIT : 4 Contracts.

- General Principles.
- What is contract – Execution of contract when contract become void – Discharge of contract.
- Types of contract.3
- Scope of contract.
- Contractors duties and liabilities under the contract.
- Duties and liabilities in profession
- professional relation with client and contractors.
- Articles of agreements of the Appe

REFERENCES

- 1) Drucker, peter F. (1985) : Innovation and entrepreneurship. Practice and principles, Willian Hermann Ltd, London.
- 2) Drucker, peter F. (1976) : Management Tasks, Responsibilities and practices, Allied, Bombay
- 3) Roshan Nanavati (1984) : Professional Practice (Estimating and Valuation, Lakshi Book Depot, Bombay
- 4) Sieget Harry & Seigal Alan (1982) : A gu ide to business principles and practices for Interior Designers, Whitney Library of Designs, New York.
- 5) Kasu, A.A. (1992) : An Introduction to Art, Craft, Technique, Science and Profession of Interior Design, Iquara Publication, Bombay .

FUEL TECHNOLOGY AND ENVIRONMENT MANAGEMENT

Paper no.- HSRM – 304

ES -3

Credits -3 +1=4

Sem. – 3 (M.Sc. R.M.)

Marks – 100 +50= 150

OBJECTIVES

- ❖ To understand the potential and limitations of different energy sources and the environmental impacts of their use.
- ❖ To understand the need and the ways of energy conservation.
- ❖ To study the innovations in fuel technology and energy management.
- ❖ To be aware of the holistic economical approaches to environment.
- ❖ To be aware of the environmental problems.

UNIT : 1

- Sources of energy and their classification.
- Non – renewable Vs renewable alternatives.
- Conventional Vs non conventional, commercial Vs non commercial.
- Energy consumption pattern – national statistics.
- Calorific values of fuel and their determination.
- Introduction of nuclear power and hydro electric power .

UNIT : 2

- Introduction of solar energy – used system for water heating, cooking, refrigeration and power generation etc.
- Thermal and biochemical conversion processes available for obtaining gaseous and liquid fuels from bio – mass.
- Bio – gas plants and advanced gasohol.

UNIT : 3

- fundamentals of environment.
- Environment definition. Scope of environment studies.
- Life and the environment. Physico–chemical factors in the environment, changes in the environment – anthropogenic and non – anthropogenic.
- Environmental hazards and risks.
- Natural resources – conservation and sustainable development.

UNIT : 4

- Introduction of Eco – system.
- Impact of population growth on economic development and environment.
- Population and Environment with references to Air, Water, Soil, Noise .

PRACTICLES

- 1) To measure calorific value of available fuel.
- 2) To display different domestic fuel equipments.
- 3) To study about solar energy.
- 4) To prepare programs on energy awareness.
- 5) To visit nature park and centre of bio – diversity.
- 6) To prepare programs on environment awareness.

REFERENCES

- 1) Rai, G.D.(1996) : Non – conventional Energy, Khanna Publishers, new York.
- 2) Chaman Kashkari : Energy Resources Demand and conservation – Tata Megrow Hill.
- 3) Chatterji Manas (1981) : Energy and Environment in Developing countries, John Wiley, Chichester.
- 4) Duukerley, J. (1990) : Potters of Energy use in Developing countries.
- 5) Jain, H.C (1986) : Non – conventional sources of Energy, Sterling Publication, New Delhi.
- 6) Parich, J.K.(1980) : Energy, Systems and Development, OUP, New Delhi.

- 7) Dayal, M. (1989) : Renewable Energy, Environment and Development, Kenark Publishers.
- 8) Gusain, P.P.S. (1990) : Renewable Energy in India, Vikas Publishing House , New Delhi.
- 9) Agarwal, M.P. (1985) : Solar Energy. S. Chand & Co., New Delhi..

COMMERCIAL SPACE DESIGN

Paper no.- HSRM – 304

ES -3

Credits -3 +1=4

Sem. – 3 (M.Sc. R.M.)

Marks – 100 +50= 150

OBJECTIVES

- ❖ To develop the skill in visualizing and designing spaces of commercial interiors considering the principles of design, anthropometric data and ergonomic criteria.
- ❖ To understand the criteria for selection of appropriate materials for different surfaces taking in to consideration of ergonomic factors, aesthetics and cost.

UNIT : 1

- To study of commercial interior design, with the perception of purpose, function and aesthetics.
- Current trends in interior design.
- Current trends in architecture.
- Planning of interiors of commercial spaces with considerations of functions, orientation, grouping of areas, circulation, light, ventilation, privacy services, aesthetics and agronomical consideration.

UNIT : 2

- Designing of different types of commercial interior spaces with the layout, sectional, elevation and perspectives.
- Study of furniture and designing of furniture for commercial spaces.

UNIT : 3

- Blending of Design – Remodeling.
- Alteration, Remodeling.
- Repairs with consideration of purpose thrust
- Aesthetics and Suitability.

UNIT : 4

- Materials and finishes :
- Wood, Glass, Plastic, Metals, acoustical Boards, Floor covering, Paneling materials, False selling materials etc.
- Responsibilities of the Designer with the client.

PRACTICALS

- 1) Layout of smaller and bigger commercial areas.
- 2) Working drawings – sectional elevation and perspective.
- 3) Detailing of furniture – constructional detail of furniture, paneling, false selling mezzanine lofts, partitions.
- 4) Analysis of rates.
- 5) Rendering Techniques colour – schemes using different media.

REFERENCES

- 1) Alexander, N.I., McCusker (1972) : Designing Interior Environment. Havanovich Inc.
- 2) Ball, Victoria K.(1980) The Art of Interior Design, MC Millan & co. New York.
- 3) Bhatt, P.D. Goenka S. (1990) foundation of arts Design, Bombay, Lakhani Book Depot.
- 4) Butter Margaret G.E. Greaves Benyl S. (1980) Fabric Farnishing . ET Badsford Ltd. London
- 5) Chudly, R. (1978) Construction Technology Vol. 1 -2, HBS Long Man Ltd. New York
- 6) Robert, G.V. (1983) Rendering with pen and ink. Hudson. Thames, London.

STATISTICS AND RESEARCH METHODOLOGY

Paper no.- HSG – 305

ID -3

Credits -4 +0=4

Sem. – 3 (M.Sc. R.M.)

Marks – 100 +0= 100

OBJECTIVES

- 1** To understand the significance of statistics in Home science.
- 2** To enable students to develop the ability to present and interpret the data in a research report or thesis.
- 3** To expose the students to the various statistical techniques, to analyse and interpret data meaningfully.

UNIT : 1

- Meaning of statistics, its History, Scope, Objectives, Uses, Classification and limitation of statistics in the field of Home science.
- Variables - Types of variables and its control.
- Types of data – primary and secondary data and its methods of collecting data. Primary data, direct – personal observation. In direct – through agencies, information through agencies, Mailed Questionnaire, Secondary data, its application in various disciplines of Home science.

UNIT : 2

- Classification and Tabulation of data – Introduction and Definition, Classification and its aims, Basics of classification, Types of classification, Tabulation – types of tabulation, Array and frequency distribution, Definition, Frequency table.
- Statistics and parameters, parametric and non parametric statistics, concept of population and sample. Advantages of sampling, Selection of sample.
- Methods of sampling, simple and random sampling, stratified and purposive sampling.

UNIT : 3

- Processing of data – further understanding of variable, Nominal, Ordinal, Interval, Ratio, Derived variables – Ratio, Proportion, Rate.
- Diagrammatic and Graphical presentation of data – Bar charts, Multiple bar charts, Component bar charts, Pie charts, Histogram, Frequency polygon, Frequency curve or ogive, other types of charts .

UNIT : 4

- An introduction to research – The scientific research and its application in the field of Home science. Selection and definition of a problem, writing research proposal and types of research.
- Research methods and procedure – The historical method and the descriptive method, the co - relational and the casual comparative method and experimental method.

REFERENCES

1. Kapoor, V.K; Business Mathematics, Sultan chand and Suris Delhi.
2. Spiegel, M.R; Probability and statistics.
3. Elphence, D.N; Fundamentals of statistics.
4. Bhardvaj, R.S; Business statistics.
5. Kapoor and Sexsens; Fundamentals of statistics.
6. Shah, B.S ;]Cctr Aa>kDaxaS □a pepr – 1.
7. Vohra, N.D; Quantitative Techniques in Management, Tata Mc Graw Hill, New Delhi.
8. Chaudhary, C.N; Research Methodology, RBSA Publication, S. M.N.S. Highway, Jaipur, Raj. India.
9. Essentials of Agricultural Statistics, E.v. Divalcara Sastry, Pointer Publications, Jaipur, Raj. India.
1. A Handbook of Agricultural statistics, Dr. S.R.S. Chandel, Achal Prakashan Mandiv 117/574, Pandunagar, Kanpur – 208005.

INNOVATIVE PROGRAMMES OF EDUCATION AND DEVELOPMENT

Paper no.- HSHD – 301

CC -7

Credits -4 +0=4

Sem. – 3 (M.Sc.- H.D.)

Marks – 100 +0= 100

Objectives

- To gain a preliminary understanding of the context of innovative approaches to interventions
- To develop an overview of the key elements and processes of successful innovative approaches to interventions.
- To study selected ongoing innovative programmes at the international, national , and regional/local levels.

Unit - 1

1. The context and need for innovative programmes
 - Changing philosophical orientations at the international, and national level.(human rights, elimination of discrimination, equity and equality)
 - National/international conventions, ratification (e.g. promotion of breast feeding, protecting right of women and children) policies and commitments
 - Response to diverse cultural situations and needs
 - Specific needs of special groups of people, e.g.: tribal woman , children persons with special needs (disabled, hospitalized or street children, re fugees and so on).
 - Theoretical considerations, and cultural context of various approaches e.g. Child to child, Child rights.

Unit -2.

Historical overview of innovative approaches to intervention

Mobile crèche,crèche , Preschool programme , Womens D evelopment programme

Community Development Programme. Their theoredtical foundations, philosophy, personal talent ,commitments and sustenance mechanisms of these visionaries.

Unit- 3

A detailed overview of selected Innovative programme.

Description program should focus on Theoretical orientation, philosophy, Approches to programming, training Community involvement etc.

- Child care and education
- Women's Development programmes
- Community Development and Health

Unit- 4 Innovative programmes in regional context

References:-

Beckman, S.(1998). A fair chance; Evaluation of the Mother child Education.

Population Council: Reports of innovative Programmes (on going :Relevant issues/titles).

Swaminathan, M (Ed) (1995) SURAKSHA :Early childhood care and education in India. Monograph Series Vol-1-B., Chennai; M.S. Swaminathan Foundation.

Annual Reports of organisations and documents published by CHETNA, SEWA or other NGO.

Swaminathan , M.(1997),The first five Years; A critical perspective on early child care and education In India New Delhi : sage.

Bernard Van lecer foundation : Early childhood matters crelevant is sues) Hangu:Auther.

CHILD WITH SPECIAL NEEDS

Paper no.- HSHD – 302

CC - 8

Credits -3 +1=4

Sem. – 3 (M.Sc. H.D.)

Marks – 100 +50= 150

OBJECTIVES

- 1) To get acquainted with different kinds of children with special needs.
- 2) To study the characteristics of children with special needs.
- 3) To plan Intervention & Management programs for special children

UNIT : 1

- Meaning, concept & Need of Exceptional children. Importance of special Education for exceptional children.
- Types of Exceptional children.
- Theoretical concept and Historical perspectives of Exceptional children.
- Orthopedically handicapped children: - Meaning, Identification, Causes, Characteristics services for orthopedically handicapped children.

UNIT : 2

- Neurologically Impaired :-
Meaning, causes, Types, Characteristics & Services for Neurologically Impaired.
- Congenital Heart diseases & Endocrine dysfunction :-
Meaning, Causes & Services.
- Hearing Impairment :-
Meaning, Types, Causes, Characteristics, Identification & Services.

UNIT : 3

- Communication Impairment
Meaning, Types, Causes, Characteristics Identification & Services.
- Visual Impairment :-
Meaning, Types, Causes, Identification, Characteristics & Services.
- Mentally Retarded
Meaning, Types, Causes, Identification, Characteristics & Services.
- Learning Disabled
Meaning, causes, Identification, Characteristics & Services.

UNIT : 4

- Gifted
Meaning, Characteristics, Identification & services.
- Emotionally Disturbed children
Meaning, Identification, Types, causes, characteristics & services.
- Juvenile and youthful Offenders.
Meaning, Causes, Pretention of Delinquency and Treatment.
- Special Education and Integrated
Education for exceptional children.

PRACTICAL

- 1) To visit and Institution of every disabled children.
- 2) To prepare teaching aid according to need of exceptional children.
- 3) To study and suggest Remedial measures for disabled and gifted children.
- 4) To study the attitude of parents towards their special need child.
- 5) Case practices of special need child.
- 6) To study the characteristics of exceptional children.
- 7) Interviews / Observation of child with special need & their parents.

REFERENCES

- 1) Panda, K.C; 1981; Elements of child Development; Kalyani publishers.
- 2) Chaudhary, paul.D; 1980; Child welfare / Development; New De lhi; Atma Ram & Sons.
- 3) Margay, James F; Elechorn, John R; 1964; The Exceptional child; New york; Chicago, San Fransisco, Toranto, London; Holt; Rechart and winstor.
- 4) Chitamanikar; 1998; Exceptional children; Their Psychology and Education; Sterling Pablshers Private Limited.
- 5) Baker, Harry J; 1959; Introduction to exceptional children; New york; the Macmillan company.

ADVANCE HUMAN DEVELOPMENT – 2

Paper no.- HSHD – 303

CC -9

Credits -4 +0=4

Sem. – 3 (M.Sc.- H.D.)

Marks – 100 +0= 100

OBJECTIVES

- 1) To understand the stage of adolescence, youth and mid aged.
- 2) To study the major developmental characteristics of these stages.
- 3) To stay the issues of identity, developmental tasks and problems associated with these stages.

UNIT : 1

- The adolescent stage.
- The concept of adolescence in India
- Characteristics.
- Developmental task of adoles cence.
- Theoretical perspectives
G. Stanley Hall, Anna Fruid, Erik Eskon, Indian Perspectives.
- Physical development.
- Physiological and Psychological changes.

UNIT : 2

- Cognitive development.
- Social development.
- Emotional development.
- Personally development & Moral development.
- Problems of adolescents.
- School college, work and career.

UNIT : 3

- Juvenile delinquency.
- Developmental task of youth.
- Physical / Cognitive / Social development of youth.
- Marital relation and adjustment.
- Career and work.

UNIT ; 4 Middle age :-

- Characteristics.
- Developmental tasks.
- Adjustment in middle age.
 - Marital
 - Vocational
 - Social etc.
- Problems arises in middle age.

REFERENCES

- 1) Balk D.E. (1995). Adolescent development.
New York : Brooks / Cole.h
- 2) Saraswathi, P.S. & Dutt. R. (1988). Invisible boundaries : Grooming for adult roles. New Delhi. Nor tern, Book centre.

PARENTHOOD EDUCATION AND COUNSELING.

Paper no.- HSHD – 304

ES -3

Credits -2 +2=4

Sem. – 3 (M.Sc. H.D.)

Marks – 50+50= 100

OBJECTIVES

- 1) To understand the importance of parenting and parenthood education.
- 2) To understand the significance of parents role in childhood period.
- 3) To develop skill to involve parents in childhood education.
- 4) To understand the need for counseling human development.
- 5) To discuss the processes involved in counseling at different stages in life .

UNIT : 1

Parenthood, Meaning, Importance, duties and role. Effect of family structure on parenthood.

- The task of parenting and the concept of parenting skills.
- Changing concept of parenthood and childhood.
- Being a competent parent.

UNIT : 2 Individual parenting Roles.

- Determinants of parenting behaviour.
- Characteristics of the parenting roles.
- The mothering role.
- The fathering role.
- Concept of family, the family life cycle stages.
- Effect of culture and family tradition.

UNIT : 3

- Parenthood and planning of family.
- Methods of child rearing practices.
- Principles of counseling and therapy
- Approaches to counseling at different developmental stages.
- Family therapy approach.

UNIT : 4

- Qualities and skills of a counselor.
- The process of counseling.
- Types of counseling.

PRACTICALS

- 1 Conducting home visits and interviewing to parents.
- 2 Organizing parent education literature based on parents needs.
- 3 Study about children problems faced by parents and prepare to their needs.
- 4 Conducting parent – teacher meeting.
- 5 Learn about the counseling process.
- 6 Conducting counseling programs for parents.
- 7 Visit to a counseling center.

REFERENCES

- 1 Burnard, P (1999). Counseling Skalls training. New Delhi, Viva Books.
- 2 Manthei .R (1997), Counseling , the Skalls of finding solutions to pr oblems. Londen, Roulledge.
- 3 Micolsan, D and Ayers. H (1995). Individual counseling, Therapy and Practice, London, David Fulton.
- 4 Diane E. Papalia (1992), Human denelipment 5th sdition, International edition M C Grow Hill, IMC.

WOMEN'S STUDIES & CHILD WELFARE.

Paper no.- HSHD – 304

ES -3

Credits -2+2=4

Sem. – 3 (M.Sc.- H.D.)

Marks – 50 +50= 150

OBJECTIVES

- 1) To develop awareness regarding status of women in India and sensitivity to women's issues and concerns.
- 2) To understand theoretical and Methodological concerns related to women's studies.
- 3) To understand the children problems.
- 4) To give information regarding welfare agencies for women & children.
- 5) To be aware of issues and concerns related to situation of women with specific references to the Indian context.

UNIT : 1

- The rationale for women's studies.
- Meaning and significance.
- Growth of women's studies in India and other countries.
- The women's movement in India.
- Theoretical perspectives in women's studies.
- Historical and social – cultural basis of women's status.

UNIT : 2

- Consequences of gender differences.
- Sexual division of labor and its implications.
- Concepts related to gender differences from societal and developmental perspective.
- Gender and education.

UNIT : 3

- Economic empowerment and gender.
- Development processes in women's studies.
- Problems and issues related to women in India.
- Child marriage, Female foeticide
- Dowry, Violence, women's identity.
- Educational opportunities.
- Employment.

UNIT : 4

- Women in politics
- Legal status of women
- Women's Rights.
- Problems of children.
- Child labor etc.
- Legal status of children
- Welfare agencies for children.

PRACTICAL

- To study the profile of women.
- To study the gender discrimination aspects.
- To study the factors affecting to female foeticide.
- To study the rights of women & children
- To study the recent status of women.
- To study the recent status of children.
- To study the problems of dual burden women.
- To study problems and issues related to women and children.

REFERENCES

- 1) Desai N & Patel V. Indian women:
Change and challenges in the international decade : Popular Prakasan, Bombay.
- 2) Parashar, A. women and Family law reforms in India : Uniform civil code and
gender equity : sage, New Delhi.

STATISTICS AND RESEARCH METHODOLOGY

Paper no.- HSG – 305

ID -3

Credits -4 +0=4

Sem. – 3 (M.Sc. H.D.)

Marks – 100 +0= 100

OBJECTIVES

- 1** To understand the significance of statistics in Home science.
- 2** To enable students to develop the ability to present and interpret the data in a research report or thesis.
- 3** To expose the students to the various statistical techniques, to analyse and interpret data meaningfully.

UNIT : 1

- Meaning of statistics, its History, Scope, Objectives, Uses, Classification and limitation of statistics in the field of Home science.
- Variables - Types of variables and its control.
- Types of data – primary and secondary data and its methods of collecting data. Primary data, direct – personal observation. In direct – through agencies, information through agencies, Mailed Questionnaire, Secondary data, its application in various disciplines of Home science.

UNIT : 2

- Classification and Tabulation of data – Introduction and Definition, Classification and its aims, Basics of classification, Types of classification, Tabulation – types of tabulation, Array and frequency distribution, Definition, Frequency table.
- Statistics and parameters, parametric and non parametric statistics, concept of population and sample. Advantages of sampling, Selection of sample.
- Methods of sampling, simple and random sampling, stratified and purposive sampling.

UNIT : 3

- Processing of data – further understanding of variable, Nominal, Ordinal, Interval, Ratio, Derived variables – Ratio, Proportion, Rate.
- Diagrammatic and Graphical presentation of data – Bar charts, Multiple bar charts, Component bar charts, Pie charts, Histogram, Frequency polygon, Frequency curve or ogive, other types of charts.

UNIT : 4

- An introduction to research – The scientific research and its application in the field of Home science. Selection and definition of a problem, writing research proposal and types of research.
- Research methods and procedure – The historical method and the descriptive method, the co - relational and the casual comparative method and experimental method.

REFERENCES

1. Kapoor, V.K; Business Mathematics, Sultan chand and Suris Delhi.
2. Spiegel, M.R; Probability and statistics.
3. Elphence, D.N; Fundamentals of statistics.
4. Bhardvaj, R.S; Business statistics.
5. Kapoor and Sexsens; Fundamentals of statistics.
6. Shah, B.S ;]Cctr Aa>kDaxaS □a pepr – 1.
7. Vohra, N.D; Quantitative Techniques in Management, Tata Mc Graw Hill, New Delhi.
8. Chaudhary, C.N; Research Methodology, RBSA Publication, S.M.N. S. Highway, Jaipur, Raj. India.
9. Essentials of Agricultural Statistics, E.v. Divalcara Sastry, Pointer Publications, Jaipur, Raj. India.
10. A Handbook of Agricultural statistics, Dr. S.R.S. Chandel, Achal Prakashan Mandiv 117/574, Pandunagar, Kanpur – 208005.

SOCIAL AND PSYCHOLOGICAL ASPECTS OF CLOTHING

Paper No HSCT (301)

CC - 7

Credits : 4 + 0 = 4

SEM – III(M.Sc. C.T.)

Marks : 100

Objective

The aim of this course is to study the psychological effect of clothing on the individual in social situations.

Unit -1

Origin of Clothing

- Why costumes differ all over the world, material aspects and climate.
- Religious influence
- Events of the world
- Clothing symbols

Unit -2

Socialisation and development of the self

- Social norms
- Attitudes and value formation
- Individuality and conformity
- Person and group identification

Unit -3

Personality theories

- Sigmund Freud – defense mechanisms
- Jung
- MurrayS

Unit -4

Over all influence of clothes on individual life

References

1. Avis. M. Dry (1961): The Psychology of Jung, Methuen & Co., London
2. Horn, Marilyn J. (1968): The Second Skin, Houghton Mifflin Co., USA.
3. Flugel, J.C. (1950): The psycho-analytical study of the family, The Hogarth Press & The Institute of Psycho Analysis, London.
4. Richard Wollheim (1985): Freud, Fontana Press, London.
5. Vincent Brome (1978): Jung, Granada Publishing, London, Toronto Sydney, New York.

FASHION DESIGN

Paper No HSCT (302)

CC - 8

Credits : 3 + 1 = 4

SEM – III(M.Sc. C.T.)

Marks : 100 + 50 = 150

Objective

- The course aims at providing in depth working knowledge of line development and enables a student to use and practice skills and knowledge already acquired and use it to market situation.

Unit -1

Elements used in creating a design.

Composition – with one element. With more than one element.

Unit -2

Colour – its sensitivity and composition in dress.

Harmony – in form of space coverage to design of the dress.

Unit -3

Components of fashion:

- Silhouette
- Details
- Colour
- Fabric
- Texture
- Seams
- Trims

Unit -4

Fashion Forecasting.

Study of markets and segments

Designers – International and Domestic.

Practicals

1. Sketching

- Sketching of different action croquis (front, back and side view) (Computer Application).
- Garment and garment details.
- Accessories.

2. Draping

Draping of bodice and its variation (princess seam, dart manipulation, yokes etc.)

3. Developing a line of garments on a theme (any one of the following)

- Casual wear
- Sports wear
- Cocktail wear
- Executive wear

4. Sketching

- Basic rendering techniques.
- Developing a line of garments based on a theme.

5. Understanding and sketching theme based on fashion forecast.

- Sourcing of raw materials.
- Developing line, based on fabric and theme selected
- Spec sheet study
- Sampling
- Garment analysis
- Costing – construction of garments
- Line presentation
- Use of sale promotion material

Designing of 5 garments for selected theme drafting and marking patterns for the same construction of any ½ garments.

References

1. Sharon Lee Tate, inside Fashion Design Harper and Row, Publishers N York.
2. Kathryn Samuel, Life Styles, Fashion Styles, Orbis London.
3. Milbank, C.R. (1985): COUTURE, The Great Fashion Designers, Thames and Hudson Publication.
4. Carter, E. (1977): The Changing World of Fashion, G.P. Putnam's Sons, New York.
5. Rubin, L.G. (1976): The World of Fashion, Canfield Press, San Fransisco.
6. Castelino, M.(1994): Fashion Kaleidoscope, Rup & Co.
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8. Samuel, K. (1986): Lifestyles - Fashion styles, Orbis Book Publishing Corporation Ltd., London.
9. Carr, H. and Pomery, J. (1992): Fashion Design and Product Development, Blackwell Scientific Publications, London, Edinburgh, Boston.

FASHION RETAILING

Paper No : HSCT (303)

CC - 9

Credits : 4+ 0 = 4

SEM –III (M.Sc. C.T.)

Marks : 100

Objective

- To understand the dynamics of fashion and role of fashion designers
- To develop understanding visual merchandising and its importance in today's consumer market
- To gain knowledge about the management aspect of retailing.

Unit -1

The Dynamics of Fashion

Fashion Terminology, Fashion Cycle, Fashion Adoption Theories, Fashion Forecast, the role of designers in merchandising.

The Concept of Retailing

Definitions, Role of retailing in merchandising , the retail mix, retail environment, types of retail stores.

Unit -2

Elements and Principles of Art and Design

Elements of Design : Colour, Texture, line, form, space

Principles of Design : Rhythm, Balance, Proportion, Emphasis, Unity.

Interpretation for designing a retail store.

Unit -3

Visual Merchandising

- Plan and schedule – seasons, holiday proportion, sales, themes/ideas.
- Types of Display – Window display, interior displays.
- Elements of Display – The merchandise the backdrop walls and shelves mannequins and forms, signage lightings – illuminance levels, relation to colour .

Unit -4

Planning and Budgeting for a Retail Store

Maintenance and ordering of stocks, preparation of sales reports.

Recruitment and Management of Sales Force, Types of compensation packages for sales force, Personal Selling as a means of Promotion.

References

Dhake, Spoons, (1992): Greenworld Tetail Fashion Promotion and Advertising, Mac Millan Publication.

Jarnow, J.A. Judellie, B. and Guerreiro, M. (1981): Inside the Fashion Business, John Wiley & Sons, NY, Toranto, Brisbane.

Frings G.S. (1982): Fashion from Concept to Consumer, Prentice Hall Inc., Englewood Cliffs, New Jersey.

Easey, M (1995): Fashion Marketing, Blackwell Science Ltd.

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Stone, E. and Samples, J.A. (1995): Fashion Merchandising – An Introduction, McGraw Hill Book Company.

TEXTILE TESTING AND QUALITY CONTROL

Paper No : HSCT (304)

ES-3

Credits – 2+2=4

SEM – III(M.Sc. C.T.)

Marks : 50 + 50 = 100

Objective

- To develop and understanding of method and technique used to analyse textile fibre yarns and fabrics for end-use performance.
- To acquire knowledge and understanding of various structural properties of textiles and relate them to end use fabric performance and product.
- To familiarize students with the different testing equipments , their underlying principles and the international accepted standards, test methods and the language of measurement.
- To be able to analyse and interpret the result and predict the general textile testing.

Unit- 1 Introduction to Textile Testing

- Concept and scope
- Application areas
- Use of statistics in data management
- Sampling procedures

Unit- 2 Total quality management (TQM) approach in the field of Textiles & Clothing.

Unit-3 Standardization

- Standards for fabric performance.
- Organisations for Standardisation (National and International).

- Quality control of Textile products.
- Quality standards as applicable to various types of textiles (Garments, Yardage, knits, woven, carpets, processing, dyeing).

Unit-4 Properties of textiles at different stages of processing and their principle of measurement

- Fibres – length, fineness, evenness
- Yarn – strength, evenness, openness, load, elongation, crimp.
- Fabrics – strength, elongation, shrinkage, thickness, cover, air permeability, crease recovery, weight, comfort, stiffness, flammability, colour fastness.
- Garment Finishing – Colour fastness, shrinkage
- Concept of fabric faults as related to stages of manufacture and the remedies.

Practicals

1. Physical Testing of Textiles using appropriate standardized procedures

- Fibres – length, diameter, fineness
- Yarn – count, heaviness, twist, crimp, strength
- Fabric – Thread count, thickness, air porosity, abrasion, strength [Tensile Tear Bursting], water vapour permeability, cover, stiffness, drapability, crease recovery, pilling, abrasion.

2. Chemical Testing

- Identification of fibres.
- Binary Fabrics – Blend composition
- Shrinkage, water, oil repellency
- Sensitivity to various reagents.

3. Dyes

- a. Identification of dye class
- b. Colour Fastness

4. Mechanical Testing

- Seam Strength
- Identification of fabric weave, Thread count.

5. Inspection Of Final Garment

References

1. Booth, J.E.: Principles of Textile Testing – Newness Butter Worth London.
2. Billie, J. Collier and Helen H. Epps – Textile Testing and Analysis – Prentice Hall, New Jersey.
3. John, H. Skinkle – Textile Testing – Booklyn, New York.
4. Grover and Hamby – Hand book of Textile Testing and Quality Control, Wiles.
5. ISI Specification, BIS Specification.
6. ASTM Standards.

DYEING AND PRINTING

Paper No : HSCT (304)

ES-3

Credits – 2+2=4

SEM – III(M.Sc. C.T.)

Marks : 50 + 50 = 100

Objective

- i. To impart the knowledge about preparation of fabric for dyeing & printing.
- ii. To understand the theory of dyeing in relation to various classes of dyes.
- iii. Application of various dyes & properties related to it.
- iv. To introduce the concept of dyeing at commercial level.
- v. To inculcate awareness of the different methods of printing and appreciate the technical advantages of each.
- vi. To develop technical competency in printing with different dyes on different fabrics.

Unit- 1.

- A. Preparation of fabric for dyeing & printing
 - Scouring, bleaching, designing
 - Reagents used & their application
 - Specific preparatory steps for industrial level for yarn, fabric & price goods

Unit- 2

Dye

- Classification, definition, com
- Colour & chemical constitution of dyes
- Dyeing with chemical dyes
 - a. Direct, reactive, vat, sulphur, azo [for cellulosic]
 - b. Acid, metal complex, disperse [for protein]
 - c. Basic, nylomine, disperse [for man-made]
- Dyeing with natural dyes
- use of pigments
- Dyeing machines for fibers, yarns & fabrics
- Industrial dyeing practices

- Dyeing auxiliaries & their uses
- Dyeing of blends
- Unit 2.a Textile design through dyeing
- Tie & dye
- Batik
- Union & Cross dyeing
- Dyeing defects & remedies

Unit -3

Introduction to printing – difference between dyeing and printing.

Methods of printing

- Historical development of printing methods – block stencil. Screen roller and rotary screens used at cottage and industrial level.

Printing pastes – Thickening agents and auxiliaries for printing and their suitability to various classes of dyes and fibres. Preparation of printing pastes for different dyes and different fibres.

Unit -4

Styles of Printing

Direct style, dyed, resist or reserve style, discharge style and raised style.

Styles and methods of printing traditionally used in India.

Special printing procedures

Polychromatic dyeing, transfer printing, carpet printing, flock printing.

Finishing and after treatment of printed goods at cottage and industrial level.

Practicals

1. Preparation of fabric for dyeing & printing
2. Dyeing of yarns & fabric with different classes of dyes, in fibre & blends (variable – MLR, con, temp leveling/ exhausting agents)
 - Direct, reactive, vat, sulphur, azo
 - Acid, chrome, metal complex
 - Basic, disperse
 - Natural dyes

3. Preparation of fabric for printing – different fibre groups with different dyes, different styles of printing.
4. Preparation of screens for printing
5. Printing with blocks and screens on cotton, silk, wool and cotton wool, cotton silk and cotton polyester blends in different styles with different dye classes.
 - Direct style
 - Mordant or dyed style, Azok style
 - Discharge style
 - Resist style
 - Raised style
 - Transfer printing
6. Finishing the printed goods
7. Reports of visits to processing and printing units – cottage and industrial level.

References

1. V.A. Shenai (1987), Chemistry of Dyes and Principles of Dyeing, Sevak Praksshan, Mumbai.
2. H.A. Lubs, Robert, E. The chemistry of Synthetic Dyes and Pigments, Krieger Publishing company, New York.
3. V.A. Shenai (1999), Azo Dyes – Facts and Figures – Sevak Prakashan, Mumbai.
4. R.S. Pryag, Technology Textile Printing – Noyes Data Corporation.
5. V.A. Shenai (1977), Technology of Printing – Technology of Textile Processing, Vol. IV, Sevak Publication.
6. M.L. Gulrajani and Deepti Gupta (1990), Natural Dyes and their Application to Textiles”. Ed. I.I.T. Delhi Publication.
7. John and Margarot Cannon (1994), Dye Pla nts and Dyeing, The Herbert Press (UK).
8. ASTM and ISI Standatds.
9. K. Venkatrama (1970), Chemistry of Synthetic Dyes, Part I and II.

STATISTICS AND RESEARCH METHODOLOGY

Paper no.- HSG – 305

ID -3

Credits -4 +0=4

Sem. – 3 (M.Sc. C.T.)

Marks – 100 +0= 100

OBJECTIVES

- To understand the significance of statistics in Home science.
- To enable students to develop the ability to present and interpret the data in a research report or thesis.
- To expose the students to the various statistical techniques, to analyse and interpret data meaningfully.

UNIT : 1

- Meaning of statistics, its History, Scope, Objectives, Uses, Classification and limitation of statistics in the field of Home science.
- Basic terms in statistics – population and sample, Data, Variables Types of variables and its control.
- Types of data – primary and secondary data and its methods of collecting data. Primary data, direct – personal observation. In direct – through agencies, information through agencies, Mailed Questionnaire, Secondary data, its application in various disciplines of Home science.

UNIT : 2

- Classification and Tabulation of data – Introduction and Definition, Classification and its aims, Basics of classification, Types of classification, Tabulation – types of tabulation, Array and frequency distribution, Definition, Frequency table.

- Statistics and parameters, parametric and non parametric statistics, concept of population and sample. Advantages of sampling, Selection of sample.
- Methods of sampling, simple and random sampling, stratified and purposive sampling.

UNIT : 3

- Processing of data – further understanding of variable, Nominal, Ordinal, Interval, Ratio, Derived variables – Ratio, Proportion, Rate.
- Diagrammatic and Graphical presentation of data – Bar charts, Multiple bar charts, Component bar charts, Pie charts, Histogram, Frequency polygon, Frequency curve or ogive, other types of charts.

UNIT : 4

- An introduction to research – The scientific research and its application in the field of Home science. Selection and definition of a problem, writing research proposal and types of research.
- Research methods and procedure – The historical method and the descriptive method, the co - relational and the casual comparative method and experimental method.

REFERENCES

1. Kapoor, V.K; Business Mathematics, Sultan chand and Suris Delhi.
2. Spiegel, M.R; Probability and statistics.
3. Elphence, D.N; Fundamentals of statistics.
4. Bhardvaj, R.S; Business statistics.
5. Kapoor and Sexsens; Fundamentals of statistics.
6. Shah, B.S ;]Cctr Aa>kDaxaS □a pepr – 1.
7. Vohra, N.D; Quantitative Techniques in Management, Tata Mc Graw Hill, Ne w Delhi.

8. Chaudhary, C.N; Research Methodology, RBSA Publication, S.M.N.S. Highway, Jaipur, Raj. India.
9. Essentials of Agricultural Statistics, E.v. Divalcara Sastry, Pointer Publications, Jaipur, Raj. India.
10. A Handbook of Agricultural statistics, Dr. S.R.S. Chandel, Achal Prakashan Mandiv 117/574, Pandunagar, Kanpur – 208005

CHEMISTRY

Paper : I CHN-601-(I) Inorganic Chemistry

Unit – 1

- © E.S.R. Spectra of transition metal complexes

Theory of E.S.R. (Basic principles). The presentation of E.S.R. Spectrum.

Hyperfine splitting. Spin Hamiltonian, applications.

- © N. Q. R. Spectroscopy :-

Theory of N.Q.R., Origin of transition, experimental techniques. Townes and Dailey's formula, Structural information from N.Q.R. illustrated by suitable examples.

Unit :- 2

- © Applications of

(a) Valence – electron & photo-electron Spectroscopy

(b) X-ray photoelectron spectroscopy.

Unit :- 3

Principle & application of magneto chemistry : Basic (Diamagnetic, Para magnetic, ferromagnetic, anti ferromagnetic), Magnetic properties of free ions.

Unit :- 4

- © Organo metallic compounds (OMC) :

- General Introduction & principles. Factors governing the properties of OMC, General trends in chemical properties, Nature of metal-carbon. Bond, preparative methods, reactions & applications.

- Organo Aluminum & Beryllium compounds, organo boranes.

Paper : II CHN-602-(I) Inorganic Chemistry

Unit :- 1

© Bio-inorganic Chemistry :-

Introduction, The Biochemistry of iron, Iron Storage and Transport. Haemoglobin and Myoglobin, Cytochromes. Other Iron-porphyrin Biomolecules, other Natural oxygen Carriers, Iron-Sulfur Proteins.

Unit :- 2

© The Biochemistry of :

Zinc, Copper, Cobalt, Molybdenum and Tungsten Miscellaneous Other Elements : Vanadium, Chromium, Nickel.

Unit :- 3

© Organometallic compounds & metal complexes as catalyst in Homogeneous & Heterogeneous Systems : Oxidative-addition, Reductive elimination. Migration (insertion) reactions, Hydroformylation, Hydrogenation, Carboxylation. Polymerization, Fisher-Trops process, water gas shift reaction.

Unit :- 4

© Chemistry of trans uranic elements :

Paper : III
CHN-603 (I) (Coord) Inorganic Chemistry (Co-ordination Chemistry)

Unit :- 1

- © Theories of bonding :

Theoretical principles of CFT, Introduction to spherical harmonics & the shape of d-orbitals, Derivation of crystal field potential for tetragonal, cubic and square planar arrangement of ligands around central metal ion, Transformation of these potential from Cartesian to spherical harmonics, Effect of V_{oct} on d^1 system. Evaluation of the various integrals involved,. Solution of the secular determinant to obtain energies and corresponding wave functions, Crystal field splitting diagram for O_h , T_d & Square planar systems.

Unit :- 2

- © RS Coupling & J. J. Coupling

- © Ladder operators :

- Step up & step down operators and their use to obtain wave functions.
- Derivation and use of the equation.

$$X(\alpha) = \frac{\sin(1+1) \alpha/2}{\sin \alpha/2} = 2A_{2g} / 3T_{1g}$$

Unit :- 3

- © Weak field approximation :

The splitting of the free ion terms of d^2 in an o_h field Calculation in weak field, approximation energy of the various terms; $2A_{2g}$, $3T_{2g}$, & $3 T_{1g}$ derived from $3F(d^2)$ in an O_h field.

- © Strong field approximation :

Determination of multiplicities by the method of descending symmetry. Calculation of energy of various terms within the frame work of strong field approximation.

Unit :-4

- © Electronic spectra of metal complexes :

Introduction, Selection rules, Vibronic coupling spectra of $Ti(III)$, $VO(IV)$, $Ni(II)$, $Co(II)$, $Co(III)$, $Fe(II)$, $Fe(III)$, $Cu(II)$, $Mn(II)$ complexes under different geometries, Jahn-Teller theorem.

Paper : III CHN-603 (I) (Crns) Inorganic Chemistry (Corrosion)

Unit :1

- a. Importance of studying corrosion.
Electrochemical mechanism – Type of corrosion damage, (uniform attack, pitting, Dezincification. Intragranular cracking).
- b. Corrosion tendency and electrode potential : The oxygen electrode and differential cell aeration cell, Pourbaix diagram, emf and galvanic series.

Unit :2

- a. Polarization : The polarized cell, How measured, Causes of polarization, Hydrogen over voltage, Influence of polarization on corrosion rate.
- b. Atmospheric corrosion : Types of atmospheres, corrosion product films. Factors influencing corrosivity of the atmosphere, remedial measures.

Unit :3

- a. Underground corrosion : Factors influencing the corrosivity of soils, Pitting characteristics, Remedial measures.
- b. Oxidation and Turnish : Theory e.g. of oxidation, Wagner theory of corrosion. Oxidation resistant alloys.

Unit :4

- a. Stray current corrosion : Sources of stray current Detection of stray current.
Method of measuring the resistivity of soil, Effect of stray current on steel covered by concrete. Damage of steel by SC.
- b. Stress corrosion cracking – Mechanism of cracking.
Hydrogen cracking – Mechanism of cracking
Corrosion fatigue – Mechanism of cracking
Fretting corrosion – Mechanism of cracking
Treatment of water and steam system. Hot and cold water treatment, Boiler water treatment.

Paper : I CHN-601-(O) Organic Chemistry

Unit :- 1

® Natural Colouring Matter :-

- Classification General method of Structural determination, Biosynthesis studies of Anthocyanine (Cyanin and Palargonidin), Flavones (Chrysin), Flavonols (Quercetin), Flavonone (Dihydro flavone) and Isoflavones(Daidzein), Coumarin, Quinones (Polyporic Acid), Porphyrin.
- Chemistry of Haemin and Chlorophyll.

Unit :- 2

® Terpenoids :-

- Chemistry of Abietic acid, Gibberllic acid (Gibberllin – A), Squalenes, Eudesmol, Phytol and –Cadinene.
- Biosynthetic study of Tri-Terpenoids and Tetra Terpenoids

Unit :- 3

® Vitamins :-

Detailed study of chemistry of Thiamine (Vitamin-B1), Pantothenic acid (Vitamin-B2), Ascorbic acid (Vitamin-C), Tocopherol (Vitamin-E), and Biotin (Vitamin-H), Biological importance of Vitamins.

Unit :-4

® Alkaloids :-

- General Biogenetic studies of Alkaloids.
- Chemistry of Reserpine, Coichicine, Strychnine and Narcotine.

Paper : II CHN-602-(O) Organic Chemistry

Unit :- 1

- ® Basic Principles : Basic chemical data, Batch versus continuous operation, Design Flowcharts, chemical process selection, safety hazards, fire and toxic materials, research and development, patents.
- ® Unit process and Unit operations, Nitration, halogenation, amination, sulphonation and hydroxylation.

Unit :2

- ® Soap and Detergents :
 - Detergents, surfactants, Alkylbenzenes, Fatty acids and Fatty alcohols, Soaps.
 - Essential oils, constituents, animal fixatives, fruit concentrates, Vanilla, chocolate, monosodium glutamate, food additives, preservatives.

Unit :3

- ® Vegetable oils, cotton seed oil, Hydrogenation.
- ® Agrochemicals and Pharmaceuticals :
 - Insecticides, fungicides, weedicides, rodenticides, plant nutrients, plant hormones.

Unit :4

- ® Pulp, pulping processes, Sugar-Ethanol industries base carboxyl. manu facture of paper and rayon.
 - Alkylation (Phenobarbital, Cimetidine), Carboxylation and Acetylation Salicylic acid derivatives, condensation and cyclization, Diazepam, piperazine citrate.

Paper : III CHN-603-(O) Organic Chemistry

Unit : 1

- Introduction Naming of Organic Medicinal Compounds,
- Literature of Medicinal Chemistry.
- Classification of Drugs.
- Drug Design.
- Relation between molecular structure and Biological Activity.(QSAR)
- Receptor site Theory.
- Pharmacopeias, Indian standards.
- Modern methods of pharmaceutical Analysis.
- Diagnostic Agents,
- Pharmaceutical aids : Solvents, Vehicles, Flavors, Suspending agents, surfactants, Emulsifying agents.

Unit : 2

- ® Antibiotics
Classification, Synthesis and Activity of : Penicillin, Cephalosporins, Streptomycin, Tetracyclines, Actinomycine, Chloroamphenicol and Polyenes.

Unit :3

- ® Sulphadrugs :
 - Chemistry of Sulfonamides
 - Synthesis and uses : Sulphanilamides, Sulphafurazole, Sulphaguanidine, Sulphathiazole, Sulphamerazine, Sulphalene, Sulphathiadiazole, Trimethoprim.

Unit : 4

- ® Drugs stimulating or Blocking the peripheral Nervous System:
 - Cholinergic & Anticholinergic Drugs
 - Histamine & Antihistamine.
 - Local Anaesthetics.

Paper – I CHN-601(P) Physical Chemistry

Unit :- 1

☛ Photo chemistry – 1

- Einstein law, quantum yield (numerical), Types of Photochemical reaction. Classification of photo chemical reactions.
- Rate constants and life times of reactive energy states.
- Determination of rate constants of reactions.
- Effect of light intensity on the rate of photochemical reactions.
- Photofragmentation or a photodissociation., Isomerisation and other rearrangement reactions, Photoreduction and related reactions.
- Photoreduction of dyes by two electron transfer process.
- Photooxidation and photooxygenation.,

Unit :- 2

☛ Adsorption

- Chemical & Physical adsorption, surface tension, Adsorption Isotherms, Freundlich, Langmuir and BET adsorption equation,
- Adsorption from solution, Gibb's adsorption isotherm, methods for determination of surface area, thermodynamic of adsorption isotherm.
- Insoluble films, types of films and their advantages. Heat of adsorption and experimental determination of heat of adsorption.
- Detergency and Adsorption, Adsorption theory and Homogeneous/Heterogeneous catalysis.

Unit :- 3

☛ Solid state chemistry :

- Type of solids, Difference between crystalline solid and Amorphous solid, Factors affecting the shape of growing crystal, Techniques of single crystal growth.
- Close packing, perfect and imperfect crystals, intrinsic and extrinsic defects, point defects, line and plane defects. Thermodynamics of Schottky and Frenkel defect formation.
- Metals, insulators semiconductors, Band theory, free electron theory of metals, Zone theory of solids. BCS theory of superconductors, Meissner's effect Superconductors of type I and II.
- Solid state reactions : General principles, experimental procedures, co-precipitation as a precursor to solid state reaction, kinetics of solid state reaction.

Unit :- 4

☀ Spectroscopy

- Infrared Spectroscopy :- Instrumentation, Calculation of Vibrational frequencies and Interpretation of IR spectra.
- Proton Nuclear magnetic resonance spectroscopy (^1H NMR): Theory of ^1H NMR, ^1H NMR spectrum, chemical shift, signal intensities, spin-spin coupling, complex ^1H NMR spectra and spin – spin splitting.
- ^{13}C NMR : ^{13}C NMR spectrum, operating frequency, ^{13}C – H coupling DEPT ^{13}C spectra, ^{13}C – C correlation.
- UV – Visible chiroptical spectroscopy : Linearly and Circularly polarized light, optical rotatory dispersion (ORD) and circular dichroism (CD), chiroptical properties, octant rule, Application of ORD – CD.

Paper – II CHN-602(P) Physical Chemistry

Unit :- 1

- The Phenomena and Mechanism of Electrolysis : The electrolytic Dissolution Theory (Ionic theory) Influence of solvent on dissolution.
- Electrolytic Conductance : Conductance ratio, Equivalent conductance minima, Equivalent Conductance at Infinite dilution, Independence migration of ions, Ionic mobility, Experimental determination of ionic mobility, Factors effecting ionic mobilities, abnormal ion conductances.
- Mechanism of electrolytic conductance (Debye Huckel Onsagar conductance equation) validity of DHO Equation (Aqueous & non aqueous solution), Deviation of DHO Equation, Debye Falkenhagen effect and Wein effect.
- Transference number (True, Apparent & Abnormal), Transference numbers in mixture, Factors effecting transference numbers, Methods for determining transference numbers.

Unit :- 2

- Acids and Bases : Types of solvents, Dissociation constant, Determination of dissociation constants of mono and Poly basic acids by E.M.F. methods, colorimetric methods and conductimetric methods,
- Effect of solvent on dissociation constant, Determination of ionic product of water by conductometric method and E.M.F. method.
- Amphoteric Electrolytes : Properties of Dipolar ions, E.M.F. methods for determination of dissociation constant of amino acids, Proporation of Dipolar ions, Isoelectric point.
- Neutralization curves for ampholytes, Activity coefficient of ampholytes.

Unit :- 3

- Overvoltage : Theories of Hydrogen Overvoltage (Bubble formation, Combination of atoms as slow process, Ion Discharge as the slow process, Proton transfer as the slow process), Factors effecting Overvoltage, Oxygen overvoltage, Hydrogen overvoltage.
- Polarisation : Electrolytic polarization, Disolution and decomposition potentials, metal deposition, Concentration polarization, Decomposotion voltage in auccous solutions, Metal dissolution.
- Reversible Oxidation and Reduction : Reversible Oxidation and reduction process, Non Reversible process, Factors effecting electrolytic reduction and electrolytic Oxidation, Appliction of electrolytic oxidation and reduction (polymerization of anions, Oxidation of Fatty acids, Brown-walker Electro synthesis.

Unit :- 4

- Electrokinetic Phenomena: Electro Osmosis, Streaming potential, Electrophoresis, Determination of Zeta potentials, Influence of Zeta potentials of ions on Electrokinetic phenomena, Electrophoretic mobility and Bond Hydrogen ion.
- Quantum aspects of charge transfer : quantum aspects of charge transfer reaction or electrode solution interface, mechanics of electron, penetration of electrons into classically forbidden regions, Probability of electron tunneling through barriers, Tunneling condition and Proton transfer curve, De-electrons, reaction. A symmetry Factor B.

Paper – III CHN-603(P) Physical Chemistry

Unit :- 1

- **Introduction to polymer** : History, Classification on the basis of use and structure (chemical structure and geometrical structure),
- Fibers, Elastomers and Plastics,
- Degree of polymerization, Polydispersity, Average Molecular weight and molecular weight distribution, molecular Forces and chemical Bonding in polymers.

Unit :- 2

- **Kinetics of polymerization** : Free Radical, cationic & Anionic chain polymerization,
- polycondensation (Acid catalysed & Noncatalysed)
- **Coordination polymerization** :- Ziegler – Natta Catalysts, Mechanism of Ziegler – Natta Polymerization (mono-metallic & Bio-metallic),
- Early kinetics models for Ziegler-Natta catalysts, Active center.

Unit :- 3

- **Glass Transition Temperature** : Definition of Glass Transition Temp. (state of Aggregate & state of Phase),
- Secondary glass transition temp., Transition and Associated properties. Factors effecting T_g,
- Relation between T_m & T_g, The WLF equation Methods for determination of Glass Transition Temp.

Unit :- 4

- **Polymer Degradation** : Types of degradation, Photo degradation, Mechanical degradation, Thermal degradation, oxidative degradation, Hydrolytic degradation.
- **Polymer Reaction** : Acidolysis, Aminolysis, Addition, Substitution, Crosslinking and Cyclisation Reaction.
- Crystallisability, Factors effecting the Crystallisability,

Paper – 1 CHN-601(A) Analytical Chemistry

Unit -1

Basic concepts of classical methods :

Scope of Analytical chemistry (Introduction, Application & its importance). Classical methods & Instrumental methods, methods of quantitative analyses & qualitative analyses. Analytical methodology (steps of total analyses process). Sampling, treatment of analytical data, sources of error, Deviation (average deviation & standard deviation), absolute error & accuracy. F test.

't' test, analysis of variation, rejection of a result 2D, 4D, Q test, linear least squares method, correlation coefficient.

Unit – 2

HPLC principles, instrumentation & applications. Super critical fluid chromatography.

Unit – 3

Non-aqueous acid – base titration : role of solvent in acid – base titration, properties of a solvent, autoprotolysis constant, dielectric constant, redox titrations, feasibility of redox titrations, redox indicators, Iodometric & Iodimetric determinations, Industrial applications of aqueous & Non-aqueous titrations.

Unit – 4

Environmental Chemistry :

Environment concept & scope of analytical chemistry. Environmental segments & the natural cycles. Atmosphere structure, particulate ions & radical in atmosphere, green house effect, ozone hole.

Industrial pollution : waste management, Methodologies, Techniques available & new approaches, Water analyses, collection of samples, Determination of hardness, alkalinity, DO, BOD, COD, chloride, sulfate and nitrate – nitrite.

Paper – II CHN-602(A) Analytical Chemistry

Unit : 1

- (i) Fundamental of spectroscopy
- (ii) Atomic spectroscopy : Atomic absorption & fluorescence spectroscopy- Introduction, sample admission techniques, Instrumentation-interferences- Analytical applications. IR, non-dispersive IR & FTIR-Fourier transform IR spectroscopy-principle, Instrumentation & applications.

Unit :2

Nuclear magnetic Resonance (NMR) :- The technique, the chemical shift, the fine structure - line shapes & rate processes, Application.

FT NMR Instrumentation, ^{13}C NMR, Basic principle, Experimental techniques for spectral assignment, Nuclear spin relaxation (Correlation & Spectral density function, dipole-dipole relaxation, spin rotation, chemical shift anisotropy, scalar -relation- electron nuclear relaxation , Nuclear overhauser effect) solid state ^{13}C NMR, Application in macromolecular & quantitative Analysis.

Unit :3

Molecular spectroscopy UV & visible : Principle theory, Choice of solvent, Instrumentation & applications.

Atomic emission spectroscopy : Classification, flame emission & inductively coupled plasma emissions spectroscopy - principle, theory & applications.

Atomic X- ray spectroscopy :- Production & properties of X - ray, X- ray absorbance, X-ray fluorescence & X-ray diffraction quantitative & Quantitative phase analysis.

Unit :4

Flame photometer, AAS & Plasma emission :

Flame photometry, Flame - emission - Flame photometry, Determination of Ca, Mg, K, Mn & Be

AAS:- Theory, Instrumentation, Doppler broadening, pressure broadening, self reversal broadening, Flame & Flameless AAS, Background absorption & correction

Paper – III CHN-603(A) Analytical Chemistry

Unit :1

Molecular spectroscopy UV & visible : Principle theory, Choice of solvent, Instrumentation & applications.

Atomic spectroscopy : Atomic absorption & fluorescence spectroscopy- Introduction, sample admission techniques, Instrumentation-interferences- Analytical applications. IR, non-dispersive IR & FTIR-Fourier transform IR spectroscopy-principle, Instrumentation & applications.

IR, non-dispersive IR & FTIR-Fourier transform IR spectroscopy-Principle, Instrumentation & application.

Unit :2

Thermal Analysis :- TGA, DTA, DSC, DTG - Principle, Instrumentation & analytical applications.

Surface characterisation by spectroscopy & Electromicroscopy:- Introduction, spectroscopic. methods for surface analysis

Role of Thermal Analysis in characterization of polymers.

Unit :3

Liquid chromatography HPTLC :- Principle, Instrumentation & application
super critical fluid chromatography

Electrochromatography :- principle of electrophoresis , dental assembly, Reverse osmosis, Electro dialysis, zone electrophoresis, curtain electrophoresis. Capillary electrophoresis – applications.

Unit :4

Super critical Fluid Chromatography Into molecular for as in SFC, Fluid & haze Behavior, Instrumentation Method Development.

Capillary electrophoreses : theory, Instrumentation Method Development & validation.

CHN – 604(A) Organic Photochemistry

CH-501 (b) Photochemistry

30 Hrs (1 Hr/week)

I Photochemical Reactions 4 Hrs

Interaction of electromagnetic radiation with matter, types of excitations, fate of excited molecule, quantum yield, transfer of excitation energy, actinometry.

II Determination of Reaction Mechanism 4 Hrs

Classification, rate constants and life times of reactive energy states - determination of rate constants of reactions. Effect of light intensity on the rate of photochemical reactions. Types of photochemical reactions - photo-dissociation, gas-phase photolysis.

III Photochemistry of Alkenes 6 Hrs

Intramolecular reactions of the olefinic bond - geometrical isomerism, cyclisation reactions, rearrangement of 1,4- and 1,5- dienes,

IV Photochemistry of Carbonyl Compounds 8 Hrs

Intramolecular reactions of carbonyl compounds - saturated, cyclic and acyclic, β,γ -unsaturated and α,β -unsaturated compounds. Cyclohexadienones. Intermolecular cycloaddition reactions - dimerisations and oxetane formation.

V Photochemistry of Aromatic Compounds 4 Hrs

Isomerisations, additions and substitutions, di π methane rearrangement

VI Miscellaneous Photochemical Reactions 4 Hrs

Photo-Fries reactions of anilides. Photo-Fries rearrangement. Barton reaction. Singlet molecular oxygen reactions. Photochemical formation of smog. Photodegradation of polymers. Photochemistry of vision.

Books Suggested

1. Fundamentals of Photochemistry, K. K. Rohtagi-Mukherji, Wiley- Eastern
2. Essentials of Molecular Photochemistry, A. Gilbert and J. Baggott, Blackwell Scientific Publication.
3. Molecular Photochemistry, N. J. Turro, W. A. Benjamin.
4. Introductory Photochemistry, A. Cox and T. Camp, McGraw-Hill
5. Photochemistry, R. P. Kundall and A. Gilbert, Thomson Nelson.
6. Organic Photochemistry, J. Coxon and B. Halton, Cambridge University Press.

CHN – 604 (B) Photoinorganic Chemistry

Photoinorganic Chemistry

60 Hrs (2 Hrs/week)

I Basics of Photochemistry

10 Hrs

Absorption, excitation, photochemical laws, quantum yield, electronically excited states-life times-measurements of the times. Flash photolysis, stopped flow techniques. Energy dissipation by radiative and non-radiative processes, absorption spectra, Franck-Condon principle, photochemical stages – primary and secondary processes

II Properties of Excited States

10 Hrs

Structure, dipole moment, acid-base strengths, reactivity. Photochemical kinetics-calculation of rates of radiative processes. Bimolecular deactivation – quenching

III Excited States of Metal Complexes

8 Hrs

Excited states of metal complexes: comparison with organic compounds, electronically excited states of metal complexes, charge-transfer spectra, charge transfer excitations, methods for obtaining charge-transfer spectra.

IV Ligand Field Photochemistry

8 Hrs

Photosubstitution, photooxidation and photoreduction, lability and selectivity, zero vibrational levels of ground state and excited state, energy content of excited state, zero-zero spectroscopic energy, development of the equations for redox potentials of the excited states.

V Redox Reactions by Excited Metal Complexes

16 Hrs

Energy transfer under conditions of weak interaction and strong interaction-excipient formation; conditions of the excited states to be useful as redox reactants, excited electron transfer, metal complexes as attractive candidates (2,2'-bipyridine and 1,10-phenanthroline complexes), illustration of reducing and oxidising character of Ruthenium²⁺(bipyridal complex, comparison with Fe(bipy)₃; role of spin-orbit coupling-life time of these complexes. Application of redox processes of electronically excited states for catalytic purposes, transformation of low energy reactants into high energy products, chemical energy into light

VI Metal Complex Sensitizers

8 Hrs

Metal complex sensitizer, electron relay, metal colloid systems, semiconductor supported metal or oxide systems, water photolysis, nitrogen fixation and carbon dioxide reduction

Books Suggested

1. Concepts of Inorganic Photochemistry, A.W. Adamson and P.D. Fleischauer, Wiley.
2. Inorganic Photochemistry, J. Chem. Educ., vol. 60, no. 10, 1983.
3. Progress in Inorganic Chemistry, vol. 30, ed. S.J. Lippard, Wiley.
4. Coordination Chem. Revs., 1981, vol. 39, 121, 131; 1975, 15, 321; 1990, 97, 313.
5. Photochemistry of Coordination Compounds, V. Balzani and V. Carassiti, Academic Press.
6. Elements of Inorganic Photochemistry, G. J. Ferraudi, Wiley.

CHN-604 (C) Biophysical Chemistry

CH-502 (c) Biophysical Chemistry

30 Hrs (1 Hr/week)

I Biological Cell and its Constituents 2 Hrs

Biological cell, structure and functions of proteins, enzymes, DNA and RNA in living systems. Helix coil transition.

II Bioenergetics 3 Hrs

Standard free energy change in biochemical reactions, exergonic, endergonic. Hydrolysis of ATP, synthesis of ATP from ADP.

III Statistical Mechanics in Biopolymers 5 Hrs

Chain configuration of macromolecules, statistical distribution end to end dimensions, calculation of average dimensions for various chain structures. Polypeptide and protein structures, introduction to protein folding problem.

IV Biopolymer Interactions 5 Hrs

Forces involved in biopolymer interactions. Electrostatic charges and molecular expansion, hydrophobic forces, dispersion force interactions. Multiple equilibria and various types of binding processes in biological systems. Hydrogen ion titration curves.

V Thermodynamics of Biopolymer Solutions 4 Hrs

Thermodynamics of biopolymer solutions, osmotic pressure, membrane equilibrium, muscular contraction and energy generation in mechanochemical system.

VI Cell Membrane and Transport of Ions 3 Hrs

Structure and functions of cell membrane, ion transport through cell membrane, irreversible thermodynamic treatment of membrane transport. Nerve conduction.

VII Biopolymers and their Molecular Weights 5 Hrs

Evaluation of size, shape, molecular weight and extent of hydration of biopolymers by various experimental techniques. Sedimentation equilibrium, hydrodynamic methods, diffusion, sedimentation velocity, viscosity, electrophoresis and rotational motions.

VIII Diffraction Methods 3 Hrs

Light scattering, low angle X-ray scattering, X-ray diffraction and photo correlation spectroscopy. ORD.

Books Suggested

1. Principles of Biochemistry, A. L. Lehninger, Worth Publishers.
2. Biochemistry, L.Stryer, W.H.Freeman.
3. Biochemistry, J. David Rawn, Neil Patterson.
4. Biochemistry, Voet and Voet, John Wiley.
5. Outlines of Biochemistry, E. E. Conn and P. K. Stumpf, John Wiley.
6. Bioorganic Chemistry: A Chemical Approach to Enzyme Action, H. Dugas and C. Penny, Springer-Verlag.
7. Macromolecules: Structure and Function, F. Wold, Prentice Hall.

CHN – 604 (D) Environmental Chemistry

CH-503 Environmental Chemistry

60 Hrs (2 Hrs/week)

- I Environment 8 Hrs**
Introduction. Composition of atmosphere, vertical temperature, heat budget of the earth atmospheric system, vertical stability atmosphere. Biogeochemical cycles of C, N, P, S and O. Biodistribution of elements.
- II Hydrosphere 12 Hrs**
Chemical composition of water bodies-lakes, streams, rivers and wet lands etc. Hydrological cycle.
Aquatic pollution – inorganic, organic, pesticide, agricultural, industrial and sewage, detergents, oil spills and oil pollutants. Water quality parameters – dissolved oxygen, biochemical oxygen demand, solids, metals, content of chloride, sulphate, phosphate, nitrate and micro-organisms. Water quality standards.
Analytical methods for measuring BOD, DO, COD, F, Oils, metals (As, Cd, Cr, Hg, Pb, Se etc.), residual chloride and chlorine demand.
Purification and treatment of water.
- III Soils 6 Hrs**
Composition, micro and macro nutrients, Pollution – fertilizers, pesticides, plastics and metals. Waste treatment.
- IV Atmosphere 8 Hrs**
Chemical composition of atmosphere – particles, ions and radicals and their formation. Chemical and photochemical reactions in atmosphere, smog formation, oxides of N, C, S, O and their effect, pollution by chemicals, petroleum, minerals, chlorofluorohydrocarbons. Green house effect, acid rain, air pollution controls and their chemistry.
Analytical methods for measuring air pollutants. Continuous monitoring instruments.
- V Industrial Pollution 12 Hrs**
Cement, sugar, distillery, drug, paper and pulp, thermal power plants, nuclear power plants, metallurgy. Polymers, drugs etc. Radionuclide analysis. Disposal of wastes and their management.
- VI Environmental Toxicology 14 Hrs**
Chemical solutions to environmental problems, biodegradability, principles of decomposition, better industrial processes.

Bhopal gas tragedy, Chernobyl, Three mile island, Sewozo and Minamata disasters.

Books Suggested

Environmental Chemistry, S. E. Manahan, Lewis Publishers.

Environmental Chemistry, Sharma & Kaur, Krishna Publishers.

Environmental Chemistry, A. K. De, Wiley Eastern.

Environmental Pollution Analysis, S.M. Khopkar, Wiley Eastern

Standard Method of Chemical Analysis, F.J. Welcher Vol. III, Van Nostrand Reinhold Co.

Environmental Toxicology, Ed. J. Rose, Gordon and Breach Science Publication.

Elemental Analysis of Airborne Particles, Ed. S. Landsberger and M. Creatchman, Gordon and Breach Science Publication.

Environmental Chemistry, C. Baird, W. H. Freeman.

CHN - 604(E) Bioorganic Chemistry

CH-502 (b) Bioorganic Chemistry

30 Hrs (1 Hr/week)

I Introduction 2 Hrs

Basic considerations. Proximity effects and molecular adaptation.

II Enzymes 6 Hrs

Introduction and historical perspective, chemical and biological catalysis, remarkable properties of enzymes like catalytic power, specificity and regulation. Nomenclature and classification, extraction and purification. Fischer's lock and key and Koshland's induced fit hypothesis, concept and identification of active site by the use of inhibitors, affinity labeling and enzyme modification by site-directed mutagenesis. Enzyme kinetics, Michaelis-Menten and Lineweaver-Burk plots, reversible and irreversible inhibition.

III Mechanism of Enzyme Action 3 Hrs

Transition-state theory, orientation and steric effect, acid-base catalysis, covalent catalysis, strain or distortion. Examples of some typical enzyme mechanisms for chymotrypsin, ribonuclease, lysozyme and carboxypeptidase A.

IV Kinds of Reactions Catalysed by Enzymes 6 Hrs

Nucleophilic displacement on a phosphorus atom, multiple displacement reactions and the coupling of ATP cleavage to endergonic processes. Transfer of sulphate, addition and elimination reactions, enolic intermediates in isomerization reactions, β -cleavage and condensation, some isomerization and rearrangement reactions. Enzyme catalyzed carboxylation and decarboxylation.

V Co-Enzyme Chemistry 4 Hrs

Cofactors as derived from vitamins, coenzymes, prosthetic groups, apoenzymes. Structure and biological functions of coenzyme A, thiamine pyrophosphate, pyridoxal phosphate, NAD⁺, NADP⁺, FMN, FAD, lipoic acid, vitamin B₁₂. Mechanisms of reactions catalyzed by the above cofactors.

VI Enzyme Models 4 Hrs

Host-guest chemistry, chiral recognition and catalysis, molecular recognition, molecular asymmetry and prochirality. Biomimetic chemistry, crown ethers, cryptates. Cyclodextrins, cyclodextrin-based enzyme models, calixarenes, ionophores, micelles, synthetic enzymes or synzymes.

VII Biotechnological Applications of Enzymes

5 Hrs

Large-scale production and purification of enzymes, techniques and methods of immobilization of enzymes, effect of immobilization on enzyme activity, application of immobilized enzymes, use of enzymes in food and drink industry-brewing and cheese-making, syrups from corn starch, enzymes as targets for drug design. Clinical uses of enzymes, enzyme therapy, enzymes and recombinant DNA technology.

Books Suggested

1. Bioorganic Chemistry: A Chemical Approach to Enzyme Action, Hermann Dugas and C. Penny, Springer-Verlag.
2. Understanding Enzymes, Trevor Palmer, Prentice Hall.
3. Enzyme Chemistry: Impact and Applications, Ed. Collin J Suckling, Chapman and Hall.
4. Enzyme Mechanisms Ed, M. I. Page and A. Williams, Royal Society of Chemistry.
5. Fundamentals of Enzymology, N.C. Price and L. Stevens, Oxford University Press.
6. Immobilized Enzymes: An Introduction and Applications in Biotechnology, Michael D. Trevan, John Wiley.
7. Enzymatic Reaction Mechanisms, C. Walsh, W. H. Freeman.
8. Enzyme Structure and Mechanism, A Fersht, W.H. Freeman.
9. Biochemistry: The Chemical Reactions of Living Cells, D. E. Metzler, Academic Press.

CHN-604(RM) Research Methodology

Unit : I Research and objective of research

Introduction Motivation for research, research and scientific method, research process in flow chart, descriptive and analytical research, applied and fundamental research, qualitative and quantitative research, conceptual and empirical research, signification of research.

Unit :II Research & Methods

Research and Scientific methods, various methods to complete a research process : formulating a research problem, extensive literature review, development of working hypothesis , preparing a research design, determining sample design, collecting data, execution of project, analysis of data, hypothesis testing, preparation of thesis, Importance of earlier known literature criteria for good research.

Unit :III Research Problem & Design

Research problem, selecting a problem, techniques, for defining a problem, research design, feature, of good research design, Important concepts related to research design, (Dependent & Independent variables, extraneous variables, control, confounded relationship, research hypothesis, experimental & non experimental hypothesis testing research, experiment & control group, treatments, experiment) Different experimental research designs, (Informal and formal)

Unit :IV Research scenario (Chemistry)

Problems faced by researchers in India, comparison of research activities of state universities with central universities. Research Developments in India and their comparison with global output.

Research developments and facilities in our university campus. Role of state governments & central government in research developments. Role of modern technology and research in chemistry.

Reference

Research Methodology
Methods and Techniques (Second revised edition) -CR Kothari
New Age International Publishers

CHN-605 (I) Practicals Inorganic Chemistry

1. Qualitative analysis (Mixture of eight radicals, out of which two must be radical of less familiar elements W, Li, Th, V, Ce, Be, Ti, Mo) (Minimum – Six)
2. Complexometric analysis of mixtures containing two components (at least four)
3. Water Analysis (Minimum Five)

CHN-605-(O) Organic Chemistry

Practicals

(1) Organic Separation :

Separation, Purification and identification of three compounds (Ternary mixture) from 8 grams organic mixture by semimicro Method- Preparation of Derivative.

(Minimum Five mixtures should be done)

(2) Organic Estimation (Semimicro methods)

a. Estimation of Penicilline.

b. Estimation of Amino acid (Glycin).

c. Estimation of Sulphadrugs.

d. Estimation of Enol group

(3) Organic Preparation :

Two & Three stage preparations from 4 to 5 grams starting material by semimicro method (Minimum five should be done) including name reactions.

CHN-605-(P) Physical Chemistry
Practicals
Section – I Minimum 04

1. Investigate the complex ion formation between Fe(III) and thiocyanate ion by job's method (Colorimeter)
 - (i) Determine free energy
 - (ii) Determine equilibrium constant
2. Determine the composition of the following binary mixtures by using spectrophotometer or Colourimeter (Additiv rules)
 - (i) $\text{CoCl}_2, 2\text{H}_2\text{O} + \text{NiCl}_2, 6\text{H}_2\text{O}$
 - (ii) Crystal violet + Aurine
 - (iii) $\text{K}_2\text{Cr}_2\text{O}_7 + \text{KMnO}_4$
3. Spectrophotometric determination of lead on leaves using solvent extraction.
4. Determination inorganic phosphorus in human urine or serum Spectrophotometrically.
5. Spectrophotometric titration of copper and Bismuth mixture by EDTA.
6. Separation of dyes TLC

Malachite green	Alizarin
Crystal violet	Methyl orange
Cresol Red	Congo Red
Fast green	Sunset yellow
Rhodamine B	Pera Red
7. Separation of inorganic icons :
 $\text{Co}^{+2}, \text{Ni}^{+2}, \text{Zn}^{+2}, \text{Fe}^{+2}, \text{Mn}^{+2}, \text{Mo}^{+3}, \text{Cl}, \text{Br}, \text{I}$ by TLC / Paper chromatography.
8. Separation of mixture of methylene blue and fluorescein on alumina column.

Section II Minimum 04

1. Determine the equivalent conductance of a strong electrolyte at several dilutions and hence verify the Onsager equation.
2. Titration of KI solution against HgCl_2 solution conductometrically.
3. Polarographic determination of $\text{Pb}_2^+, \text{Cd}_2^+$ or Cu_2^+ ions.
4. Determine molar reflection of methyl acetate, ethyl acetate, n-hexane & CCl_4 . Calculate the atomic reflections of C, H, & Cl atoms.
5. To Study the influence of ionic strength on solubility of CaSO_4 .
6. To determine the iso electric point of glycine by pH metric.
7. Determine the standard electrode potential of Ag/Cu/Pb/Zn.
8. Fluorimetric determination of $\text{Al}^{3+}, \text{Cd}^{3+}, \text{Ca}^{2+}$ or Zn^{2+}
9. Estimate Na^+ or K^+ ion by flame photometer.

Section – III Minimum 04

1. Investigate the reaction between iodine and acetone.
2. Determine the formula of Ag-NH₃ complex by potentiometric method and instability constant.
3. Photo catalytic degradation of nitro aniline (-O/-m-p) using ZnO/TiO₂ as semiconductor.
4. Photo electrochemical degradation of picric acid and or (-O/-m-p nitro phenol)
5. Determine formula of complex formed between cupric ion & NH₃ by distribution method.
6. Determine the radius of molecule of sucrose by viscosity measurements.
7. Study the variation of viscosity with composition of mixture of
 - (i) Ethanol – water
 - (ii) Methanol – ethylene diamineDetermine whether there is complex compound formation between two layers.
8. Investigate solubility of component system & hence draw a tie line on binodal.
9. Separation of amino acids/proteins by electrophoresis.

CHN-605 (A) Analytical Chemistry Practicals

1. Qualitative analysis (Mixture of eight radicals, out of which two must be radical of less familiar elements W,Li,Th,V,Ce,Be,Ti,Mo)(Minimum – Six)
2. Complexometric analysis of mixtures containing two components (at least four)
3. Water Analysis (Minimum Five)
4. Applied Analyses

ENVIRONMENTAL
SCIENCE

M.Sc. Environmental Science Curriculum

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. <i>Practical :III & Industrial Tour</i>	120 Marks

Semester IV

16. Major Project (Master's Thesis)	400 Marks
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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**

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
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2. General Viva	050
3. Regularity and Performance	050