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|            | Theory  |                                    | 20| 2 | 8 | 26 |

**Total Contact Hours**

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**Total**

|            |         |                                    |---|---|---|----|
|            | Practical|                                    | 20| 4 | 8 | 27 |

**Total Contact Hours**

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# Review of the core subjects studied up to the current semester
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**Total Contact Hours**: 29

* An industrial training of minimum two weeks has to be undergone by the student in the winter/summer vacation of the III/IV semester.

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**Total Contact Hours**: 26

# Review of the core subjects studied up to the current semester

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**An industrial training of minimum two weeks has to be undergone by the student in the winter/summer vacation of the V/VI semester.**
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**Summary Table**

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**TOTAL CREDITS TO BE EARNED FOR THE AWARD OF THE DEGREE:** 176

**LIST OF ELECTIVES**

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**NOTE:**
All electives having odd numbers shall be offered only during odd semesters, others during even semesters.
SYLLABUS
SEMESTER – I

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PURPOSE
To provide an adequate mastery of communicative English Language training primarily - reading and writing skills, secondarily listening and speaking skills.

INSTRUCTIONAL OBJECTIVES
To provide language training to the engineering students which will enable them to understand and acquire knowledge in technical subjects.

LISTENING
Listening Practice – Hints on Listening – Listening Practice
Note Taking: Note Taking Strategies

SPEAKING
Phonetics: Pronunciation-Phonetic Transcription-Stress-Intonation

READING
Comprehension: Skimming-scanning-close reading-Comprehension – Transferring Information – Exercise – An unseen passage should be given and questions may be asked in the form of True or False statements, MCQ, short answers.
Transcoding : Interpreting tables, flow charts, pie chart, bar diagram, tree diagram, graphs.

WRITING
Art of Writing: Writing Language – Rules for effective writing – Technical Essay Writing – Exercise
Report Writing: Technical Writing – Lab Report – Exercise
Curriculum Vitae – Placing an Order.
Dialogue Writing

FOCUS ON AND COMMUNICATION AND “COMUNICATION”
Communication (Communicate through Computers – Power Point & Tele Conference).

INTERNAL ASSESSMENT
Based on the submission of Assignments and test performance of the students marks will be awarded.

TEXT BOOKS

REFERENCE BOOKS
PURPOSE
To impart analytical ability in solving mathematical problems as applied to the respective branches of Engineering.

INSTRUCTIONAL OBJECTIVES
At the end of the course, student should be able

1. To apply advanced matrix knowledge to Engineering problems.
2. To improve their ability in solving geometrical applications of differential calculus problems.
3. To equip themselves familiar with the functions of several variables.
4. To familiarize with the applications of differential equations.
5. To expose to the concept of three dimensional analytical geometry.

MATRICES

GEOMETRICAL APPLICATIONS OF DIFFERENTIAL CALCULUS

FUNCTIONS OF SEVERAL VARIABLES

ORDINARY DIFFERENTIAL EQUATIONS
Simultaneous first order linear equations with constant coefficients – Linear equations of second order with constant and variable coefficients – Homogeneous equation of Euler type – Equations reducible to homogeneous form.

THREE DIMENSIONAL ANALYTICAL GEOMETRY

TEXT BOOK

REFERENCE BOOKS
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**PURPOSE**
The purpose of this course is to develop scientific temper and analytical capability through learning physical concepts and their applications in engineering and technology. Comprehension of some basic physical concepts will enable the students to logically solve engineering problems.

**INSTRUCTIONAL OBJECTIVES**
At the end of the course, the student will be able to:
- Understand the general scientific concepts required for technology,
- Apply the concepts in solving engineering problems,
- Explain scientifically the new developments in engineering and technology, and
- Get familiarized with the concepts, theories, and models behind many technological applications.

**PROPERTIES OF MATTER AND SOUND**

**ELECTROMAGNETISM AND MICROWAVES**

**OPTICS**
**Photometry**: Principles and Lummer-Brodhun photometer. **Lasers**: Principles and characteristics – Types of lasers (CO₂, excimer, NdYAG, GaAs, free electron) – Holographic mass storage. **Optical Fiber**: Principles – Physical structure and types – Optical fiber communication. **Photo elasticity**: Theory and applications.

**CRYSTAL PHYSICS AND CRYOGENICS**

**ENERGY PHYSICS**
Introduction to non-conventional energy sources – Solar cells – Thermoelectric power generators – Thermionic power generator – Magneto hydrodynamic power generator – Fuel cells (H₂O₂) – Solid state batteries (Lithium) – Low voltage and high voltage nuclear cells – Thermocouple based nuclear cell – Ultra capacitors.

**TEXT BOOKS**

**REFERENCE BOOKS**
PURPOSE
To impart a sound knowledge on the principles of chemistry involving the different application oriented topics required for all engineering branches.

INSTRUCTIONAL OBJECTIVES
The students should be conversant with
- The role of applied chemistry in the field of engineering.
- The knowledge of water quality parameters and the treatment of water.
- The principles involved in corrosion and its inhibitions.
- Important analytical techniques, instrumentation and the applications.
- Knowledge with respect to the phase equilibria of different systems.

TECHNOLOGY OF WATER

CORROSION AND ITS CONTROL

PHASE EQUILIBRIA
Phase rule: Statement – explanation of the terms involved - one component system (water system only). Condensed phase rule - thermal analysis – two component systems: simple eutectic, Pb-Ag; Br, Cd - solid solution Cu-Ni and compound formation Mg-Zn - applications of eutectics.

POLYMERS AND REINFORCED PLASTICS

INSTRUMENTAL METHODS OF ANALYSIS

TEXT BOOKS
REFERENCE BOOKS

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PART A - CIVIL ENGINEERING

PURPOSE
To get exposed to the glimpses of Civil Engineering topics that is essential for an Engineer.

INSTRUCTIONAL OBJECTIVES
To know about different materials and their properties.
To know engineering aspects related to buildings.
To know about the importance of surveying.
To know about the transportation systems.
To get exposed to the rudiments of engineering, related to Dams, Water Supply, Transportation system and Sewage Disposal.

BUILDING MATERIALS AND THEIR PROPERTIES

BUILDINGS AND THEIR COMPONENTS

UTILITY AND SERVICES

TEXT BOOKS

REFERENCE BOOKS
PART B MECHANICAL ENGINEERING

PURPOSE
To familiarize the students with the basics of Mechanical Engineering.

INSTRUCTIONAL OBJECTIVES
To familiarize with
- The basic machine elements
- The Sources of Energy and Power Generation
- The various manufacturing processes

MACHINE ELEMENTS

ENERGY
Sources: Renewable and non-renewable (various types, characteristics, advantages/disadvantages). Power Generation: External and internal combustion engines - Hydro and nuclear power plants (layouts, element/component description, advantages, disadvantages, applications). Simple Problems.

MANUFACTURING PROCESSES

TEXT BOOKS

REFERENCE BOOKS
4. Nagpal G. R., “Power Plant Engineering”, Khanna Publisher, Delhi, 2004

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PURPOSE
The purpose of this course is to build confidence and inculcate various soft skills and to help students to identify and achieve their personal potential.

INSTRUCTIONAL OBJECTIVES
1. To guide thought process.
2. To groom student’s attitude.
3. To develop communication skill.
4. To build confidence.
METHODOLOGY
The entire program is designed in such a way that every student will participate in the class room activities. The activities are planned to bring out the skills and talents of the students which they will be employing during various occasions in their real life.

1. Group activities + individual activities.
2. Collaborative learning.
3. Interactive sessions.
4. Ensure Participation
5. Empirical Learning

Self-analysis SWOT - Time management - Creative chain story telling

Vocabulary games I – Attitude - Interpersonal skills

Motivation I - Vocabulary games II - Article review

Team building exercise - Critical thinking - Event Management

Business situation - Leadership Qualities - Review

SCHEME OF INSTRUCTION
Marks allocated for regular participation in class

SCHEME OF EXAMINATION
Complete internal evaluation on a regular basis.

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Prerequisite
Nil

I. YOGA SYLLABUS

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<td>VIII Meditation Santhi Kayakalpa Asanas, Kiriyas, Bandas, Muthras</td>
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**Hours = 30**

TEXT BOOKS:
1. Vedatri Maharshi, “Yoga for Modern Age”
2. Vedatri Maharshi, “Simplified Physical Exercises”

NATIONAL SPORTS ORGANISATION (NSO)

Each student must select two of the following games and practice for two hours per week. An attendance of 80% is compulsory to earn the credits specified in the curriculum.
List of games:

Basket Ball
Football
Volley Ball
Ball Badminton
Cricket
Throw ball

NATIONAL CADET CORE (NCC)

Any student enrolling as a member of National Cadet Core (NCC) will have to attend sixteen parades out of twenty parades each of four periods over a span of an academic year.

Attending eight parades in first semester will qualify a student to earn the credits specified in the curriculum.

IV. NATIONAL SERVICE SCHEME (NSS)

A student enrolling as member of NSS will have to complete 60 hours of training / social service to be eligible to earn the credits specified in the curriculum.

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Prerequisite
Nil

PURPOSE
This Lab Course will enable the students to understand the basics of computer and to know the basics of MS-Office.

INSTRUCTIONAL OBJECTIVES
1. To learn the basics of computer.
2. To work on MS-Word, MS-Excel, MS-Power Point and MS-Access

EXPERIMENTS TO IMPLEMENT
Study experiment on evolution of computer programming languages.
Suggest some of the Network Topologies that can be incorporated in your campus. Justify your choice.
Experiments to demonstrate directory creation and file creation.
Create a document with all formatting effects.
Create a document with tables.
Create labels in MS word.
Create a document to send mails using mail merge option.
Create an Excel File to analyze the student’s performance. Create a chart for the above data to depict it diagrammatically.
Create Excel sheet to use built-in-function.
Create Excel sheet to maintain employee information and use this data to send mails using mail merge.
Create a Power Point presentation for your personal profile with varying animation effects with timer.
Consider student information system which stores student personal data, mark information and non academic details.
* Use MS-Access to create Tables and execute SQL queries to do this following
* Display all student records.
* Display student details with respect to his identity.
* Delete some records from the table.
* Find total marks obtained by student in each list.

TEXT BOOK
PH 0103  PHYSICS LABORATORY

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Prerequisite
Nil

PURPOSE
The purpose of this course is to develop scientific temper and analytical capability among the engineering students.

INSTRUCTIONAL OBJECTIVES
At the end of the course, the student will be able to:

- Understand scientific concepts in measurement of different physical variables
- Develop the skill in arranging and handling different measuring instruments
- Get familiarized with the errors in various measurements and planning / suggesting how these contributions may be made of the same order so as to make the error in the final result small.

LIST OF EXPERIMENTS
- Determination of Young’s Modulus of the material – Uniform bending
- Determination of Rigidity Modulus of the material – Torsion Pendulum
- Determination of velocity of Ultrasonic waves in liquids
- Determination of dispersive power of a prism using spectrometer
- Determination of laser parameter – Divergence and wavelength for a given laser source – laser grating
- Particle size determination using laser
- Study of attenuation and propagation characteristics of optical fiber cable
- Calibration of voltmeter using potentiometer.
- Calibration of ammeter using potentiometer.
- Construction and study of regulation properties of a given power supply using IC

REFERENCE BOOKS
PURPOSE
To provide the students with, hands on experience on different trades of engineering like fitting, carpentry, smithy, welding and sheet metal.

INSTRUCTIONAL OBJECTIVES
To familiarize with
- The basics of tools and equipments used in fitting, carpentry, sheet metal, welding and smithy.
- The production of simple models in the above trades.

LIST OF EXPERIMENTS

EMPHASIS TO BE LAI ON REAL LIFE APPLICATIONS WHEN FRAMING THE EXERCISES.

FITTING
Tools & Equipments – Practice in Filing and Drilling.
Making Vee Joints, Square, dovetail joints, Key Making.

CARPENTARY
Tools and Equipments- Planning practice. Making Half Lap, dovetail, Mortise & Tenon joints, a mini model of a single door window frame.

SHEET METAL
Tools and equipments - Fabrication of a small cabinet, Rectangular Hopper, etc.

WELDING
Tools and equipments - Arc welding of butt joint, Lap Joint, Tee Fillet. Demonstration of Gas welding, TIG & MIG.

SMITHY
Tools and Equipments –Making simple parts like hexagonal headed bolt, chisel.

TEXT BOOKS

REFERENCE BOOKS

PURPOSE
To draw and interpret various projections of 1D, 2D and 3D objects.
To prepare and interpret the drawings of buildings.
INSTRUCTIONAL OBJECTIVES
To familiarize with
- The construction of geometrical figures
- The projection of 1D, 2D & 3D elements
- Sectioning of solids and development of surfaces
- Preparation and interpretation of building drawing

FUNDAMENTALS OF ENGINEERING GRAPHICS
Lettering, two dimensional geometrical constructions, conics, representation of three-dimensional objects –
principles of projections – standard codes – projection of points.

PROJECTION OF LINES AND SOLIDS
Projection of straight lines, projection of solids – auxiliary projections

SECTIONS AND DEVELOPMENTS
Sections of solids and development of surfaces.

PICTORIAL PROJECTIONS
Conversion of projections: Orthographic projection, isometric projection of regular solids & combination of solids.

BUILDING DRAWING
Building Drawing – plan, elevation and section of single storied residential (or) office building with flat RCC roof and brick masonry walls having not more than 3 rooms (planning / designing is not expected in this course).

TEXT BOOKS

REFERENCE BOOKS

II SEMESTER

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Prerequisite
Nil

PURPOSE
To provide guiding principles and tools for the development of the whole person recognizing that the individual is comprised of Physical, Intellectual, Emotional and Spiritual dimensions.

INSTRUCTIONAL OBJECTIVES
To help individuals think about and reflect on different values.
To deepen understanding, motivation and responsibility with regard to making personal and social choices and the practical implications of expressing them in relation to themselves, others, the community and the world at large.
To inspire individuals to choose their own personal, social, moral and spiritual values and be aware of practical methods for developing and deepening

Values:
- Personal values
- Social values
- Professional values
- Moral and spiritual values
- Behavioral (common) values


REFERENCE BOOKS
2. “Values(Collection of Essays)”, Published by : Sri Ramakrishna Math., Chennai—4.,(1996)
6. “The Bible”
7. “The Kuran”
8. “The Bagavath Geetha”

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(Common to all Branches of Engineering except BT, BP, BI, BME, FPE, & GE)

PURPOSE
To impart analytical ability in solving mathematical problems as applied to the respective branches of Engineering.

INSTRUCTIONAL OBJECTIVES
At the conclusion of the course, students should have understood Multiple Integrals , Laplace Transforms, Vector Calculus and Functions of a complex variable including contour integration and able to apply to all their Engineering problems.

MULTIPLE INTEGRALS
Double integration in Cartesian and polar coordinates – Change of order of integration – Area as a double integral – Triple integration in Cartesian coordinates.

LAPLACE TRANSFORMS
Transforms of simple functions – Basic operational properties – Transforms of derivatives and integrals – Initial and final value theorems – Inverse transforms – Convolution theorem – periodic functions – Applications of
Laplace transforms for solving linear ordinary differential equations up to second order with constant coefficients only.

**VECTOR CALCULUS**
Gradient, divergence, curl – Solenoidal and irrotational fields – Vector identities (without proof) – Directional derivatives – Line, surface and volume integrals – Statements of Green’s, Gauss divergence and Stroke’s theorems only – Verification and applications to cubes and parallelopipeds only.

**ANALYTIC FUNCTIONS**
Definition of Analytic Function – Cauchy Riemann equations – Properties of analytic functions - Determination of harmonic conjugate – Milne-Thomson’s method – Conformal mappings: \(1/z, az+az+b\) and bilinear transformation.

**COMPLEX INTEGRATION**
Line integral – Cauchy’s integral theorem (without proof ) – Cauchy’s integral formulae (with proof) – application of Cauchy’s integral formulae – Taylor’s and Laurent’s expansions (statements only) – Singularities – Poles and Residues – Cauchy’s residue theorem (with proof) - Evaluation of line integrals.

**TEXT BOOK**

**REFERENCE BOOKS**

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**PURPOSE**
The purpose of this course is to develop comprehension of the rapidly changing technological scenario and the requisite expertise for appropriate selection of materials for specific engineering applications.

**INSTRUCTIONAL OBJECTIVES**
At the end of the course, the student will be able to:
1. Understand electrical properties of materials,
2. Understand the properties and applications of semi conducting materials,
3. Understand general properties and applications of magnetic and dielectric materials,
4. Understand the behavior of materials on exposure to light,
5. Understand general properties and application of modern engineering and bio materials, and
6. Get familiarized with the concepts of Nano Science and Technology.

**ELECTRONIC AND PHOTONIC MATERIALS**
Electronic materials: Importance of Classical and Quantum free electron theory of metals – Fermi energy and Fermi Dirac distribution function – Variation of Fermi level with temperature in intrinsic and extrinsic semiconductors – Hall effect – Dilute Magnetic Semiconductors (DMS) and their applications – High
temperature Superconductivity. Photonic materials: LED and LCD materials – Photo conducting materials – Nonlinear optical materials (elementary ideas) and their applications.

MAGNETIC, DIELECTRIC AND MODERN ENGINEERING MATERIALS

**Magnetic materials:** Ferrites and garnets – Magnetic bubbles and their applications – Giant Magneto Resistance (GMR) – Colossal Magneto Resistance (CMR).

**Dielectric materials:** Various polarization mechanisms in dielectrics (elementary ideas) and their frequency and temperature dependence – Dielectric loss – Piezo electric and ferro electric materials and their applications.

**Modern engineering materials:** Shape memory alloys – Metallic glasses – Advanced ceramics and composites.

BIO MATERIALS

Classification of biomaterials – Comparison of properties of some common biomaterials – Effects of physiological fluid on the properties of biomaterials – Biological responses (extra and intra vascular system) – Metallic, Ceramic and Polymeric implant materials – Introduction to bio sensors and tissue engineering.

NANO MATERIALS AND NANOTECHNOLOGY


MECHANICAL PROPERTIES OF MATERIALS

Stress Strain diagram for different engineering materials – Engineering and true stress strain diagram – Ductile and brittle material – Tensile strength – Hardness – Impact strength – Fatigue – Creep – Fracture (Types and Ductile to brittle transition) – Factors affecting mechanical properties.

PRACTICALS

1. Band gap determination using Post office box.
2. Dielectric constant measurement.
3. Photoconductivity measurement.
4. Resistivity determination for a semiconductor wafer using Four probe method.
5. Determination of Hall coefficient and carrier type for a semiconductor material.
6. To trace the hysteresis loop for a magnetic material.
7. Magnetic susceptibility – Quincke’s method.
8. Determination of thermal conductivity – Lee’s Disc method
9. Visit to Nano Technology Laboratory (optional)

TEXT BOOKS


REFERENCE BOOKS

PURPOSE
To provide a basic understanding of biological mechanisms from the perspective of engineers.

INSTRUCTIONAL OBJECTIVES
To familiarize the students with the basic organization of organisms and subsequent building to a living being. With this knowledge, the student will be then imparted with an understanding about the machinery of the cell functions that is ultimately responsible for various daily activities. Nervous and immune systems will be taught as examples of this signaling machinery.

FROM ATOMS TO ORGANISMS
The Cell: the Basic Unit of Life - Molecular Components of Cells - Expression of Genetic Information - Protein Structure and Function- Cell Metabolism - Cells Maintain Their Internal Environments - Cells Respond to Their External Environments - Cells Grow and Reproduce - Cells Differentiate

THE MOLECULAR DESIGN OF LIFE
Biochemistry and the Genomic Revolution- DNA Illustrates the Relation between Form and Function- Biochemical Unity Underlies Biological Diversity- Chemical Bonds in Biochemistry - Biochemistry and Human Biology- Protein Synthesis Requires the Translation of Nucleotide Sequences Into Amino Acid Sequences-2. Aminoacyl-Transfer RNA Synthetases Read the Genetic Code- A Ribosome Is a Ribonucleoprotein Particle (70S) Made of a Small (30S) and a Large (50S) Subunit-Protein Factors Play Key Roles in Protein Synthesis- Eukaryotic Protein Synthesis Differs from Prokaryotic Protein Synthesis Primarily in Translation Initiation

CATALYTIC STRATEGIES

MECHANOCHEMISTRY

SENSORY AND IMMUNO SYSTEMS
General Principles of Cell Signaling-Signaling via G-Protein-linked Cell-Surface Receptors-Signaling via Enzyme-linked Cell-Surface Receptors-Target-Cell Adaptation-The Logic of Intracellular Signaling: Lessons from Computer-based "Neural Networks"-The Cellular Basis of Immunity-The Functional Properties of Antibodies-The Fine Structure of Antibodies-The Generation of Antibody Diversity-T Cell Receptors and Subclasses-MHC Molecules and Antigen Presentation to T Cells- Cytotoxic T Cells- Helper T Cells and T Cell Activation-Selection of the T Cell Repertoire

TEXT BOOK

REFERENCE BOOKS:
2. Lodish, 2004, “Molecular cell biology” FREEMAN.
<table>
<thead>
<tr>
<th>GE0104</th>
<th>PRINCIPLES OF ENVIRONMENTAL SCIENCE</th>
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**PURPOSE**
The course provides the comprehensive knowledge in environmental science, environmental issues and the management.

**INSTRUCTIONAL OBJECTIVES**
The importance of environmental education, ecosystem and ethics.  
Knowledge with respect to biodiversity and its conservation.  
To create awareness on the various environmental pollution aspects and issues.  
To educate the ways and means to protect the environment.  
Important environmental issues and protection

**ENVIRONMENT AND ECOSYSTEMS**
Environmental education: definition - scope - objectives and importance. Concept of an ecosystem – types (terrestrial and aquatic ecosystems) – structure and function – ecological succession - food chains, food webs and ecological pyramids

**BIODIVERSITY**
Introduction: definition - genetic, species and ecosystem diversity - value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values - threats to biodiversity: habitat loss, poaching of wildlife - endangered and endemic species of India, Conservation of biodiversity: in-situ and ex-situ conservations.

**POLLUTION AND WASTE MANAGEMENT**
Solid waste management: causes - effects of municipal waste, hazardous waste, bio medical waste - process of waste management.

**CURRENT ENVIRONMENTAL ISSUES**
Environmental ethics -issues and possible solutions- population explosion, climatic change, ozone layer depletion, global warming, acid rain and green house effect.  
Sustainable development: definition, objectives and environmental dimensions of sustainable development-environmental audit for sustainable development.

**ENVIRONMENTAL PROTECTION**
National and international concern for environment: Important environmental protection acts in India – water, air (prevention and control of pollution) act, wild life conservation and forest act – functions of central and state pollution control boards - international effort – key initiatives of Rio declaration, Vienna convention, Kyoto protocol and Johannesburg summit.

**TEXT BOOKS**

**REFERENCE BOOKS**
PURPOSE
This course provides comprehensive idea about circuit analysis, working principles of machines and common measuring instruments. It also provides fundamentals of electronic devices, transducers and integrated circuits.

INSTRUCTIONAL OBJECTIVES
At the end of the course students will be able
To understand the basic concepts of magnetic circuits, AC & DC circuits.
To explain the working principle, construction, applications of DC & AC machines and measuring instruments.
To gain knowledge about the fundamentals of electric components, devices, transducers and integrated circuits.

PART A - ELECTRICAL ENGINEERING

ELECTRICAL MACHINES
Definition of mmf, flux and reluctance, leakage flux, fringing, magnetic materials and B-H relationship. Problems involving simple magnetic circuits, Faraday’s laws, induced emfs and inductances, brief idea on Hysteresis and eddy currents. Working principle, construction and applications of DC machines and AC machines (1-phase transformers, 3-phase induction motors, single phase induction motors – split phase, capacitor start and capacitor start & run motors).

AC & DC CIRCUITS
Circuit parameters, Ohms law, Kirchhoff’s law. Average and RMS values, concept of phasor representation. RLC series circuits and series resonance, RLC parallel circuits (includes simple problems in DC & AC circuits) Introduction to three phase systems – types of connections, relationship between line and phase values. (qualitative treatment only)

WIRING & LIGHTING
Types of wiring, wiring accessories, staircase & corridor wiring, Working and characteristics of incandescent, fluorescent, SV & MV lamps. Basic principles of earthing, simple layout of generation, transmission & distribution of power.

TEXT BOOKS

REFERENCE BOOKS

PART B - ELECTRONICS ENGINEERING

ELECTRONIC COMPONENTS AND DEVICES
Passive components: Resistors- Inductors and Capacitors and their types.
Semiconductor: Energy band diagram- Intrinsic and Extrinsic semiconductors- PN junction diodes and Zener diodes – characteristics.
TRANSDUCERS AND MEASURING INSTRUMENTS
Measuring Instruments: Basic principles and classification of instruments, Moving coil and Moving iron instruments, CRO – Principle of operation.

DIGITAL ELECTRONICS & LINEAR ICs

TEXT BOOKS

REFERENCE BOOKS

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<tr>
<th>NE0102</th>
<th>ELEMENTS OF NUCLEAR SCIENCE AND ENGINEERING</th>
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PURPOSE
To introduce to the students the various basic concepts in nuclear science and the theory of nuclear reactors.

INSTRUCTIONAL OBJECTIVES
The objective of this course is to make students familiar with the concepts of radioactivity, nuclear reactions, and reactor physics.

BASIC CONCEPTS IN NUCLEAR PHYSICS
Nuclear constituents – charge, mass, shape, and size of nucleus, Binding energy, packing fraction, nuclear magnetic moment, saturation and short range nuclear forces, Radioactivity – Laws of radioactive decay, half life, mean life, specific activity, Nuclear models – single particle shell model, evidence and limitations of shell model, liquid drop model : Introduction, assumptions, semi-empirical mass formula

MECHANISMS OF NUCLEAR DECAY

NUCLEAR DETECTORS AND ACCELERATORS
Types of detectors, Geiger-Mueller counter, Scintillation counter, classification of accelerators, Cyclotron, Betatron.

INTRODUCTION TO NUCLEAR ENGINEERING
Theories of Nuclear reactions, Conservation laws, Q-value equation, Nuclear fission, explanation on the basis of liquid drop model, energy available from fission, Nuclear chain reaction, Nuclear fusion.

NUCLEAR REACTORS
Nuclear Reactor – Basic principle, classification, constituent parts, Heterogeneous reactor, Swimming pool reactor, Breeder reactor, Heavy water cooled and moderated CANDU type reactors, Gas cooled reactors
TEXT BOOK
D.C. Tayal, Nuclear Physics, Himalayan Publication house, Bombay, 1980.

REFERENCE BOOKS

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<tr>
<th>PD 0102</th>
<th>PERSONALITY DEVELOPMENT - II</th>
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Prerequisite
Nil

PURPOSE
The purpose of this course is to build confidence and inculcate various soft skills and to help students to identify and achieve their personal potential

INSTRUCTIONAL OBJECTIVES
1. To guide thought process.
2. To groom student’s attitude.
3. To develop communication skill.
4. To build confidence.

METHODOLOGY
The entire program is designed in such a way that every student will participate in the classroom activities. The activities are planned to bring out the skills and talents of the students which they will be employing during various occasions in their real life.

1. Group activities + individual activities.
2. Collaborative learning.
3. Interactive sessions.
4. Ensure Participation.
5. Empirical Learning

Puzzles I - Poster design/Caption/Slogan writing (Social issues) - Bone of contention I – debate
Bone of contention II - Puzzle II - Survey and Reporting (favorite channel, music, food)
Interpretation of Visuals of I & II - Vocabulary games III
Book Review - Quiz I - Presentation Skills I
Presentation Skills II - Analytical Thinking - Review

EVALUATION
1. Activities assessed by both group and individual participation
2. Continuous assessment based on daily participation

SCHEME OF INSTRUCTION
Marks allocated for regular participation in all oral activities in class

SCHEME OF EXAMINATION
Complete internal evaluation on a regular Basis
PURPOSE:
To introduce programming languages, C and C++ as tools to solve problems and to provide hands on training.

INSTRUCTIONAL OBJECTIVES:
After completing the course, the students should be able to
Understand the program development life cycle
Design algorithms to solve simple problems using computers
Convert algorithms into C and C++ programs and execute

PROGRAMMING FUNDAMENTALS
Computer Basics; Program Development Life Cycle: Flow Chart, Algorithm, Compilation and Execution; Introduction to C Language: program structure, variables, keywords, data types; Input / Output functions: scanf, printf, simple programs.

DECISION AND LOOP CONTROL STRUCTURE
Logical operators; Decision statements: if/else, switch/case statements; Loop control statements – for, while, do/while.

ARRAYS AND FUNCTIONS
Arrays:
Introduction to arrays; one dimensional arrays: declaration, reading and printing array elements, sorting and searching.

Functions:
Definition; declaration of functions; return statement; recursion.

INTRODUCTION TO OOP CONCEPTS
OOP concepts: data hiding, encapsulation, inheritance, overloading, polymorphism; classes and objects; constructor and destructor; simple program in C++.

INHERITANCE AND OVERLOADING
Inheritance – single, multiple, multilevel; Overloading – Function overloading, Operator overloading.

LIST OF EXERCISES
Note to the Instructors: Design exercise problems to demonstrate the use of C and C++ in the area of specialization.
1. Programs to demonstrate the use of scanf ( ) and printf( ) functions
2. Programs to evaluate arithmetic expressions
3. Programs using conditional statements
4. Programs using for, while, do…while
5. Programs on arrays
6. Programs to perform matrix addition and multiplication
7. Programs to implement functions
8. Programs to illustrate recursion
9. Program to create classes and objects using C++
10. Program to implement Constructor and Destructor in C++
11. Program to implement single inheritance in C++
12. Program to implement Function overloading in C++
13. Program to implement Operator overloading in C++

REFERENCE BOOKS

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(Only First Angle Projection is to be followed)

**PURPOSE**

To draw and interpret various projections of 1D, 2D and 3D objects.
To prepare and interpret the drawings of buildings.

**INSTRUCTIONAL OBJECTIVES**

To familiarize with
- The construction of geometrical figures
- The projection of 1D, 2D & 3D elements
- Sectioning of solids and development of surfaces
- Preparation and interpretation of building drawings

**FUNDAMENTALS OF ENGINEERING GRAPHICS**

Lettering, two dimensional geometrical constructions, conics, representation of three-dimensional objects – principles of projections – standard codes – projection of points.

**PROJECTION OF LINES AND SOLIDS**

Projection of straight lines, projection of solids – auxiliary projections

**SECTIONS AND DEVELOPMENTS**

Sections of solids and development of surfaces.

**PICTORIAL PROJECTIONS**

Conversion of projections: Orthographic projection, isometric projection of regular solids & combination of solids.

**BUILDING DRAWING**

Building Drawing – plan, elevation and section of single storied residential (or) office building with flat RCC roof and brick masonry walls having not more than 3 rooms (planning / designing is not expected in this course).

**TEXT BOOKS**


**REFERENCE BOOKS**

PURPOSE
To provide the students with, hands on experience on different trades of engineering like fitting, carpentry, smithy, welding and sheet metal.

INSTRUCTIONAL OBJECTIVES
To familiarize with
- The basics of tools and equipments used in fitting, carpentry, sheet metal, welding and smithy.
- The production of simple models in the above trades.

LIST OF EXPERIMENTS
EMPHASIS TO BE LAID ON REAL LIFE APPLICATIONS WHEN FRAMING THE EXERCISES.

FITTING
Tools & Equipments – Practice in Filing and Drilling.
Making Vee Joints, Square, dovetail joints, Key Making.

CARPENTARY
Tools and Equipments- Planning practice. Making Half Lap, dovetail, Mortise & Tenon joints, a mini model of a single door window frame.

SHEET METAL
Tools and equipments - Fabrication of a small cabinet, Rectangular Hopper, etc.

WELDING
Tools and equipments - Arc welding of butt joint, Lap Joint, Tee Fillet. Demonstration of Gas welding, TIG & MIG.

SMITHY
Tools and Equipments –Making simple parts like hexagonal headed bolt, chisel.

TEXT BOOKS

REFERENCE BOOKS
SEMESTER III

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<th>LE0201</th>
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PURPOSE
Enabling the Engineering Students to one more Foreign Language, especially German, which is scientific and technical language. This may be useful in the field of employment opportunities as well as helping them to develop projects on browsing German websites.

INSTRUCTIONAL OBJECTIVES
Developing pronunciation so that they can read the text and e-mail during their employment, instructing them to write their own CV and developing a fundamental conversation with any German national.

INTRODUCTION
German Language, Alphabets and Pronunciation.

THEMEN
Name, Land, Leute, Beruf, Familie geschwister, Einkaufen, Reisen, Zahlen, Haus, Freunden, Essen and Stadium, Fest, Zeit.

LISTENING
Listening to the cassette and pay special attention to the meaning and sounds. Listening Comprehension – Announcements / Airport / Station / General.

READING
Listening to the cassette and reading it allowed.
READING COMPREHENSION BASICS / STATION / NEWS / NOTICE BOARDS.

GLOSSARY
Technical Words Lesson (1-5)

TEXT BOOK WITH CASSETTES
1. Grundkurs Deutsch
2. Momentmal (Max Mueller Bhavan – Goethe Institute, Germany).

SCHEME OF EVALUATION
Internal 50 = Listening – 10 Marks, Speaking – 20 Marks, Reading – 10 Marks and Writing = 10 Marks
External 50 – 3 hours final written exam

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PURPOSE
1. In view of globalization, learning Foreign Language by Engineering graduates enhances their employment opportunities.
2. Get awareness of understanding of International culture.
3. Widening the Linguistic Skills of the Students.

INSTRUCTIONAL OBJECTIVES
To learn the scripts of Japanese Languages namely Hiragana, Katakana and Kanji, Vocabularies etc. To learn basic grammar and acquire basic communication skills. To understand Japanese culture.

Alphabets (Hiragana), Self Introduction, Greetings, Classroom expressions, Numbers, Conversation.
Alphabets Hiragana (continued), Vocabularies.
Counters, Time expression, Conversation

Katakana and related vocabulary,
Kanjis – introduction, conversation.


TEXT BOOKS
1. Nihongo Shoho I main Text sold in India by the Japanese Language Teachers Association Pune.
2. Hiragana and Katakana Work Book published by AOTS Japan
3. Grammar and Kotoba (Work Book)
4. Japanese for Dummies. (Conversation) CD.

SCHEME OF EVALUATION
Internal 50 = Listening – 10 Marks, Speaking – 20 Marks, Reading – 10 Marks and Writing = 10 Marks
External 50 = 3 hours final written exam

PLE0205 FRENCH LANGUAGE PHASE I
Prerequisite

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PURPOSE
1. As language skills are as valuable as technical skills knowledge of French enables the engineering graduates in career orientation.
2. As a second international global Lang after English there is a wider choice of job opportunities in the international employment market and also multinationals in India and an understanding of French culture thro language.

INSTRUCTIONAL OBJECTIVES
Characterized by the Roman script, grammar, vocabulary and colloquial expressions are taught which enables them to communicate effectively with any native speaker.

INTRODUCTION AND PRONUNCIATION
Introduction of the French Language, Alphabets and Pronunciation, Greetings (Wishing, Thanking and Bidding good bye), Introducing oneself & someone Presenter quelqu’un et se presenter - conversational French sentences based on the topics discussed above.

VOCABULARY
Numbers and Dates, Days, Months and Seasons, Time, Nouns, Professions and Nationalities. Conversational sentences on weather, time, and professions.

GRAMMAR
Basic Verbs (Avoir, Etre, Aller, Faire) – Conjugation – Present tense, Affirmative, Negative, Interrogative, Adjectives (Qualitative), Subject Pronouns and Disjunctive Pronouns.

CONVERSATION AND LISTENING
Conversational sentences on physical description and expressions with verbs like avoir, etre and faire

GRAMMAR
Prepositions (a, de, dans, en, sur, sous, pour….), Contracted Articles, Question Tag (Qui, Quel, Ou, ……etc)

TEXT BOOK:
1. Panorama – Goyal Publishers
2. Apprenons le Francais I, Sarawathy publication.
SCHEME OF EVALUATION
Internal 50 = Listening – 10 Marks, Speaking – 20 Marks, Reading – 10 Marks and Writing = 10 Marks
External 50 – 3 hours final written exam

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PURPOSE
To equip the students with the knowledge of slightly advanced topics of mathematics.

INSTRUCTIONAL OBJECTIVES
After the completion of the course, the students should be able to apply
1. The rudiments of Fourier series
2. The theory and problems of PDE
3. The applications of PDE to boundary value problems.
4. Fourier transforms and to their branches of engineering.

FOURIER SERIES

PARTIAL DIFFERENTIAL EQUATIONS
Formation – Solution of standard types of first order equations – Lagrange’s equation – Linear homogeneous partial differential equations of second and higher order with constant coefficients - Classification of second order linear partial differential equations.

ONE DIMENSIONAL WAVE & HEAT EQUATION
Boundary and initial value problems - Transverse vibrations of elastic string with fixed ends – Fourier series solutions – One dimensional heat equation - Steady and transient states – problems.

TWO DIMENSIONAL HEAT EQUATION

FOURIER TRANSFORMS

TEXT BOOK

REFERENCE BOOKS


**NE0201 MECHANICS OF MATERIALS**

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**Prerequisite**
Nil

**PURPOSE**
To introduce to the students, the various opportunities in the emerging field of nuclear Engineering and nuclear technologies.

**INSTRUCTIONAL OBJECTIVES**
The Objective of this course is to make students familiar with the important of mechanical properties and its applications.

**STRESSES, PRINCIPLE STRESSES, STRAIN ENERGY**
Basic definitions: Stress-Strain-Shear-Poison’s ratio- 1D Hook’s law and constitutive equation for elastic behaviour-Examples of various stress states 2D and 3D multiaxial stress states -Principal stresses: Theory principle stresses-Calculations of Octahedral and maximum shear stress, Stress-Strain Temperature relations-Stress– Strain diagram for different engineering materials - Strain Energy: Strain energy Density-Stress concentration.

**SHAFTS & DEFLECTION OF BEAMS**
Introduction to Shafts- Plastic Deformation in circular Shafts - Thin-Walled Hollow shafts-Deflection of Beams: Introduction-Deformation of a beam under Transverse loading-Direct Determination of the elastic curve from the Load distribution-Method of Superposition-Application of Superposition to statically indeterminate Beams.

**COLUMNS& ECCENTRIC LOADING**
Introduction-Stability of Structures-Euler’s Formula for Pin-ended columns-Extension of Euler’s formula to columns with other end condition-Eccentric loading: The Secant formula Design of column under a centric load- Design of column under an Eccentric load.

**ENERGY METHODS & BEAMS OF ELASTIC FOUNDATIONS**

**FAILURE CRITERIA**

**TEXT BOOK**

**REFERENCE BOOKS**

**NE0203 NEUTRON PHYSICS**

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**Prerequisite**
Nil

**PURPOSE**
The ultimate aim of this course is to have deeper understanding of the contemporary and the recent researches in nuclear engineering applications
INSTRUCTIONAL OBJECTIVES
This course is intended to provide the students with description of the computational methods for neutron physics research.

INTRODUCTION/REACTOR LAYOUT AND CLASSIFICATION
Chart of nuclides/neutron sources- Neutron reactions/Boltzman distribution/number density- Neutron cross-sections- Binding energy/liquid drop model/fission process- Tour of MIT research reactor- Burners, converters, breeders/neutron life cycle-Neutron life cycle- Criticality accidents/why is radiation dangerous- Neutron flux, reaction rates, current-One velocity model

CRITICALITY CONDITIONS AND KINEMATICS OF NEUTRON SCATTERING
Non-multiplying media- Multiplying media-Criticality conditions- Kinematics of neutron scattering- Group diffusion method- Solution of group equations

FLUX,GROUP THEORY AND MONTE CARLO METHODS
Energy dependence of flux- Group theory/four factor formula-Reactors of finite size- Reactors of multiple regions: One group- Reactors of multiple regions: Two group- Application of the two-group equations- Few group and multi-group approaches- Monte Carlo analysis

REACTOR OPERATION AND FEEDBACK
Subcritical multiplication and reactor startup- Reactor operation without feedback- Analytic solution of reactor kineticsDynamic period and inhour equation- Reactor operation with feedback effects- Achievement of feedback effects/Chernobyl

TMI
Shutdown margin/review of TMI

TEXT BOOK

REFERENCES

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PURPOSE
To introduce to the students, the various opportunities in the emerging field of nuclear Engineering and nuclear technologies.

INSTRUCTIONAL OBJECTIVES
The objective of this course is to make students familiar with the important of nuclear environments, characterisation and materials selection for nuclear applications.

NUCLEAR MATERIAL
CHARACTERISTICS OF NUCLEAR MATERIALS
Radiation, Fission, reactor and reactor elements, characteristics of fission materials-Density – Melting point-

APPLICATION OF RADIOISOTOPES
Nuclear systematics - naturally occurring radioactive isotopes and series - instrumental techniques for detection and measurement of radioactivity - radioactive methods for prospecting and assaying of mineral (radioactive and non-radioactive) deposits - applications of radioactivity and radon in prospecting for oil and hydrocarbon deposits - applications of radiometric studies to paleoseismology-Radioisotopes and applications in industry and medicine.

RADIATION APPLICATIONS
Radiotracing principle and techniques-Radiotracers applications to engineering processes-Radiogauging principles, techniques and applications- Radiation shielding- Environmental transport of radionuclides.

NUCLEAR REACTOR & APPLICATIONS
Thermal Parameter-sources and distribution of thermal loads in nuclear Power reactor- Conservation equation and their applications to nuclear power systems - Nuclear reactor materials and applications-Nuclear imaging- Nuclear waste management.

TEXT BOOK

REFERENCE BOOKS

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PURPOSE
To introduce to the students, the various opportunities in the emerging field of nuclear technology.

INSTRUCTIONAL OBJECTIVES
The objective of this course is to make students familiar with the energy exchange processes due to temperature differences (Heat transfer) that are relevant to nuclear energy systems.

INTRODUCTION
Fundamental Concepts, Fluid Motion, Viscosity Hydrostatics and Manometry, Force on Submerged Surfaces.

SYSTEMS AND CONTROL VOLUMES

KINEMATICS
Momentum Equation, Incompressible Inviscid flow: Pressure and Measurement, Energy and Bernoulli Equations Dimensional Analysis: Flow Similarity and Scaling Internal

LAMINAR FLOW
TURBO MACHINERY ANALYSIS

TEXT BOOK

REFERENCE BOOKS

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PURPOSE
To introduce to the students, the basic concepts and knowledge about thermodynamic laws and relations

INSTRUCTIONAL OBJECTIVES
The objective of this course is to make students familiar with the important concepts of thermodynamics applicable to nuclear engineering.

BASIC CONCEPTS OF THERMODYNAMICS

THERMODYNAMIC LAWS AND ENTROPY

THERMODYNAMIC RELATIONS
Gas Mixtures – Dalton’s law of partial pressures – P-v-T behaviour of gas mixtures– Property calculations..

HEAT AND MASS TRANSFER

POWER GENERATION
Superheater, reheater and Intercoolers in Gas-Turbine power plants- Hydro power plants - turbine characteristics.

**TEXT BOOKS**
1. H.B. Callen, Thermodynamics and an Introduction to thermostatistics, John Wiley, Toronto, 1985

**REFERENCE BOOKS**

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<th>PD0201</th>
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**PURPOSE**
The purpose of this course is to build confidence and inculcate various soft skills and to help students to identify and achieve their personal potential.

**INSTRUCTIONAL OBJECTIVES**
1. To guide thought process.
2. To groom student’s attitude.
3. To develop communication skill.
4. To build confidence.

**METHODOLOGY**
The entire program is designed in such a way that every student will participate in the class room activities. The activities are planned to bring out the skills and talents of the students which they will be employing during various occasions in their real life.

1. Group activities + individual activities.
2. Collaborative learning.
3. Interactive sessions.
4. Ensure Participation.
5. Empirical Learning

Goal Setting - Problem Solving - Emotional Quotient

Assertiveness - Stress Management - Quiz II

Lateral Thinking (Situational) - Team Work (Role Plays) Impromptu - Text Analysis

Business plan presentation I - Business plan presentation II - Chinese Whisper

Picture Perfect - Case Studies – Review

**SCHEME OF INSTRUCTION**
Marks allocated for regular participation in all oral activities in class

**SCHEME OF EXAMINATION**
Complete internal evaluation on a regular basis.
NE 0211  THERMODYNAMICS LAB

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Prerequisite
Nil

PURPOSE
This laboratory class will teach the students to know about the fundamental laws of Thermo dynamics and its applications

INSTRUCTIONAL OBJECTIVES
1. To learn and understand the principles of thermal and mechanical energy. This includes the study of energy transformations and thermodynamic relationships applied to flow and non-flow processes in power and refrigeration cycles.
2. To provide the student the necessary analytical skills to solve and analyze a variety of energy related problems.

LIST OF EXPERIMENTS
1. Temperature sensor Calibration
2. EES-Energy transfer
3. Calorimeter
4. EES first law of thermo dynamics
5. EES second law of thermo dynamics
6. EES – refrigeration cycle, internal combustion engine simulation
7. Refrigeration cycle
8. Energy balance experiment (1st law Experiment)

REFERENCE
1. Laboratory manual

NE 0213  NUCLEAR THERMO-HYDRAULICS LAB-I

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Prerequisite
Nil

PURPOSE
This course will acquaint students with various fluid flow and heat transfer phenomena seen in nuclear reactor systems and design.

INSTRUCTIONAL OBJECTIVES
1. Gain knowledge on working of Flow meters
2. Able to compare performance of various machines at different operating points.

LIST OF EXPERIMENTS
1. Basic Hydrostatic Pressure and Manometer Experiment
2. Reynolds Experiment
3. Flow Meters and DP Measurements
4. Flow around Bodies
5. Turbulence and Vortex Visualization in a Vertical Channel
6. Pipe Friction and Similarity Law
7. Drag Force on Spheres

REFERENCE
1. Laboratory manual
## SEMESTER IV

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**Prerequisite**

LE0201

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### PURPOSE

Enabling the Engineering Students to one more Foreign Language, especially German, which is scientific and technical language. This may be useful in the field of employment opportunities as well as helping them to develop projects on browsing German websites.

### INSTRUCTIONAL OBJECTIVES

Developing pronunciation so that they can read the text and e-mail during their employment, instructing them to write their own CV and developing a fundamental conversation with any German national.

### SPEAKING;

Dialogue – Questioning / Basic queries / Conversational with practical exposure.

### GRAMMATIK (WRITING)


### GLOSSARY

Technical words. Lesson (6-10)

### TEXT BOOK WITH CASSETTES

- Grundkurs Deutsch
- Mo’ntmal (Prescribed by Max Mueller Bhavan – Goethe Institute, Germany).

### SCHEME OF EVALUATION

Internal 50 = Listening – 10 Marks, Speaking – 20 Marks, Reading – 10 Marks and Writing = 10 Marks

External 50 – 3 hours final written exam

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### PURPOSE

In view of globalization, learning Foreign Language by Engineering graduates enhances their employment opportunities.

Get awareness of understanding of International culture.

Widening the Linguistic Skills of the Students.

### INSTRUCTIONAL OBJECTIVES

- To learn the scripts of Japanese Languages namely Hiragana, Katakana and Kanji, Vocabularies etc.
- To learn basic grammar and acquire basic communication skills. To understand Japanese culture.
- Lesson 2- {Korewa Tsukue desu } – Grammar, Sentence pattern, Marume . Conversation
- Lesson 4– {Asokoni hito ga imasu} - Grammar, Sentence pattern, Marume . Conversation.
- Lesson 5– {Akairingo wa ikutsu arimasu ka}-Grammar, Sentence pattern, Marume . Conversation.
- Lesson 6– {Barano hana wa ippon ikura desu ka}- Grammar, Sentence pattern.Marume.Conversation

### TEXT BOOKS

1. Nihongo Shoho Imain Text sold in India by the Japanese Language Teachers Association Pune.
2. Hiragana and Katakana Work Book published by AOTS Japan
3. Grammar and Kotoba ( Work Book )
4. Japanese for Dummies.(Conversation) CD.
SCHEME OF EVALUATION
Internal 50 = Listening – 10 Marks, Speaking – 20 Marks, Reading – 10 Marks and Writing = 10 Marks

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PURPOSE
1. As language skills are as valuable as technical skills knowledge of French enables the engineering graduates in career orientation.
2. As a second international global Lang after English there is a wider choice of job opportunities in the international employment market and also multinationals in India and an understanding of French culture thro language.

INSTRUCTIONAL OBJECTIVES
Characterized by the Roman script, grammar, vocabulary and colloquial expressions are taught which enables them to communicate effectively with any native speaker

Sports (Ski, natation, tennis, Tour de France), Cuisine (French dishes), Cinema (Review of a film) – Articles on these topics and group discussion will be followed.

GRAMMAR
Possessive Adjectives, Demonstrative Adjectives, Past tense – Passé Compose (Verbe Auxiliare: Etre et Avoir)
Culture and Civilization French Monuments (Tres celebres), French History (Jeanne d’ Arc, Louis XIV, Prise de la Bastille), Culture and Civilisation (vin, fromage, mode, parfums)

Transport system, government and media in France – articles on these topics.

Comprehension and Grammar Comprehension passages and conversational sentences in different situations (at the restaurant, at the super market)

TEXT BOOK:
1. Panorama – Goyal Publishers
2. Apprenons le Francais II, Sarawathy Publications

SCHEME OF EVALUATION
Internal 50 = Listening – 10 Marks, Speaking – 20 Marks, Reading – 10 Marks and Writing = 10 Marks
External 50 – 3 hours final written exam

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PURPOSE
To introduce the students to the idea of probability and random process, an important mathematical tool in signal processing.

INSTRUCTIONAL OBJECTIVES
At the end of the course, the students should be fully equipped with the knowledge of
1. Probability and Random variables
2. 2 – D Random variables
3. The concepts of Random process
4. The Correlation Functions and
5. The applications of Fourier Transforms like Spectral Density and others.
PROBABILITY AND RANDOM VARIABLES:

TWO DIMENSIONAL RANDOM VARIABLES

RANDOM PROCESSES

CORRELATION FUNCTIONS:
Autocorrelation function and its properties – Cross Correlation function and its properties – Linear System with Random inspects.

SPECTRAL DENSITY

TEXT BOOK

REFERENCE BOOK
Trivedi K S, “ Probability and Statistics with reliability, Queueing and Computer Science Applications”, Prentice Hall of India, New Delhi, 1984

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<th>NE0204</th>
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PURPOSE
To introduce to the students, the various opportunities in the emerging field of nuclear technology.

INSTRUCTIONAL OBJECTIVES
The objective of this course is to make students familiar with the energy exchange processes due to temperature differences (Heat transfer) that are relevant to nuclear energy systems.

INTRODUCTION

ONE-DIMENSIONAL AND TWO-DIMENSIONAL, STEADY-STATE CONDITION

TRANSIENT CONDUCTION AND CONVECTION
The Lumped Capacitance Method - Validity of the Lumped Capacitance Method - General Lumped Capacitance Analysis - Spatial Effects - The Plane Wall with Convection - Radial Systems with Convection - The Semi-Infinite Solid - Objects with Constant Surface Temperatures or Surface Heat Fluxes - Periodic Heating - Finite-Difference Methods
The Convection Boundary Layers - Local and Average Convection Coefficients - Laminar and Turbulent Flow -
The Boundary Layer Equations.

INTERNAL - EXTERNAL FLOW AND CONVECTION
The Empirical Method - The Flat Plate in Parallel Flow - Methodology for a Convection Calculation - The Cylinder in Cross Flow - The Sphere. Hydrodynamic Considerations - Thermal Considerations - The Energy Balance -
Physical Considerations - The Governing Equations - Similarity Considerations - Laminar Free Convection on a
Vertical Surface - The Effects of Turbulence - Empirical Correlations.

BOILING AND CONDENSATION
Boiling and Condensation, Heat Exchanges, Radiation: Processes and Properties, Radiation Exchange between
Surfaces, Diffusion Mass Transfer.

TEXT BOOK

REFERENCE BOOKS
Sons (2007)

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<th>NE0206</th>
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PURPOSE
To introduce to the students, the various opportunities in the emerging field of nuclear engineering.

INSTRUCTIONAL OBJECTIVES
The objective of this course is to make students familiar with the important concepts applicable to controlled
thermonuclear fusion and its application in the field of power production.

NUCLEAR FUSION
Fusion power generation, concept of cross section, mean free path and collision frequency. Radiation losses.
fusion reactor energy, system energy balance, plasma heating, Lawson criterion.

PLASMA PHYSICS
Nature of plasma, plasma characteristics, magnetic configuration and particle orbit, plasma as magneto
hydrodynamic (MHD) fluid. MHD macroscopic equilibrium and stabilities. MHD relaxation confinement

THERMONUCLEAR FUSION-I
Open magnetic confinement – magnetic and kinetic pressure, magnetic flux surfaces, magnetic mirrors,
instabilities in mirror fields. Classical mirror confinement.

THERMONUCLEAR FUSION-II
Closed magnetic systems - Torroidal fields, Tokamak features, particle trapping.
Tokamaks-devices, equilibrium, beta limit of elongated plasma, impurity control, scrap- off layer and divertor,
boot strap current. Neoclassical tearing mode.

APPLICATION OF THERMONUCLEAR FUSION
Reversed field pinch (RFP) stellarator - configuration, relaxation, confinement. Oscillating field device,
stellarator- helical field, stelarator devices, neoclassical diffusion in helical field, confinement of stellarator
system.
TEXT BOOKS
1. Kenro Miyamoto, “Plasma physics and controlled nuclear fusion”, springer, 2005

REFERENCE BOOKS
2. A.A.Harms, “Principles of fusion energy”, world scientific, 2000

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PURPOSE
To introduce to the students, the various concepts in the design of nuclear reactors and power plants.

INSTRUCTIONAL OBJECTIVES
The objective of this course is to make students familiar with the important concepts applicable in the design of nuclear plants and reactors, their fundamental performance principles, concepts and modeling techniques.

REACTOR HEAT GENERATION
Energy release and deposition, Heat generation parameters, Neutron flux distributions and power profiles in reactor cores, Power peaking factors, Heat generation in the structure, Reactor shutdown heat generation

REACTOR HEAT REMOVAL
Heat transfer via thermal conduction, Thermal properties of fuel materials, Radial steady-state temperature distribution in fresh fuel and restructured fuel elements, Heat transfer via convection in single-phase coolants, Radial heat transfer from fuel element to coolant, Hydraulic flow in heated channels, heat transfer coefficients, Axial steady-state temperature distribution in fuel elements, Boiling heat transfer in nuclear reactors, Pressure drop through primary coolant loop, Heat removal and pumping power

NUCLEAR REACTOR DESIGN
Hot channel, hop spot factors, statistical methods, Overall hot channel factor, Applications of hot channel factors, Determination of reactor core characteristics (thermal – hydraulic analysis), Thermal design limits and safety margins, Figures of merit for core thermal performance

DESIGNS OF NUCLEAR POWER PLANTS
Pressurized Water reactors, Boiling water reactors, gas-cooled reactors, heavy water reactors, liquid metal-cooled fast reactors

TRANSIENT ANALYSIS (DYNAMICS AND SAFETY)
Temperature coefficients of reactivity, reactivity feedback, Loss-of-cooling accidents, Reactivity insertion accidents, Containment pressurization process, Response of a PWR pressurizer to load changes, Nuclear Power Plant control

TEXT BOOK

REFERENCE BOOKS
PURPOSE
To introduce to the students, the various opportunities involved in the field of Applied Radiochemistry

INSTRUCTIONAL OBJECTIVES
The objective of this course is to make the students familiar with the important concepts in the field of Applied Radiochemistry.

INTRODUCTION TO RADIOCHEMISTRY
Mass defect, binding energy, mean binding energy of stable nuclei. Disintegration theory-Nuclear stability and group displacement law. Synthesis of radioisotopes: 14C, 3H, 35S, 36Cl, 82Br, 131I, 32P. Contribution of the discovery of artificial radioactivity in the field of heavy element chemistry.

DETECTION AND MEASUREMENT OF RADIOACTIVITY
Ionization chamber, Geiger- Muller, proportional, scintillation counters, Wilson cloud chamber, Health physics instrumentation-Film badges, Pocket ion chambers, portable counters and survey meters, Accelerators: Van de Graff and cyclotron.

ISOTOPE EFFECTS AND ISOTOPIC EXCHANGE REACTIONS
Isotope effect-Definition, physical and chemical isotope effects- Generalities of isotope effects- Isotopic exchange: basic concept, characteristics of isotopic exchange, mechanism of isotopic exchange - kinetics of homogenous and heterogeneous isotopic exchange reactions, self diffusion, and surface measurements.

INTERACTION OF RADIATION WITH MATTER
Primary radiation – Chemical Process, Direct interaction of radiation with matter, ionization, excitation, neutron impact. Basic reactions involving active species produced in the primary act, and Radiation dosimetry.

TRACERS
Selection of radioisotopes as tracer-Application of radioisotopes as tracers-analytical,-physico- chemical, medical, agriculture and industrial applications-Neutron activation analysis- Radiometric titrations and isotope dilution techniques- Radiopharmaceutical, radioimmunoassay and radiation sterilization.

TEXT BOOK

REFERENCE BOOKS
The relationship between load and resistance offered by material through equilibrium compatibility and material property.

INTRODUCTION TO MECHANICS

PROPERTIES OF SURFACE AND SOLIDS
Determination of areas and volumes – first moment of area and the centroid of sections – rectangle, circle, triangle, T section, I section, Angle section, hollow sections by using standard formula – second and product moments of plane, area for rectangle, triangle, circle, T, I, Angle sections, hollow sections by standard formula – parallel and perpendicular axis theorem, polar moment of inertia – mass moment of inertia for rectangular, prism, sphere – (simple problems only).

MECHANICS OF DEFORMABLE BODIES

TEXT BOOK

REFERENCE BOOKS

PART – B FLUID MECHANICS

PURPOSE
To learn fundamental concepts in the field of fluid mechanics.

INSTRUCTIONAL OBJECTIVES
1. To know the importance, application and inter-relationship of various properties of fluid.
2. To study theories those explain the behaviour and performance of fluid when the fluid is in motion.
3. To study theories those explain the behaviour and performance of fluid when the fluid is flowing through the pipe.

FLUID PROPERTIES

FLUID KINEMATICS
FLUID DYNAMICS AND FLOW THROUGH PIPES

TEXT BOOK

REFERENCE BOOKS

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PURPOSE
The purpose of this course is to build confidence and inculcate various soft skills and to help students to identify and achieve their personal potential

INSTRUCTIONAL OBJECTIVES
1. To guide thought process.
2. To groom student’s attitude.
3. To develop communication skill.
4. To build confidence.

METHODOLOGY
The entire program is designed in such a way that every student will participate in the class room activities. The activities are planned to bring out the skills and talents of the students which they will be employing during various occasions in their real life.
1. Group activities + individual activities.
2. Collaborative learning.
3. Interactive sessions.
4. Ensure Participation.
5. Empirical Learning

Motivation II - Interpretation of Visuals of I & II
Humor in real life - Body language - Collage and poster designing and slogan writing
Brain Teasers – JAM - Current News Update I
Current News Update II - Enactment (SKIT –I) - Enactment (SKIT – II)
Survey and Reporting (heroes, sports persons etc.) - Quiz III – Review

EVALUATION:
1. Activities assessed by both group and individual participation
2. Continuous assessment based on daily participation

SCHEME OF INSTRUCTION
Marks allocated for regular participation in all oral activities in class

SCHEME OF EXAMINATION
Complete internal evaluation on a regular Basis
NE 0214 | NUCLEAR THERMO-HYDRAULICS LAB-II | L 0 | T 0 | P 3 | C 2
| Prerequisite
| Nil

PURPOSE

This course will teach students various techniques of detecting and making measurements of nuclear or high energy radiation through hands-on radiation experiments.

INSTRUCTIONAL OBJECTIVES

1. Gain knowledge on working of Flow meters
2. Able to compare performance of two phase regimes

LIST OF EXPERIMENTS

1. Two-Phase Natural Circulation
2. Two-Phase Flow Regimes
3. Thermal Conduction
4. Natural and Forced Convection
5. Pool Boiling
6. Critical Flow and Phase Change (Blow down Expt.)

REFERENCE

1. Laboratory manual

NE0216 | FLUID MECHANICS LAB | L 0 | T 0 | P 3 | C 2
| Prerequisite
| Nil

PURPOSE

To enable the students to acquire knowledge of flow meters. Give student insight into working of various fluid machines and be able to compare performance of fluid machines under different working conditions.

INSTRUCTIONAL OBJECTIVES

Gain knowledge on working of centrifugal pumps, positive displacement pumps, hydraulic turbines centrifugal blowers and steam turbines.
Able to compare performance of various machines at different operating points.
To gain the knowledge of various flow meters and the concept of fluid mechanics.

LIST OF EXPERIMENTS

1. Determination of coefficient of discharge of orifice meter.
2. Determination of coefficient of discharge of venturi meter.
4. Verification of Bernoulli’s theorem.
6. Performance test centrifugal blower with different impellers.
7. Performance test on reciprocating air compressor.

REFERENCE

1. Laboratory manual
PURPOSE
To provide a complete review of Nuclear Science and Engineering topics covered in the first four semesters, so that a comprehensive understanding is achieved. It will also help students to face job interviews and competitive examinations.

INSTRUCTIONAL OBJECTIVES
1. To provide overview of all Nuclear Science and Engineering topics covered in the first four semesters.
2. To assess the overall knowledge level in the following topics of Nuclear Science and Engineering

COMPREHENSION
A. Review of the topics
B. Seminar/group discussion

Students shall have seminar/group discussion sessions on the topics listed under A above under the guidance of staff.
(Evaluation is based on an end semester examination)
SEMESTER V

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PURPOSE
To provide engineering students with the management skills to enable them to assess, evaluate and take key management decisions by the application of management concepts.

INSTRUCTIONAL OBJECTIVES
At the end of the course, the students are expected to
1. Understand the various key concepts of micro economics.
2. Demonstrate the effect of time value of money and depreciation.
3. Apply the various project management techniques
4. Understand the various issues related to industrial safety.

Role and Importance of Economics for Engineers, Law of demand and supply, Break-even analysis, Pricing Policies.


Marketing Concepts, Marketing Mix, Product life cycle, Plant layout, Plant location, Material Handling, Productivity, Plant Maintenance and Industrial Safety.


TEXT BOOKS

REFERENCE BOOKS
2. Prasanna Chandra, “Finance Sense for non-finance executives”, TMH.

<table>
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PURPOSE
To empower the students in the emerging field with the futuristic opportunities of Molecular and cell biology

INSTRUCTIONAL OBJECTIVES
The objective of this course is to make the students familiar with the recent tasks and by themselves to know about cell systems

INTRODUCTION TO MOLECULAR BIOLOGY
GENETIC ENGINEERING


INTRODUCTION TO CELL BIOLOGY

Introduction - definition, scope, cell organization- Prokaryotic and Eukaryotic. Cell boundries, cell wall-gross layers ie middle lamella, Primary wall, secondary wall - structure, chemistry and functions of cell wall -pits (simple and bordered), Plasmodesmataplasm membrane- occurrence, structure. (light microscopic, electron microscopic and molecular) chemistry, function and origin.

COMPOSITION AND STRUCTURE OF DNA

Occurrence, structure, functions and origin of Endoplasmic reticulum, Golgi bodies, lysosomes, Ribosomes, perioxisomes, Mitochondria and Chloroplast. DNA autonomy of organelles.

NUCLEUS: ORGANISATION AND DIVISION

Nucleus, nuclear membrane, chromosomes, euchromatin, heterochromatin, giant chromosomes polytene and lamprunish. Cell cycle, cell division, mitosis and meiosis, cytokinesis.

TEXT BOOKS


REFERENCES BOOKS

7. Freifelder, D. Microbial

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<th>NE0317</th>
<th>COMPUTERS IN REACTOR ANALYSIS</th>
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PURPOSE

To introduce to the students the basic computational methodsand modern numerical methods used in reactor analysis

INSTRUCTIONAL OBJECTIVES

The objective of this course is to make the students comprehend the theory behind the modern numerical methods and acquire skill in application of various computational methods like MATLAB,FORTRAN and UNIX

MODERN NUMERICAL METHODS

NEURAL COMPUTING IN ENGINEERING - I
Features of membership function - Standard forms and boundaries - Fuzzification - Membership value assignments - Intuition - Inference - Rank ordering - Fuzzy to crisp conversions - Lambda- cuts for Fuzzy sets - Lambda cuts for Fuzzy relations - Defuzzification methods.

NEURAL COMPUTING IN ENGINEERING - II
The Basic Neuron: Introduction - Modeling the single neuron, learning in simple neurons, the perception - a vertical perspective, the perception learning rule, proof, limitations of perceptions.
The Multilayer Perceptron: Introduction, altering the perception model, the new model, the new learning rule, the multi layer perception algorithm, the XOR problem reverted, visualizing network behavior, multi layer perceptions as classifiers, generalization, fault tolerance, learning difficulties, radial basis functions, applications.

UNIX
Overview of Unix-Unix documentation-files, directories - Accounts and processes - Redirections and pipes - Shells - Editing texts-Dot files - Regular expressions - X Windows

MATLAB
Familiarisation with MATLAB- control system tool box, MATLAB- SIMULINK tool box - Determination of step response for first order & second order system with unity feedback & calculations of control system specifications like time constant, % peak overshoot, settling time etc., from the response. - Simulation of step response & impulse response for type-0, type-1 & type-2 system with unity feedback using MATLAB- Determination of root locus, BODE- Plot, NYQUIST- plot using MATLAB - control system toolbox for 2nd order system & determination of different control system specifications from the plot.

TEXT BOOKS

REFERENCE BOOKS

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<th>NE0319</th>
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PURPOSE
The ultimate aim of this course is to have deeper understanding of the contemporary and the recent researches in nuclear engineering applications.

INSTRUCTIONAL OBJECTIVES
This course is intended to provide the students with description of the computational methods for nuclear engineering applications. By the end of the course, the students will be able to perform analytical and numerical calculations necessary in nuclear system research and development.

INTRODUCTION
Course overview- Fundamental concepts- Nuclear energetics-Radioactivity-Binary nuclear reactions, neutron-nuclear reactions- Principles of nuclear reactors, nuclear power
FUNDAMENTALS OF NUCLEAR SYSTEMS
Characteristics of the fission reaction, neutron moderation, practical fission fuels-Reactor power, fuel burn up, and fuel consumption-Neutron chain-reacting systems-Homogeneous and heterogeneous cores, reflectors-Reactor kinetics and dynamics, reactivity feedback- Core composition changes during reactor operation, nuclear system lifetime

MATHEMATICAL DESCRIPTION OF PHYSICAL PHENOMENA: NEUTRON AND MODELLING METHODS
General considerations about reactor physics, engineering requirements- Description of the neutron distribution: fluxes, currents, and sources-Nuclear data, cross sections, and reaction rates- Basic scheme of nuclear system modeling methods-Deterministic modeling of nuclear systems-Neutron balance (conservation) equations

NUCLEAR DATA AND CROSS SECTION PROCESSING
Cross-section data- Evaluated nuclear data files-Introduction to the data formats and procedures of the ENDF-6 system- NJOY nuclear data processing system, multigroup cross section libraries

CORE COMPOSITION CHANGES DURING REACTOR OPERATION
Core composition changes-Nuclide production-destruction equations, adiabatic fuel depletion modeling-Equilibrium fuel cycle-Solution of the nuclide production-destruction equations-Reactivity effects of fuel composition changes

TEXT BOOK

REFERENCE BOOKS

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PURPOSE
The ultimate aim of this course is to have deeper understanding of the contemporary and the recent researches in nuclear engineering applications

INSTRUCTIONAL OBJECTIVES
The objective is to relate the fundamental physical principles, concepts and modeling techniques to analysis and design of nuclear reactors. It prepares to analyze nuclear reactors including aspects of performance, dynamics and safety and to either develop new designs or to assess existing or proposed designs based upon fundamental understanding of reactor physics.

INTRODUCTION
Course overview -Neutron nuclear reactions -Neutron chain fission reactions - Classification of nuclear reactors

ONE-GROUP DIFFUSION THEORY, MULTIREGION REACTORS
One-dimensional two-region reactor - Reflected reactor; reflector savings- Numerical solutions of one-group diffusion problems

MULTIGROUP DIFFUSION THEORY
Multigroup diffusion theory - Analytical solutions of 2-group diffusion problems - Collapsing multigroup cross sections
REACTOR KINETICS AND DYNAMICS
General considerations about reactor dynamics, classification of time problems-Delayed neutrons-The transport equation with delayed neutrons-Reactor kinetics equations under diffusion approximation-Point reactor kinetics equations-Solution of the point kinetics equations, inhour equation, period-reactivity relations

POINT REACTOR KINETICS
Delayed fission neutrons - Point kinetics problems and their approximate Solutions- Numerical solutions of point kinetics problems

TEXT BOOK

REFERENCES

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<th>NE0323</th>
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PURPOSE
The purpose of this course is to expose the student to the use of ionizing radiation and its biological effects in the medical field.

INSTRUCTIONAL OBJECTIVES
The student will
1. Understand the use of ionizing radiation in medical and industrial applications.
2. Understand the biological effects of low and high doses of ionizing radiation.

ACTION OF RADIATION IN LIVING CELLS
Various theories related to radiation at cellular level. DNA and chromosomal damages.

SOMATIC APPLICATION OF RADIATION
Radio sensitivity protocols of different tissues of human. LD50/30 effective radiation on skin, Bone marrow, eye, endocrine glands, and basis of radio therapy.

GENETIC EFFECTS OF RADIATION
Threshold and linear dose, gene control hereditary diseases effect of dose.

EFFECT OF MICROWAVE AND RF WITH MATTERS
Effects of various human organs and systems. Wavelength in tissue, non thermal interaction. Standards of protection, national and international standards and precautions.

UV RADIATION
Classification of sources, measurement, photo medicine, UV radiation safety visible and infrared radiation.

TEXT BOOK

REFERENCE BOOK
PURPOSE
The purpose of this course is to build confidence and inculcate various soft skills and to help students to identify and achieve their personal potential

INSTRUCTIONAL OBJECTIVES
At the end of the course the students will be able to
1. Acquire the important soft skills for employment
2. Take part in group discussions and job interviews confidently
3. Appear for placement aptitude tests confidently
4. Gain self confidence to face the placement process

METHODOLOGY
The entire program is designed in such a way that every student will participate in the class room activities. The activities are planned to bring out the skills and talents of the students which they will be employing during various occasions in their real life.
1. Group activities + individual activities.
2. Collaborative learning.
3. Interactive sessions.
4. Ensure Participation.
5. Empirical Learning

Syllogism - Binary Logic [cause & effect] - Assertive & Counter Argument - Simple Interest - Time & Work - Time & Distance
Upstream &Downstream Reasoning - Verbal Comprehension I - Verbal Comprehension II - Compound Interest Logarithms - Surds & Indices
Verbal Reasoning I - Verbal Reasoning II - Verbal Reasoning III – Percentage – Test – Averages
Deductive Reasoning I - Deductive Reasoning II - Language Usage I - Decimal Fractions - Profit & Loss – Probability
Language Usage II - Logic Games I - Logic Games II – Area - Pipes & Cisterns – Test

SCHEME OF INSTRUCTION
Marks allocated for regular participation in all oral activities in class

SCHEME OF EXAMINATION
Complete internal evaluation on a regular Basis
LIST OF EXPERIMENTS

1. Study of first order and second order system responses—measurement of system parameters
2. Simulation of step and pulse response using MATLAB
3. Documentation using UNIX
4. 3D Assembly-level/High-level language program for FFT Computation using FORTRAN
5. Determination of root locus using MATLAB
6. Control system toolbox for 2nd order system
7. Determination of different control system specifications from the Nyquist plot

REFERENCE

1. Laboratory manual

<table>
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<th>NE 0327</th>
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PURPOSE

To enable the students to acquire knowledge Detector counting statistics and working principle of detectors

INSTRUCTIONAL OBJECTIVES

Able to compare performance of various detectors at different reactors
To gain the knowledge of alpha and gamma spectrometry

LIST OF EXPERIMENTS

1. G-M Counter characteristics, counting statistics.
2. Scintillation detectors and gamma spectrometry.
3. Multichannel analysis.
4. Semiconductor detectors for alpha and gamma spectrometry.
5. Coincidence measurements.
6. BF 3 counters.
7. Foil Activation.
8. Cadmium ratio measurements.

REFERENCE

1. Laboratory manual

<table>
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PURPOSE

To expose the students to the industrial working environment and make them industry ready.

IMPLEMENTATION

A minimum of 2 weeks in-plant training has to be undergone by the student after 3rd semester but before 5th semester. A certificate from the company to the effect that the student has undergone the training successfully is to be produced by the student. The student is required to present a report on the observations and knowledge gained during the training, which will be evaluated by a panel of senior faculty members.
SEMESTER VI

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<th>NE0320</th>
<th>FUZZY APPROACHES IN ENGINEERING</th>
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**PURPOSE**
To introduce to the students the principles of Fuzzy logic and approaches and to lay emphasis on the fundamentals.

**INSTRUCTIONAL OBJECTIVES**
The objective of this course is to make the students comprehend with the mathematical fundamentals of fuzzy logic theory and to emphasize its applications in engineering.

**INTRODUCTION TO FUZZY SETS**
Crisp sets- Fuzzy sets- Operation and properties- Fuzzy relation- properties - Fuzzy tolerance and equivalence relations – value assignments.

**FUZZY-CRISP CONVERSIONS**

**OPERATIONS ON FUZZY SETS AND FUZZY LOGIC**
Fuzzy Arithmetic, numbers, vectors and the extension principle – Fuzzy numbers – Internal arithmetic - Fuzzy logic- Approximate reasoning- Fuzzy tautologies, contradictions, equivalence and logical proofs- Forms of implication operator- Max-Min Composition – Max Product Composition - other Composition operation.

**FUZZY RULE BASED SYSTEM**

**FUZZY CONTROL SYSTEM**

**TEXTBOOK**

**REFERENCE BOOKS**

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**PURPOSE**
The ultimate aim of this course is to have deeper understanding of the contemporary and the recent researches in nuclear engineering applications.

**INSTRUCTIONAL OBJECTIVES**
This course is intended to provide the students with description of the computational methods for nuclear engineering applications.
NEUTRON MODERATION
Neutron moderation in infinite homogeneous media- Moderation without absorption Moderation with infinitely massive absorber- Moderation with real materials Neutron moderation in finite homogeneous media- Continuous slowing down theory Moderation without absorption, fast non-leakage probability- Moderation with absorption, resonance-escape probability

MULTIGROUP METHOD
Problems posed by the solution of the Boltzmann equation, multigroup method- Multigroup diffusion method- Spectrum calculations and cross section averaging Numerical solution of the multigroup equations, multigroup iteration methods Zero-dimensional multigroup diffusion problem

PERTURBATION THEORY
Motivations for a perturbation theory- Adjoint problem-First-order perturbation theory Applications of first-order perturbation theory

CORE COMPOSITION CHANGES DURING REACTOR OPERATION II
Core management, reload pattern optimization- Reactor properties over life – estimating core life, nuclear fuel management-Fission product buildup (fission product poisoning)

NUCLEAR REACTOR DESIGN PRINCIPLES AND APPLICATIONS OF THE INTRODUCED MODELING TECHNIQUES
Nuclear reactor analysis and design, neutronics and thermo hydraulics coupling- Computational analysis capabilities for Generation IV systems

TEXT BOOK

REFERENCE BOOKS
2. K. O. Ott, W. A. Bezella, Introductory Nuclear Reactor Statics, American

<table>
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PURPOSE
To introduce to the students, the various opportunities in the emerging field of Nuclear fuel system.

INTRODUCTION

FUEL FABRICATION AND ISOTROPIC ENRICHMENT OF URANIUM

POWER REACTOR
Introduction - fission in nature; the fission process - natural fission -fundamentals of fission reactor: fission chain reaction, prerequisites for a reactor - choice of moderator - feed back mechanism - reactor control - decay heat - fission products and transuranics - reactors types.

WASTE TREATMENT
ENVIRONMENTAL RADIOACTIVITY AND SAFETY
Atmospheres - terrestrial environment - artificial radionuclide of special interest - risk assessment management- critical control - THORP.

TEXT BOOK

REFERENCE BOOKS

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PURPOSE
The purpose of this course is to build confidence and inculcate various soft skills and to help students to identify and achieve their personal potential

INSTRUCTIONAL OBJECTIVES
At the end of the course the students will be able to
1. Acquire the important soft skills for employment
2. Take part in group discussions and job interviews confidently
3. Appear for placement aptitude tests confidently
4. Gain self confidence to face the placement process

METHODOLOGY
The entire program is designed in such a way that every student will participate in the class room activities. The activities are planned to bring out the skills and talents of the students which they will be employing during various occasions in their real life.
1. Group activities + individual activities.
2. Collaborative learning.
3. Interactive sessions.
4. Ensure Participation.
5. Empirical Learning

Self Introduction - Narration - Current News Update – Numbers - Height & Distance - Square & Cube Roots

Current Tech Update - Verbal Aptitude Test I - GD –I - Odd man out series - Permutation & Combination - Problems on ages

GD –II - Resume Writing - Mock Interview I / reading comprehension - Problems on trains – Allegation of Mixtures - Test


GD – IV - Verbal Aptitude Test II – Review – Partnership – Puzzles - Test

SCHEME OF INSTRUCTION
Marks allocated for regular participation in all oral activities in class

SCHEME OF EXAMINATION
Complete internal evaluation on a regular Basis

55   NE – 09-10 – SRM – E&T
**NE 0326  NUCLEAR MEASUREMENT LAB-II**

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**Prerequisite**
Nil

**PURPOSE**

To enable the students to acquire knowledge of Neutron reactors working principle and its counters

**INSTRUCTIONAL OBJECTIVES**

Able to compare performance of various kinetics
To gain the knowledge of oscilloscopes and pulsed detection electronics

**LIST OF EXPERIMENTS**

1. Oscilloscopes and Pulse-detection Electronics
2. Geiger-Müller Counters
3. silicon Semiconductor Detectors
4. Stopping Power for Alpha Particles
5. Gamma-Ray Coincidences, Timing, and Compton Scattering Kinematics Measurements
6. Neutron Activation Analysis with HP-Ge Detectors
7. Neutron Detection
8. Natural Uranium-Light Water Subcritical Assembly
9. Neutron Flux Measurement

**REFERENCE**

1. Laboratory manual

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**NE0328  REACTOR LAB**

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**Prerequisite**
Nil

**PURPOSE**

To enable the students to acquire knowledge of reactor operation and its instrumentation

**INSTRUCTIONAL OBJECTIVES**

To gain the knowledge of various accessories used in the reactor
Activation and analysis of neutron data in reactor

**LIST OF EXPERIMENTS**

1. Reactor operation
2. Control rod calibration
3. Reactor power measurement
4. Neutron activation experiments
5. Thermal column and neutron beam port demonstration.
6. Application of reactor physics principals to operation
7. Neutron activation analysis
8. Instrumentation
9. Reactivity evaluation

**REFERENCE**

1. Laboratory manual
PURPOSE
To provide a review of Nuclear Science and Engineering topics covered up to VI semester, so that a comprehensive understanding is achieved. It will also help students to face job interviews and competitive examinations.

INSTRUCTIONAL OBJECTIVES
1. To provide overview of all Nuclear Science and Engineering topics covered up to VI semester.
2. To assess the overall knowledge level in the following topics of Nuclear Science and Engineering.

COMPREHENSION
A. Review of the topics
B. Seminar/group discussion
Students shall have seminar/group discussion sessions on the topics listed under A above under the guidance of staff.

(Evaluation is based on an end semester examination).

PURPOSE
To acquire extramural knowledge on the computer implementation of various engineering solutions.

IMPLEMENTATION
The students are expected to undergo at least two computer courses from a list of courses provided from time to time by the departments of engineering and technology. Resources for conducting the courses will be found from in-house talents and outside professionals with expertise in the particular course. Certification will be done by both the university and the bodies notified for the purpose. The students are required to obtain a minimum grade for gaining the required credit.
SEMESTER – VII

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PURPOSE
The ultimate aim of this course is to have deeper understanding of the contemporary and the recent researches in nuclear engineering applications

INSTRUCTIONAL OBJECTIVES
The objective is to relate the fundamental physical principles, concepts and modeling techniques to analysis and design of nuclear reactors. It prepares to analyze nuclear reactors including aspects of performance, dynamics and safety and to either develop new designs or to assess existing or proposed designs based upon fundamental understanding of reactor physics.

CONCEPT OF CRITICALITY; PRINCIPAL EIGENVALUE & FUNDAMENTAL MODE
Criticality - One-group diffusion theory, bare homogeneous reactor - Criticality search - size and composition effects

HETEROGENEOUS REACTORS
Homogenization of a fuel-moderator assembly - Core homogenization - Effective diffusion theory for control rods - Power peaking factors

TEMPERATURE COEFFICIENTS OF Reactivity
Temperature coefficients of reactivity - Perturbation theory evaluation - Reactivity feedback

CHANGES DUE TO DEPLETION & FISSION PRODUCT BUILDUP
Nuclide production-destruction equations - Reactivity effects of fuel composition changes - Samarium and xenon

NUCLEAR REACTOR ANALYSIS
Nuclear power reactors - Nuclear reactor analysis - Reactor physics and thermodynamics coupling

TEXT BOOK

REFERENCE BOOKS

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PURPOSE
The ultimate aim of this course is to have deeper understanding of the contemporary and the recent researches in nuclear engineering applications

INSTRUCTIONAL OBJECTIVES
The objective is to relate the fundamental physical principles, concepts and modeling techniques to analysis and design of nuclear reactors. It prepares to analyze nuclear reactors including aspects of performance, dynamics
and safety and to either develop new designs or to assess existing or proposed designs based upon fundamental understanding of reactor physics.

SUSTAINABLE DEVELOPMENT AND FAST SPECTRUM SYSTEMS
Spent fuel - light water reactor, light water reactor MOX, fast reactor MOX Radiotoxicity of fission products- Advanced conditioning of minor actinides-Transmutation of minor actinides

PARTITIONING AND TRANSMUTATION SCIENCE AND ENGINEERING IN RADIOACTIVE WASTE MANAGEMENT
Aqueous and pyrochemical reprocessing technologies and recycling of transuranic elements and fission products- Partitioning of minor actinides from aqueous reprocessing streams- Pyrochemical reprocessing Separation of long lived fission and activation products- Conditioning of separated minor actinides- Dual purpose conditioning for transmutation and disposal - inert matrix fuels-Global status of reprocessing

TRANSMUTATION
Physics of transmutation, transmutation efficiency-Transmutation strategies-Homogeneous recycling- Heterogeneous recycling and its potential limitations-Transmutation issues of long-lived fission product-Fuel concepts for transmutation-Transmutation potential of various nuclear systems including dedicated cores- Transmutation systems and safety

FAST REACTORS

HYBRID SYSTEMS
Hybrid system principles-Size of hybrid systems-Practical systems-Evaluation of hybrid systems-Accelerator driven systems – international trends in research and Development-Fusion-driven systems

TEXT BOOK

REFERENCE BOOKS

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<thead>
<tr>
<th>NE 0435</th>
<th>RADIOLOGY MEASUREMENT LAB</th>
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</table>

PURPOSE
To enable the students to acquire knowledge of the construction and operation of general radiographic and fluoroscopic equipment, mammographic unit and dental radiographic equipment.

INSTRUCTIONAL OBJECTIVES
To be familiar with principles of radiographic imaging
To apply this knowledge to the production of radiograph and the assessment of image quality
To understand the construction, operation of imaging and processing equipment, radiation protection and quality control
Control and manipulate parameters associated with exposure and processing to produce a required image of desirable quality.
LIST OF EXPERIMENTS
1. Radioisotope applications
2. Biological effects of ionising radiation
3. X-Ray and related equipment
4. Image characteristics
5. Interaction of ionising radiation with matter
6. Detection of ionising radiation
7. Dosimetry
8. Dental Radiography
9. Mammography
10. Xeroradiography

REFERENCE
1. Laboratory manual

<table>
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<th>Course Code</th>
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Prerequisite
Nil

PURPOSE
To expose the students to the industrial working environment and make them industry ready.

IMPLEMENTATION
A minimum of 2 weeks in-plant training has to be undergone by the student after 5th semester but before 7th semester. A certificate from the company to the effect that the student has undergone the training successfully is to be produced by the student. The student is required to preset a report on the observations and knowledge gained during the training, which will be evaluated by a panel of senior faculty members.

SEMESTER VIII

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ELECTIVES

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<th>HIGH INTENSITY LASER PLASMA INTERACTIONS</th>
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Prerequisite
Nil

PURPOSE
The topic of the course is the physics of the interaction of high intensity light fields with matter and their interactions.

INSTRUCTIONAL OBJECTIVES
The objective of this course is to make the students familiar with the high intensity laser technology, laser plasma physics, and their applications.

HIGH INTENSITY LASER TECHNOLOGY
Ultrashort pulse generation; amplification of femtosecond laser pulses, Ti:Sapphire technology and OPCPA amplifiers; pulse diagnostics; future PetaWatt and ExaWatt laser systems, Electrons in relativistic light fields; introduction into plasma physics; absorption processes; electron acceleration; bubble acceleration; ion acceleration mechanisms

LASER ACCELERATED PARTICLES AND APPLICATIONS
Monoenergetic electron acceleration with lasers, Bremsstrahlung generation and applications in nuclear physics; ion acceleration and applications in accelerator physics; medical applications, strong field quantum electrodynamics with intense laser fields

LASER PLASMA PHYSICS
Coulomb collisions and transport processes, Motion of charged particles in magnetic fields: plasma confinement schemes. MHD models: simple equilibrium and stability analysis, Two-fluid hydrodynamic plasma models: wave propagation in a magnetic field; Introduces kinetic theory; Vlasov plasma model: electron plasma waves and Landau damping.

PLASMA INTERACTIONS
Comprehensive theory of electromagnetic waves in magnetized plasma, Wave propagation in cold and hot plasmas; Energy flow, Absorption by Landau and cyclotron damping and by transit time magnetic pumping (TTMP); Wave propagation in inhomogenous plasma; WKB theory, mode conversion, connection formulae, and Budden tunneling; Applications to RF plasma heating, wave propagation in the ionosphere and laser-plasma interactions.

TEXT BOOK

REFERENCE BOOKS
1. Jung, Ralph Laser-Plasma Interaction with Ultra-Short Laser Pulses, VDM Verlag
2. Jaroszynski Dino a (Author), Bingham R a (Author), Jaroszynski, Dino A. (Editor) Laser-Plasma Interactions, Taylor & Francis Group
PURPOSE
To introduce to the students, the various opportunities in the emerging field of Nuclear Engineering.

INSTRUCTIONAL OBJECTIVES
The objective of this course is to make students familiar with the important concepts applicable to reactor safety methods, analysis and NRC rules and procedures.

OPERATIONAL FEATURES OF NUCLEAR REACTOR SYSTEM – RELVANCE OF SAFETY

REACTOR CONTAINEMENT AND ENGINEERED SAFETY FEATURES

TRANSIENT ANALYSIS AND ACCIDENT ANALYSIS OF REPRESENTATIVE REACTOR TYPES
Reactor physics, Fuel, Fuel element temperatures, Gas pressure inside sheath, Fuel behavior in accidents, Over power, dry out, Low coolant flow, Loss of coolant, Heat transport system, Fuel channels

NRC REGULATIONS AND PROCEDURES
Statement of organization and general information, Rules of practice for domestic licensing proceedings and issuance of orders, Interpretations, Criteria and procedures for determining eligibility for access to restricted data or national security information or an employment clearance, Criteria and procedures for determining eligibility for access to or control over special nuclear material

TYPICAL REACTOR SAFETY ANALYSES
Reactor Safety
Temperature Excursion/Temperature Runaway, Safe Design and Operating Guidelines, Stability Criteria, Catalyst Loading and Preparations, General Emergency Guidelines,

Troubleshooting
High Reactor Pressure Drop, Pressure Drop Buildup During Operating Cycle, Pressure Pulsing of the Reactor, Channeling, Flow Maldistribution, Temperature Maldistribution, Quench Efficiency, Low Initial Catalyst Activity, Loss of Catalyst Activity, Low Temperature Response

TEXT BOOK

REFERENCE BOOKS
4. Hand book of nuclear engineering, Cacuci, Dan Gabriel (Ed)
5. Nuclear Engineering , Glasstone & Sesoske
PURPOSE
The purpose of this course is to introduce the students to the use of special transducers in the field of biomedical instrumentation.

INSTRUCTIONAL OBJECTIVES
At the end of the course the student will be able to
1. The use of force, pressure and motion measurement in the biomedical field.
2. The use of flow, temperature and radiation measurement in the biomedical field.

BIO-SENSORS
Study of biological sensors in the human body and their basic mechanism action organization of nervous system- neuronal mechanism and circuit processing - Study of various corpuscles like pacinian - functions and modelling - Chemoreceptors, hot and cold receptors, barro receptors, sensors for smell, sound, vision, osmolality and taste.

FORCE, PRESSURE AND MOTION MEASUREMENT
Various transducers capable of measuring low pressure and force, its measuring system, external and catheter tip transducers, transducer to measure single movement and differential movement, velocity transducers, seismic pick-up, accelerometer, biomedical applications.

CHEMICAL AND OPTICAL TRANSDUCER
Bio sensors - Ion exchange membrane electrodes- oxygen electrodes- CO2 electrodes enzyme electrode - construction - ISFET for glucose, urea etc. Electrolytic sensors - optical sensor - fiber optic sensors. Ion sensor, cation and anion sensor, liquid and solid ion exchange membrane electrodes, enzyme electrodes, molecular electrode, photo acoustic sensor, PPG sensors, biomedical applications.

TEMPERATURE AND PRESSURE MEASUREMENT
Different Transduction principles - Temperature transducers - thermo resistive transducers, thermoelectric, chemical thermometry. Displacement transducers - potentiometer - resistive strain gauges - inductive displacement - capacitive displacement transducer. Pressure transducer - indirect method - measurement of blood pressure using sphygmomanometer -instrument based on Korotkoff sound, strain gauge and LVDT transducers, capacitive and piezo electric type, catheter tip transducers - measurement of intracranial pressure – cathetertip-implantabletype.

FLOW MEASUREMENT
Flow measurement transducer -Electro magnetic flow meters and ultrasonic blood flow meters - Fibre optic flow transducers & transducers for light . Transducer to measure a velocity, magnitude and direction flow, various methods of measuring the parameter, invivo and invitro type of measurements.

TEXT BOOKS:-
2. R S C Cobbold, *Transducers for Biomedical Instruments*, Prentice

REFERENCE BOOKS
MEDICAL INFORMATICS

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**Prerequisite:** Nil

**PURPOSE**
To give comprehensive idea about multimedia applications in medical field to develop educational / training packages.
To understand the component of virtual reality and virtual reality applications in medicine

**INSTRUCTIONAL OBJECTIVES**
To study the methods utilized for data storage ,data retrieval and analysis
To study the concept of visual programming and to develop VB based medical information systems.
To expose to various applications of computer in medical field like neural network, fuzzy system and virtual reality.
Based on the above knowledge to develop packages for transmission of medical information and for training.

**MEDICAL DATABASE IMPLEMENTATION**
Medical data acquisition and database systems: PC based mutlichannel data acquisition system; storage, analysis and retrieval techniques.

**VISUAL BASIC**
Visual programming concepts; visual Basic environment, tools and controls; Dynamic data exchange; VB based Medical information System.

**COMPUTERS IN SYSTEM DESIGN**
Hospital Information System its design and functional characteristics; Principles and application of Artificial Intelligence, Pattern Recognition, Neural Network and Fuzzy Logic in Medicine.

**MULTIMEDIA AND VIRTUAL REALITY APPLIED TO MEDICINE**
Basic concepts of Multimedia; Design of Multimedia information systems; Components of virtual reality; Virtual reality applications in medicine.

**COMPUTERS IN MEDICAL RESEARCH**
Medical Informatics and its levels; Design and development of educational packages on medical sciences; Integrated design concepts; Interactive multimedia, Virtual and digital libraries, Internet and its applications.

**TEXT BOOK**

**REFERENCE BOOKS**

INTRODUCTION TO REHABILITATION ENGINEERING

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**Prerequisite:** Nil

**PURPOSE**
To familiarize the students with the technology currently used to improve the quality of life of individuals with disabilities, and those recovering from trauma
INSTRUCTIONAL OBJECTIVES
On completion of the course the student will be able to
1. Explain the need for medical aids.
2. Devise new concepts for future development and applications
3. Have a understanding of the orthopedic prosthetics and orthotics in rehabilitation
4. Have a understanding of the sensory rehabilitation systems
   literature Concepts, Engineering Concepts in Sensory Rehabilitation and Motor Rehabilitation, Engineering
   Concepts in Communication Disorders.

ORTHOPEDIC PROSTHETICS AND ORTHOTICS IN REHABILITATION
in customized component design, Example- Intelligent prosthetic knee, hierarchically controlled Prosthetic
Hand.

WHEELED MOBILITY: WHEELCHAIRS AND PERSONAL TRANSPORTATION
Categories of Wheelchairs, Wheelchair structure and Component design, Ergonomics of Wheelchair Propulsion,
Power Wheelchair Electrical Systems. Personal Transportation for the Handicap: Vehicle Selection, Lift

SENSORY REHABILITATION SYSTEMS
Tactual Augmentation, Tactual Substitution.

PRINCIPLES OF APPLICATION
Conceptual frameworks, Provision Process, Education and Quality Assurance, Specific Impairments and
Related technologies, Future Developments.

TEXT BOOKS
1. Robinson C.J., Rehabilitation Engineering Handbook of Electrical Engineering, CRC Press,
   Bocaration 1993.
2. The biomedical engineering handbook, by joseph d. brozino

REFERENCE BOOK
1. Keswick. J., What is Rehabilitation Engineering, Annual Reviews of Rehabilitation-Springer-Verlag,

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<th>NE0006</th>
<th>HUMAN ASSIST DEVICES</th>
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PURPOSE
To understand functioning and usage of electromechanical units which will restore normal functional ability of
particular organ which is defective temporarily or permanently.

INSTRUCTIONAL OBJECTIVES
To study various mechanical techniques that will help failing heart.
To study the functioning of the unit which does the clearance of urea from the blood?
To understand the tests to assess the hearing loss and development of electronic devices to compensate for the
loss.
To study the various orthodic devices and prosthetic devices to overcome orthopedic problems.
To understand electrical stimulation techniques used in clinical applications.

CARDiac ASSIST DEVICES
Principle of External counter pulsation techniques, intra aortic balloon pump, Auxiliary ventricle and schematic
for temporary bypass of left ventricle, prosthetic heart valves.
HEMODIALYSERS
Artificial kidney, Dialysis action, hemodialyser unit, membrane dialysis, portable dialyser monitoring and functional parameters.

HEARING AIDS
Common tests – audiograms, air conduction, bone conduction, masking techniques, SISI, Hearing aids – principles, drawbacks in the conventional unit, DSP based hearing aids.

ORTHOSTHETIC AND ORTHODIC DEVICES
Hand and arm replacement – different types of models, externally powered limb prosthesis, feedback in orthodic system, functional electrical stimulation, Sensory assist devices.

STIMULATOR AND RESPIRATORY ASSIST DEVICES
Stimulation, Practical applications of Stimulation, bio-feedback, Ventilator, IPPB unit, Nebulizer, Humidifier.

TEXT BOOKS

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<th>NE0007</th>
<th>MODELLING OF PHYSIOLOGICAL SYSTEMS</th>
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Prerequisite
Nil

PURPOSE
To understand basic ideas related to modelling and different modelling techniques of certain physiological systems like respiratory system, thermal regulation system and lung model.

INSTRUCTIONAL OBJECTIVES
At the end of this course students are,
1. Able to model any physiological system.
2. Gain thorough knowledge of modelling of thermal regulation system, Respiratory system
3. Pharmacokinetic modeling

Physiological processes and principles of their control flow, gas exchange ultra filtration, biochemical reactions, pneumatic transport, digestion, energy utilization and waste disposal, linear and non linear control systems, principles of open loop and feedback systems techniques for system response characterization – Pupillary control system, characterization of physiological feed back system.

Modeling of human thermal regulatory system: Parameters involved, control system model etc. biochemistry of digestion, types of heat loss from body, models of heat transfer between subsystems of human body like skin core, etc. and systems like within body, body environment etc.

Respiratory system: Modeling oxygen uptake by RBC and pulmonary capillaries, mass balancing by lungs, gas transport mechanism of lungs, oxygen and carbon dioxide transport in blood and tissues. Lung Model.

Ultra Filtration system Transport through cells and tubules, diffusion, facilitated diffusion and active transports, methods of waste removal, counter current model of urine formation in nephron, moellir Henle’s loop.

Modeling body dynamics: Principles of mechanical modeling of bone, tissues etc., and modeling stress were propagation in bones, hills, model of muscle mechanisms current trends: Pharmacokinetic modeling with illustrated example like drug diffusion, computer aided modeling etc.
TEXT BOOKS:
1. *Advanced Methods of Physiological System Modeling* by V.Z. Marmarelis
2. *Applied mathematical model in Human Physiology* by Johnny T. Ottesen, Mette S. Olufsen, Jesper K. Larsen

REFERENCE BOOKS:

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<th>NE0008</th>
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PURPOSE
The ultimate aim of this course is to have deeper understanding of the Nanotechnology.

INSTRUCTIONAL OBJECTIVES
To understand the basic concepts involve in this technology and to explore their limitations.

PRODUCT DESIGN
Concept Generation-Product Architecture-Industrial Design Process-Management of Industrial Process and assessing the quality of insutrial design-Establishing the product specification

PRODUCT DEVELOPMENT
Criteria of selection of product-Product development-Process design of manufacture-Estimate the manufacturing cost-Reduce the support cost-Prototyping-Economics of project development projects-Elements of economic analysis financial models selective analysis and influence of the quantitative factors

MANAGEMENT TECHNIQUES
Technology management-Scientific management-Development of management thought-principals of management functions of management-Planning Organization-Directing staffing and controlling management by objective-SWOT analysis-Enterprise resource planning and supply chain management

ENTREPRENEURIAL COMPETENCE AND ENVIRONMENT
Concept of entrepreneurship - Entrepreneurship as a career personality – Characteristics of a successful entrepreneur - Knowledge and skill required for an entrepreneur - Business environment entrepreneurship development training - Centre and state Govt policies and regulations-International business

MANAGEMENT OF SMALL BUSINESS
Prefeasibility study - Ownership - Budgeting-Project Profile preparation - Feasibility report preparation evaluation criteria market and channel selection product launching monitoring and evaluation of business effective management of small business

TEXT BOOKS :

REFERENCES BOOKS :
(1) S. Rosenthal “ Effective Product Design and Development”, Irwin,1992
(3) J.J Massie,” essentials of Management” Prentice Hall of India Pvt Ltd,1985
PURPOSE
The ultimate aim of this course is to have deeper understanding of the Nanotechnology.

INSTRUCTIONAL OBJECTIVES
To understand the basic concepts involve in this technology and to explore their limitations.

IP LAW BASICS

DESIGN OF IP

PROTECTING CUMULATIVE INNOVATIONS

LICENSING AND JOINT VENTURE

LITIGATION AND ENFORCEMENT

TEXTBOOKS:

REFERENCE BOOKS:
(1) Industrial Organization: Contemporary Theory & Practice, 3e, L. Pepall, D.J. Richards, and G. Norman, South-Western 2005.

PURPOSE
To introduce to the students, the various opportunities involved in the field of Nuclear Power Systems

INSTRUCTIONAL OBJECTIVES
The objective of this course is to make the students familiar with the important concepts of Thermal hydraulics, reactor kinetics process instrumentation and control.

INTRODUCTION TO NUCLEAR POWER SYSTEMS
Thermal parameters - definitions and uses-Sources and distribution of thermal loads in nuclear power reactors-Conservation equations and their applications to nuclear power systems: power conversion cycles.
STRUCTURAL MECHANICS
Fundamentals of structural mechanics-Explanation of concepts involved in structural mechanics-Applications to nuclear systems

NUCLEAR REACTORS

REACTOR KINETICS
Introduction to control theory- Point reactor kinetics with introduction to feedback Effects- Non-linear effects.-Shielding-Introduction to reactor reliability and safety analysis- Radioactive waste disposal.

PROCESS INSTRUMENTATION AND CONTROL
Basic concepts, sensing and transmission/receiving of temperature, flow, liquid level, pressure, force, viscosity, humidity-Nuclear Materials: fabrication and properties of metallic fuels, ceramic fuels, applications.

TEXT BOOK

REFERENCE BOOKS

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<th>OPERATIONS RESEARCH</th>
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PURPOSE
To introduce managerial skill for budding engineers

INSTRUCTIONAL OBJECTIVES
1. To equip the students with scheduling and network analysis
2. To make the students aware of replacement policy and game theory
3. To introduce the topic of inventory control
4. To make students aware of the problems of linear programming

RESOURCE SCHEDULING AND NETWORK ANALYSIS
Problem of sequencing – Sequencing n jobs through 2 machines and 3 machines, 2 jobs through m machines. PERT and CPM –Critical path calculation – Probability and cost consideration.

REPLACEMENT AND GAME THEORY
Replacement Models – Replacement of items that deteriorate with time – Equipment that fails suddenly. Two person zero sum games – Pure strategies and saddle point – Mixed strategies – 2 x n and m x 2 games – Method of dominance – Numerical and graphical solutions.

INVENTORY CONTROL
Inventory models – Deterministic models – Economic ordering quantity, Reorder level, optimum cost – Instantaneous and Non-instantaneous receipt of goods with or without shortages.

LINEAR PROGRAMMING

ADVANCED LINEAR PROGRAMMING PROBLEMS
TEXT BOOK

REFERENCE BOOKS