U.P. TECHNICAL UNIVERSITY
LUCKNOW

SYLLABUS

1. **Mathematics –III**
2. **Science Based Open Electives**
3. **Industrial Psychology**
4. **Industrial Sociology**
5. **Human Values and Professional Ethics**
6. **Cyber Security**

[Effective from the Session: 2015-16]

COMMON COURSES

NAS-301: MATHEMATICS –III

L P T 3 1 0

1. Preamble: Mathematics III is the combination of Numerical and statistical approach widely used in engineering.

.**2. Course Objective**

a) The subject thoroughly explains the principles of Differentiation and Integration.
b) Subject was clear to understand Fourier sine and cosine transform and enhances the ability to solve engineering problems related to signal processing and heat and mass transfer.
c) The subject clearly explains the method for analyzing the data by using Chi –Square test and t-test.
d) The subject clearly explained the methods to find roots of various polynomials and also enhanced the ability of forecasting using interpolation.
e) The subject explains the techniques used for solving integration and differentiation real life problems such as traffic and population.

3. Course Outcome:

On successful completion of this course students will be able to:

1. Solve the problem of complex number and use as a tool in engineering problems.
2. Understand the definition of fourier sine and cosine transform and the properties of fourier transform which is very useful in engineering problem (example: signals processing.)
3. Generate the concept of mean, median, mode and concept of moments and standard derivation.
4. Find the roots of varies polynomials used to solve the mathematical formulation of engineering problems.
5. Solve the system of differential equations representing the modeling of different real life problem (traffic, population etc.)

4. Pre-Requisite:

- Knowledge on any language

5. Links to Other Courses:

All engineering subject

6. Course Content:

Unit – I:

Function of Complex variable

Analytic function, C-R equations, Harmonic Functions, Cauchy's integral theorem, Cauchy's integral formula, Derivatives of analytic functions, Taylor's and Laurent's series, Singularities,
Zeroes and Poles, Residue theorem, Evaluation of real integrals of the type

Unit – II:

Integral Transforms

Fourier integral, Complex Fourier transform, Inverse Transforms, Convolution Theorems,
Fourier sine and cosine transform, Applications of Fourier transform to simple one dimensional
heat transfer equations, wave equations and Laplace equations
Z- transform and its application to solve difference equations

Unit – III:

Statistical Techniques

Moments, Moment generating functions, Skewness, Kurtosis, Curve fitting, Method of least squares, Fitting of straight lines, Polynomials, Exponential curves, Correlation, Linear, non – linear and multiple regression analysis, Binomial, Poisson and Normal distributions, Tests of significations: Chi-square test, t-test

Unit – IV:

Numerical Techniques – I

Zeroes of transcendental and polynomial equations using Bisection method, Regula-falsi method and Newton-Raphson method, Rate of convergence of above methods.

Interpolation: Finite differences, Newton's forward and backward interpolation, Lagrange's and Newton's divided difference formula for unequal intervals**.**

Unit – V:

Numerical Techniques –II

Solution of system of linear equations, Matrix Decomposition methods, Jacobi method, Gauss-Seidal method.Numerical differentiation, Numerical integration, Trapezoidal rule, Simpson's one third andthree-eight rules,Solution of ordinary differential equations (first order,second order and simultaneous) by Euler's,Picard's and fourth-order Runge- Kutta methods.

Test Books:-

1. Peter V. O'Neil, Advance Engineering Mathematics Thomson (Cengage) Learning, 2007.
2. Jain, Iyenger Jain, Numerical Methods for Scientific and Engineering Computation, New Age International, New Delhi
3. J.N. Kapur, Mathematical Statistics, S. Chand & company Ltd.
4.B.S.Grewal,Higher Engineering Mathematics, Khanna Publishers

Reference Books:-

1. R.K. Jain & S.R.K. Iyenger, Advance Engineering Mathematics, Narosa Publication House,.
2. Chandrika Prasad, Advanced Mathematics for Engineers, Prasad Mudralaya, 1996.
3. S.S.Sastry,Introductory Methods of Numerical Analysis, PHI Learning Private Limited, New Delhi
4. E. Balagurusamy, Numerical Methods, Tata McGraw-Hill Publishing Company Limited , New Delhi
5. T. Veerajan& T. Ramchandrandran, Theory & Problems in Numerical Methods, TMH, New Delhi

NHU-301 INDUSTRIAL PSYCHOLOGY

L T P 2 0 0

1.Preamble: To provide knowledge about work places it is a social system at first. To make one aware about how to improve job satisfaction as well as company productivity as it is vital to success of many organizations. The course intends to impart knowledge and learning of different aspects of society especially in the organizational context.

2. Course Objectives

a) To study the human behavior and to suggest various ways and means to improve the efficiency of workers in industries.
b) To know how to improve the labour relations in industry.
c) To understand how to achieve the target from the available resources.

3. Course Outcomes

On successful completion of this course students will be able to:

a) Learn about different managerial approaches and their implications.
b) Understand and implement motivational techniques for improvement of personnel.
c) Manage stress; maintain organizational culture through effective leadership.
d) Know about engineering psychology to create effective work environment.
e) Analyze the jobs for right recruitment and selection and get the awareness about different organizational training and development methods.

4. Pre-Requisite

Knowledge about human nature, need and personality type.

5. Links to other Courses

Industrial Psychology links with HRM, Business management, Ergonomics, Personnel Management and many more subjects.

6. Course Content –

Unit -1

Introduction to industrial psychology: Definition &scope, Hawthorne experiment, organization culture, leadership and group dynamics.

Unit -II

Work environment and psychology: fatigue, boredom, accident and safety, job analysis, recruitment selection, reliability and validity tests.

Unit -III

Introduction to sociology: nature, importance, scope, difference between psychology and sociology, scientific management, consequences, causes and limitation of industrialization, industrialization in India.

Unit -IV

Grievances & grievance handling procedure industrial disputes: causes, strikes and lock outs, schemes of workers participation in management, work committee, collective bargaining, bi- partie and tri – partie agreement, code of discipline, standing orders, labour courts and industrial tribunals.

Text/Reference Books:

1. Gisbert Pascal, Fundamentals of Industrial sociology, Tata McGraw Hill Publishing Co., New Delhi, 1972.
2. Schneider Engno V, Industrial Sociology 2nd Edition, McGraw Hill Publishing Co., New Delhi, 1979.
3. Miner J.B. (1992) Industrial/Organizational Psychology. N Y : McGraw Hill.
4. Blum & Naylor (1982) Industrial Psychology. Its Theoretical & Social Foundations CBS Publication.

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NHU–402: INDUSTRIAL SOCIOLOGY

L T P 2 0 0

1. Preamble: To provide knowledge about workplace as it is a social system at first. To make one aware about how to improve job satisfaction as well as company productivity as it is vital to success of many organizations. The course intends to impart knowledge and learning of different aspects of society especially in the organizational context.

2. Course Educational Objectives:

The objective of this course is to understand the ability, responsibility and accountability for society as an engineer. The course intends to impart knowledge and learning of different aspects of society especially in the organizational context.

3. Course Outcomes:

a) Understand society with their responsibility and accountability for it, as an engineer.
b) Learn about different managerial approaches and their implications.
c) Know the impacts of industrialization on different social institutions.
d) Become familiar with industrial grievances and grievances handling procedures.
e) Gets awareness about different regulations/ acts regarding employees welfare in the industry.

4. Pre-Requisite

Knowledge about human nature, need and personality type

5. Links to other Courses

Industrial Psychology links with HRM, Business management, Ergonomics, Personnel Management and many more subjects.

6. Course Content –

Unit-I

Industrial Sociology: Nature, Scope and Importance of Industrial Sociology, Social Relations in Industry, Social Organization in Industry- Bureaucracy, Scientific Management and Human Relations

Unit-II

Rise and Development of Industry: Early Industrialism – Types of Productive Systems – The Manorial or Feudal system. The Guild System, The Domestic or Putting-out System, and the Factory system, Characteristics of the factory system, Causes and Consequences of Industrialization, Obstacles to and Limitations of Industrialization.

Unit-III

Industrialization in India: Industrial Policy Resolutions – 1956, Science, Technology and Innovation Policy of India 2013

Unit-IV

Contemporary Issues: Grievances and Grievance handling Procedure, Industrial Disputes: Causes, Strikes and Lockouts, Preventive Machinery of Industrial Disputes: Schemes of Workers Participation in Management- Works Committee, Collective Bargaining, Bi-partite & Tri-partite Agreement, Code of Discipline, Standing Orders. Labour courts & Industrial Tribunals.

Text books:

1. Gisbert Pascal, Fundamentals of Industrial sociology, Tata McGraw Hill Publishing Co., New Delhi, 1972.
2. Schneider Engno V., Industrial Sociology 2nd Edition, McGraw Hill Publishing Co., New Delhi, 1979.
3. Mamoria C.B. And Mamoria S., Dynamics of Industrial Relations in India.

RefrenceBooks :

1. Sinha G.P. and P.R.N. Sinha, Industrial Relations and Labour Legislations, New Delhi, Oxford and IBH Publishing Co., 1977.
2. Nadkarni, Lakshmi, Sociology of Industrial Worker, Rawat,Jaipur,1998.
3. Bhowmick Sharit, Industry, Labour and Society,Orient,2012.

AUC-001- HUMAN VALUE AND PROFESSIONAL ETHICS

L T P 3 1 0

1. Preamble: The aim proposes and asks its listeners to investigate and explore into their own inner self and connect to what is innate and intact in all of them as something which is universal, natural and all-fulfilling for them as well as others. One can do this irrespective of his/her own religion or faith or beliefs.

2. Course Objective

a) Appreciate the essential complementarily between 'VALUES" and 'SKILLS' with its relation of engineering concept.
b) Ensure sustained happiness and prosperity which are the core aspirations of all human beings keeping social environmental,economic,political scenario.
c) Understand the harmony in society with the political, economic,environment & technological issue.
d) Understand the harmony with nature keeping technological advancement.Highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually satisfying human behavior and mutually enriching interaction with nature by using engineering,management principle.

1. Course Outcome:

On successful completion of this course students will be able to:

a) Understand the significance of value inputs in a classroom and start applying them in their life and profession
b) Distinguish between values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual, etc.
c) Understand the value of harmonious relationship based on trust and respect in their life and profession
d) Understand the role of a human being in ensuring harmony in society and nature.
e) Distinguish between ethical and unethical practices, and start working out the strategy to actualize a harmonious environment wherever they work.

4. Pre-Requisite:

- Knowledge on any language

5. Links to Other Courses:

All engineering subject

6. Course Content:

Unit – I:

Introduction –Need, Basic Guidelines and Content

1. Understanding the need , basic guidelines, content and process for value Education
2. Self Exploration – What is it? – its content and process: 'Natural Acceptance' and Experiential Validation – as the mechanism for self explanation
3. Continuous Happiness and Prosperity – A look at basic Human Aspirations

Unit – II:

Process for Value Education

1. Right Understanding, Relationship and Physical Facilities – basic requirements for fulfillment of aspirations of every human being with their correct priority
2. Understanding Happiness and prosperity correctly – A critical appraisal of the current scenario
3. Method to fulfill the above human aspirations; understanding and living in harmony at various levels

Unit – III:

Understanding Harmony in the Human Being

1. Understanding human being as a co-existence of the sentient 'I' and the material 'Body'
2. Understanding the needs of Self ('I') and 'Body' – Sukh and Suvidha
3. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)

Unit –IV:

Harmony in Myself

1. Understanding the characteristics and activities of 'I' and harmony in 'I'
2. Understanding the harmony of I with the Body: Sanyam and Swasthya: correct appraisal of Physical needs, meaning of Prosperity in detail
3. Programs to ensure Sanyam and Swasthya – practice exercises and Case Studies will be taken up in Practice Sessions

Unit – V:

Understanding Harmony in the Family and Society – harmony in Human - Human Relationship

1. Understanding harmony in the family – the basic unit of human interaction
2. Understanding values in human relationship; meaning of Nyaya and Program for its fulfillment to ensure Ubhay-tripti
3. Trust (Vishwas) and Respect (Samman) as the foundational values of relationship.

Text Books:

1. R R Gaur, R,Sangal, G.P Bagaria, 2009, A Foundation Course in valueEducation(English)

2. R R Gaur, R Sangal G P Bagaria, 2009, Teacher's Manual (English)

3. Pradeep Kumar Ramancharla, 2013, Teacher's Manual (Telugu)

Reference Books:

1. Ivan Ilich, 1974, Energy& Equity, The Trinity Press, Worcester, and harper Collins, USA
2. E.F. Schumacher, 1973, small is Beautiful; a study of economics as if people mattered, Blond & Briggs, Bratain

AUC-002: INFORMATION SECURITY AND CYBER LAWS

L T P 2 0 0

1.Preamble : Subject provides a platform to explore about information system and to maintain awareness regarding the information security and its laws.

2. Course Objectives:

a) The goal of this course is for students to maintain an appropriate level of awareness, knowledge and skill to allow them to minimize the occurrence and severity of information security incidents.

b) To provide suitable coverage of cyber laws of India.

3. Course Outcomes:

a) Know the basics of information security and cyber laws.
b) Develop information systems.
c) Establish responsibility and accountability for information security in organizations.

4. Pre-Requisite

Knowledge about human nature, need and personality type

5. Links to other Courses

Industrial Psychology links with HRM, Business management, Ergonomics, Personnel Management and many more subjects.

6. Course Content –

UNIT-1
Introduction to information systems, Types of information Systems, Development of Information
Systems, Introduction to information security, Need for Information security, Threats to Information Systems, Information Assurance, Cyber Security, and Security Risk Analysis.

UNIT-2
Application security (Database, E-mail and Internet), Data Security Considerations-Backups, Archival Storage and Disposal of Data, Security Technology-Firewall and VPNs, Intrusion Detection, Access Control. Security Threats -Viruses, Worms, Trojan Horse, Bombs, Trapdoors, Spoofs, E-mail viruses, Macroviruses, Malicious Software, Network and Denial of Services Attack, Security Threats to E-Commerce-Electronic Payment System, eCash, Credit/Debit Cards. Digital Signature, public Key Cryptography.

UNIT-3
Developing Secure Information Systems, Application Development Security, Information Security Governance & Risk Management, Security Architecture & Design Security Issues in Hardware, Data Storage & Downloadable Devices, Physical Security of IT Assets, Access Control, CCTV and intrusion Detection Systems, Backup Security Measures.

UNIT-4

Security Policies, Why Policies should be developed, WWW policies, Email Security policies, Policy Review Process-Corporate policies-Sample Security Policies, Publishing and Notification Requirement of the Policies. Information Security Standards-ISO, IT Act, Copyright Act, Patent Law, IPR. Cyber Laws in India; IT Act 2000 Provisions, Intellectual Property Law: Copy Right Law, Software License, Semiconductor Law and Patent Law.

Text book:

1. Charles P. Pfleeger, Shari LawerancePfleeger, "Analysing Computer Security ", Pearson Education India.
2. V.K. Pachghare, "Cryptography and information Security", PHI Learning Private Limited, Delhi India.
3. Dr. Surya PrakashTripathi, RitendraGoyal, Praveen kumarShukla ,"Introduction to Information Security and Cyber Law" Willey Dreamtech Press.

Reference book:

1. Schou, Shoemaker, " Information Assurance for the Enterprise", Tata McGraw Hill.
2. CHANDER, HARISH**,"** Cyber Laws And It Protection **"**, PHI Learning Private Limited ,Delhi ,India

List of Open Electives for B. Tech. Courses

SCIENCE BASED OPEN ELECTIVE

NOE-037 / NOE-047	Material Science
NOE-031 / NOE-041	Introduction to Soft Computing (Neural Networks, Fuzzy Logic and Genetic Algorithm)
NOE-032 / NOE-042	Nano Sciences
NOE-033 / NOE-043	Laser Systems and Applications
NOE-034 / NOE-044	Space Sciences
NOE-035 / NOE-045	Polymer Science & Technology
NOE-036 /NOE-046	Nuclear Science
NOE-038 / NOE-048	Discrete Mathematics
NOE-039/ NOE-049	Applied Linear Algebra

SCIENCE BASED OPEN ELECTIVES

NOE-047: MATERIAL SCIENCE

L T P 3 1 0

1. Preamble: This course provides an introduction of material structure, types and properties. This course also provides the different testing and heat treatment process as well as knowledge about different materials and its applications.

2. Course objective

a) To study the basic of material science and its structure.
b) To study the different testing of material.
c) To study the heat treatment processes of material.
d) To study different properties and applications of different materials

3. Course Outcome:

a) Have a thorough understanding of the fundamental concepts of Material structure.

b) To understand, formulate and solve problems related to different mechanical testing.

c) Have a thorough understanding of the fundamental concepts Heat treatment and its process.

d) Study and analysis of Electrical properties of materials and also understand the composition and properties of ferrous and non ferrous metals.

e) Ability to understand the concept of different advance materials its composition, properties and its application in the welfare of society.

4. Pre-Requisite

Basics of Physics and chemistry.

5. Links to other Courses

Project

6. Course Content:

Unit - I

Introduction : Importance of materials. historical perspective, Brief review of modern & atomic concepts in Physics and Chemistry. Atomic models, Periodic table, Chemical bondings.

Crystallography and Imperfections : Concept of unit cell space lattice, Bravais lattices, common crystal structures, Atomic packing factor and density. Miller indices. Xray crystallography techniques.Imperfections, Defects & Dislocations in solids.

Unit-II

Mechanical properties and Testing : Stress strain diagram, Ductile & brittle material, Stress vs strength.Toughness, Hardness, Fracture, Fatigue and Creep. Testing of material such as Strength tests, Hardness tests, Impact tests, Fatigue tests, Creep tests, and Non-destructive testing (NDT).

Microstructural Exam : Microscope principle and methods. Preparation of samples and Microstructure exam and grain size determination. Comparative study of microstructure of various metals & alloys such as Mild steel, CI, Brass.

Phase Diagram and Equilibrium Diagram : Uniary and Binary diagrams, Phase rules. Types of equilibrium diagrams: Solid solution type, eutectic type and combination type. Iron-carbon equilibrium diagram.

Unit-III

Ferrous materials : Various types of carbon steels, alloy steels and cast irons, its properties and uses.

Heat Treatment : Various types of heat treatment such as Annealing, Normalizing, Quenching, Tempering (Austempering, Martempering), and various case hardening processes. Time Temperature Transformation (TTT) diagrams.

Diffusion: Diffusion of Solids, Ficks I and II law.

Non-Ferrous metals and alloys : Non-ferrrous metals such as Cu, Al, Zn, Cr, Ni etc. and its applications. Various type of Brass and Bronze, bearing materials, its properties and uses. Aluminum alloys such as Duralumin. Other advanced materials/alloys.

Unit-IV

Dielectric Materials: Dielectric Materials and their applications.

Magnetic properties : Concept of magnetism - Dia, para, ferro Hysteresis. Soft and hard magnetic materials, Magnetic storages.

Electric properties, Semi conductors and Super conductors: Energy band concept of conductor, insulator and semi-conductor. Intrinsic & extrinsic semi-conductors. P-n junction and transistors. Basic devices and its application. Super conductivity and its applications. Messier effect. Type I & II superconductors. High Tc superconductors.

Unit-V

Ceramics : Structure types and properties and applications of ceramics. Mechanical/Electrical behavior and processing of Ceramics.

Plastics : Various types of polymers/plastics and its applications. Mechanical behaviour and processing of plastics. Future of plastics.

Other materials : Brief description of other material such as optical and thermal materials, Composite Materials and its uses. Introduction to Smart materials & Nano-materials and their potential applications

Performance of materials in service: Brief theoretical consideration of Fracture, Fatigue, and Corrosion and its control.

Text books:

1. Callisters Materials Science and Engineering, by William D. Callister, Jr, (Adopted by R.Balasubramaniam), Wiley India Pvt. Ltd.
2. Elements of Material Science & Engineering by Van Vlack, Pearson
3. Materials Science and Engineering - A First Course by Raghavan, PHI
4. Material Science and Engineering by Smith, Hashemi and Prakash, TMH

References books :

1. Introduction to Materials Science for Engineers by Shackelford, Pearson
2. Material Science by Narula , TMH.
3. Material Science for Engineering Students by Fischer, Academic Press
4. Technology of Engineering materials by Philip and Bolton, Butterworth-Heinamann

NOE-031/NOE-041: INTRODUCTION TO SOFT COMPUTING
(Neural Networks, Fuzzy Logic and Genetic Algorithm)

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3 1 0

Unit-I : Neural Networks-1(Introduction & Architecture)
Neuron, Nerve structure and synapse, Artificial Neuron and its model, activation functions, Neural network architecture: single layer and multilayer feed forward networks, recurrent networks.Various learning techniques; perception and convergence rule, Auto-associative and hetro-associative memory. **8**

Unit-II : Neural Networks-II (Back propogation networks)
Architecture: perceptron model, solution, single layer artificial neural network, multilayer perception model; back propogation learning methods, effect of learning rule co-efficient ;back propagation algorithm, factors affecting backpropagation training, applications. **8**

Unit-III : Fuzzy Logic-I (Introduction)
Basic concepts of fuzzy logic, Fuzzy sets and Crisp sets, Fuzzy set theory and operations, Properties of fuzzy sets, Fuzzy and Crisp relations, Fuzzy to Crisp conversion. **8**

Unit-IV : Fuzzy Logic –II (Fuzzy Membership, Rules)
Membership functions, interference in fuzzy logic, fuzzy if-then rules, Fuzzy implications and Fuzzy algorithms, Fuzzyfications & Defuzzificataions, Fuzzy Controller, Industrial applications. **8**

Unit-V : Genetic Algorithm(GA)
Basic concepts, working principle, procedures of GA, flow chart of GA, Genetic representations, (encoding) Initialization and selection, Genetic operators, Mutation, Generational Cycle, applications. **8**

Text Books:

1. S. Rajsekaran & G.A. Vijayalakshmi Pai, "Neural Networks,Fuzzy Logic and Genetic Algorithm:Synthesis and Applications" Prentice Hall of India.
2. N.P.Padhy,"Artificial Intelligence and Intelligent Systems" Oxford University Press.

Reference Books:

3. Siman Haykin,"Neural Netowrks"Prentice Hall of India
4. Timothy J. Ross, "Fuzzy Logic with Engineering Applications" Wiley India.
5. Kumar Satish, "Neural Networks" Tata Mc Graw Hill

NOE-032/NOE-042: NANO SCIENCES

L T P
3 1 0

UNIT -1 :

Introduction:

Difinition of Nano-Science and Nano Technology, Applications of Nano-Technology. **1**

Introduction to Physics of Solid State:

Structure: Size dependence of properties; crystal structures, face centered cubic nanoparticles; Tetrehedrally bounded semiconductor structures; lattice vibrations.

Energy Bands: Insulators, semiconductor and conductors; Reciprocal space; Energy bands and gaps of semiconductors; effective masses; Fermi Surfaces.

Localized Particles: Acceptors and deep taps; mobility; Excitons. **6**

UNIT-2

Quantum Theory For Nano Science:

Time dependent and time independent Schrodinger wave equations.

Particle in a box, Potential step: Refelection and tunneling(Quantum leak). Penetration of Barrier, Potential box(Trapped particle in 3D:Nanodot), Electron trapped in 2D plane(Nano sheet), Quantum confinerment effect in nano materials. **4**

Quantum Wells, Wires and Dots

Preparation of Quantum Nanostructure; Size and Dimensionality effect, Fermigas; Potential wells; Partial confinement; Excitons; Single electron Tunneling, Infrared etectors; Quantum dot laser Superconductivity. **3**

Properties of Individual Nano particles

Metal Nano clusters: Magic Numbers; Theoretical Modelling of Nanopraticles; geometric structure; electronic structure; Reactivity; Fluctuations Magnetic Clusters; Bulle to Nano structure.

Semi conducting Nanoparticles: Optical Properties; Photofragmentation; Coulmbic explosion.

Rare Gas & Molecular Clusters: Inert gas clusters; Superfluid clusters molecular clusters.

UNIT-3

Growth Techniques of Nanomaterials:

Lithograpahic and Nonlithograpahic techniques, Sputtering and film deposition in glow discharge, DC sputtering technique(p-$CuAlO_2$ deposition). Thermal evaporation technique, E-beam evaporation, Chemical Vapour deposition(CVD), Synthesis of carbon nano-fibres and multi-walled carbon nanotubes, Pulsed Laser Deposition, Molecular beam Epitoxy, Sol-Gel Techniuqe (No chemistry required), Synthesis of nanowires/rods, Electrodeposition, Chemical bath deposition, Ion beam deposition system, Vapor-Liquid –Solid (VLS) method of nanowires. **8**

UNIT -4

Methods of Measuring Properties:

Structure: Crystallography, particle size determination, surface structure,

Microscopy: Scanning Prob Microscopy (SPM), Atomic Force Microscopy (AFM), Field Ion Microscopy, Scanning Electron Microscopy, Transmission Elecrtron Microscopy (TEM)

Spectroscopy: Infra red and Raman Spectroscopy, X-ray Spectroscopy, Magnetic resonance, Optical and Vibrational Spectroscopy, Luninscence. **8**

UNIT-5

Buckey Ball:

Nano structuresof carbon(fullerene):

Carbon nano-tubes: Fabrication , structure. electrical, mechanical, and vibrational properties and applications.

Nano diamond, Boron Nitride Nano-tubes, single elecron transistors, Moelcular machine, Nano-Biometrics, Nano Robots. **7**

Text/Reference Books:

1. C.P.Poole Jr F.J. Owens, "Introduction to Nanotechnology".
2. "Introduction to S.S. Physics" - (7^{th} Edn.) Wiley 1996.
3. S. Sugano & H. Koizuoni, "Microcluster Physics" –Springor 1998
4. "Handboole of Nanostructured Materials & Nanotechnology" vol.-5. Academic Press 2000
5. A.K.Bandyopadhyay, "Nano Materials" New Age International.

NOE-033/NOE-043: LASER SYSTEMS AND APPLICATIONS

L T P
3 1 0

UNIT-I & II

Introduction:

Review of elementary quantum physics, Schrodinger equation, concept of coherence, absorption, spontaneous emission and stimulated emission processes, relation between Einstein's A and B coefficients, population inversion, pumping, gain, optical cavities. **15**

UNIT-III & IV

Lasers & Laser Systems:

Main components of Laser, principle of Laser action, introduction to general lasers and their types. Three & four level Lasers, CW & Pulsed Lasers, atomic, ionic, molecular, excimer, liquid and solid state Lasers and systems, short pulse generation and Measurement. **18**

UNIT-V

Applications:

Laser applications in medicine and surgery, materials processing, optical communication, metrology and LIDAR and holography. **7**

Text/ Reference Books:

1. K.R. Nambiar, "Laser Principles, Types and Application" New Age International.
2. S. A. Ahmad, "Laser concepts and Applications" New Age International.

NOE-034/NOE-044: SPACE SCIENCES

L T P
3 1 0

1. **Introduction:**
   Introduction to space science and applications, historical development

2. **Solar System:**
   Nebular theory of formation of our Solar System.
   Solar wind and nuclear reaction as the source of energy.
   Sun and Planets: Brief description about shape size, period of rotation about axis and period of revolution, distance of planets from sun, Bode's law, Kepler's Laws of planetary motion, Newton's deductions from Kepler's Laws, Newton's Law of gravitation, correction of Kepler's third law, determination of mass of earth, determination of mass of planets with respect to earth.
   Brief description of Asteroids, Satellites and Comets.

3. **Stars:**
   Stellar spectra and structure, stellar evolution, nucleo-synthesis and formation of elements.
   Classification of stars: Harvard classification system, Hertzsprung-Russel diagram, Luminosity of star, variable stars; composite stars (white dwarfs, Neutron stars, black hole, star clusters, supernova and binary stars); Chandrasekhar limit.

4. **Galaxies:**
   Galaxies and their evolution and origin, active galaxies and quasars.

5. **Creation of Universe:**
   Early history of the universe, Big-Bang and Hubble expansion model of the universe, cosmic microwave background radiation, dark matter and dark energy.

Text Books / Reference Books:

1. K. S. Krishnaswami, "Astrophysics: A modern Perspective" New Age International.
2. K. S. Krishnaswami, "Understanding cosmic Panorama" New Age International.

NOE-035/NOE-045: POLYMER SCIENCE AND TECHNOLOGY

L T P
3 1 0

UNIT –I & II
POLYMERS:
Introduction, chemistry of polymer synthesis, polymer reaction kinetics, physical properties and characterization of polymers, effect of structure on properties of polymers, organic polymers. Introduction to high performance polymers and composites and their processing. **18**

UNIT –III & IV
POLYMERIZATION:
Introduction, step-growth polymerization, free radical chain growth polymerization, emulsion polymerization, ionic and cationic polymerization, chain statistics and rubber elasticity. **13**

UNIT – UNIT –V & VI
PREPARATION AND APPLICATIONS:
Preparation, properties and technical applications of thermo-plastics (PVC, PVA), thermostats (PF, UF) and elastomers (SBR, GR-N), silicones. Application of polymers in space, ocean, electronics, medical, agriculture, automobile, sports and building construction. **9**

NOE-036/NOE-046: NUCLEAR SCIENCE

L T P
3 1 0

UNIT-I
Nucleus and Its Basic Features:
Nuclear structure; nuclear forces and their properties, nuclear stability, nuclear radius and its meassurement, nuclear spin, nuclear magnetic and electrical moments. **8**

UNIT-II
Nuclear Models:
Single particle model, liquid drop model and semi-emperical mass formula, nuclear potential and shell model, collective model. **8**

UNIT-III
Nuclear Reaction:
Nuclear reaction and laws of conservation, types of nuclear reaction, mechanism of nuclear reaction, nuclear fission & binuclear fusion and their explanation by liquid drop model. **8**

UNIT-IV
Nuclear Decay:
Decay constant, half life period and mean life, alpha decay, beta decay, gamma decay, interaction of nuclear radiation with matter. **6**
Nuclear Instruments-I
Mass spectrograph,: General principle, Aston's Mass Spectrograph. **2**

UNIT-V
Nuclear Instruments-II
Accelerators: Van de Graph Generator, Cyclotron, Synchrotron. **6**
Detectors: G M Counter, Scintillation counter, cloud chamber, Bubble Chamber, production and detection of neutrons and Gamma-photon.
Application of Nuclear Techniques: Nuclear magnetic resonance, positron emission topography, radiotracer techniques and applications in material science and agriculture. **2**

Text Books:

1. Tayal, "Nuclear Physics" Himalaya Publishing House.
2. S.N. Ghosal, "Nuclear Physics" S. Chand & Co.
3. S. B. Patel, "Nuclear Physics: An Introduction New Age International.
4. H. B. Lal, "Introuctory Nucler Physics" United Book Depot.
5. Wang, "Introductory Nuclear Physics", PHI Learning

Reference Books:

6. Roy & Nigam, "Nuclear Physics" John Wiley & sons.
7. W.E. Burcham, "Nuclear Physics" Longmans Publications.
8. Green, "Nuclear Physics" McGraw Hill.

NOE-038 / NOE-048: DISCRETE MATHEMATICS

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UNIT-I

Set Theory: Definition of Sets, Venn Diagrams, complements, cartesian products, power sets, counting principle, cardinality and countability (Countable and Uncountable sets), proofs of some general identitites on sets, pigeonhole principle.

Relation: Definition, types of relation, composition of relations, domain and range of a relation, pictorial representation of relation, properties of relation, partial ordering relation.

Function: Definition and types of function, composition of functions, recursively defined functions. **10**

UNIT-II

Propositional logic: Proposition logic, basic logic, logical connectives, truth tables, tautologies, contradiction , normal forms(conjunctive and disjunctive), modus ponens and modus tollens, validity, predicate logic, universal and existential quantification.

Notion of proof: proof by implication, converse, inverse, contrapositive, negation, and contradiction, direct proof, proof by using truth table, proof by counter example. **7**

UNIT-III

Combinatories: Mathematical induction, recursive mathematical definitions, basics of counting, permutations, combinations, inclusion-exclusion, recurrence relations (n^{th} order recurrence relation with constant coefficients, Homogeneous recurrence relations, Inhomogeneous recurrence relation), generating function (closed form expression, properties of G.F., solution of recurrence relation using G.F, solution of combinatorial problem using G.F.) **7**

Unit-IV

Algebraic Structure: Binary composition and its properties definition of algebraic structure; Groyas Semi group, Monoid Groups, Abelian Group, properties of groups, Permutation Groups, Sub Group, Cyclic Group, Rings and Fields (definition and standard results). **6**

UNIT-V

Graphs:

Graph terminology, types of graph connected graphs, components of graph, Euler graph, Hamiltonian path and circuits, Graph coloring, Chromatic number.

Tree: Definition, types of tree(rooted, binary), properties of trees, binary search tree, tree traversing (preorder, inorder, postorder).

Finite Automata: Basic concepts of Automation theory, Deterministic finite Automation(DFA), transition function, transition table, Non Deterministic Finite Automata (NDFA), Mealy and Moore Machine, Minimization of finite Automation. **10**

Text/Reference Books:

1. Kenneth H. Rosen, "Discrete Mathematics and its Applications", Mc.Graw Hill, 2002.
2. J.P.Tremblay & R. Manohar, "Discrete Mathematical Structure with Applications to Computer Science" Mc.Graw Hill, 1975.
3. V. Krishnamurthy, "Combinatories:Theory and Applications", East-West Press.
4. Seymour Lipschutz, M.Lipson, "Discrete Mathematics" Tata Mc Graw Hill, 2005.
5. Kolman, Busby Ross, "Discrete Mathematical Structures", Prentice Hall International.

NOE-039/NOE-049 APPLIED LINEAR ALGEBRA

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3 1 0

UNIT-1
Fields, Vector-spaces, sub-spaces, linear- combination, linear-dependence and independence. Basis, dimensions and coordinates (each and every fact to be illustrated by suitable examples). (8)

UNIT-2
Linear-transformation, definition and examples, matrix representation, similarity, range and kernel, rank-nullity theorem and its consequences. (8)

UNIT-3
Singular and non singular linear transformations, sum and product of linear transformations, vector space of linear transformations, nilpotent linear transformations. (6)

UNIT-4
Inner product spaces, definition and examples, orthogonality, Cauchy-Schwartz Inquality, Minkowski Inequality, polarization Identity, complete orthonormal set, Bessel's Inequality, Gram-Schmidt's orthogonalization process. (8)

UNIT-5
Linear functional, definition and examples, vector space of linear functional, dual vector spaces, adjoint, self adjoint, unitary and normal operators, examples and properties, eigen values and eigen vectors, diagonalisation of linear operators, quadratic forms, principle axis theorem(without proof), some applications to engineering problems. (10)

Text/Reference Books:

1. Dym, H. Linear Algebra in action, University Press.2012
2. Halmos, P.R.: Finite Dimensional Vector Spaces (1990) Narosa.
3. Hoffman, K. and Kunze, R.: Linear Algebra PHI (2012)
4. Kolman, B. And Hill, D.R.: Introductory linear algebra with applications(2008)
5. Lipschutz, S. and Lipson M.: Linear Algebra (2005) Schaum's Series.
6. Noble, B. And Daniel, J.W.: Applied linear algebra. (1988) PHI