SEMESTER - IV

Paper - I : Material Science - II

Max. Marks : 55
Time : 3 Hrs

Note : Nine questions will be set and students will attempt 5 questions. Question No. 1 will be compulsory consisting of 4 parts based on the conceptual aspects of the whole syllabus. The answers should not be in yes/no. In addition to Question No. 1 there will be four Units in the question-paper each containing two questions belonging to four Units in the syllabus. Students will select one question from each unit.

UNIT - I

Superconductivity : Occurrence of superconductivity, conventional super conductors, Meissner effect.
Properties of Superconductors : Heat capacity, Infrared properties, Isotope effect, energy gap in super conductors, Thermodynamics of superconducting transition, The attraction between electrons, cooper pairs, Type I and II Super conductors, London equation, Flux quantization.

UNIT - II

Properties of superconductors : Qualitative discussion of BCS Theory, Coherence length, Duration of persistent Current, DC and AC Josephon Effects. Single Particle Tunneling, Josephon Tunneling. Macroscopic Quantum interference.
High Temperature Super Conductors : High temperature oxide super conductors, discovery and properties, chemical aspects and structure of La-Ba-Cu-O, Y-Ba-Cu-O, Bismuth and thallium based superconductors.

UNIT - III

Polymers And Ceramics : Polymers, Polymerization, Molecular weight and molecular weight distribution, Thermosets and thermoplasts, Amorphous and crystallic polymers, response of polymers to stress over a temperature range, Rigid, Viscoelastic and rubbery regions.

UNIT - IV

Mechanical models for behaviour of polymers, Maxwell and Kelvin elements, Mechanical analog to the behaviour of polymers, Introduction to Engineering and conducting polymers.
Ceramics : Introduction to physical and mechanical properties of ceramics, Traditional ceramics, cement and concrete, New ceramics.

References

1. Metal, ceramics and polymers - O.H. Wyatt and D.D. Hughes.
2. Textbook of Polymers Science - Fred W. Billmeyer, JR.
3. Foundation of material science and engineering - William F. Smith.
4. Introduction to solid state physics - C. Kittel

SEMESTER - IV

Paper - II : Applied Nuclear Techniques

Max. Marks : 55
Time : 3 Hrs

Note : Nine questions will be set and students will attempt 5 questions. Question No. 1 will be compulsory consisting of 4 parts based on the conceptual aspects of the whole syllabus. The answers should not be in yes/no. In addition to Question No. 1 there will be four Units in the question-paper each containing two questions belonging to four Units in the syllabus. Students will select one question from each unit.

UNIT - I

Basic principle, working and applications of Van-de-Graff, Tandom and Pelletron Accelerators
Cyclotron, Focussing in Cyclotrons, Relativistic limitation, Variable energy cyclotron, Microtron.
Betatron Induction acceleration machine, Electron synchroton, Proton synchroton,
Medical application of accelerators, Mega volt therapy.

UNIT - II

Charged Particle Induced X-ray Emission (PIXE) spectrometry : Basic Principle, X-ray production process, Radiative and Non-radiative transitions, Coster Krönig transitions, continuous background, Brenmsstrahlung, PIXE set-up, Instrumentation, Beam preparation, collimation, Beam current measurement
Qualitative analysis: Energy calibration, comparison with standard. Quantitative analysis : Absolute method, Relative method, Relationship between X-ray intensities and concentrations, Limits of detection, Accuracy of analysis, Application of PIXE in air and water pollution industry, Archaeology, Biology, and Earth Science, External beam PIXE, Micro beam PIXE, Proton Microprobe, Micro beam applications.

UNIT - III

X-rays fluorescence spectrometry : Nature and origin of X-rays, characteristic X-ray, notation for spectrum, Continuous spectra, Duane - Hunt Law, Relationship between X-ray emission and atomic number,

Sources of X-rays : X-ray tube, Function and requirements, Radioisotope source,
XRF spectrometer, wave length dispersive devices, Energy dispersive devices, pulse height selection.
Data analysis identification of the peaks, equation for concentration of elements, Matrix effects, Absorption - enhancement effect, Detection limits. Application of XRF in various fields, Advantages and disadvantage of XRF.

UNIT - IV

Neutron Activation Analysis (NAA) : Introduction, Theory of activation method, Neutron energy distribution, Classification of neutron activation methods : Prompt γ-ray neutron activation, Delay γ-ray neutron activation. Radiochemical and instrumental NAA, Kinetics of activation. Experimental considerations in activation methods : Irradiation conditions, Measurements of radioactivity, methods of standardisation, Classic relative method, Analysis of the gamma spectra, Applications NAA for semiconductor materials, Soil science, Geological science, Accuracy and sensitivity of NAA.

References

1. Instrumental methods of Analysis - Hobart H. Willard, et al. VIIed CBS Publishers.
2. Handbook of Analytical Instrumentation - RS Khandpur.
3. Principles of Instrumental Analysis - Douglas A Skoog et al. Saunders Golden Sunbrust series.
4. Particle Induced X-ray Emission spectroscopy - Ed Sten A.E. Johnson et al. John Willey and Sons, N.Y.
5. Principles and Practice of X-ray spectroscopy - Eugene P. Bertin Plenum Press.
6. An Introduction to X-ray Spectrometer R. JenKins, Heydon London Publication.
7. Neutron Activation Analysis - D. De Soete et al. Johan Wiley and Sons N.Y.
8. Activation Analysis : Vol. I and II - Z.B. Alfarsi CRC Press.

SEMESTER - IV

Paper - III : Computational Physics

Max. Marks : 55
Time : 3 Hrs

Note : Nine questions will be set and students will attempt 5 questions. Question No. 1 will be compulsory consisting of 4 parts based on the conceptual aspects of the whole syllabus. The answers should not be in yes/no. In addition to Question No. 1 there will be four Units in the question-paper each containing two questions belonging to four Units in the syllabus. Students will select one question from each unit.

UNIT - I

Basic computer organisation: Input unit, Output unit, Arithmetic logic unit, Control unit, Central processing unit. Elements of Fortran language and programme organization: Data types, Arithmetic and logical expressions, Numerical input / output statements, Loop instructions, Transfer of control through logical statements.
Arrays and subscripted variables, Use of functions and subroutines, Common statement, Developing and testing of computer programme for various numerical problems viz. solution of linear and quadratic equations.

UNIT - II

Errors : Round off error, Truncation error, Machine error and propagation error.
Solution of algebric equations : Bisection method, Iteration method, Newton-Raphson method.
Interpolation and extrapolation : Finite differences, Forward differences and Backward differences.

UNIT - III

Matrix addition, Subtraction and Multiplication, Trace and normalisation of matrix, Inverse of matrix.
Solutions of simultaneous linear algebric equation : Gauss elimination method, Gauss-Jordon elimination method. Matrix eigen values and eigen vectors.

UNIT - IV

Differentiation : Taylor series method, Numerical differentiation using Newton's forward difference formula, backward difference formula
Integration : Trapezoidal rule, Simpson's 1/3 rule and 3/8 rule, Gaussian quadrature, Legendre - Gauss Quadrature.

References

1. Theory and problems of programming with Fortran - S. Lipschutz and A. Poe, Shaums Series Publication.
2. Numerical methods in Fortran - J.M. McCormick and M.G. Salvodori, Prentice Hall Publication
3. Programmes in Fortran - Raja Ramana, PHI
4. Fortran Programming and Numerical Methods – R.C. Desai, Tata McGraw Hill.
5. Numerical Methods – C Balachandra Rao and C K Santha.

SEMESTER - IV

Paper - IV : Fibre Optics

Max. Marks : 55
Time : 3 Hrs

Note : Nine questions will be set and students will attempt 5 questions. Question No. 1 will be compulsory consisting of 4 parts based on the conceptual aspects of the whole syllabus. The answers should not be in yes/no. In addition to Question No. 1 there will be four Units in the question-paper each containing two questions belonging to four Units in the syllabus. Students will select one question from each unit.

UNIT - I

Introduction to Optical Fibres : Importance, An Idea about generations of Telephone System and Optical fibres.
Propagation of light in optical fibres, Propagation of light in an optical fibre, Basic structure and optical path of an optical fibre, Acceptance angle and acceptance cone, Numerical aperture (General), Modes of propagation, meridional and skew rays, number of modes and cut off parameters of fibres, Single mode propagation, Comparison of step and graded index fibres.

UNIT - II

Classification of optical fibres, Fibres : Stepped-index fibre, stepped - index Monomodefibre, Disadvantage of monomodefibre, graded index multi mode fibre
Fibre Fabrication Techniques : Outside vapour phase oxidation, vapour phase axial deposition, modified chemical vapour deposition.
Fibre Cables : Fibre cable construction, Strength member, Cable tensile loading, Minimum bend radius, Losses incurred during installation of cables or during subscriber service, testing of cables, cable selection criteria.

UNIT - III

Measurement of optical fibres : Measurement of numerical aperture and its related terms, measurement of fibre attenuation, loss measurement of each mode, scattering losses measurement, Measurement of dispersion losses, Measurement of refractive index, cut off wavelength measurement, Measurement of dispersion together with cut off

wavelength, macrobending loss measurement, measurement of mode field diameter, Near field scanning technique, Indirect method, Transverse offset technique, Variable aperture technique.

UNIT - IV

Optical fibre communication systems : Transmitter for fibre optic communication - High performance transmitter circuit, LED analog transmitter, Comparison between analog and digital transmitter, Laser transmitter, Digital Laser transmitter, Analog Laser transmitter, Analog laser transmitter with A/D conversion and digital multiplexing, Transmitter design, Bit stuffing : fibre optic receiver, a high performance receiver, Repeaters, Fibre based Modems, Transreceiver.

Reference

1. Optical fibre communication (second edition) - Gerd Keiser, McGraw Hill, Inc. New York.
2. Optical fibres and fibre optic communication systems - S.Sarkar.
3. Opto Electronics (second edition) - J. Wilson, J.F.B. Hawkes, Prentice Hall of India, New Delhi.

SEMESTER - IV

Paper - V : Communication Systems

Max. Marks : 55
Time : 3 Hrs

Note : Nine questions will be set and students will attempt 5 questions. Question No. 1 will be compulsory consisting of 4 parts based on the conceptual aspects of the whole syllabus. The answers should not be in yes/no. In addition to Question No. 1 there will be four Units in the question-paper each containing two questions belonging to four Units in the syllabus. Students will select one question from each unit.

UNIT - I

Pulse Communication - PAM, PWM, PPM, PCM and applications, Digital Communication (characteristic of data transmission circuit), Model of communication system, Analysis and Design of communication system, classification of signal and systems.

UNIT - II

System response and filters, spectral analysis of modulation and Demodulation operations, Random Signal theory, Information and channel capacity, Base band data transmission - Base band Binary PAM system, Modulation schemes - Binary ASK, PSK, FSK schemes, comparison of Digital Modulation schemes.

UNIT- III

Error control coding, Methods of controlling errors. Facsimile - Introduction, transmission and reception. Satellite Communication - Introduction, orbits, station keeping, satellite Altitude, Transmission path, path losses, Noise consideration.

UNIT - IV

Point to Point Communication : Telephone networks, Automatic exchange switching systems, Introduction to Computer based communication - ISDN (integrated Service Digital Network), LAN (Local Area Network), Basic RADAR concept - RADAR system

(introduction). Primary radar, Secondary surveillance radar (SSR), Introduction to TV systems and standards.

References

1. Foundations of Electromagnetic theory - J.R. Reiz and Milford, Addition Wesley.
2. Microwave Devices and Circuits - Samuel Y. Liao, PHI Pvt. Ltd.
3. Electronic Communications - Roody and Coolon.
4. Electronic Communication - George Kennedy.
5. Digital and Analog Communication System - K. Sam Shanmugan, John Wiley and Sons 1994.
6. Electronic Engineers Reference Book - FF Mazda (Sixth Edition), Butter Worth International.
7. Monochroms and Colour TV - R.R. Gulati.