महात्मा ज्योतिबा फुले रूहेलखण्ड विश्वविद्यालय, बरेली
MAHATAMA JYOTIBA PHULE ROHILKHAND UNIVERSITY, BAREILLY

पत्रांक : रु0वि0 / शैक्षणिक / समिति / 2017/849-52 दिनाँक : 26.05.2017

प्राचार्य / प्राचार्या,
समस्त सम्बद्ध महाविद्यालय,
एम0 जे0 पी0 रूहेलखण्ड विश्वविद्यालय, बरेली।

विषय : **एम0एस0सी0 भौतिक विज्ञान विषय का नवीन पाठ्यक्रम सत्र 2017–18 से प्रभावी किये जाने के सम्बन्ध में।**

महादेय / महोदया,

विषय पाठ्यक्रम समिति की बैठक दिनाँक 22.08.2016 द्वारा प्रस्तावित एम0एस0सी0 भौतिक विज्ञान का पाठ्यक्रम जोकि विद्या–परिषद की बैठक दिनाँक 25–10–2016 एवं कार्य परिषद की बैठक दिनाँक 25.10.2016 द्वारा अनुमोदित किया जा चुका है, को विश्वविद्यालय की बेबसाइट www.mjpru.ac.in पर इस आशय से अपलोड किया जा रहा है कि समस्त सम्बद्ध महाविद्यालय जहाँ यह पाठ्यक्रम संचालित हो रहा हो, वे उक्त पाठ्यक्रम के अनुसार ही सत्र 2017–18 से पठन–पाठन सुनिश्चित करने का कष्ट करें।

भवदीय

(डा0 एस0 एल0 मौर्य)
कुलसचिव

प्रतिलिपि : निम्नलिखित को सूचनार्थ एवं आवश्यक कार्यवाही हेतु प्रेषित।

1. निजी सचिव, कुलपति को कुलपति महोदय के संज्ञानार्थ।
2. परीक्षा नियन्त्रक।
3. प्रभारी अति गोपनीय / कम्प्यूटर अनुभाग / शैक्षणिक अनुभाग

कुलसचिव

M. J .P. ROHILKHAND UNIVERSITY, BAREILLY

Course Structure for M.Sc. (Physics)

With Specialization in Electronics

This is a two-year course. Each year there will be four theory papers and one practical with aggregate marks 600. The details are as follows:

M.Sc. (P) **600 Marks**

Paper-1 Mathematical Physics (60 marks) & Classical Mechanics (40 marks)

Paper-2 Quantum Mechanics (40 marks) & Atomic and Molecular Spectroscopy (60 marks)

Paper-3 Solid State Physics, Electronics (60 Marks) & Nano Science (40 Marks)

Paper-4 Statistical Mechanics (60 marks) & Electrodynamics (40 Marks)

Paper-5 Practical 200 Marks

(a) Two Practical 120 Marks (60 marks each)
(b) Record 40 Marks
(c) Viva-Voice 40 Marks

M.Sc. (F) **600 Marks**

Paper-1	Advanced Quantum Mechanics	100 Marks
Paper-2	Nuclear & Particle Physics	100 Marks
Paper-3	Communication Electronics	100 Marks
Paper-4	Analog& Digital Electronics	100 marks
Paper-5	Practical & Project Work	200 Marks

(a) Two Practical 100 Marks (50 marks each)
(b) Record 25 Marks
(c) Viva-Voice 25 Marks
(d) Project 50 Marks

The last date for the submission of project report will be 31stJanuary every year so that the examiner may evaluate the same in due course of time. The university will appoint separate examiners for the said purpose. Only the faculty members of the aided colleges (as internal) shall guide the project.

M.Sc. Previous

Paper 1: Mathematical Physics (60 marks) & Classical Mechanics (40 marks)

Mathematical Physics

Unit I

Analytic functions, The Cauchy-Riemann Equations, Cauchy's Integral Theorem, Cauchy's Integral formula for a Function and its derivatives, Taylor & Laurent Series, Singularities of a function, Zeroes and Poles, Cauchy's Residue Theorem, Contour Integration of Simple functions.

Legendre, Bessel, Hermite Differential Equation: Solution and Orthonormal Properties

Linear Ordinary Differential Equations of First and Second Order, Partial Differential Equations (Laplace, Wave and Heat Equations in two and three dimensions), Green's function method of solving inhomogeneous boundary value problems

Unit II

Fourier series and Fourier Transforms, Applications to boundary value problems,

Interpolation (equal and unequal intervals), extrapolation, Numerical Integration by Trapezoid and Simpson's Rule, Solution of first order differential equations using Runge-Kuttamethod, Finite difference methods

Unit III

Covariant and Contravariant Tensor, Contraction of tensors, Metric Tensor.

Elementary theory of Probability, Random Variables, Binomial, Poisson &Normal distributions, Central Limit theorem, Data interpretation and Analysis, Precision and Accuracy, Error analysis, Propagation of errors, Least squares fitting

Abelian Group, Cyclic Group, Group Multiplication Table, Subgroups, Cosets, Conjugate Elements and Classes, Reducible and Irreducible Representations of a Group, Character tables, SU(3) and O(3)

Books Recommended

1. Mathematical Physics: PC Chattopadhyay, Wiley Eastern
2. Special Functions by WW Bell
3. Mathematics for Physicists: Mary L Boas
4. Mathematical Methods for Physics: G Arfken
5. Advanced Engineering Mathematics by E. Kreyszig
6. Group Theory and Quantum Mechanics: M Tinkham, TMH
7. Matrices and Tensors for Physicists by A.W. Joshi
8. Introductory Methods of Numerical Analysis, S.S. Shastry, PHI Pvt. Ltd.
9.Numerical Methods, Balaguruswami, Tata McGraw Hill, 2009
10. Complex Variables , Schuam's Outline Series

Classical Mechanics

Unit I

Lagrange's equations of motion, Application to simple problems, Conservation laws and Symmetry properties, Noether's Theorem, Hamilton's principle, Derivation of Lagrange's Equations from Hamilton's principle

Hamilton's Equations, Hamiltonian, Application to simple problems, Canonical Transformations, Poisson Brackets, Equation of motion in Poisson Bracket form, Jacobi's Identity, Poisson Brackets and Canonical Transformations, Hamilton-Jacobi theory, Application to Harmonic Oscillator problem and Kepler'sproblem

Unit II

Rigid body dynamics, Moment of Inertia Tensor, Euler's equations, Theory of small oscillations, Normal modes, Central force motions, two bodies Collisions-Scattering in laboratory and Centre of mass frames

Books Recommended

1. Classical Mechanics: H. Goldstein, Narosa Publishing Home, New Delhi
2. Classical Mechanics: N.C. Rana&P.S. Joag, Tata McGraw Hill, New Delhi.
3. Classical Mechanics: J.C.Upadhyay, Himalaya Publishing House, Mumbai.
4. Classical Mechanics:R.G. Takawale and P. S. Puranik, Tata McGraw Hill, New Delhi.
5. Classical Mechanics of Particles and Rigid Bodies: Kiran C Gupta

Paper 2: Quantum Mechanics (40 Marks) and Atomic & Molecular Spectroscopy (60 Marks)

Quantum Mechanics

Unit I

Postulates of Quantum Mechanics, Wave function in Co-ordinate &Momentum Representation, Momentum Eigen-Functions, box normalization, Schrödinger Equation for Spherically Symmetric Potentials, Degeneracy, Hydrogen Atom, Radial Equation, Eigen Values and Eigen Functions, Radial Probability

Linear operators, Hermitian operators, unitary operators and Unitary Transformation, Matrix representation of operators, Diagonalization of matrices, Parity operator, Simultaneous measurement and commuting operators

Unit II

Angular momentum operators and their commutation relations, Ladder operators, Introduction to Dirac's Bra andKet notation, Matrices for J^2, J_z, J_x, J_y,J_+, & J_-;Addition of two angular momenta-Clebsch-Gordon coefficients

Time independent perturbation theory-non degenerate and degenerate cases, applications to Harmonic oscillator, Ground state of He atom, Zeeman Effect without electron spin, first order & second order Stark effect in Hydrogen

The Variational method-application to ground state & excited states of He atom, electron interaction energy, variation of parameter

W.K.B. method and its application to alpha decay problem, identical particles and exchange degeneracy, symmetric and anti-symmetric wave functions

Books Recommended

1. Quantum Mechanics: LI Schiff, McGraw Hill
2.Quantum Mechanics: Mathews and Venkatesan
3. Quantum Mechanics: Ghatak and Loknathan
4. Quantum Mechanics: Merzbacker
5. Quantum Mechanics: AP Messiah

Atomic and Molecular Spectra

Unit I: Atomic Spectra

Relativistic correction for energy levels of Hydrogen, Spin-orbit interaction and fine structure, Lamb-shift, Spectra of alkali atoms, LS & jj couplings

Normal and Anomalous Zeeman Effect, Paschen –Back effect, Hyperfine structure and isotopic shift, examples of hyperfine structure, Back &Goudsmit effect

Weak field and strong field Stark effect in Hydrogen, Natural width, Doppler width, Collision and pressure induced width of spectral lines, Width due to stark effect

Unit II: Molecular Spectra

Observed molecular spectra and their representation by empirical formulae- Different energy states of molecules, spectra in the visible and ultraviolet regions, spectra in the infrared region, microwave spectra, Raman spectra

Interpretation of the principal features of infrared and Raman spectra by means of the models of the Rigid –rotator and of the Harmonic oscillator, interpretation of the fine details of infrared and Raman spectra by means of the models of An-harmonic oscillator, non-rigid rotator, Vibrating rotator and Symmetric top, Intensities in Rotation- Vibration spectra

Unit III: Electronic Spectra

Electronic Spectra-Electronic Energy &Total Energy, Vibrational Structure of Electronic Transitions, Rotational Structure of Electronic Bands, Intensity Distribution in the Vibrational Structure, Frank-Condon Principle

Books Recommended

1.Introduction to Atomic Spectra by H. E. white
2. Fundamentals of Molecular Spectroscopy by C. M. Banwell
3. Spectroscopy, Vol. I, II & III by Walker and Straughen
4. Introduction of Molecular Spectroscopy by G.H. Barrow
5. Spectra of Diatomic Molecules by G.Herzberg
6. Modern Spectroscopy by J. M. Holias

Paper 3: Solid State Physics , Electronics (60 Marks) and Nano Science (40 Marks)

Unit I: Electronics

JFET-Construction, Working, Biasing, as an amplifier; Depletion & Enhancement MOSFET-Construction, Working, applications; Power Amplifiers-Class A, Class B, Class AB, Class C; Multi-vibrators ; Regulated Power Supply

Veractor,schotky,liquid crystal diode,diac,triac, LDR and its uses in ac voltage regulators.darlington pair,SMPS

Unit II: Solid State Physics

Free electron gas in three dimensions, Heat Capacity of the electron gas, Response and Relaxation phenomena, Drude Model of electrical and thermal conductivity of metals, Sommerfield Model of electrical conductivity, Wiedemann-Franz law, Hall effect and Thermoelectric power

Kronig- Penney model,bandtheory of solids, distinction between Metal, Semiconductor and Insulators, Effective Mass of electrons, Experimentalmethods in Fermi surface determination- de Hass-van Alphen effect

Unit III: Superconductivity and Magnetism

Superconductivity: Meissner effect, isotope effect, Heat Capacity and Energy gap, Type I &Type II Superconductors ,Thermodynamics & Electrodynamics of superconducting transition, Electron-Electron interaction via phonons-BCS theory, High T_c superconductors, Superconducting tunneling-Dc and Ac Josephson effects, SQUID's

Weiss Theory of Ferromagnetism, Exchange interaction, Temperature Dependence of Saturation Magnetization, Antiferromagnetic Order- Neel temperature, Nuclear Magnetic Resonance (NMR), Electron Spin Resonance (ESR), Mossbauer Effect, Debye-Waller factor

Frenkel&Schottkydefects, Order-disorder transformation, elementary idea of dislocations, Liquid crystals, types and propertiesofliquid crystals, applications

Unit IV: Nano Science-1

Nano science & Nano technology, Size effect, Quantum confinement, Fullerines and carbon Nano tubes, single wall and multi wall Carbon nanotubes, mechanical and electronic properties of Carbon nanotubes, carbon nanotube based electronic devices, other types of nanotubes, methods of synthesis of Nano structured materials, Quantum wells, Quantum wires and Quantum dots

Unit V: Nano Science-2

Films and surfaces-Study of surface topography by multiple beam interferometries, conditions of accurate determination of step height and film thickness, electrical conductivity of thin films, elementary concepts of surface crystallography, Scanning, Tunneling and Atomic Force Microscopy.

Books Recommended

1. Crystallography and Solid State Physics: Verma and Srivastava
2. Introduction to Solid State Physics: C. Kittel
3. Solid State Physics: Ashcroft and Mermin

4. Solid State Physics: M. Ali Omar
5. Solid State Physics: JP Srivastava
6. Quantum Theory of Solids: C.Kittel
7. Theoretical Solid State Physics: Huang
8. Nano Technology: C Poole
9.Solid State Physics: S.O. Pillai
10. Solid State Physics: R.L.Singhal
11.Thin Films: Heavens
12.Multiple Beam Interferometry: Tolansky
13. Electronic Principles: Malvino A.P.

Paper 4: Statistical Mechanics (60 Marks) & Electrodynamics (40 Marks)

Statistical Mechanics

Unit I

Phase space of a classical system, the macroscopic and the microscopic states, quantum states and the phase space, magnetization of spin-half system, the micro canonical ensemble and its application to one-dimensional harmonic oscillator

Canonical Ensemble- Partition function, free energy and its connection with thermodynamic quantities, energy fluctuations, application to the system of harmonic oscillators

Grand Canonical Ensemble-equilibrium between a system and particle-energy reservoir, grand partition function, chemical potential, application to a system of independent and localized particles, density and energy fluctuations

Unit II

Identical particles, symmetric and antisymmetric wave functions, partition function for bosons and fermions, Ideal Bose Gas- thermodynamic behavior, Bose-Einstein Condensation, blackbody radiation and Planck's law, Ideal Fermi Gas-thermodynamic behavior, magnetic behavior- Pauli Paramagnetism, Landau theory of diamagnetism

Unit III

Phases of matter, Thermodynamic Potential, First- order phase transitions, Continuous phase transitions, Ising model-mean field theory, Order parameter, Landau theory, Superfluidity, Diffusion Equation, Random walk and Brownian motion

Books Recommended

1. Fundamentals of Statistical and Thermal Physics :F.Reif- Mc. GrawHill Publications
2. Statistical Mechanics: R.K.Pathria,PergamonPress.
3. Relativity and Statistical Physics: Sundar Singh, Jai Prakash Nath& Co. Meerut
4. Statistical Mechanics:K.Huang, JohnWiley& Sons Ltd.
5. Statistical Mechanics: Landau and Lifshitz, Pergamon Press
6. Statistical Mechanics: R.K. Kubo
7.Statistical Physics: F.Mandl, JohnWiley&Sons Ltd.
8. Introductory Statistical Mechanics: RogerBowley and Mariana Sanchez, Oxford University Press

Electrodynamics

Unit I

Dynamics of charged particles in static and uniform electromagnetic fields, Scalar and Vector Potentials, Maxwell's Equations in terms of Electromagnetic Potentials, Electromagnetic Wave Equation, Non-uniqueness of Electromagnetic Potentials and Concept of Gauge, Gauge Transformations-Coulomb Gauge and Lorentz Gauge, Green's Function for the Wave Equation, Transformation properties of Electromagnetic Fields, Lorentz invariance of Maxwell's Equations.

Unit II

Maxwell's modification of Ampere's Law- Displacement Current, Maxwell's Equations in free space and linear isotropic media, boundary conditions on the fields at interfaces, Electromagnetic waves in free space, dielectrics and conductors; Reflection and Transmission-Fresnel's Law, Polarization.

Propagation of Electromagnetic Waves in Rectangular Waveguides-TE and TM Modes, Cut off frequency, Energy Flow and Attenuation, Modal Analysis of guided modes in a cylindrical waveguide.

Multipole expansion of electromagnetic fields, Field and Radiation due to an Oscillating Electric Dipole, field due to a Magnetic Dipole, Retarded and Advanced Potentials, Lienard- WiechartPotentials for moving charge, fieldsproduced by a charge in uniform and accelerated motion, Radiated power, angulardistribution of radiation due to accelerated charge, Bremsstrahlung, Synchrotron Radiation.

Books Recommended

1. Classical Electrodynamics: J.D. Jackson, Third Edition, John Wiley
2. Classical Electricity and Magnetism: Panofsky and Phillips, Addison Wesley
3. Electrodynamics: DJ Griffith, Third Edition, Prentice Hall of India, New Delhi
4. Introduction to Electrodynamics: AZ Capri and PV Panat, Narosa Publishing House

M .Sc. Final

Paper I: Advanced Quantum Mechanics

Unit I: Time Dependent Perturbation Theory

Time dependent perturbation theory, Perturbation constant in time, Transition probability, transition to a continuum-Fermi Golden Rule, Harmonic perturbation, radiative transitions in atoms- principle of detailed balance, dipole transitions, selection rules,quantum theory of radiation- Einstein's A & B coefficients, Sudden approximation, sudden reversal of a magnetic field, Adiabatic approximation.

Schrödinger, Heisenberg and Interaction picture, representation of operators and equations of motion, Dyson's time-ordered operator and Dyson series

Unit II: Many Electron Systems-Atoms and Molecules

Central Field approximation, Thomas-Fermi Statistical Model, Hartree's self-consistent field method, equivalence of Hartree's method to Variational principle,Hartree-Fock method, molecular orbital theory for Hydrogen Ion- LCAO approximation, Heitler-London theory of hydrogen molecule

Unit III: Scattering Theory

Differential &Total Scattering cross sections, relationbetween angles, energies and cross-sections etc in Laboratory and Center of mass system of coordinates,normalization of incoming wave-Green's function for scattering, Scattering amplitude, Born approximation- Integral equation of scattered waves, Condition for validity of Born approximation, scattering by a Screened Coulomb potential-Rutherford scattering formula, scattering by square well & Gaussian potentials under Born approximation

Scattering theory and time dependent perturbation, Method of partial wave and phaseshifts, Optical theorem, scatteringby a perfectly rigid sphere, scattering from a square well potential, Lippmann-Schwinger equation and the scattering matrix

Unit IV: Identical Particles and Spin

Angular momentum, Integral and Half integral angular momentum spinEigen functions, Conservation rules, Identical particles, Physical meaning of identity, Distinguishabilityof identical particles, Symmetric and Antisymmetric wave function, Construction fromunsymmetrised function, Slater's Determinant, Connection of spin and statistics, Pauli spin matrices, scattering between identical particles, Stern-Gerlach Experiment

Unit V: Relativistic Wave equations

The Klein-Gorden equation for free particle and electromagnetic Potential,Inadequacy of Klein-Gordon Equation, The Diracequation, Properties of Dirac matrices, Free particle solutions, existense of electron spin, Magnetic moment of electron, Dirac equation for central field of force, Spin-orbitcoupling, Solution for hydrogen atom, Negative energy states

Second quantization of harmonic oscillator, the N representation, Creation, Destruction, and Number Operators, Vacuum State, One-body and two-body operators in Occupation number representation, Co-ordinates of the Schrödinger field, The Klein-Gordon field, The Dirac field, and the Electromagnetic field

Books Recommended

1. Quantum Mechanics: LI Schiff, McGraw Hill
2.Quantum Mechanics: Mathews and Venkatesan
3. Quantum Mechanics: Ghatak and Loknathan, MacMillan Publishers
4. Quantum Mechanics: Eugen Merzbacker, John Wiley & Sons
5. Quantum Mechanics: AP Messiah
6. Modern Quantum Mechanics: JJ Sakurai, Addison Wesley
7. Quantum Mechanics: DJ Griffith, Pearson Education
8. Quantum Mechanics VolI & II: Cohen Tannoudji, John Wiley

Paper II Nuclear & Particle Physics

Unit I: Basic Properties of Atomic Nucleus and Nuclear Models

Nuclear size and charge distribution, High-energy electron scattering (Hofstadter method)
Shape of nucleus- electric dipole and quadrupole moments, magnetic moment, experimental determination of magnetic moment and electric quadrupole moment
Angular momentum, parity and statistics of the nucleus
Liquid drop model: semi-empirical mass formula, mass parabola, nuclear fission, nuclear fusion
Evidence of shell structure in nuclei, qualitative discussion of extreme single particle model, quantitative treatment of single particle states in nuclei, Spin-orbit interaction and nuclear levels, reproduction of magic numbers and spins and parities, Islands of Isomerism, Validity and limitations of Shell model, Single particle shell model, Independent particle model
Collective model- simple discussion of rotational and vibrational states, Electromagnetic properties of even-even and odd-odd nuclei

Unit II: Two body problem and Nuclear Forces

Qualitative and quantitative discussion of ground state of deuteron (using central force)
Neutron- proton scattering below 10 Mev, Partial wave analysis and scattering length, effective range theory, spin dependence of n-p interaction, effect of chemical binding on n-p scattering, Low energy p-p scattering
Spin dependence and non-central feature of nuclear forces, general form of non-central forces and their properties, qualitative and quantitative discussion of ground state of deuteron and its magnetic moment using non central forces
Qualitative discussion of exchange forces, Isospin formalism, general form of nucleon-nucleon interaction

Unit – III: Nuclear Decay

Alpha decay: Measurement of energy of alpha particles, Absorption of alpha particles-Range, Ionization and Stopping power, Range-energy curves, Fine structure of alpha particles, Nuclear energy levels, Gamow's theory and Geiger-Nuttal law
Beta decay processes, measurement of beta ray energies, Neutrino hypothesis, Fermi's theory of beta decay, Kurie plots, allowed and forbidden transitions, Selection rules, Non-conservation of parity in beta decay
Electromagnetic interactions in nuclei, Multipole transitions in nuclei, Parity and angular mom entum selection rules, Internal conversion, Comparative half life, Allowed and forbidden transitions,
Gamma decay and nuclear energy levels-nuclear isomerism

Unit – IV: Nuclear Reactions and Detectors & Accelerators

Description of Nuclear reactions, Reaction kinematics-Q value equation, Discussion of Direct and Compound nuclear reaction mechanisms, expressions for scattering and reaction crosssections in terms of partial wave amplitudes, Resonances, Discussion and applications of Breit-Wigner single level formula, Stripping and pic-up reactions with Shell models
Outline of interaction of charged particles and of Gamma rays with matter, Ionization Chamber, Solid-state detectors, G.M Counter, Scintillation Counter, Cerenkov Detectors, Scaling Circuits, Coincidence circuits, Radiation detectors, and Neutron detection techniques, Accelerators-Ion Sources, Cyclotron, Synchrotron, Synchro-cyclotron,Betatron, Introduction of Modern Colliders (LHC and RHIC), and Storage Ring

Unit V: Elementary Particles

Classification of fundamental forces, elementary particles and their quantum numbers (Charge, Spin, Parity, Isospin, Strangeness etc.), Nishijima Scheme, Conservation laws, Associated production and Strangeness, Space-inversion Invariance (parity), Time reversal and charge conjugation, Combined Inversion(CP) violation, Combined inversion of CPT , Baryons and Mesons, Quark Model , SU(2) and SU(3) symmetries

Books Recommended

1. Atomic and Nuclear Physics, Vol. II: S.N.Ghoshal
2. Nuclear Physics Vol.III: D.C.Tayal
3. Introductory Nuclear Physics: S.S.M.Wong
4. Nuclear Theory: Elton
5. Nuclear Physics: C.Cohen
6. Nuclear Structure: Preston and Bhaduri
7. Nuclear Structure: M.K.Pal
8. Nucleon-nucleon Interaction: Brown and Jackson

Paper III: Communication Electronics

Part A: Analog Communication Systems

Unit I: Microwave Electronics & Radar Communication

Microwave characteristic features & Applications, Waveguides and Cavity Resonators, Two Cavity Klystron, Reflex Klystron, GunnEffect& Gunn diode, Gunn Oscillators, Microwave antenna, Detection of microwaves, Dielectric constant measurement, Isolator and circulator, P IN diode modulator, Directional coupler

Basic Radar systems, Radar range equation and performance factor, Radar Crosssection, Pulsed Radar sys tem, Duplexer, Radar Display, Doppler Radar, CWIF Radar, FMCW Radar, Moving Target Indicator (M TI), Blind Speeds

Unit II: Analog Signal Transmission

Modulation, Amplitude, Frequency & Phase modulation, AM, FM, Modulating and Demodulating circuits, AM, FM Receivers functioning (BLOCK diagram) and Cha racteristic Features, Pulse modulation, Sampling processes, PAM, PWM and PPM modulation and d emodulation, Quantization processes, Compounding and Quantization noise, PCM, Differential PC M and Delta Modulation systems, Comparison of PCM and DM, Time division multiplexing

Unit III: Satellite Communication

Principle of Satellite Communication, Satellite frequency allocation and band spectrum, Satellite orbit, tra jectory and its stability, Satellite link design, Elements of Digital Satellite Communication, Multiple Acce ss technique, Antenna system, Transponder, Satellite Applications

Part B : **Digital Communication Systems**

Unit IV: Signals, Systems and Noise

Elements of communication systems, Fourier representation of periodic and non-periodic signals, Power spectral density, Impulse and step response of systems, Time and frequency doma in analysis of systems, Ideal and Real filters, Noise in communication systems, Represen-tation of narrow band noise, Signal to noise ratio, Noise equivalent band width and noise figure

Introduction, Amount of information, Average information, Shannon's encoding algorithm, **c**ommunicati on channels, Rate of information and capacity of discrete memoryless channels, ShanonHartley theorem.

Unit V: Digital Signal (Data) Transmission & Fiber Optic Communication

Introducation, Base band and Pass band data transmission. Base band binary PAM system, Optimum rec eiver for binary digital modulation schemes, Binary ASK, FSK, PSK and differential PSK signaling sche mes, Serial data communication in computers, USART **8251**, MODEM

Basic optical communication system, wave propagation in optical fiber media, step and graded index fiber, material dispersion and mode propagation, losses in fiber, optical fiber source and detector, optical joints and coupler. Digital optical fiber communication system, First/Second generation system, D ata Communication Network

Books Recommended

1. Digital and Analog Communication Systems: K. San Shanmugam
2. Communication Systems: Simon Haykin
3. Optical Fibre Communication: Kaiser
4. Microwave and Radar Engineering: M. Kulkarni
5. Electronic Communication Systems: Kennedy & Davis
6. Satellite Communication: Pratt and Bostiern
7. Microwaves: K.C. Gupta

Paper IV: Analog & Digital Electronics

Unit I

Differential Amplifier,Operational Amplifier and its Characteristics, Inverting and Non-inverting Configurations, Op-Amp as Voltagefollower, Adder,Subtractor, Integrator, Differentiator, Log Amplifier, Antilog amplifier, Applicability of Op-Amp in analog computation, Analog Multimeter, Divider circuit, RMS circuit, function fitting and time function generator

Frequency Response of Op-Amp, Active Filter, Comparator, Monostable, Astable, and BistableMultivibrators, Schmitt Trigger, Triangular wave generator, VoltageControlled Oscillator, Phase Locked Loop(PLL), Voltage to Frequency and Frequency to Voltageconvertor, 555 timer and its applications

Unit II

Number Systems, Codes (Grey code, ASCII code and BCD code), Logic gates,Half& full adder and subtractor,RTL,DTL, TTL and ECL Logic circuit, Karnaugh (K-) Map, Pairs, Quads and Octets, RS, JK, D, T, JK M/S Flip flops, Race problem, Preset and Clear inputs

Pin out Diagrams, Truth Tables and WorkingofDecoders: 1-of-4(IC 74AS139) and 1-of-16 (IC 74154), BCD to Decimal Decoder(IC 7445), BCD to Seven Segment Decoder Driver(IC 7446A, 7448), Encoders: Decimal to BCD Encoder (IC 74147), Multiplexers: 16-to-1(IC 74150) and Implementation ofBoolean Functions,Demultiplexer: 1-of-16 Demultiplexer/ Decoder(IC 74154)

Unit III

Shift Registers: SISO, SIPO, PISO, PIPO, Universal Shift Register. Tristate Switches, Tristate Registers, Asynchronous and Synchronous Counters, Up, Down, Parallel, Modulus Counters: Counter Reset Method, Logic Gating Method, Ring Counter, Memory Devices: Read Only Memories, Masked Memory, ROM, Programmable ROM, EPROM, Random AccessMemory(RAM),Static(SRAM) and Dynamic(DRAM)RAM, Bipolar Ram Cell, Static RAM cell

Unit IV

Weighted Resistor D/A Converter, Ladder Network D/A Converter, D/A Converter Specifications-Resolution, Accuracy, Linearity, Settling Time, Temperature Sensitivity

A/D Conversion, Quantization and Encoding,Parallel-comparator A/D Convertor, Successive Approximation A/D Converter, Counter method, Single and DualSlope A/D Converter, Specifications of A/D converters

Unit V

Intel Microprocessors: Historical Perspective, Organization of Microcomputer, 8085 Microprocessor: Programming model, Registers, Accumulator, Flags, Program Counter,

Stack Pointer, 8085 Instruction Set, Data Transfer Operation, Arithmetic Operations,

Logic Operations, Branching Operations, One, Two and Three Byte Instructions, Op Code Format, Brief introduction to 16-bit microprocessors 8086 & 8088.

Books Recommended

1. Integrated Electronics, Millman and Halkias

2. Op Amp and Linear Integrated Circuits, R. A. Gayakwad
3. Linear Integrated Circuits, Choudhary and Jain
4. Digital Principle and Applications, A P Malvino and D P Leach
5. Digital Circuit and Design, S. Salivahanan and S. Arivazhagan
6. Modern Digital Electronics, R.P. Jain
7. Microprocessor Architecture, Programming, and Applications with the 8085, R S Goankar

PRACTICALS

A: GENERAL EXPERIMENTS

1. Hall Effect
2. E.S.R
3. Four Probe
4. Forbidden Energy Gap
5. GM Counter
6. B-H Curve
7. Klystron
8. Study of He-Ne Laser
9. e/m helical method
10. Ultrasonics

B**: ELECTRONICS EXPERIMENTS**

1. Study of Digital Circuits
2. Study of Microprocessor IC 8085
3. Study of Difference Amplifier
4. Study of Schmitt Trigger
5. Study of PAM, PWM, PPM
6. Study of PCM Receiver and Transmitter
7. Study of OpAmp Characteristics
8. Study of Analog to Digital Converters
9. Study of Digital to Analog Converters
10. Study and design of Multivibrators
11. Study of 555 Timers
12. Study of ALU IC 74181
13. Study of flip-flops
14. Verification of Network Theorems
15. Study of RAM
16. Determination of Hybrid Parameters
17. Characteristics of FET

NB: The above list of experiments to be divided into two parts for M.Sc. (P) & M.Sc. (F) and there may be changes in the list as per availability in the respective labs.