B.Tech in Mechanical Engineering

Faculty of Engineering

Revised in June 2015
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Vision of the Institute

To be a global leader in the delivery of engineering education, transforming individuals to become creative, innovative, and socially responsible contributors in their professions.

Mission of the Institute:

* To provide best-in-class infrastructure and resources to achieve excellence in technical education,
* To promote knowledge development in thematic research areas that have a positive impact on society, both nationally and globally,
* To design and maintain the highest quality education through active engagement with all stakeholders—students, faculty, industry, alumni and reputed academic institutions,
* To contribute to the quality enhancement of the local and global education ecosystem,
* To promote a culture of collaboration that allows creativity, innovation, and entrepreneurship to flourish, and
* To practice and promote high standards of professional ethics, transparency, and accountability.
**Vision of the Department**

To transform our students into outstanding mechanical engineers with strong domain knowledge and skills, society-centric research intent, and exemplary ethical values, making them the most desired professionals by research institutions, industry, and society.

**Mission of the Department**

- To develop in each student, a profound understanding of fundamentals, motivation for continuous learning, and practical problem-solving skills for building a successful career.
- To create and share technical knowledge and collaborate with Industry and Institutions for the betterment of Society.
- To imbibe ethical values, leadership skills and entrepreneurial skills in students.
- To sustain a conducive environment to involve students and faculty in research and development.
Programme Educational Objectives (PEOs)

The department envisages the students to

- Apply their Knowledge in Science, Mathematics and Engineering to address Industrial and Societal problems with a strong emphasis on creativity, confidence, ethics, and responsibility.
- Apply latest computational, analytical, simulation tools and techniques to develop and improve products and processes.
- Solve multidisciplinary problems by working in cross functional teams.
- Develop and upgrade technical, intellectual and emotional skills for life-long learning to compete in a rapidly evolving world.
- Nurture entrepreneurial ventures and foster research activities that support sustainable economic development to enhance the quality of life.

Programme Specific Outcomes (PSOs)

- Apply knowledge acquired in the field of Design, Manufacturing, Thermal, and Fluid sciences to solve real-world engineering problems using emerging technologies.
- Extend and implement innovative thinking on product design and development with the aid of modern CAD/CAM/CAE tools.
- Apply the Science and Engineering knowledge for materials design and processing for development and improvement of products and processes.

Program Outcomes (POs)

- **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- **Problem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
• **Design/Development of Solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

• **Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

• **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

• **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

• **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

• **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

• **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

• **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

• **Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

• **Life-long Learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
### Semester I

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* A maximum of One Elective course can be chosen from the Electives prescribed for other Branches or from under Science Electives.

** Students undertaking and registering for a Live-in-Lab project, can be exempted from registering for an Elective course in the higher semester.

### Semester VII

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* A maximum of One Elective course can be chosen from the Electives prescribed for other Branches or from under Science Electives.

** Students undertaking and registering for a Live-in-Lab project, can be exempted from registering for an Elective course in the higher semester.

**ELECTIVES**

**DESIGN STREAM**

15MEC230 Aircraft Systems and Engineering
15MEC231 Automotive Chassis Design
15MEC232 Automotive Technology
15MEC233 Condition Monitoring and Diagnostic Maintenance
15MEC234 Design for Manufacture and Assembly
15MEC235 Fracture Mechanics
15MEC236 Materials Selection in Mechanical Design
15MEC237 Mechatronics
15MEC238 Micro-Electro Mechanical Systems
15MEC239 Modelling and Simulation of Engineering Systems
15MEC240 Optimization Techniques in Engineering
15MEC241 Pressure Vessel Design
15MEC242 Theory of Elasticity
15MEC243 Tool Design

THERMAL STREAM

15MEC246 Automotive Electronics
15MEC247 Combustion Engineering
15MEC248 Computational Fluid Dynamics
15MEC249 Design of Thermal Systems
15MEC250 Fluid Power Drives and Controls
15MEC251 Fundamentals of Nuclear Engineering
15MEC252 Gas Dynamics and Jet Propulsion
15MEC253 Internal Combustion Engines and Pollution Control
15MEC254 Petroleum Refinery Engineering
15MEC255 Power Plant Engineering
15MEC256 Refrigeration and Air Conditioning
15MEC257 Renewable Sources of Energy
15MEC258 Turbomachinery
15MEC259 Advanced Fluid Mechanics

MANUFACTURING STREAM

15MEC261 Advanced Casting Technology
15MEC262 Advanced Manufacturing Processes
15MEC263 Advanced Materials and Processes
15MEC264 Advanced Metrology and Sensing Systems
15MEC265 Advanced Welding Technology
15MEC266 CNC Machines
15MEC267 Composite Materials and Processing
15MEC268 Metal Forming Technology
15MEC269 Micro-manufacturing
15MEC270 Modern Practices in Product Design and Manufacture
15MEC271 Non-Destructive Testing
15MEC272 Product Cost Estimation
15MEC273 Quality Control and Reliability Engineering
15MEC274 Simulation, Modelling of Manufacturing Systems

MANAGEMENT ELECTIVES

15MEC331 Engineering Economic Analysis
15MEC332 Enterprise Management
15MEC333 Financial Management
15MEC334 Industrial Engineering
15MEC335 Lean Manufacturing
15MEC336 Managerial Statistics
15MEC337 Marketing Management
15MEC338 Operations Management
15MEC339 Project Management
15MEC340 Supply Chain Management
15MEC341 Total Quality Management

SCIENCE ELECTIVES (3 0 0 3)

15CHY231 Advanced Polymer Chemistry
15CHY232 Biomaterials Science
15CHY233 Catalytic Chemistry
15CHY234 Chemistry of Advanced Materials
15CHY235 Chemistry of Engineering Materials
15CHY236 Chemistry of Nanomaterials
15CHY237 Chemistry of Toxicology
15CHY238 Colloidal and Interfacial Chemistry
15CHY239 Computational Chemistry and Molecular Modelling
15CHY241 Electrochemical Energy Systems and Processes
15CHY242 Environmental Chemistry
15CHY243 Fuels and Combustion
15CHY244 Green Chemistry and Technology
15CHY245 Instrumental Methods of Analysis
15CHY246 Medicinal Organic Chemistry
15CHY247 Modern Polymer Composites
15CHY248 Organic Reaction Mechanisms
15CHY249 Organic Synthesis and Stereochemistry
15CHY250 Polymer Materials and Properties
15CHY251 Polymers for Electronics
15CHY252 Solid State Chemistry
15CHY331 Batteries and Fuel Cells
15CHY332 Corrosion Science
15PHY230 Advanced Classical Dynamics
15PHY233 Biophysics and Biomaterials
15PHY234 Introduction to Computational Physics
15PHY238 Electrical Engineering Materials
15PHY239 Electromagnetic Fields and Waves
15PHY240 Electronic Material Sciences
15PHY241 Lasers in Material Processing
15PHY243 Microelectronic Fabrication
15PHY245 Nuclear Energy – Principles and Applications
15PHY247 Photovoltaics
15PHY248 Physics of Lasers and Applications
15PHY250 Quantum Physics and Applications
15PHY251 Thin Film Physics
15PHY331 Astronomy
15PHY333 Concepts of Nanophysics and Nanotechnology
15PHY335 Medical Physics
15PHY338 Physics of Semiconductor Devices
15PHY532 Astrophysics
15PHY535 Earth's Atmosphere
15PHY536 Earth's Structure and Evolution
15PHY540 Nonlinear Dynamics
15PHY542 Optoelectronic Devices
**HUMANITIES ELECTIVES**

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Evaluation Pattern

50:50 (Internal: External) (All Theory Courses)

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80:20 (Internal: External) (Lab courses and Lab based Courses having 1 Theory hour)

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70:30 (Internal: External) (Lab based courses having 2 Theory hours/ Theory and Tutorial)

**Theory- 60 Marks; Lab- 40 Marks**

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65:35 (Internal: External) (Lab based courses having 3 Theory hours/ Theory and Tutorial)

Theory- 70 Marks; Lab- 30 Marks

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*CA – Can be Quizzes, Assignment, Projects, and Reports.

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Grades O to P indicate successful completion of the course

\[
CGPA = \frac{\sum (C_i \times Gr_i)}{\sum C_i}
\]

Where

\(C_i\) = Credit for the \(i^{th}\) course in any semester

\(Gr_i\) = Grade point for the \(i^{th}\) course

\(Cr.\) = Credits for the Course

\(Gr.\) = Grade Obtained
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Objectives:

To make the students communicate their thoughts, opinions, and ideas freely and naturally. To make them understand the different styles in communication.

To make the students understand the aesthetics of reading and writing To bring in a spirit of enquiry

To motivate critical thinking and analysis To help them ruminate on human values

Contents:

Reading: Different styles of communication – Reading Comprehension - critical thinking and analysis – Note-making – Any two pieces from the text

Writing: Prewriting techniques- Kinds of paragraphs- basics of continuous writing - Grammar & Usage: Parts of Speech, Tenses, Concord, Phrasal Verbs, Modal Auxiliaries, Modifiers (Workbook) - Any two pieces from the text.

Practical sessions (Listening & Speaking): Introduction to English pronunciation including minimal pairs and word stress – differences between British and American English – Listening comprehension and Note-taking - Any two pieces from the text

Activities: Short speeches, seminars, quizzes, language games, debates, and discussions, Book Reviews etc.

Outcomes:

CO 1: Demonstrate competency in all the four linguistic skills viz, listening, speaking, reading and writing. CO 2: Apply different styles of communication in professional context.

CO 3: Take part in different planned & extemporaneous communicative activities. CO 4: Interpret and Discuss facts and information in a given context.

CO 5: Develop an appreciation for human values.

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TEXT BOOKS/REFERENCES:

Language through Reading: Compilation by Amrita University for internal circulation

Poems:
1. *The Poplar Field* by William Cowper
2. *Telephone Conversation* by Wole Soyinka
Prose:
1. *Higher Mathematics* by R. K. Narayan
2. *Wings of Fire* by Abdul Kalam (Part III.11)

Short Stories:
1. *Best Investment I Ever Made* by A. J. Cronin
2. *Death of an Indian* by Krishna Charan Das

1. Language through Practice: Compilation by Amrita University for internal circulation

**15MAT111 Calculus and Matrix Algebra**

(Pre-Requisite: Nil)

**Objectives:**

1. To learn the theory and applications of Linear System of Equations and to solve system by Numerical Methods to use these techniques in Eigenvalue problems. To introduce the concept of eigenvalues and eigenvectors and its applications.
2. To study the concept of similar matrices and to analyze the possibility of diagonalization and hence compute a diagonal matrix, if possible. To apply the knowledge of diagonalization to transform the given quadratic form into the principal axes form and analyze the given conic section.
3. To learn to obtain dominant eigenvalue numerically as it may be required in the case of matrices of large (size)n
4. To learn to graph basic functions and to study the shifting and scaling of graphs.
5. To familiarize the types of discontinuities and the intermediate value property and the concept of non-differentiability, graphing of functions.
6. To learn the theory of integration in the setting of area beginning with finite sums and letting the number of terms goes to infinity and to use it to find volumes, lengths of plane curves etc.

**Keywords:**

Eigenvalues and Eigenvectors, Diagonalization, Similarity Transformation, Computational Linear Algebra, Non-differentiability, Extreme values, Graphing.

**Contents:**


Outcomes:

CO1: Understand the basic concepts of functions, limits, continuity, derivatives and analyze them.
CO2: Apply the concept of differentiability to find the extreme values of the given function and analyze the derivatives to sketch the graph of the given function.
CO3: Recall the terms, facts and basic concepts of definite integrals and the techniques of obtaining antiderivatives. CO4: Understand the notion of eigenvalues and eigenvectors, analyze the possibility of diagonalization and hence compute a diagonal matrix, if possible.
CO5: Apply the knowledge of diagonalization to transform the given quadratic form into the principal axes form and analyze the given conic section.
CO6: Understand the advantages of the iterative techniques and apply it to solve the system of equations and finding eigenvectors.

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TEXT BOOKS/REFERENCES:

2. “Advanced Engineering Mathematics”, Erwin Kreyszig,

15CSE100 Computational Thinking and Problem Solving 3 0 2 4

Objectives:

1. Develop algorithms by arriving at steps and rules and representing them a flow of sequential, conditional and repetitive actions. Apply logical reasoning to arrive at a reasoning sequence that makes conclusion more rational.
2. Understand and explore the building blocks of problem solving and algorithmic thinking
using tools (Spreadsheet, Scratch, Raptor and Flowgorithm).

3. Understand behavior of algorithms, model states of computation and verify it for correctness. Examine algorithms and instruction snippets to debug, find equivalent, alternative representations and/or solutions.

Keywords:

Contents:


Problem Solving Techniques: Factoring and Recursion Techniques, Search and Sort techniques, Greedy Techniques, Divide and Conquer, Text processing and Pattern matching.

Outcomes:

CO1: Apply computational thinking principles and algorithmic building blocks to understand, define, and solve problems

Design algorithms and implement solutions for problems

CO2: Represent, organize, manipulate and interpret data

CO3: Trace computational states and analyse techniques/strategies for given solutions

CO4: Design algorithms and implement solutions for problems

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TEXT BOOKS/REFERENCES:

2. R.G. Dromey, “How to solve it by Computer”, PHI, 2
Objectives:

3. To provide simple and clear elucidations of main physical ideas and theories of the 20-th century.
4. To explain these concepts and theories through a broad range of current applications and examples.
5. To liven up the mind with brief sketches of the historical development of 20th-century physics.
6. Develop an understanding of the current basis of broad knowledge in modern physics.
7. Enhance the critical thinking, analytical reasoning and problem solving skills.
8. Discuss the problems, confronting modern physics in the 21-st century.

Keywords:

Relativity, Quantum Mechanics, Classical and quantum statistics, solid state physics.

Contents:

Special Theory of Relativity: Frames of reference, postulates of special theory of relativity, time dilation, length contraction, relativistic mass, relativistic momentum, mass and energy, Lorentz Transformation, velocity addition, Doppler Effect.

Physical Background for Quantum Mechanics: Black body radiation, photoelectric effect, Compton effect, X-ray diffraction, pair production, de-Broglie waves, Uncertainty (I)

Quantum Mechanics: Wave function, wave equation, Schrodinger equation (time dependent), expectation values-operators, eigen functions and eigen values, Schrodinger equation (steady state), particle in a box-finite potential, tunneling effect, quantum theory of hydrogen atom. (II)


Solid state Physics: Crystalline and amorphous solids-ionic crystals-covalent crystals-Van der Walls bond-metallic bond-Band theory of solids-semiconductor devices. (III)

Outcomes:

CO1: Understand, Comprehend and acquaint with concepts of Modern Physics
CO2: Analyze and solve (idealized and quasi practical) physics problems pertaining to various concepts of Modern Physics
CO3: Apply concepts of Modern Physics to solve engineering problems that needs ideas from Modern Physics

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EXTBOOKS/REFERENCES:

(3 rd edition).

15CHY100 CHEMISTRY 3 0 0 3

Unit 1

Chemical Bonding
Review of orbital concept and electronic configuration, electrovalency and ionic bond formation, ionic compounds and their properties, lattice energy, solvation enthalpy and solubility of ionic compounds, covalent bond, covalency, orbital theory of covalency - sigma and pi bonds - formation of covalent compounds and their properties. Hybridization and geometry of covalent molecules - VSEPR theory - polar and non-polar covalent bonds, polarization of covalent bond - polarizing power, polarisability of ions and Fajan’s rule, dipole moment, percentage ionic character from dipole moment, dipole moment and structure of molecules - co-ordinate covalent compounds and their characteristics, molecular orbital theory for H2, N2, O2 and CO, metallic bond - free electron, valence bond and band theories, weak chemical bonds – inter and intra molecular hydrogen bond - van der Waals forces.

Unit 2

Thermodynamic Parameters
Stoichiometry - mole concept, significance of balanced chemical equation - simple calculations - Conditions for occurrence of chemical reactions - enthalpy, entropy and free changes - spontaneity – Thermochemistry - heats of reactions - (formation, combustion, neutralization) - specific heats - variation of enthalpy change with temperature - Kirchhoff’ relation (integrated form) - bond enthalpy and bond order - Problems based on the above.

Kinetics
Review of molecularity and order of a reaction, rate law expression and rate constant - first, second, third and zero order reactions, pseudo-first order reactions (pseudo-unimolecular reactions) - complex reactions - equilibrium and steady state approximations - mechanism of these reactions - effect of temperature on reaction rates - Arrhenius equation and its significance, Michaelis Menden kinetics-enzyme catalysis.

Unit 3

Electrochemistry
Electrolytes - strong and weak, dilution law, Debye-Huckel theory, faraday’s laws, origin of potential, single electrode potential, electrochemical series, electrochemical cells, Nernst equation and its application, reference electrodes- SHE, Ag/AgCl, Calomel.
Photochemistry
Photochemistry, laws of photochemistry - Stark-Einstein law, Beer-Lamberts law, quantum efficiency-determination, photochemical processes - Jablonsky diagram, internal conversion, inter-system crossing, fluorescence, phosphorescence, chemiluminescence and photo sensitization, photo polymerization.

Outcomes:

CO1: Understand the fundamental concepts of chemistry to predict the structure and properties of engineering materials

CO 2: Develop analytical skills to evaluate the cause, feasibility and course of chemical reactions

CO 3: Design and apply the idea of cutting edge area of chemistry to solve engineering related problems

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REFERENCE BOOKS

*Physical chemistry, Puri and Sharma*
*Inorganic chemistry, Puri and Sharma*

15PHY181 Physics Lab 0 0 2 1

Objectives:

1. Physics practical work involves „learning by doing“.
2. Careful and stepwise observation of sequences during an experiment or activity facilitate personal investigation as well as small group or team learning.
3. A practical physics course should enable students to do experiments on the fundamental laws and principles, and gain experience of using a variety of measuring instruments.
4. To develop intellectual communication skills and discuss the basic understanding of various experimental principles involved.

Keywords:
Non uniform bending, Radius of curvature, wavelength, angle of minimum deviation, rigidity modulus, viscosity, energy gap, efficiency

Contents:

Introduction: Measuring instruments
1. Young’s -nonmodulus-uniformbending
2. Newton’s ring
3. LASER-wavelength and particle size determination
4. Spectrometer
5. Carey Foster’s bridge
6. Rigidity modulus- Torsional pendulum
7. Viscosity of liquid by Stoke’s method
8. Energy gap of a semiconductor
9. Solar cell characteristics

Outcomes:

CO1: Prepare for the lab experiment and perform individually a wide spectrum of experiments. CO2: Present experimental data in various appropriate forms like tabulation, and plots.
CO3: Analyze, Interpret and Summarize experimental results.
CO4: Communicate clearly understanding of various experimental principles, instruments/setup, and procedure.

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TEXT BOOKS/REFERENCES:

- “Laboratory Manual”, Department of Sciences, Amrita School of Engineering, Amrita Vishwa Vidyapeetham.
1. Acid base titration (double titration)  
2. Complexometric titration (double titration)  
3. Redox (permanganometry) titration (double titration)  
4. Conductometric titration  
5. Potentiometric titration  
6. Ester hydrolysis

**Outcomes:**

CO1: Develop analytical skills for the determination of water quality parameter  
CO2: Understand the electrochemical principles of conductance and electrode potentials and its application in analytical science  
CO3: Develop analytical skills in the determination of rates of chemical reactions and its application CO4: Learn the basics of redox reaction and applying it for quantitative determination.  
CO5: Create skills to convert basic chemical reactions to analytical application.

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**15MEC180 Workshop A**

**Objectives:**

1. To introduce basic concepts pertaining to product dismantling and assembly.  
2. To enable understanding of basic pneumatic components; design and validate simple circuits.  
3. To develop and fabricate simple objects with sheet metal.  
4. Hands-on training on welding and soldering joints.

**Keywords:**

Product dismantling, arc welding, sheet metal work, pneumatic circuits, soldering.

**Contents:**

1. Product Workshop  
Disassemble the product of sub assembly-Measure various dimensions using measuring instruments-Free hand rough
sketch of the assembly and components - Name of the components and indicate the various materials used - Study the functioning of the assembly and parts - Study the assembly and components design for compactness, processing, ease of assembly and disassembly - Assemble the product or subassembly.

1. Pneumatic and PLC Workshop

Study of pneumatic elements - Design and Assembly of simple circuits using basic pneumatic elements - Design and assembly of simple circuits using electro-pneumatics - Study of PLC and its applications - Simple programming using ladder diagrams.

1. Sheet Metal Workshop

Study of tools and equipment - Draw development drawing of simple objects on sheet metal (cone, cylinder, pyramid, prism, tray etc.) - Fabrication of components using small shearing and bending machines - Riveting and painting practice.

1. (a) Welding Workshop

Study of tools and equipment - Study of various welding methods - Arc welding practice and demonstration of gas welding and cutting.

(b) Demo and Practice Workshop

Fitting : Study of tools, practice in chipping, filing and making joints.

Carpentry : Study of tools, planning practice and making joints.

Outcomes:

CO1: Dismantle and assemble various products.

CO2: Design and simulate pneumatic and electro-pneumatic circuits.

CO3: Fabricate sheet metal objects.

CO4: Perform arc welding and soldering.

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TEXT BOOK/REFERENCE:

Concerned Workshop Manuals

15EEE180 WORKSHOP B 0 0 2 1

Part A - Electronics
Identification of electronic components (Passive and Active)
Study of measuring instruments (Voltmeter, Ammeter and Multimeter) Measurement and theoretical Verification of series and parallel combination of resistors and capacitors
Calibration of CRO and measurements of signal parameters (RMS, maximum value, peak value, time and frequency)
Calibration of function generator using CRO Soldering practice

Part B - Electrical
1. Study on power supply and protective devices
2. Study on tools and electrical accessories
3. Study on sources of light
4. Study on energy efficiency
5. Study on water pump
   b. Fan
   c. Refrigerator
   d. Air conditioner
7. House wiring I – Glow an incandescent lamp using SPST switch
8. House wiring II – Glow a fluorescent lamp using SPST switch
9. House wiring III – Operate a fan and an incandescent lamp using two independent SPST switch
10. House wiring IV – Operate a fluorescent lamp and a 3 pin socket using two independent SPST switch
11. House wiring V – Staircase wiring
12. House wiring VI – Godown wiring

Course Outcomes

15EEE180.1 Understand electrical safety measures and identify electrical tools, electronic components and their symbols.
15EEE180.2 Understand electric laws using simulation studies and detect failures in electrical and electronic circuits.
15EEE180.3 Build/Solder and test, residential wiring/Electronic circuits and measure electrical parameters.
15EEE180.4 Estimate the materials required for wiring a building.

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15MEC100 ENGINEERING DRAWING - CAD 2 0 2 3

Objectives:

1. To develop drawings using Bureau of Indian Standards (BIS)
2. To communicate effectively through drawings
3. To enhance visualization skills, which will facilitate the understanding of engineering systems.

Keywords:
Coordinate system, Orthographic projections, Isometric projections

Contents:


Outcomes:
CO1: Understand the fundamental principles of first angle and third angle projections. CO2: Dimension and label the drawings as per standards.
CO3: Construct the drawings by choosing appropriate line type.
CO4: Visualize and construct projections of line and lamina when inclined to one reference plane and both reference planes.
CO5: Visualize and construct solid entities in its simple position and when inclined to one reference plane. CO6: Construct the drawings using computer aided design and drafting software package

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TEXTBOOKS/REFERANCES:
5. 15CUL101 Cultural Education I 2 0 0 2

Objectives:
The course is designed as an introductory guide to the variegated dimensions of Indian cultural and intellectual heritage, to enable students to obtain a synoptic view of the grandiose achievements of India
in diverse fields. It will equip students with concrete knowledge of their country and the mind of its people and instil in them some of the great values of Indian culture.

**Keywords:**

Culture, Purusharthas, Symbols, Epics

**Contents:**

The necessity of Cultural Education, Know your university, Meaning of college prayer, Know your Chancellor-Introduction to Amma.

Purusharthas (Goals of life), Varnasrama Dharma, Doctrine of Karma, Practices for Happiness.

Symbols of Indian Culture, Festivals of India, Living in harmony with nature, Relevance of our epics in this scientific age, Lessons from Ramayana and Mahatmas.

**Outcomes:**

CO1: Be introduced to the foundational concepts of Indian culture and heritage, will be able to understand the cultural ethos of Amrita Vishwa Vidyapeetham, and Amma”s life.

CO2: Understand the foundational concepts of Indian civilization like purusharthas, law of karma, etc, which contributes towards personality growth.

CO3: Gain a positive appreciation of Indian culture, traditions, customs and practices CO4: Imbibe spirit of living in harmony with nature, and principles and practices of Yoga CO5: Get guidelines for healthy and happy living from the great spiritual masters

**CO-PO Mapping:**

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**TEXT BOOKS/REFERENCES:**

1. “*Eternal Values for a Changing Society*”, Swami Ranganathananda
2. “*Symbolism in Hinduism*”, Swami Nityanand
Objectives:

1. To understand the basic concepts of ODE, apply them in modeling and solving first order equations.
2. To recall the techniques of solving second order linear homogeneous ODE with constant coefficients.
3. Understand and modify the above techniques for solving Euler-Cauchy equations. Understand and apply methods of undetermined coefficients and variations of parameters to solve the second order linear nonhomogeneous differential equations.
4. Understand and apply the techniques of solving system of linear ODE. Understand and analyze the critical points and stability of the system.
5. Understand the vector functions, scalar and vector fields. Understand the derivatives of vector functions and its physical and geometrical interpretations. Understand the concept of gradient, divergence and curl and apply them appropriately.
6. Under the concept of line integral and analyze the independence of path.
7. Understand the concept of multiple integrals. Apply Green’s theorem for pl Stokes’ theorem to evaluate the integrals of vector

Keywords:

ODE, Homogeneous, non- homogeneous, linear non homogeneous, undetermined coefficients, surfaces, vector fields.

Contents:

Ordinary Differential Equations: First Order ODE (basic Concepts of Modeling),Exact Differential equations and Integrating Factors (sections 1.1,1.4)

Second Order Differential Equations: Homogeneous and non- homogeneous linear differential equations of second order (Review), Modeling of Free Oscillations of Mass Spring system, Euler-Cauchy Equations, Solution by the method of Undetermined Coefficients and solution by the method of variation of parameters(Sections 2.1,2.2,2,4,2.5,2.7,2.10)

System of Ordinary Differential Equations: Engineering Applications, Basic Theor Constant Coefficient systems, Phase plane method, Criteria for critical Points, Stability (sections4.1,4.2,4.3,4.4)

Vector Differential Calculus: Gradient, Divergence and Curl :Vector Differentiation: Vector and Scalar Functions and their fields, Vector calculus Derivatives, Curves, Arc Length, Calculus Review, Functions of several variables(Optional) Gradient , of a scalar field, Directional Derivative, Divergence of a vector field, Curl of a vector Field, (Sections 9.4,9.5,9.7,9.8,9.9)

Vector Integral Calculus(Integral Theorem): Line integrals, Path Independence of line integrals, Calculus review, Double Integrals Green’s Theorem, in the plane, –Surfac Divergence Theorem of Gauss, Stokes’ Theorem. (section

Outcomes:
CO 1: Able to understand, and interpret the concepts. CO 2: Able to apply the concept and understand them. CO 3: Able to understand and implement the concepts in application oriented problems. CO 4: Able to understand and analyze the and apply the knowledge of diagonalization of matrices to transform the given quadratic form. CO5: Able to understand the basic concepts and apply them in modeling the first order ODEs. CO6: Able to understand and apply methods of undetermined coefficients and variation of parameters to solve second order ODEs.

**CO – PO Mapping:**

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**REFERENCE BOOKS:**


**15CSE102 COMPUTER PROGRAMMING 3 0 0 3**

**Unit 1**

Introduction to C language: Structure of a C program, comments, Data types, Variables, constants, Data input and output statements, input assertions; expressions and evaluation. Functions: inter function communication, standard functions, scope. Selection: two way selection, multi-way selection, repetition: concept of loop, loop invariant, pretest and post-test loops, initialization and updating, event and counter controlled loops. Recursion: recursive definition, recursive solution, designing recursive functions, limitations of recursion.

**Unit 2**

Unit 3

Strings: fixed length and variable length strings, strings and characters, string input output, array of strings, string manipulation functions, sorting of strings. Enumerated types, Structures: Structure vs array comparison, complex structures, Structures and functions, Union, binary input output, Command line arguments.

TEXTBOOK:


REFERENCES:


Outcomes:

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<td>Design algorithms and implement solutions for problems</td>
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<td>Represent, organize, manipulate and interpret data</td>
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<td>Trace computational states and analyze techniques/strategies for given solutions</td>
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15MEC101 ENGINEERING DRAWING - CAD II 2023

Sections of Solids: Introduction, Section planes, Sectional views, apparent shapes and true shapes of sections of right regular prisms, cylinders, pyramids and cones.

45
Development of lateral surfaces: Introduction, Development of lateral surfaces of prisms, cylinders, pyramids and cones and their frustums & truncations.


Orthographic Views of 3 dimensional solids.

Course Outcomes

15MEC101.1 Construct sectional views of prisms, cylinder and pyramids to view the apparent shape and true shapes of the solid geometry.

15MEC101.2 Construct lateral surfaces of prisms, cylinder, pyramids, cone and truncated solid geometry.

15MEC101.3 Construct isometric projection drawings of prisms, cylinder, pyramids, cones and simple machine parts.

15MEC101.4 Construct orthographic views of solid geometry and simple machine parts.

15MEC101.5 Change orthographic views of solid geometry and simple machine parts into isometric view.

15MEC101.6 Change isometric views of solid geometry and simple machine parts into orthographic view.

TEXTBOOK:


REFERENCES:


15MEC102 ENGINEERING MECHANICS

Unit 1

Principles of Statics: Introduction to vector approach - free body diagrams - forces in plane - forces in space - concurrent forces - resolution of forces - equilibrium of particle.

Statics of rigid bodies in two dimension: Moment of a force about a point - moment of a couple - equivalent force - couple system. Rigid body equilibrium: Beams - support reactions.

Unit 2

Centroid of lines, areas - composite areas. Second Moment of area - polar moment of inertia - mass moment of inertia - radius of gyration.

Unit 3

Dynamics of particles: Kinematics of particles - rectilinear motion - relative motion - position, velocity and acceleration calculations in cylindrical coordinates. Dynamics of rigid bodies: General plane motion - translation and rotation of rigid bodies - Chasle’s theorem.

Course Outcomes

15MEC102.1 Determine rectangular components of a force
15MEC102.2 Obtain the equivalent force - couple system of a given system
15MEC102.3 Analyze the equilibrium state of a particle and rigid body
15MEC102.4 Estimate the moment of inertia of composite area about centroidal or any arbitrary axis
15MEC102.5 Determine the velocity and acceleration of a particle in rectangular and cylindrical coordinate systems and angular velocity of rigid bodies in general plane motion.

TEXTBOOKS:


REFERENCES:


15CSE180 Computer Programming Laboratory 0 0 2 1

Objectives:

□ The laboratory intends to provide hands-on experience on the structured programming paradigm.
□ This laboratory facilitates students to apply the structured programming principles to solve problems

Contents:

Solving simple problems with operators, programs on conditional control constructs, programs on loops (while, do-while and for), programs using user-defined functions and library functions, programs on files, arrays (single and multi-dimensional), programs using DMA, programs on strings,
Outcomes:

CO1: Develop solutions for problems systematically using structured logic approach.
CO2: Develop computer programs for a given problem scenario.
CO3: Make use of the programming constructs effectively while developing computer programs.
CO4: Develop modular solutions for a given scenario.

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TEXT BOOKS/REFERENCES:


15CUL111 Cultural Education II 2002

Objectives:

The students will be able to deepen their understanding and further their knowledge about the different aspects of Indian culture and heritage.

Keywords:

Education, Personality, Oneness, Bhagavadgita

Contents:

To the world from India, Education system in India, Insights from Mahabharata, The human personality India”s scientific system for personality refinement,—The hand book for human life

Examples of Karmayoga in modern India, Chanakya”sions guid with Amma.

Outcomes:
CO1: Get an overview of India and her contribution to the world in the field of science and literature.

CO2: Understand the foundational concepts of ancient Indian education system and practices associated with them.

CO3: Learn the important concepts of Vedas, Bhagavad-Gita and Yogasutras and their relevance to daily life.

CO4: Familiarize themselves with the inspirational characters and anecdotes from the epics and Indian history.

CO5: Gain a rational understanding of the underlying principles of Indian spirituality.

CO-PO Mapping:

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| CO5   | 1   | 1   | 3   | 3   | 3   | 3   | 3   | 3   | 3   |      |      |      |      |

TEXT BOOKS/REFERENCES:

1. The Vedas - Sri ChandrasekharendraSaraswati
2. A Concise history of Science in India - D. M. Bose, S. N. Sen. B. V. Subbarayappa

15MEC201 ENGINEERING THERMODYNAMICS 3 0 0 3

Unit 1

Introduction and importance of thermodynamics, different approaches in the study of thermodynamics, SI units, basic concepts and definitions – system, surroundings, types of systems, properties. Pressure measurement, thermodynamic equilibrium, quasi static process, cyclic process, and thermodynamic energy interactions - evaluation of work type interaction, heat interaction, energy and forms of energy, history of laws of thermodynamics.

First law for closed system, analysis of closed systems. Concept of Zeroth Law, thermometry, temperature scales.

Unit 2


The inequality of Clausius and thermodynamic Temperature scale, concept of entropy, Entropy change in different processes, principle of increase in entropy for closed systems.

Unit 3

Thermodynamic properties of fluids, Pure Substance, phase-change process of pure substance, P-V-T surface, T-v, p-v and other diagrams, specific internal energy and enthalpy and other properties and steam tables.

Perfect gas, equation of state, specific heats, characterization of thermodynamic processes. Real gas models - Van der waals equation, compressibility chart.

Thermodynamic property relations: Introduction, important mathematical relations, cyclic rule, Maxwell relations, enthalpy, entropy, internal energy and specific heat relations; Clausius-Clapeyron equation, Joule Thomson coefficient and inversion line.

Course Outcomes

15MEC201.1 Evaluate the deviation of a real gas from ideal gas behavior based on compressibility chart and best known equations of state
15MEC201.2 Solve energy balance problems for closed and open systems for pure substances, ideal gases, liquids and solids
15MEC201.3 Examine the possibility of a thermodynamic process based on first and second law of thermodynamics and increase of entropy
15MEC201.4 Determine the expressions for the thermal efficiencies and coefficients of performance for reversible heat engines, heat pumps, and refrigerators by modelling thermodynamic cycles
15MEC201.5 Evaluate the performance of power plants, automobiles, refrigeration and air-conditioning units
15MEC201.6 Establish relationship between measurable and derivable properties

TEXTBOOK:


REFERENCES:

1. DRAWING STANDARDS
Code of practice for Engineering Drawing, BIS specifications - Welding symbols, riveted joints, keys, fasteners – Reference to handbook for the selection of standard components like bolts, nuts, screws, keys etc.

2. 2-D DRAWINGS

3. CAD PRACTICE (USING APPLICATION PACKAGES)
Drawing, Editing, Dimensioning, Plotting Commands, Layering Concepts, Hatching, Detailing, Assembly, basic principles of GD & T (geometric dimensioning & tolerance).

4. ASSEMBLY DRAWING (MANUAL & USING APPLICATION PACKAGES)
Manual parts drawing and preparation of assembled views given part details for components followed by practicing the same using CAD packages.

5. PREPARATION OF BILL OF MATERIALS AND TOLERANCE DATA

SUGGESTED ASSEMBLIES:
Detailed drawings of following machine parts are given to students to assemble and draw the sectional or plain elevations / plans / and side views with Dimensioning and bill of materials.

Sleeve & Cotter joint, Spigot & Cotter joint, Knuckle joint, Stuffing Box, Screw Jack, Foot step bearing, Universal Coupling, Plummer Block, Swivel Bearing, Simple Eccentric, Machine Vice, Protected type flanged coupling, Connecting Rod, Tail Stock.

Course Outcomes

15MEC202.1 Interpret and Make use of standards and conventions to draw machine components and assembly.

15MEC202.2 Apply limits and tolerances to assemblies and Judge on the appropriate fit.

15MEC202.3 Develop solid models of machine components and assembly, and Construct sectional and orthographic views of components.

15MEC202.4 Make use of CAD packages for solid modeling of machine parts and Create bill of materials.
TEXTBOOKS:


REFERENCE BOOKS:


15MEC203 MATERIAL SCIENCE AND METALLURGY 3 0 0 3

Unit 1


Unit 2


Unit 3


Classification of cast iron and steels - properties, microstructures and uses of cast irons, plain carbon, alloy, stainless, heat resistant, tool and die steels. Composition, properties, microstructures and uses of non-ferrous alloys - brass,
bronze, aluminium, magnesium, nickel and zinc alloys.

**Course Outcomes**

15MEC203.1 Understand the concepts of four major elements structure properties, performance and processing related to metallurgy and materials

15MEC203.2 Analyze the various modes of imperfections and failure in solids and methods to strength it.

15MEC203.3 Classify the various phase diagrams and analyze the phase transformations from it.

15MEC203.4 Interpret the effect of mechanical properties on various heat treatment processes

**TEXTBOOK:**


**REFERENCES:**


**15MEC204 MECHANICS OF SOLIDS 3 0 0 3**

**Unit 1**

Simple Stress and Strain

Composite section, Volumetric strain, expression for volumetric strain, Elastic constants, relationship among elastic constants, Thermal stresses (including thermal stresses in compound bars). Strain Energy & Impact loading.

Compound Stresses
Introduction, Stress components on inclined planes, General two-dimensional stress system, Principal planes and stresses and Mohr’s circle of stresses.

**Unit 2**
Torsion of circular shafts
Introduction – Pure torsion-torsion equation of circular shafts, Strength and stiffness, Torsional rigidity and polar modulus, Power transmitted by shaft of solid and hollow circular sections.

Bending moment and shear force in beams
Introduction, Types of beams loadings and supports, Shearing force in beam, Bending moment, Sign convention, Relationship between loading, shear force and bending moment, Shear force and bending moment equations, SFD and BMD with salient values for cantilever beams, simply supported beams and overhanging beams considering point loads, UDL, UVL and Couple. Bending and shear stresses in beams.

Unit 3

Deflection of beams
Introduction – Definitions of slope, deflection, Elastic curve-derivation of differential equation of flexure, Sign convention Slope and deflection for standard loading classes using Macaulay’s method for prismatic beams and overhanging beams subjected to point loads, UDL and Couple.

Thick and Thin Cylinders and shells
Analysis of thin cylindrical shells and analysis of thick cylindrical shells using Lame’s equation.

Elastic stability of columns
Introduction – Short and long columns, Euler’s theory on columns, Effective length slenderness ratio, radius of gyration, buckling load, Assumptions, derivations of Euler’s Buckling load for different end conditions, Limitations of Euler’s theory, Rankine’s formula and problems.

Course Outcomes

15MEC204.1 Apply the principles of equilibrium, superposition, and compatibility to estimate the stress-strain behavior of linear elastic solids under axial and torsional loading
15MEC204.2 Construct shear force and bending moment diagrams, to estimate the deflection and stress distribution in beams of various cross sections
15MEC204.3 Analyze stresses at inclined planes and construct Mohr’s circle to predict the principal and maximum shear planes
15MEC204.4 Determine longitudinal and circumferential stresses in thin and thick cylinders subjected to internal and external pressures
15MEC204.5 Apply Euler’s and Rankine’s formulae to determine the buckling load of columns under different end conditions

TEXTBOOKS:


REFERENCES:
15EEE205  ELECTRICAL AND ELECTRONICS ENGINEERING 3 0 2 4

Unit 1

Electrical Engineering
Introduction to Electrical Power System - different sources of electrical energy (conventional / alternate), Ideal Independent Current and Voltage Sources, Reference Directions and Symbols; Resistance, Inductance and Capacitance, Seriesparallel combination of R, L and C Components.Ohm’s law, Kirchhoff’s law, Energy and Power, Voltage Divider and Current Divider Rules, Network Analysis by Mesh Currents, Nodal analysis. Faraday’s law of Electromagnetic Induction; Magnetic Circuit Elements; Analysis of magnetic Circuits, Self and Mutual Inductances. Generation of alternating current, Sinusoidal voltage; Instantaneous, Average and rms values of periodic functions; Peak factor, form factor, Phasor representation of sinusoids, Real and Reactive Power, Power factor
Introduction to Three Phase Systems; Balanced 3-Phase STAR and DELTA connections of Load, Three phase power

Unit 2


Unit 3

Electronics Engineering
Introduction to semiconductors and doping: Intrinsic and extrinsic semiconductors, PN junction diode characteristics: forward and reverse bias – breakdown – barrierpotential Rectifiers: half wave and full wave, Zener diode – design of regulatorsand Characteristics.Introduction to BJT: BJT characteristics curves and region of operation, common emitter, common base configurations, MOSFET characteristics.Introduction to Operational amplifier: inverting and non-inverting amplifier.Introduction to logic gates: Boolean Algebra Theorems, De Morgan's theorem. Logic gates, NOT Gate, AND Gate, OR Gate, XOR Gate, NAND Gate, NOR Gate, X-NORGate. Microcontrollers: Introduction to Microcontrollers, 8051, Microcontroller, Architectureand an example of Microcontroller, based stepper motor control system (only Block Diagram approach).

Course Outcomes

15EEE205.1  Understand different components and parameters in electric circuit
15EEE205.2  Formulate electric circuits based on fundamentals laws
15EEE205.3 Illustrate the construction and operation and characteristics of electromagnetic devices
15EEE205.4 Understand the characteristics of diodes transistors and Operational Amplifiers
15EEE205.5 Develop rectifiers, regulators and amplifiers using various electronic devices
15EEE205.6 Understand the functional feature of microcontroller and stepper motor control application

TEXTBOOKS:


REFERENCES:


15MAT204 TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS

Unit 1

Unit 2
Convolution, Integral Equations, Partial Fractions, Differential Equations, Systems of Differential Equations. (Sections: 6.1 to 6.7)


Unit 3
Partial Differential Equations: Basic Concepts, Modeling; Vibrating String, Wave Equation, Separation of Variables, Use of Fourier Series, Heat Equation; Solution by Fourier Series. (Sections: 12.1-12.5)

Course Outcomes

15MAT204.1 Understand the concepts of Laplace and Fourier transforms and its properties to transform a function from time domain to the frequency domain.

15MAT204.2 Obtain the Laplace and Fourier transform and its inverse transform of impulsive, discontinuous and some complicated periodic signals.

15MAT204.3 Solve the initial value problems’ using Laplace and Fourier transforms on signals arising by changing over to frequency domain.

15MAT204.4 Define the Fourier series for periodic functions and determine the Fourier coefficients.

15MAT204.5 Understand the formation of partial differential equations and apply some standard methods to obtain its solutions.

15MAT204.6 Apply Fourier series technique to solve the heat, wave and Laplace equations.

TEXTBOOK:


REFERENCE BOOKS:


15MEC281 MATERIALS TESTING AND METALLURGY LAB. 0 0 2 1

Mechanical testing of materials: Experiments to determine Young’s modulus, yield strength, ultimate tensile strength of ductile and brittle materials. Shear and impact test on materials, determination of Brinell’s, Rockwell and Vicker’s hardness, micro hardness, fatigue and flexural strength of materials.


Course Outcomes
15MEC281.1 Determine tensile properties of rods and thin wires made of ductile materials
15MEC281.2 Compare the hardness, impact strength and modulus of different materials
15MEC281.3 Determine modulus of elasticity of timber and modulus of rigidity of spring
15MEC281.4 Prepare the specimens and characterize the microstructures of different ferrous and non-ferrous metals.
15MEC281.5 Understand heat treatment procedures and their effect on the properties of steel.
15MEC281.6 Measure the hardness and hardenability of materials.

15AVP201/ AMRITA VALUES PROGRAMME I/ 1 0 0 1
15AVP211 AMRITA VALUES PROGRAMME II 1 0 0 1

Amrita University's Amrita Values Programme (AVP) is a new initiative to give exposure to students about richness and beauty of Indian way of life. India is a country where history, culture, art, aesthetics, cuisine and nature exhibit more diversity than nearly anywhere else in the world.

Amrita Values Programmes emphasize on making students familiar with the rich tapestry of Indian life, culture, arts, science and heritage which has historically drawn people from all over the world.

Students shall have to register for any two of the following courses, one each in the third and the fourth semesters, which may be offered by the respective school during the concerned semester.

Courses offered under the framework of Amrita Values Programmes I and II

Message from Amma’s Life for the Modern World
Amma’s messages can be put to action in our life through pragmatism and attuning of our thought process in a positive and creative manner. Every single word Amma speaks and the guidance received in on matters which we consider as trivial are rich in content and touches the very inner being of our personality. Life gets enriched by Amma’s guidance and She teaches us the art of exemplary life skills where we become witness to all the happenings around us still keeping the balance of the mind.

Lessons from the Ramayana
Introduction to Ramayana, the first Epic in the world – Influence of Ramayana on Indian values and culture – Storyline of Ramayana – Study of leading characters in Ramayana – Influence of Ramayana outside India – Relevance of Ramayana for modern times.

Lessons from the Mahabharata
Introduction to Mahabharata, the largest Epic in the world – Influence of Mahabharata on Indian values and culture – Storyline of Mahabharata – Study of leading characters in Mahabharata – Kurukshetra War and its significance - Relevance of Mahabharata for modern times.

Lessons from the Upanishads
Introduction to the Upanishads: Sruti versus Smrti - Overview of the four Vedas and the ten Principal Upanishads - The central problems of the Upanishads – The Upanishads and Indian Culture – Relevance of Upanishads for modern times – A few Upanishad Personalities: Nachiketas, SatyakamaJabala, Aruni, Shvetaketu.

Message of the Bhagavad Gita

Life and Message of Swami Vivekananda
Brief Sketch of Swami Vivekananda’s Life – Meeting with Guru – Disciplining of Narendra - Travel across India - Inspiring Life incidents – Address at the Parliament of Religions – Travel in United States and Europe – Return and reception India – Message from Swamiji’s life.

Life and Teachings of Spiritual Masters India
Sri Rama, Sri Krishna, Sri Buddha, Adi Shankaracharya, Sri Ramakrishna Paramahamsa, Swami Vivekananda, Sri Ramana Maharshi, Mata Amritanandamayi Devi.

Insights into Indian Arts and Literature
The aim of this course is to present the rich literature and culture of Ancient India and help students appreciate their deep influence on Indian Life - Vedic culture, primary source of Indian Culture – Brief introduction and appreciation of a few of the art forms of India - Arts, Music, Dance, Theatre.

Yoga and Meditation
The objective of the course is to provide practical training in YOGA ASANAS with a sound theoretical base and theory classes on selected verses of Patanjali’s Yoga Sutra and Ashtanga Yoga. The coverage also includes the effect of yoga on integrated personality development.

Kerala Mural Art and Painting
Mural painting is an offshoot of the devotional tradition of Kerala. A mural is any piece of artwork painted or applied directly on a wall, ceiling or other large permanent surface. In the contemporary scenario Mural painting is not restricted to the permanent structures and are being done even on canvas. Kerala mural paintings are the frescos depicting mythology and legends, which are drawn on the walls of temples and churches in South India, principally in Kerala. Ancient temples, churches and places in Kerala, South India, display an abounding tradition of mural paintings mostly dating back between the 9th to 12th centuries when this form of art enjoyed Royal patronage . Learning Mural painting through the theory and practice workshop is the objective of this course.

Course on Organic Farming and Sustainability
Organic farming is emerging as an important segment of human sustainability and healthy life. Haritamritam’ is an attempt to empower the youth with basic skills in tradition of organic farming and to revive the culture of growing vegetables that one consumes, without using chemicals and pesticides. Growth of Agriculture through such positive
initiatives will go a long way in nation development. In Amma’s words “it is a big step in restoring the lost harmony of nature“.

**Benefits of Indian Medicinal Systems**
Indian medicinal systems are one of the most ancient in the world. Even today society continues to derive enormous benefits from the wealth of knowledge in Ayurveda of which is recognised as a viable and sustainable medicinal tradition. This course will expose students to the fundamental principles and philosophy of Ayurveda and other Indian medicinal traditions.

**Traditional Fine Arts of India**
India is home to one of the most diverse Art forms world over. The underlying philosophy of Indian life is ‘Unity in Diversity” and it has led to the most diverse expressions of culture in India. Most art forms of India are an expression of devotion by the devotee towards the Lord and its influence in Indian life is very pervasive. This course will introduce students to the deeper philosophical basis of Indian Art forms and attempt to provide a practical demonstration of the continuing relevance of the Art.

**Science of Worship in India**
Indian mode of worship is unique among the world civilisations. Nowhere in the world has the philosophical idea of reverence and worshipfulness for everything in this universe found universal acceptance as it in India. Indian religious life even today is a practical demonstration of the potential for realisation of this profound truth. To see the all-pervading consciousness in everything, including animate and inanimate, and constituting society to realise this truth can be seen as the epitome of civilizational excellence. This course will discuss the principles and rationale behind different modes of worship prevalent in India.

**Outcomes:**

CO1: Understanding the impact of *itihasas* on Indian civilization with a special reference to the *Adiparva* of Mahabharata

CO2: Enabling students to importance offighting *adharma* for the welfare of the society through Sabha and Vanaparva.

CO3: Understanding the nuances of dharma through the contrast between noble and ignoble characters of the epic as depicted in the Vana, Virata, Udyoga and Bhishma parvas.

CO4: Getting the deeper understanding of the Yuddha Dharma through the subsequent Parvas viz., Drona, Karna, Shalya, Sauptika Parvas.

CO5: Making the students appreciative of spiritual instruction on the ultimate triumph of dharma through the presentations of the important episodes of the MB with special light on Shanti, Anushasana, Ashwamedhika, Ashramavasika, Mausala, Mahaprabhanika and Swargarohana Parvas.

**CO-PO Mapping**

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60
15MEC211 FLUID MECHANICS AND MACHINERY 4 0 0 4

Unit 1

Hydrostatic Force on plane surfaces and curved surface.


Eulerian and Lagrangian description of fluids, local and convective acceleration. Flow visualization – streamlines, streak lines, pathlines, time lines, contour and vector plots.

Flow kinematics - vorticity and rotationality.

Unit 2
Reynold’s Transport Theorem. Governing equations for mass, linear and angular momentum and energy in the integral form. Applications of these equations. Laminar and turbulent flow regimes.

Bernoulli’s equation. Limitations. Applications of Bernoulli’s equation. Hydraulic and energy grade lines.


Laminar flow in circular pipes - average and maximum velocities, shear stress distribution, Pressure drop computation - Hagen Poiseuille Law.

Flow rate measurement for closed conduits - Venturimeter, Orificemeter, Pitot tube, rotameter, other electrical and mechanical flow measuring systems.

Unit 3


Course Outcomes

15MEC211.1 Solve practical problems involving fluid properties and hydrostatic pressure, and predict the stability of floating bodies
15MEC211.2 Evaluate fluid kinematic properties to classify types of fluid flow using flow visualization techniques
15MEC211.3 Apply the governing equations for mass, momentum and energy based on Reynolds Transport Theorem and utilize them in practical problems
15MEC211.4 Estimate the pumping power by considering major and minor losses in flow through pipes
15MEC211.5 Apply dimensional analysis for fluid problems based on Buckingham-Pi Theorem and utilize it for model testing of fluid machineries
15MEC211.6 Analyze the performance characteristics of centrifugal pumps and hydraulic turbines

TEXTBOOK:

REFERENCES:

15MEC212 KINEMATICS OF MACHINES 3 0 2 4

Unit 1
Basics of Mechanisms
Definitions – Link, Kinematic pair, Kinematic chain, Mechanism and Machine - Degree of Freedom – Mobility - Kutzbach criterion (Gruebler’s equation) - Grashoff’s law - Kinematic Inversions of four-bar chain and slider crank chain - Mechanical Advantage - Transmission angle. Description of common Mechanisms - Offset slider mechanism as quick return mechanisms, Pantograph, Straight line generators (Peaucellier and Watt mechanisms), Steering gear for automobile, Hooke’s joint, Toggle mechanism, Ratchets and escapements - Indexing Mechanisms, Steering gear mechanisms such as Davis and Ackermann Steering gear.

Unit 2
Kinematic Analysis
Analysis of simple mechanisms (Single slider crank mechanism and four bar mechanism) - Graphical Methods for
displacement, velocity and acceleration polygons, Instantaneous Centre of Velocity, Kennedy Theorem, Klein’s Construction; Shaping machine mechanism - Coincident points – Coriolis acceleration, Analytical method of analysis of slider crank mechanism and four bar mechanism. Approximate analytical expression for displacement, velocity and acceleration of piston of reciprocating engine mechanism.

**Unit 3**

**CAMS**

Classifications - Displacement diagrams - Parabolic, Simple harmonic and Cycloidal motions - Graphical construction of displacement diagrams and layout of plate cam profiles - circular arc and tangent cams.

**GEARS**

Classification of gears - Gear tooth terminology - Fundamental Law of toothed gearing and involute gearing - Length of path of contact and contact ratio - Interference and undercutting - Gear trains - Simple, compound and Epicyclic gear trains - Differentials.

**Unit 4 (Practicals)**

- To study various types of kinematics links, pairs, chains and mechanisms
- To study inversions of a 4-Bar mechanism
- To study the inversions of single mechanism
- To study the inversions of double slider crank mechanism
- To plot joint angle, velocity and acceleration of coupler link against crank rotation for a four-bar mechanism.
- To plot slider displacement, velocity and acceleration of slider against crank rotation for slider crank mechanism
- To study various types of gears – helical, cross helical, worm, bevel gear, rack and pinion.
- To study various types of cam and follower arrangements.
- To Study various types of gear trains – Simple, Compound, reverted, Epicyclic and Differential.
- To Develop a prototype of a four-bar mechanism
- To Develop a prototype of a Geneva mechanism

**Course Outcomes**

- 15MEC212.1 Classify mechanisms and Solve for mobility
- 15MEC212.2 Perform kinematic analysis of mechanisms
- 15MEC212.3 Construct cam profiles for a given motion
- 15MEC212.4 Analyze different types of gear trains
- 15MEC212.5 Develop and perform kinematic analysis of mechanisms using software

**TEXTBOOK:**


**REFERENCES:**

15MEC213 MANUFACTURING PROCESS I 3 0 0 3

Unit 1
Metal casting processes: Introduction to Metal casting - Pattern, core and Mould making - Moulding, sand properties and testing - Principles of gating and riser design - Melting furnaces - Casting processes - sand, die, gravity, centrifugal castings, shell mould and Investment casting. Fettling and cleaning of casting - Inspection of casting and Casting defects.

Unit 2
Metal forming processes: mechanics of forming processes and forming operations
– rolling, forging, drawing, deep drawing, bending, extrusion, punching and blanking
– high energy forming processes – defects in metal forming – problems.

Unit 3
Metal joining processes: Principles of welding – fusion, resistance and solid state welding – soldering, brazing and adhesive bonding, arc welding, resistance welding, gas welding, thermit welding, ultrasonic welding, electron beam welding, laser beam welding and explosive welding – weld defects and inspection.


Course Outcomes

15MEC213.1 Select a suitable casting process for a specific application.
15MEC213.2 Recommend a suitable metal forming process for a specific application.
15MEC213.3 Classify various welding process and select a suitable welding process for a given application.
15MEC213.4 Identify the various defects in manufacturing process

TEXTBOOK:

REFERENCES:
3. Amitabh A. Ghosh and Asok Kumar Malti - ‘Manufacturing Science’ - Affiliated East-West, Press Private Limited - 2010

15MAT214 PROBABILITY AND STATISTICS 2 1 0 3

Unit 1

Random Variable and Distributions: Introduction to random variable – discrete and continuous distribution functions - mathematical expectations – moment generating functions and characteristic functions. Binomial, Poisson, Geometric, Uniform, Exponential, Normal distribution functions (MGF, mean, variance and simple problems) – Chebyshev’s theorem

Unit 2
Sampling Distributions: Distributions of Sampling Statistics, Chi-square, t and F distributions (only definitions and use). Central Limit Theorem.  

Unit 3
Testing of Hypothesis: Large and small sample tests for mean and variance – Tests based on Chi-square distribution.

Course Outcomes

15MAT214.1 Understand the basic concepts of probability and probability modeling.
15MAT214.2 Gain knowledge about statistical distributions and their properties
15MAT214.3 Get in-depth knowledge about statistical distributions and their real time applications.
15MAT214.4 Understand some approximation theorems on probability and distributions.
15MAT214.5 Know the importance of estimating the parameters of probability models.
15MAT214.6 Ability to make decisions under uncertainties using statistical testing of hypotheses

TEXTBOOK:

REFERENCE BOOKS:
Calibration of flow measuring devices: Notches, Orifice meter, Venture meter, Verification of Bernoulli’s equation, Reynolds apparatus and Meta centric height of a floating body. Experiments to study frictional losses in pipes, losses in bends and elbows.

Performance test on different types of pumps, Impact of jet on vanes, Performance test on different types of turbines.

Course Outcomes

15MEC285.1 Calibrate flow measuring devices
15MEC285.2 Compute the major and minor losses in flow through pipes
15MEC285.3 Assess the stability of a floating body based on buoyancy
15MEC285.4 Study the performance of hydraulic turbines and pumps

Soft skills and its importance: Pleasure and pains of transition from an academic environment to work - environment. Need for change. Fears, stress and competition in the professional world. Importance of positive attitude, self motivation and continuous knowledge upgradation.

Self-confidence: Characteristics of the person perceived, characteristics of the situation, characteristics of the perceiver. Attitude, values, motivation, emotion management, steps to like yourself, positive mental attitude, assertiveness.

Presentations: Preparations, outlining, hints for efficient practice, last minute tasks, means of effective presentation, language, gestures, posture, facial expressions, professional attire.

Vocabulary building: A brief introduction into the methods and practices of learning vocabulary. Learning how to face questions on antonyms, synonyms, spelling error, analogy, etc. Faulty comparison, wrong form of words and confused words like understanding the nuances of spelling changes and wrong use of words. Listening skills: The importance of listening in communication and how to listen actively.

Prepositions, articles and punctuation: A experiential method of learning the uses of articles and prepositions in sentences is provided.

Problem solving level I: Number system; LCM &HCF; Divisibility test; Surds and indices; Logarithms; Ratio, proportions and variations; Partnership;

Problem solving level II: Time speed and distance; work time problems;
Data interpretation: Numerical data tables; Line graphs; Bar charts and Pie charts; Caselet forms; Mix diagrams; Geometrical diagrams and other forms of data representation.

Logical reasoning: Family tree; Deductions; Logical connectives; Binary logic; Linear arrangements; Circular and complex arrangement; Conditionalities and grouping; Sequencing and scheduling; Selections; Networks; Codes; Cubes; Venn diagram in logical reasoning; Quant based reasoning; Flaw detection; Puzzles; Cryptographs.

TEXTBOOKS:
5. Quantitative Aptitude by R. S. Aggarwal,S. Chand
6. Quantitative Aptitude – Abijith Guha, TMH.
7. Quantitative Aptitude for Cat - Arun Sharma. TMH.

REFERENCES:
3. The BBC and British Council online resources
4. Owl Purdue University online teaching resources
5. www.the grammarbook.com - online teaching resources www.englishpage.com- online teaching resources and other useful websites

15MEC301 DESIGN OF MACHINE ELEMENTS I 3 0 0 3

Unit 1
Introduction:

Design for Strength:
Design for Static Loading: Simple Stresses - tensile Stress, Compressive Stress and Shear Stress, Compound Stresses - Torsional Stress and Bending Stress, Types of Loading, Simple and Compound Stresses, Working Stress, Factor of Safety, Factors Influencing selection of FOS, Eccentric Loading, Combined Loading, Theories of Failure,


Stress Concentration: Stress Concentration, Stress Concentration Factor, Determination of Stress Concentration factor, Methods of Reducing Stress Concentration,
Unit 2

DESIGN OF SHAFTS: Design for strength and Rigidity with Steady loading, ASME & BIS codes for Power Transmission shafts, Shafts subjected to Combined Twisting Moment and Bending Moment, Shafts under Fluctuating loads and Combined loads.

KEYS AND COUPLINGS: Keys and Splines, Design of keys, Design of Rigid and Flexible couplings.

Unit 3
MECHANICAL JOINTS:
Welded Joints: Types, Strength of Butt and Fillet welds, Eccentrically loaded Welded Joints

POWER SCREWS: Types of Screw Threads used for Power Screws, Torque required to Raise and Lower the load, Efficiency and Self-locking, Design of Screw Jack. Design of screws for C-Clamp and machine vice.

Course Outcomes

15MEC301.1 Apply theories of failure to estimate the allowable loads in machine elements
15MEC301.2 Analyze steady and variable stresses induced in machine elements for different applications
15MEC301.3 Select materials and design machine elements for practical mechanical systems
15MEC301.4 Design welded and riveted joints and analyze for failure
15MEC301.5 Design screw jack and screws for C-clamp and machine vice

TEXTBOOKS:

REFERENCES:

15MEC302 DYNAMICS OF MACHINES 3 0 0 3

Unit 1
Static and Dynamic Force Analysis

Static force analysis of mechanisms - D’ Alembert’s principle - Inertia force and Inertia torque - Dynamic force analysis - Dynamic Analysis in Reciprocating Engines - Gas Forces - Equivalent masses - Bearing loads - Crank shaft Torque.

Flywheels
Turning moment diagrams - Flywheels of engines and punch press.

Unit 2
Balancing of rotating masses and Reciprocating masses
Static and dynamic balancing - Balancing of rotating masses - Balancing a single cylinder Engine - Primary and secondary unbalanced forces - Balancing Multi-cylinder Engines - Firing order - Balancing machines.

Unit 3
Control Mechanisms Governors
Types - Centrifugal governors - Gravity controlled and spring controlled centrifugal governors - Characteristics - Effect of friction - Controlling Force - Quality of governors - effect of friction.

Gyroscope
Gyroscopic couple - Gyroscopic stabilization - Gyroscopic effects in Automobiles, Airplanes and Ships

Course Outcomes

15MEC302.1 Analyze mechanisms using the principles of statics and dynamics and determining joint forces and torques.
15MEC302.2 Estimate the magnitude and position of balancing masses for unbalanced rotating and reciprocating parts.
15MEC302.3 Construct turning moment diagrams for two and four stroke engines to evaluate the flywheel mass.
15MEC302.4 Analyze the effect of gyroscopic couple on automobiles, ships, and airplanes.
15MEC302.5 Analyze and design centrifugal governors

TEXTBOOKS:

REFERENCES:
15MEC303 HEAT POWER ENGINEERING 3003

Unit 1
Combined first law and second law of open systems, reversible steady flow work, available energy, irreversibility, exergy and second law efficiency.

Vapour power cycles: Simple Rankine Cycle, reheat cycle, regenerative cycles


Steam turbines: Impulse and Reactions turbine, compounding principles.

Unit 2


Unit 3


Air conditioning systems: Psychrometry, Air-conditioning equipment, components and control, cooling load calculations.

Course Outcomes

15MEC303.1 Apply energy balance, entropy balance and exergy balance in a system to determine heat, work, entropy generation and reversible work
15MEC303.2 Evaluate the combustion properties of reacting mixtures
15MEC303.3 Evaluate efficiency of gas power and vapour power cycles
15MEC303.4 Improve the performance of the system using concepts of regeneration, reheating, intercooling, multistage compression and expansion in gas turbines
15MEC303.5 Apply energy conversion principles to engineering devices like IC engine, compressor, refrigeration and air-conditioning system for determining efficiency and coefficient of performance
15MEC303.6 Examine the operation of a steam nozzle and work output of the steam turbine using velocity triangles.

TEXTBOOKS:

REFERENCES:

15MEC304 MANUFACTURING PROCESS II 3 0 0 3

Unit 1
Theory of metal cutting: Types of metal cutting processes, Mechanism of chip formation - Forces and temperature in metal cutting, Tool life - Machinability and surface finish: Cutting tool materials and cutting fluids. Tool wear.

Cylindrical Surface Machining: Basics of turning process, lathe and its accessories, operations, process parameters.
Machining time calculations.

Drilling Machines: Types, operations, process parameters. Design considerations for drilling operations. Machining time calculations.

Unit 2
Flat and Profile Machining: Milling operations - Milling machines: types, operations, process parameters. Planing and shaping machines -types, operations. Gear machining processes.


Unit 3
CNC Machines: Overview, types, construction, tool and work holding devices, feedback devices, part programming - examples.

Course Outcomes

15MEC304.1 Choose the various processes of machining and select the appropriate machine based on the shape of any given component
15MEC304.2 Analyse the mechanism of chip formation in machining and solve simple problems related to the calculation of machining time, tool life etc.
15MEC304.3 Evaluate the various machining processes such as turning, drilling, boring, shaping, slotting, milling, grinding and calculate the machining time.
15MEC304.4 Choose the appropriate method of manufacture of gears depending on their geometry, application and quantity.
15MEC304.5 Compare CNC with conventional machines and create simple CNC manual programs.
15MEC304.6 Choose the appropriate Rapid Prototyping methods by understanding their capabilities and limitations.

TEXTBOOK:

REFERENCES:

15MAT302 NUMERICAL METHODS 2023

Unit 1
Review of Errors: Accuracy and Precision, round-off error and truncation error. (Sec. 2.2-2.4)

Roots of Transcendental and Polynomial Equations: Bisection method, Iteration methods based on first degree equation, Rate of convergence, System of nonlinear equations. (Sec. 4.2, 4.3, 5.1-5.3, 5.5)


Unit 2
Interpolation and Approximation: Lagrange and Newton interpolation for unequal intervals, Finite difference
operators, Interpolating polynomials using finite differences. (Sec. 13.1 – 13.4, 13.6)

**Unit 3**

Review of Ordinary Differential Equations:


Lab. - Implementation of these methods: MATLAB or EXCEL or Free and Open Source Software (FOSS) tools like R-programming and Scilab.

**Course Outcomes**

15MAT302.1 Understand and apply different numerical methods to solve algebraic, transcendental equations and system of nonlinear equations

15MAT302.2 Understand and apply power method, Jacobi method to find eigenvalues and eigenvectors

15MAT302.3 Understand and apply concept of interpolation and inverse interpolation

15MAT302.4 Understand and implementation of methods Taylors series, Euler method, modified Euler method and RK methods to solve ODE

15MAT302.5 Implementation of numerical methods using MATLAB and writing efficient well documented MATLAB codes and present numerical methods in an informative way.

**TEXTBOOK:**


**REFERENCE BOOKS:**


**15MEC381 MANUFACTURING PROCESS LAB.**

Study of various processes, tools and equipment’s used in foundry, exercises on mould preparation, foundry sand testing.

Course Outcomes

15MEC381.1 Explain the details of various manufacturing and machining processes, their evolution and need
15MEC381.2 Identify the correct machining process and develop process plan for various complex shaped geometries
15MEC381.3 Produce the required geometry with the required accuracy from the given raw material as per the process plan
15MEC381.4 Identify the influence of process variables and make technical inference about the process

15MEC382 THERMAL SCIENCES LAB. 0 0 2 1

Experiments to determine flash and fire point, viscosity, calorific values of solid, liquid and gaseous fuels, Carbon content (Carbon residue test).

Study of I.C engines, components and loading devices, Valve timing and port timing diagrams, Performance test, Heat balance sheet on Petrol and Diesel engines, to find Friction power: Morse test or Motoring test.

Study of Refrigeration and Air conditioning system - Performance Tests (COP), Study of Renewable energy systems (like Solar, Wind, Biomass etc.) - Performance tests.

Course Outcomes

15MEC382.1 Compute the property of fuels and lubricating oils using suitable tests.
15MEC382.2 Examine the nature of actual valve /port timing
15MEC382.3 Analyze the performance of internal combustion engines under various operating conditions
15MEC382.4 Measure the Coefficient of performance of refrigerator and air conditioning units

15SSK321 SOFT SKILLS II 1 0 2 2


Group discussions: Advantages of group discussions, structured GD – roles, negative roles to be avoided, personality traits to do well in a GD, initiation techniques, how to perform in a group discussion, summarization techniques.
Listening comprehension advanced: Exercise on improving listening skills, grammar basics: Topics like clauses, punctuation, capitalization, number agreement, pronouns, tenses etc.

Reading comprehension advanced: A course on how to approach middle level reading comprehension passages.

Problem solving level III: Money related problems; Mixtures; Symbol based problems; Clocks and calendars; Simple, linear, quadratic and polynomial equations; special equations; Inequalities; Functions and graphs; Sequence and series; Set theory; Permutations and combinations; Probability; Statistics.

Data sufficiency: Concepts and problem solving.

Non-verbal reasoning and simple engineering aptitude: Mirror image; Water image; Paper folding; Paper cutting; Grouping of figures; Figure formation and analysis; Completion of incomplete pattern; Figure matrix; Miscellaneous.

Spacial aptitude: Cloth, leather, 2D and 3D objects, coin, match sticks, stubs, chalk, chess board, land and geodesic problems etc., related problems.

**TEXTBOOKS:**
5. Quick Maths – Tyra.
6. Quicker Arithmetic – Ashish Aggarwal
7. Test of reasoning for competitive examinations by Thorpe.E. TMH
8. Non-verbal reasoning by R. S. Aggarwal, S. Chand

**REFERENCES:**
3. The BBC and British Council online resources
4. Owl Purdue University online teaching resources
   www.the grammarbook.com - online teaching resources www.englishpage.com- online teaching resources and other useful websites.

**15MEC390 / 15MEC490**  
**LIVE-IN-LAB.**  
**3 cr**

This initiative is to provide opportunities for students to get involved in coming up with technology solutions for societal problems. The students shall visit villages or rural sites during the vacations (after 4th semester or sixth semester) and if they identify a worthwhile project, they shall register for a 3-credit Live-in-Lab project, in the fifth or seventh semester. The objectives and projected outcome of the project should be reviewed and approved by the Dept. chairperson and a faculty assigned as the project guide. On completion of the project, the student shall submit
a detailed project report. The report shall be evaluated and the students shall appear for a viva-voce test on the project.

Course Outcomes

15MEC390.1 Using Human Centered Design Concepts to document observations and user experiences
15MEC390.2 Identify and Analyze various Challenge Indicators in the village using Participatory Rural Appraisal
15MEC390.3 Selection of one Challenge that needs to be solved
15MEC390.4 Preparing Field Journal to document the observations, interviews, measurements etc.
15MEC390.5 Recording ideas, personal thoughts and experiences as well as reflections and insights through Reflective Journal
15MEC390.6 Identify and Analyze the Social Structure, Social Change Agents, etc., to implement Sustainable Social Change Models
15MEC390.7 Collating and Analyzing Current Government Policies applicable for the rural India
15MEC390.8 Quantitative and Qualitative Data Collection, Representation and Analysis for problem identification
15MEC390.9 User Needs Assessment and Prioritization
15MEC390.10 Design a Technical Solution using Human Centered Design Concepts
15MEC390.11 Report Generation
15MEC390.12 Research Paper Submission
15MEC390.13 Poster Presentation

15MEC311 DESIGN OF MACHINE ELEMENTS II 3 1 0 4

Unit 1
BEARINGS
Lubrication, Bearings - Introduction, Viscosity, Classification, Hydrodynamic & Hydrostatic Lubrication, Pressure distribution - eccentricity and minimum film thickness, Thick & Thin film lubrication, Bearing materials,

Journal bearings (Sliding contact bearing) - Bearing characteristic numbers, Petroff's equation, Sommerfeld number, Mckee’s equation, Journal bearings design.

Rolling Contact Bearings - Types, Static & Dynamic load carrying capacity, Reliability, Selection of antifriction bearings for Static & Dynamic conditions, Selection of antifriction bearings for constant and varying loads.

FLEXIBLE TRANSMISSION SYSTEM
Introduction, Classification & Application of flexible power transmission systems, Simple and Compound power drives.

Belt Drives - Flat belt drives, types, belt configuration, velocity ratio, slip, condition for maximum power transmission, length of open and cross belt drives, centrifugal tension, initial tension, selection of belts, flat belt pulleys, fast and loose pulleys, Designation of V-belt, Advantages and Disadvantages of v-belt drives, Selection of
V-belt,

Rope Drives - Types, Designation of wire rope, Length of wire rope, factor of safety, Stresses in hoisting wire ropes, Selection of wire ropes, Wire rope Sheaves and Drums.

Chain drives - Introduction, Terms used in chain drives, Classification, Conveyor chains, Power transmitting chains, Roller chains, Factor of Safety for chain drives, Selection of chain drives.

**Unit 2**
GEARS - Types, Applications and Gear Terminology.

Spur Gears - Law of gearing, conjugate action and interference in gears, Gear tooth profiles, involute profile, Influence of number of teeth and pressure angle, Gear tooth failure modes, beam strength of gear tooth - Lewis equation, Gear materials, Force analysis, Design for strength, Dynamic and wear load.

Helical gears – Applications, Virtual number of teeth on helical gears, Force analysis, Design of helical gears.

Bevel Gears - Nomenclature of straight and spiral bevel gears, Applications, Design of bevel gears.

Worm Gears - Nomenclature of worm gears, Applications, Design of worm gears.

GEAR BOX
Gear Boxes - types, Gear tooth loads and bearing reactions, Standard speed ratios - speed diagram, Design of multi stage, multi speed gear boxes,

**Unit 3**
FRICION DRIVES
Clutches - Introduction, Principle of operation of friction clutches, Clutch materials, friction lining materials, Types of clutches, Single plate clutches, Multi-plate clutches, Axial clutches, Cone clutches, Centrifugal clutches, Selection of clutches.

Brakes - Introduction, Energy to be dissipated, Heating of brakes, Shoe or Block brakes (Single & Double), internal and external shoe brakes, self-locking brakes, Differential band brakes, Internal expanding brakes.

**Course Outcomes**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>15MEC311.1</td>
<td>Select and Design suitable power transmission systems for specific applications</td>
</tr>
<tr>
<td>15MEC311.2</td>
<td>Select the type of bearing and Estimate the size based on load carrying capacity in rotating machines</td>
</tr>
<tr>
<td>15MEC311.3</td>
<td>Design friction drives for automotive applications</td>
</tr>
<tr>
<td>15MEC311.4</td>
<td>Design single stage and multi stage gear boxes for machine tool applications</td>
</tr>
</tbody>
</table>

**TEXTBOOKS:**


NOTE: Design of some of the above components for practical applications can be emphasized for better understanding and Continuous Evaluation of the Course.

15MEC312 HEAT TRANSFER 3 1 0 4

Unit 1

Unit 2
Convective heat transfer: Newton's law of cooling, Prandtl number, hydrodynamic and thermal boundary layer, forced convection, Nusselt number, empirical relations in forced convection for flat plates, cylinders and spheres, Flow over tubes and bank of tubes Internal flow and heat transfer: fully developed laminar flow in pipes, turbulent forced convection, free convection, Natural convection: dimensionless numbers, combined natural and forced convection, Phase change heat transfer: Pool boiling, convective boiling, film and drop wise condensation, empirical relations for heat transfer with phase change.

Unit 3

Radiation heat transfer: electromagnetic radiation spectrum, thermal radiation, absorptivity, reflectivity, transmissivity, emissivity, black body, gray body and white body, monochromatic and total emissive power, Planck’s law, Stefan-Boltzmann law, Wein's Displacement law, Radiation exchange between surfaces, view factors, radiation shields, greenhouse effect.

Course Outcomes
15MEC312.1 Analyze one-dimensional heat conduction in solids for different geometries involving heat generation

15MEC312.2 Solve one-dimensional steady and unsteady heat conduction problems to obtain the temperature distributions and rate of heat transfer

15MEC312.3 Analyze extended surfaces, and assess how efficiently and effectively they enhance heat transfer

15MEC312.4 Evaluate heat transfer coefficient associated with forced and free convection using established empirical correlations

15MEC312.5 Analyze heat exchangers based on Logarithmic Mean Temperature Difference (LMTD) and Effectiveness-NTU methods

15MEC312.6 Determine radiation heat transfer between diffuse and gray surfaces

TEXTBOOKS:

REFERENCES:
3. Adrian Bejan - ‘Heat Transfer’ - Wiley India Pvt Ltd. - 2011

15MEC313 INTRODUCTION TO FINITE ELEMENT METHODS 3024

Unit 1
Introduction: Equilibrium equations in elasticity subjected to body force, traction forces, stress strain relations for plane stress and plane strain, Boundary conditions, Initial conditions, Euler’s Lagrange’s equations of bar, beams, Principal of a minimum potential energy, principle of virtual work, Rayleigh-Ritz method, Galerkins method, Guass elimination method, Numerical integration.

Basic Procedure: General description of Finite Element Method, Engineering applications of finite element method, Discretization process; types of elements 1D, 2D and 3D elements, size of the elements, location of nodes, node numbering scheme, half Bandwidth, Stiffness matrix of bar element by direct method, Properties of stiffness matrix, Preprocessing, post processing.

Interpolation Models: Polynomial form of interpolation functions - linear, quadratic and cubic, Simplex, Complex, Multiplex elements, Selection of the order of the interpolation polynomial, Convergence requirements, 2D Pascal triangle, Linear interpolation polynomials in terms of global coordinates of bar, triangular (2D simplex) elements,
Linear interpolation polynomials in terms of local coordinates of bar, triangular (2D simplex) elements, CST element.


**Unit 2**
Solid Mechanics Applications: Direct method for bar element under axial loading, trusses, beam element with concentrated and distributed loads, matrices, Jacobian, Jacobian of 2D triangular element, quadrilateral, Consistent load vector.

Solution of bars, stepped bars, plane trusses, space truss, beams and frames by direct stiffness method. Solution for displacements, reactions and stresses by using elimination approach, penalty approach. Plane stress, plane strain and Axisymmetric problems. Dynamic Analysis.

**Unit 3**
Heat Transfer and Fluid Flow Problems: Steady state heat transfer, 1D and 2D heat conduction governing equation, boundary conditions, One dimensional element, Functional approach for heat conduction, Galerkin approach for heat conduction, heat flux boundary condition, 1D heat transfer in thin fins, heat transfer 1D and 2D problems with conduction and convection.

Fluid flow problems and Introduction to Finite Element Packages and its application to solid mechanics, fluid and heat transfer problems

**Course Outcomes**

15MEC313.1 Understand the basics and concept of finite element method
15MEC313.2 Develop Interpolation models for 1D, 2D and 3D elements
15MEC313.3 Formulate analysis problem by selecting a suitable element, development of stiffness, force matrices and incorporating boundary conditions.
15MEC313.4 Formulate and solve structural and thermal problems
15MEC313.5 Solve complex problems using commercial packages

**TEXTBOOKS:**

**REFERENCES:**
15MEC314 METROLOGY AND MEASUREMENTS 3 0 0 3

Unit 1
Concept of Metrology: Definition and concept of Metrology - need of Inspection - Generalized measurement system - Units and standards - measuring instruments; sensitivity, stability, range, accuracy and precision, static and dynamic response, repeatability - systematic and random errors - correction; calibration.


Unit 2
Surface Texture and Screw Thread Measurement: Elements of surface texture - Evaluation of surface finish - Peak to valley height - Talysurf, Tomlinson surface meter - Screw thread terminology - Measurement of various elements of thread; Measurement of thread angle by two wire and Three wire methods; Thread gauges and floating carriage micrometer.

Form Measurements: Measurement of Straightness, Flatness, Parallelism, squareness testing, Roundness testing - Radius Gauge, Wire Gauge, etc.

Signal Representation – Signal conditioners, filters, ADC, DAC

Unit 3
W heatstone bridge, use of bridge circuits - Displacement measurement - Potentiometer - LVDT, Piezo electric type - Velocity measurement.

Nature of Vibration, accelerometers.

Strain measurement types, mechanical strain gauge, Electrical strain gauge, selection of strain gauge.

Temperature measurement: Bimetallic thermometer, Platinum resistance thermometers, Thermocouples and Pyrometers – Pressure fundamentals; Elastic transducers, thermal conductivity gauges, Vacuum pressure measurement, Flow measurement - Ultrasonic flow meter - turbine type meters - Hot wire anemometers.

Course Outcomes
Understand the concept of Metrology, Quality control, Quality Assurance and TQM

Explain the working principle of instruments used for linear and Angular measurements.

Identify the various methods used for measuring surface roughness and thread measurement.

Illustrate the construction and working principle of measuring Gear Nomenclature and geometric features of parts.

Discuss the instruments used for measurement of Displacement, Rotary, Speed and Vibration.

Perceive the various instruments used for measurement of Strain, Temperature, Pressure and Flow.

TEXTBOOKS:

REFERENCES:
5. Dr. D. S. Kumar - ‘Mechanical Measurements & Control’ - Metropolitan Book Co. Private Ltd. - ISBN 81-200 0214-8

15MEC385 HEAT TRANSFER AND THERMAL ANALYSIS LAB. 0 0 2 1

HEAT TRANSFER
To determine of thermal conductivity of metal rod and composite wall, heat transfer coefficient in free and forced convection. Performance test on extended surfaces, heat exchangers. Experiment on Transient conduction and radiation heat transfer.

THERMAL ANALYSIS
Introduction to the Software package, Analysis of flow through pipes, elbows and nozzles, Analysis of flow over different objects using CFD software, Analysis of conduction, convection and radiation problems using FEM package

Course Outcomes

15MEC385.1 Determine the thermal conductivity of insulating materials
15MEC385.2 Determine the convective heat transfer coefficient in free and forced convective conditions
15MEC385.3 Find the Rating of a heat exchanger
15MEC385.4 Estimate the radiative properties
15MEC385.5 Analyze flow and heat transfer characteristics for simple configurations using CFD

15MEC386 METROLOGY AND MEASUREMENTS LAB.

METROLOGY LAB


MEASUREMENTS LAB
Calibration of Pressure Gauge, Thermocouple, LVDT, Load cell. Measurement of load, torque, speed, angular displacement. Study of strain gauge rosettes, determination of modulus of elasticity using strain gauges. Study of stress concentration using photo-elasticity for simple components like plate with a hole under tension or bending, circular disk with circular hole under compression.

Course Outcomes

15MEC386.1 Analyze the measurements using process control charts
15MEC386.2 Measure surface roughness, tool nomenclature, threads and gear tooth thickness using appropriate instruments
15MEC386.3 Measure various physical quantities using appropriate instruments.
15MEC386.4 Choose appropriate instruments to measure physical parameters such as Temperature, Pressure, Displacement, Strain, Force, Torque, and Speed.
15MEC386.5 Evaluate the performance characteristics of speed measuring sensors like Photo electric, Capacitive, Inductive, stroboscope and optical encoder
15MEC386.6 Calibrate measuring instruments such as pressure gauge, thermocouple, LVDT, and Load cell
15MEC386.7 Determine stress concentration on test specimens using Photo elastic Polariscope
Team work: Value of team work in organisations, definition of a team, why team, elements of leadership, disadvantages of a team, stages of team formation. Group development activities: Orientation, internal problem solving, growth and productivity, evaluation and control. Effective team building: Basics of team building, teamwork parameters, roles, empowerment, communication, effective team working, team effectiveness criteria, common characteristics of effective teams, factors affecting team effectiveness, personal characteristics of members, team structure, team process, team outcomes.

Facing an interview: Foundation in core subject, industry orientation / knowledge about the company, professional personality, communication skills, activities before interview, upon entering interview room, during the interview and at the end. Mock interviews.

Advanced grammar: Topics like parallel construction, dangling modifiers, active and passive voices, etc.

Syllogisms, critical reasoning: A course on verbal reasoning. Listening comprehension advanced: An exercise on improving listening skills.

Reading comprehension advanced: A course on how to approach advanced level of reading, comprehension passages. Exercises on competitive exam questions.

Problem solving level IV: Geometry; Trigonometry; Heights and distances; Co-ordinate geometry; Mensuration.

Specific training: Solving campus recruitment papers, national level and state level competitive examination papers; Speed mathematics; Tackling aptitude problems asked in interview; Techniques to remember (In mathematics). Lateral thinking problems. Quick checking of answers techniques; Techniques on elimination of options, estimating and predicting correct answer; Time management in aptitude tests; Test taking strategies.

TEXTBOOKS:
4. The Hard Truth about Soft Skills, by Amazon Publication.
5. Data Interpretation by R. S. Aggarwal, S. Chand
6. Logical Reasoning and Data Interpretation – Niskit K Sinkha
7. Puzzles – Shakuntala Devi

REFERENCES:
3. The BBC and British Council online resources
15MEC401 ADVANCED FLUID MECHANICS 3003

Unit 1

Unit 2
The boundary layer equations. Displacement thickness. Momentum thickness. Turbulent flat plate boundary layer. Boundary layers with pressure gradients.


Unit 3

Course Outcomes

15MEC401.1 Evaluate fluid kinematic properties to classify types of fluid flow and flow visualizations technique
15MEC401.2 Solve practical flow fields with appropriate assumptions using governing equations of motion and apply boundary layer theory in the development of fluid mechanics applications
15MEC401.3 Examine lift and drag force associated with fluid flow over common geometries
15MEC401.4 Apply the thermodynamics concepts in relation to compressible flows and derive relationships between various compressible flow parameters
15MEC401.5 Analyze the consequences of compressibility in gas flow and evaluate the effects of friction and heat transfer on compressible flows
15MEC401.6 Predict the occurrence of shocks and calculate property changes across a shock wave

TEXTBOOKS:

4. Owl Purdue University online teaching resources
www.the grammarbook.com - online teaching resources www.englishpage.com - online teaching resources and other useful websites.
REFERENCES:

15MEC402 CONTROL ENGINEERING 3 0 0 3

Unit 1
Introduction: Concept of automatic controls, open and closed loop systems, concepts of feedback, requirement of an ideal control system.

Modeling of Systems: The control system, Mathematical models of physical systems - Introduction, Differential equations of physical systems – Mathematical Model: Mechanical System (both translation and rotational), Electrical systems (servos, D.C. Motors, A.C. Servomotors), Hydraulic systems (liquid level and fluid power systems), Thermal systems, Integrating devices, Hydraulic servomotor, temperature control system, error detectors.

Block Diagrams: Transfer Functions definition, function, block representation of system elements, reduction of block diagrams, Basic properties and gain formula to block.

Unit 2
System Response: First order and second order system response to step, ramp and sinusoidal inputs, concepts of time constant and its importance in speed of response


Unit 3

Control system analysis in state space: Introduction to the state concepts, state equation of linear continuous data system. Matrix representation of state equations, controllability and observability, Kalman and Gilberts test

Course Outcomes
- 15MEC402.1 Develop mathematical models for control systems
- 15MEC402.2 Analyze the models using standard test signals in time and frequency domain
- 15MEC402.3 Examine the stability and relative stability of control system in time and frequency domain
- 15MEC402.4 Design and implementation of feedback control systems for industrial application
**TEXTBOOKS:**
1. K. Ogata - ‘Modern Control Engineering - Prentice Hall (India) - Pearson Education - 2009
   - 5th Edition

**REFERENCES:**
   - 12th Edition

**15MEC403 INDUSTRIAL ROBOTICS 3 0 0 3**

**Unit 1**


**Unit 2**
Direct Kinematic Model – Mechanical structure and notations - Description of links and joints - Kinematic modeling of manipulator - Denavit-Hartenberg Notation - Kinematic Relationship between adjacent links - Manipulator Transformation Matrix.

Inverse Kinematic Model – Manipulator Workspace – Solvability - Solution techniques - Closed form solution.

**Unit 3**

**Course Outcomes**
15MEC403.1 Identify the components of a robot and distinguish the types of robot configurations
15MEC403.2 Compare, evaluate and choose sensors/drives for robot to be designed
15MEC403.3 Construct kinematic model of a given manipulator and evaluate whether the inverse kinematic model is solvable
15MEC403.4 Examine the need for vision system to be used in a robotic system
15MEC403.5 Choose and apply appropriate image processing technique for object recognition to be used in robotic system
15MEC403.6 Design and develop a robotic system for a given industrial application

**TEXTBOOK:**

**REFERENCE BOOKS:**

15MEC404 MECHANICAL VIBRATIONS 3 0 0 3

**Unit 1**

Un-damped free vibrations: Single degree of freedom systems. Un-damped free vibration-natural frequency of free vibration, stiffness of spring elements, effect of mass of spring, Compound Pendulum.

Damped free vibrations: Single degree freedom systems, different types of damping, concept of critical damping and its importance, study of response of viscous damped systems for cases of under damping, critical and over damping, Logarithmic decrement.

**Unit 2**
Forced Vibration: Single degree freedom systems, steady state solution with viscous damping due to harmonic force. Solution by Complex algebra, Reciprocating and rotating unbalance, vibration isolation - transmissibility ratio. Due to harmonic excitation and support motion, Whirling of Shafts - Whirling of shafts with and without air damping, Discussion of speeds above and below critical speeds.

Vibration measuring instruments & Vibration Control: Vibration exciters, vibrometer and accelerometer, free & forced vibration tests, vibration isolation, vibration absorbers.

**Unit 3**
Systems with two degrees of freedom: Introduction, principle modes and Normal modes of vibration, co-ordinate coupling, generalized and principal co-ordinates, Free vibration in terms of initial conditions. Geared systems. Forced
Oscillations - Harmonic excitation.


Course Outcomes

15MEC404.1 Classify different types of vibrations and develop mathematical models of vibrating systems
15MEC404.2 Analyze free and forced vibrations of single degree of freedom systems
15MEC404.3 Estimate the natural frequencies and mode shapes of multi degree of freedom systems
15MEC404.4 Design of vibration isolators and absorbers to control vibrations

TEXTBOOKS:

REFERENCES:

15ENV300 Environmental Science and Sustainability 3 0 0 3

Outcomes:

<table>
<thead>
<tr>
<th>ENV300.1</th>
<th>CO1: Integrate facts and concepts from ecological, physical and social sciences to characterize some common socio-environmental problems.</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENV300.2</td>
<td>CO2: Develop simple integrated systems and frameworks for solving common interconnected socio-environmental problems.</td>
</tr>
<tr>
<td>ENV300.3</td>
<td>CO3: Reflect critically about their roles and identities as citizens, consumers and environmental actors in a complex, interconnected world.</td>
</tr>
<tr>
<td>ENV300.4</td>
<td>CO4: Identify the ethical underpinnings of socio-environmental issues in general.</td>
</tr>
</tbody>
</table>

CO-PO Mapping:

<table>
<thead>
<tr>
<th>CO Code</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
</tr>
</thead>
</table>
This course is the first step in preparing students to play their role as responsible citizens in a sustainable world. In their professional life, it will empower them to or corporate sustainability efforts.

All four COs of this course strongly map with PO7 (Environment and Sustainability). In terms of the pedagogic approach, the whole course involves classroom activities, interaction and communication in oral and written form. Hence all the COs moderately map with PO10. This multidisciplinary course also brings out the necessity of lifelong learning beyond the boundaries of the classroom, curriculum and disciplines and hence all COs weakly map with PO12.

CO1 pertains to characterizing real-world socio-environmental problems by integrating facts and concepts from ecological, physical and social sciences. This is important because, socio-environmental problems often span different disciplines including, science, engineering, and humanities. CO1 maps moderately with PO6 (Engineer and Society) since environmental problems almost invariably have social and other dimensions. CO1 also weakly maps with PO2 (Problem Analysis) and PO4 (Investigating Complex Problems). The mapping is weak since, the course does not specifically focus on engineering problems even though it involves the identification and analysis of socio-environmental issues, drawing from various disciplines and arriving at conclusions. CO1 also weakly maps with PSO1 (Chemical Engineering Fundamentals) in the context of sustainability-related aspects of chemical engineering unit operations and processes.

CO2 pertains to developing solutions to socio-environmental problems. Such solutions must be integrated solutions (synthesis) due to the interconnected nature of socio-environmental problems. Engineering knowledge and the analysis of technical problems is only a part of such solutions, which involve many other aspects. As a result, CO2 maps weakly with PO1 (Engineering Knowledge) and PO2 (Problem Analysis). Similarly, it maps weakly with PSO2 (Chemical Engineering Problem Solving) and PSO3 (Design and Analysis).

CO3 pertains to students being able to identify their roles as responsible actors with respect to the environment and society. It moderately maps with PO8 (Ethics) since being and ethical actor is an important part of being a responsible actor. CO3 weakly maps with PO9 (Individual and Team Work) since a number of class activities involve working in teams, while there is substantial individual work in the course allowing students to play both roles. The two roles played by the students in the classes are reflective of the roles they would play in the real socio-environmental context. CO3 weakly with PO12 (Lifelong Learning) since being a lifelong learner is an important aspect of playing-environmentalone”sactorin aroledynamic contextas . Itamapsresponsi weakly with PSO1 (Chemical Engineering Fundamentals) in the context of the ethical implications of chemical processes and operations.

CO4 pertains to identifying the ethical issue at the root of socio-environmental problems. It strongly maps with PO8 (Ethics). CO4 also brings out the the need for discipline, and college years and embrace learning about different
fields including ethics and philosophy during one’s life.

15MEC481  COMPUTER INTEGRATED MANUFACTURING LAB.  0 0 2 1


Robot Programming using Teach Pendent and Offline Programming to Perform Pick and Place, Stacking of Objects.

Logical Circuits - Pneumatic and Electro-Pneumatic Circuits, Study of PLC and PLC based Electro-Pneumatic Sequencing Circuits, Visual Inspection of Objects by Computer Vision Technology.

Course Outcomes
15MEC481.1 Develop the CNC part program for various machining processes.
15MEC481.2 Develop robot programming for pick-and-place and stacking of objects.
15MEC481.3 Design and simulate various pneumatic and electro–pneumatic circuits.
15MEC481.4 Develop and simulate the PLC program for various industrial applications

15MEC482  MACHINE DYNAMICS AND CONTROL LAB.  0 0 2 1


Experiments on level, position and speed control. Study of time response of I and II order systems. Analysis of control systems using software packages – exercise on root locus and bode plots.

Course Outcomes
15MEC482.1 Demonstrate and Interpret the concepts of natural frequency, damping, critical speeds in translational and rotating vibrational systems
15MEC482.2 Determine moment of inertia and center of gravity of complex objects
15MEC482.3 Construct the characteristic plots for different types of governors
15MEC482.4 Evaluate the working of a gyroscope and Measure the gyroscopic couple
15MEC482.5 Analyze and Solve for the balancing of rotating and reciprocating masses
15MEC482.6 Analyze the time domain features of a given control system using standard test signal
15MEC482.7 Assess the stability and relative stability of control system
15MEC482.8 Design and develop a PID controller for a given application
The students are required to freeze the area of their project work and conduct the literature surveys during Phase-I of the project, under the guidance of any faculty in the department. The students are expected to work on a topic in the field of Mechanical Engineering. They will be evaluated based on the presentations made by them and a report submitted at the end of the semester by a committee of examiners appointed by the Chairman of the Department.

**Course Outcomes**

- 15MEC495.1 Identify a research topic their area of interest in mechanical Engineering
- 15MEC495.2 Conduct thorough literature review, identify gaps and define objectives and scope of work
- 15MEC495.3 Develop methodology for prototype/model/experimental setup necessary for the project
- 15MEC495.4 Document technical report and orally present the project work

**15MEC411 OPERATIONS RESEARCH 3 0 0 3**

**Unit 1**
Linear programming: Formulations - graphical solutions, simplex method, duality, Transportation model, Assignment model-travelling salesman problem.

**Unit 2**

**Unit 3**
Sequencing model - 2 machines n jobs, m machines n jobs-n jobs 2 machines.

Inventory models - deterministic and probabilistic models, Queuing models-poison arrival and exponential service times, single server, multi-server. Simulation: Monte Carlo simulation - simple problems.

**Course Outcomes**

- 15MEC411.1 Formulate operations research models to optimize resources and maximize profit
- 15MEC411.2 Formulate and solve the transportation and assignment problems and infer solutions
- 15MEC411.3 Analyze the project with appropriate technique to manage the resources and minimize the cost
- 15MEC411.4 Solve operational problems by applying different decision making methods
- 15MEC411.5 Evaluate the performance of various queuing and sequencing models
- 15MEC411.6 Choose the appropriate inventory models to optimize inventory

**TEXTBOOK:**
REFERENCES:

15MEC499 PROJECT PHASE II 10 cr

The project should be focused on the synthesis of knowledge gained over the past seven semesters and Phase-I of the project. The project should be relevant to Mechanical Engineering which could involve theoretical and / or computational and / or fabrication and/ or experimental work. Students are required to submit a report at the end of the semester. Evaluation will be done during the course of the project as well as at the end of the semester by a committee of examiners appointed by the Chairman of the Department.

Course Outcomes

15MEC499.1 Identify a research topic and conduct thorough literature survey and define objective and scope of work
15MEC499.2 Develop methodology (design) for conducting theoretical/experimental study
15MEC499.3 Plan, manage and execute experimental work to obtain results with a concern for safety, industry and environment.
15MEC499.4 Organize, analyze results and draw conclusions through group discussion.
15MEC499.5 Document technical report and orally present findings

ELECTIVES

15MEC230 AIRCRAFT SYSTEMS AND ENGINEERING 3 0 0 3

Unit 1

Introduction to Aircrafts: Basic Components of an Aircrafts, Structural Members, Aircraft Axis System, Aircraft
Motions, Control Surfaces and High Lift Devices.


Unit 2


Unit 3
Basic Principles of Flight: Significance of Speed of Sound, Air Speed and Ground Speed, Properties of Atmosphere, Bernoulli’s Equation, Forces on the Air Plane, Air Flow Over the Wing Section, Pressure Distribution over a wing section, Generation of Lift, Drag, Pitching Moments, Types of Drag, Lift Curve, Drag Curve, Lift / Drag Ratio Curve, Factors affecting Lift and Drag, Center of Pressure and it’s Effects. Aerofoil Nomenclature, Types of Aerofoil, Wing Section - Aerodynamic Center, Aspect Ratio, Effects of Lift, Drag, Speed, Air Density on Drag.


TEXTBOOKS:

REFERENCES:
15MEC231 AUTOMOTIVE CHASSIS DESIGN

Unit 1
Clutch Design Calculation: Design of single plate clutch, multi plate clutch, design of centrifugal clutch, cone clutch, energy dissipated, torque capacity of clutch, design of clutch components, design details of roller and sprag type of clutches.

Gear Box: Performance of vehicle, total resistance to motion, traction and tractive effort, acceleration, calculation of gear ratio, design of three speed gear box, design of four speed gear boxes.

Unit 2
Vehicle Frame and Suspension: Study of loads, moments and stresses on frame members, computer aided design of frame for passenger and commercial vehicles, computer aided design of leaf springs, coil springs and torsion bar springs.

Unit 3
Front Axle and Steering Systems: Analysis of loads, moments and stresses at different sections of front axle, determination of loads at kingpin bearings, wheel spindle bearings, choice of bearings, determination of optimum dimensions and proportions for steering linkages ensuring minimum error in steering.

Final Drive and Rear Axle: Design of propeller shaft, design details of final drive gearing, design details of full floating, semi-floating and three quarter floating rear shafts and rear axle housings.

TEXTBOOK:

REFERENCES:

15MEC232 AUTOMOTIVE TECHNOLOGY

Unit 1

Unit 2

Unit 3

Future Automobiles: Automobile Air Pollution, Pollution Control Norms, Alternate Power Units for Automobiles - Use of Natural Gas, LPG and Hydrogen in Automobiles as Fuels, Fuel Cells, Electric and Hybrid Vehicles. Indian Traffic Rules.

Course Outcomes
15MEC232.1 Recognize the Requirements and Functions of automobile systems and components
15MEC232.2 Explain Constructional Features of automotive systems and components
15MEC232.3 Sketch and describe assembly, disassembly & predict trouble shooting.
15MEC232.4 Analyze and Estimate design of components in a drive train Justify proper usage of material
15MEC232.5 Describe the significance & Obtain Basic knowledge in automotive emissions & combustion process & suggest remedies
15MEC232.6 Explain the electrical and electronics systems, Predict Trouble Shooting and practical problems
15MEC232.7 Explore the possibilities of alternative fuel usage in automobiles

TEXTBOOKS:

REFERENCES:
Unit 1
Basic Concepts: Machinery failures, basic maintenance strategies, factors influencing maintenance strategies, machine condition monitoring, transducer selection and location, PC interfacing and virtual instrumentation. Vibration signatures of faults in rotating and reciprocating machines; detection and diagnosis of faults.

Unit 2
Instrumentation and Signal Processing: Types of sensors in condition monitoring: vibration, acoustics and noise, acoustic emission, temperature, ultrasonic and infra-red sensors - Signal processing: basic signal and systems concepts, time domain analysis, frequency domain analysis, time-frequency analysis, wavelets and wavelet packets.

Unit 3
Pattern Recognition: Feature extraction and feature selection methods, feature reduction using PCA - discriminant functions and decision boundaries, decision trees, maximum likelihood and nearest neighbour classification - Bayesian theory, neural networks, fuzzy logic and support vector machines (SVM) in classification. Application and case studies of condition monitoring: Bearings, gear boxes, engines, structural health monitoring, machine tool condition monitoring etc.

Course Outcomes
15MEC233.1 Select the proper maintenance strategies and condition monitoring techniques for identification of failure in a machine.
15MEC233.2 Acquire and Process sound and vibration signals in a dynamic mechanical system
15MEC233.3 Predict the faulty component in a machine by analyzing the acquired vibration signals
15MEC233.4 Build a classifier model for machine learning based fault diagnosis of rotating machines

TEXTBOOKS:
1. Balageas D., Fritzen C P. and Guemes A. - ‘Structural Health Monitoring’ - Published by ISTE Ltd., USA - 2006

REFERENCE BOOKS:

15MEC234 DESIGN FOR MANUFACTURE AND ASSEMBLY  3 0 0 3

Unit 1


Design features to facilitate machining: datum features - functional and manufacturing. Component design - machining considerations, redesign for manufacture, examples. Form design of castings and weldments.

Unit 2


Interchangeable part manufacture and selective assembly - control of axial play - introducing secondary machining operations, laminated shims - examples.

Unit 3

Datum Systems: Degrees of freedom, grouped datum systems - computation of translational and rotational accuracy - geometric analysis and applications.

True Position Theory: Co-ordinate and conventional method of feature location, tolerance and true position tolerance, virtual size concept, floating and fixedfasteners, projected tolerance zone, assembly with gasket, zero true position tolerance, functional gauges, paper layout gauging - examples.


TEXTBOOKS:
   - Marcel Dekker, New York - 2012 - 4th Edition

REFERENCES:
Unit 1
Introduction to Fracture Mechanics: Failures in structures - types and causes, historical perspective, fracture mechanics approach to design - energy criterion, stress intensity approach, time dependent crack growth and damage tolerance, effect of material properties on fracture.

Linear Elastic Fracture Mechanics (LFEM): Stress concentration effect of flaws, Griffith energy balance, the energy release rate, instability and resistance curve (R-curve), stress analysis of cracks, relationship between stress intensity factor and energy release rate (K and G), crack tip plasticity, mixed mode crack initiation and propagation.

Unit 2

Fracture mechanism in metals and non-metals: Ductile fracture, cleavage, the ductile-brittle transition, intergranular fracture, fracture in polymeric materials, and fracture in ceramic and ceramic composites.

Unit 3
Applications: Introduction to fracture toughness testing of metals and non-metals for determination of fracture parameters, Application of fracture mechanics concepts in the analysis of fatigue crack growth.

Computational fracture mechanics: Overview of numerical methods for fracture mechanics problems, traditional methods in computational fracture mechanics – point matching and energy methods, the energy domain integral, finite element implementation, design of finite element mesh, linear elastic convergence study, analysis of growing cracks.

TEXTBOOK:

REFERENCES:
Unit 1
Overview of materials properties - modulus, tensile. Fatigue, creep strengths, toughness, hardness, fracture toughness, damping capacity, thermal, oxidation, corrosion and wear resistances.

Materials property charts. Materials families and classes - metals, ceramics, glasses, polymers, elastomers, composites, foams, natural.

Unit 2

Unit 3
Case studies in materials selection for various applications - oar, table leg, flywheel, kiln walls, passive solar heating, heat exchangers, bearings, springs, pressure vessel.

Principles of process selection and classification - casting, forging, moulding, fabrication, welding, joining, machining, powder processing, composite processing. Illustration of the principles with case studies.

Multiple constraints and objectives - case studies. Design of hybrid materials - case studies.

TEXTBOOK:
Ashby M. F. - ‘Materials selection in mechanical design’ - Butterworth Heinemann - 2010 - 3rd Edition

REFERENCE:
ASM Handbook - 'Materials Selection and Design’ - 1997

15MEC237 MECHATRONICS 3 0 0 3

Unit 1

Unit 2

Unit 3

Course Outcomes

15MEC237.1 Select different types of sensors and actuators used in mechatronics system
15MEC237.2 Analyze various components of control system
15MEC237.3 Demonstrate the functions of various control structures
15MEC237.4 Develop a PLC program for industrial application

TEXTBOOK:
W. Bolton - ‘Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering’
- Prentice Hall - 2013 - 5th Edition

REFERENCES:

15MEC238 MICRO-ELECTRO MECHANICAL SYSTEM 3 0 0 3

Unit 1

Unit 2
Materials for MEMS and Microsystems. Fabrication technologies – Photolithography - Ion implantation – diffusion
– oxidation – CVD - Physical Vapor Deposition – Etching.

Micro manufacturing - Bulk and surface micro machining - LIGA.

**Unit 3**
Microsystems Design - Design considerations - Process design - Mechanical Design

**Course Outcomes**
15MEC238.1 Interpret the fundamentals of scaling laws in microsystems
15MEC238.2 Select the materials and suitable manufacturing process for MEMS design
15MEC238.3 Design the microsystem for a suitable application
15MEC238.4 Develop the packages for microsystem

**TEXTBOOK:**

**REFERENCES:**

**Unit 1**


**Unit 2**

**Unit 3**

**Course Outcomes**
15MEC239.1 Develop mathematical models for engineering systems in different domains and derive analogies
15MEC239.2 Analyze first and second order systems using Laplace Transform techniques.
15MEC239.3 Analyze first and second order systems in time and frequency domain.
15MEC239.4 Develop block diagrams and estimate relative stability, gain margin and phase margin for feedback systems
15MEC239.5 Simulate mathematical models of engineering systems using simulation software

TEXTBOOK:

REFERENCES:

15MEC240 OPTIMIZATION TECHNIQUES IN ENGINEERING

Unit 1

Linear programming methods for optimum design: Review of Linear programming methods for optimum design – Post optimality analysis - Application of LPP models in design and manufacturing.

Unit 2
Optimization algorithms for solving unconstrained optimization problems – Gradient based method: Cauchy’s steepest descent method, Newton’s method, Conjugate gradient method.

Optimization algorithms for solving constrained optimization problems – direct methods – penalty function methods – steepest descent method - Engineering applications of constrained and unconstrained algorithms.

Unit 3

Course Outcomes
15MEC240.1 Formulate the engineering problems as an optimization problem.
15MEC240.2 Apply necessary and sufficient conditions for a given optimization problem for optimality
15MEC240.3 Select appropriate solution methods and strategies for solving an optimization problem
15MEC240.4 Interpret and analyse the solution obtained by optimization algorithms
15MEC240.5 Justify and apply the use of modern heuristic algorithms for solving optimization problems

TEXTBOOK:

REFERENCES:

15MEC241 PRESSURE VESSEL DESIGN 3003

Unit 1
Introduction to Pressure Vessels, Design Philosophy, Structural Integrity - Failure modes and theories - Working loads and allowable stresses - Fatigue, fracture and buckling.

Stress categorization - Primary, secondary and peak.

Design of Cylindrical Shells - ASME equations - Thin shell equations - Thick shell equations - Buckling of cylindrical shells.

Unit 2
End Closures - ASME equations for various types of heads – Hemispherical, flat, ellipsoidal, torispherical, and conical heads.

Discontinuity Stresses - Discontinuity stresses - Beams on elastic foundation, Cutouts and Reinforcements – Stress concentrations around a hole – Reinforcements.

Fatigue Assessment - Exemption from fatigue analysis - S-N curves - Design curves - Cumulative damage - Fatigue evaluation.

Unit 3
Bolted Flanges - RF and FF flanges - Gasket loading behavior - Application of ASME equations for flange analysis and bolt design.
Design of Supports - Lug support - Support skirts - Saddle support.

TEXTBOOKS:

REFERENCES:
1. Brownell and Young -Process Equipment Design’ - Wiley Publishing Ltd. - 1959

15MEC242 THEORY OF ELASTICITY 3 0 0 3

Unit 1
Analysis of Stress and Strain: Stress at a point; stress tensor; stress transformations; principal stresses; octahedral stress; geometrical representation of stress at a point; equations of equilibrium.

Infinitesimal affine transformation for deformation; strain tensor; principal strains; strain-displacement relations for finite and infinitesimal strains; compatibility conditions. Constitutive Equations: General theory; generalized Hooke’s law for anisotropic and isotropic materials.

Unit 2
Equations of Elasticity: Common equations of elasticity theory like Mitchel-Beltrami and Navier equations, formulation of the general elasticity problem; boundary conditions.

Unit 3
Solution of Some Special Boundary Value Problems: Simplifications; two-dimensional problems in rectangular and polar coordinates; Airy’s stress function; a few problems like stress concentration around a circular hole and Boussinesq problem.

A few representative three-dimensional problems; torsion and bending of non-circular prismatic bars (Saint-Venant’s solution); membrane analogy, Simple Plate bending.

Course Outcomes

15MEC242.1 Apply principles of elasticity theory to estimate stresses and strains in isotropic and non-isotropic materials using a tensorial approach
15MEC242.2 Formulate and solve boundary value problems in solid continua using stress and displacement based solution strategies
15MEC242.3 Formulate and solve planar problems using Airy stress function in rectangular and polar coordinates
Solve specific three-dimensional problems based on torsion, bending of non-circular prismatic bar, membrane analogy, and simple plate bending

**TEXTBOOKS:**

**REFERENCES:**

**15MEC243 TOOL DESIGN 3 0 0 3**

**Unit 1**

**Unit 2**

**Unit 3**

Drawing Dies: Metal flow and factors affecting drawing, blank size calculations, drawing force, single and double acting drawing dies, design and development of drawing dies for different components.

Bending and Forming Dies: Spring back, bend allowance; calculation of development length, bending force calculations types of bending dies. Curling dies.

Forging process and forging dies. (Introductory Treatment)

REFERENCE BOOKS:
2. ‘Production Technology Hand Book’ - HMT - Tata McGraw Hill

15MEC246 AUTOMOTIVE ELECTRONICS 3 0 0 3

Unit 1


Unit 2
Instrumentation systems: Introduction to instrumentation systems - Various sensors used for different parameters sensing - Driver instrumentation systems - vehicle condition monitoring - trip computer different types of visual display.


Unit 3
Engine management systems: Combined ignition and fuel management systems - Exhaust emission control - Digital control techniques - Complete vehicle control systems - Artificial intelligence and engine management – use of microprocessor in Automotives.

Lighting and security systems: Vehicles lighting Circuits - Signaling Circuit Central locking and electric windows security systems - Airbags and seat belt tensioners - Miscellaneous safety and comfort systems.

Course Outcomes
15MEC246.1 Select automotive electronic subsystems
15MEC246.2 Categorize various sensors and actuators used in automotive systems
15MEC246.3  Analyze the advantages of electronic vehicle control over conventional system

TEXTBOOK

REFERENCES

15MEC247  COMBUSTION ENGINEERING  3 0 0 3

Unit 1


Unit 2

Unit 3


TEXTBOOKS:

REFERENCES:
Unit 1


Unit 2


Unit 3
Computational heat transfer: Steady one & two dimensional heat conduction, Unsteady one-dimensional heat conduction, over-relaxation and under-relaxation. One dimensional steady convection and Diffusion.


Course Outcomes

15MEC248.1 Numerically solve 1-D, steady and unsteady diffusion problems
15MEC248.2 Numerically solve 1-D, steady advection-diffusion problems.
15MEC248.3 Understand governing equations for a flow phenomenon and define proper boundary conditions to obtain numerical solution
15MEC248.4 Apply CFD software to model relevant engineering flow problems.

TEXTBOOK:

REFERENCES:

15MEC249 DESIGN OF THERMAL SYSTEMS 3 0 0 3

Unit 1


Unit 2

Unit 3


Course Outcomes

15MEC249.1 To formulate fluid system problem mathematically and solve it using numerical simulation
15MEC249.2 To formulate and design thermal systems using sequential and simultaneous approaches
15MEC249.3 To model and control the dynamic behavior of fluid-thermal systems
15MEC249.4 To simulate fluid-thermal systems using software like pipeline network, ASPEN etc

TEXTBOOKS:

REFERENCES:
1. ‘ASHRAE Guide & applications’ - ASHRAE, USA -1985
15MEC250 FLUID POWER DRIVES AND CONTROLS 3 0 0 3

Unit 1


Unit 2
Design of Hydraulic circuits: Selection and sizing of components - calculation of frictional head loss - equivalent length for various components - actuator load calculation - pump sizing.

Unit 3
Pneumatic system fundamentals: FRL, actuators and valves. Logic Circuits - Position - Pressure Sensing, switching, electro-pneumatic systems.


PLC programming – Microprocessors - Principles of Low Cost Automation - Case studies.

TEXTBOOK:

REFERENCES:

15MEC251 FUNDAMENTALS OF NUCLEAR ENGINEERING 3 0 0 3

Unit 1

Unit 2

Power reactor systems: Pressurised water reactors - Boiling water reactors - Gas cooled and High temperature Gas cooled reactors - Pressurised Heavy water reactors - Fast breeder reactors - LMFBR & GCFBR.

Unit 3

TEXTBOOKS:

REFERENCE:

15MEC252 GAS DYNAMICS AND JET PROPULSION 3 0 0 3

Unit 1

Isentropic Flow: Nozzle and Diffusers, compressors and turbines - Use of Gas tables. Flow through ducts: Flow through constant area ducts with heat transfer (Rayleigh flow) and Friction (Fanno flow) - Variation of flow properties - Use of tables and charts - Generalized gas dynamics.

Unit 2
Normal and oblique shocks: Governing equations - Variation of flow parameters across the normal and oblique shocks - Prandtl Meyer relations – Expansion of supersonic flow, Use of table and charts - Applications.

Unit 3


Course Outcomes

15MEC252.1 Apply the thermodynamics concepts in relation to compressible flows and derive relationships between various compressible flow parameters
15MEC252.2 Develop understanding of isentropic compressible flows in variable area ducts and apply in
design of static components like nozzles and diffusers
15MEC252.3 Analyze and solve for compressible flow characteristics with friction and heat transfer
15MEC252.4 Develop relationship for shocks and determine their characteristics under various conditions
15MEC252.5 Determine performance parameters of aircraft and rocket propulsion engine

**TEXTBOOKS:**

**REFERENCES:**
1953

15MEC253 INTERNAL COMBUSTION ENGINES 3 0 0 3
AND POLLUTION CONTROL

**Unit 1**
Spark Ignition engines: Mixture requirement - Feedback control carburettors - Fuel injection systems. Stochiometric
combustion - combustion with excess air-equivalence ratio.

Stages of combustion: Normal and Abnormal combustion – Knock Combustion chambers. Simple thermodynamic
analysis of SI engine combustion.

**Unit 2**
Compression ignition engines: Nature of combustion in IC engines - Direct and Indirect injection systems - Air
motion - Combustion Chambers - Spray penetration and evaporation. Supercharging - Turbo charging.

Thermo chemistry: Pollutant formation, Instrumentation to measure pollutants - Pollutant calculation - Effect of air-
fuel ratio.

**Unit 3**
exhaust clean-up catalysts - automotive catalytic converters - Engine modifications to reduce emissions. Heat release
analysis of IC engines.

Alternate Fuels: Engine modifications for alternate fuels (liquid and gaseous fuels), homogenous charge compression ignition engines.

TEXTBOOKS:

REFERENCES:

15MEC254 PETROLEUM REFINERY ENGINEERING 3 0 0 3

Unit 1
Origin, Extraction and Testing of petroleum.

Petroleum - Origin, nature, composition, classification, exploration, drilling, transportation and storage. Petroleum processing - Nature of crude from India, Indonesia, Burma and Middle East countries, classification of crude, evaluation of petroleum - Important properties and test methods T.B.P. and ASTM distillation.

Refining of Petroleum - Dewatering and desalting - Primary Oil refining - Treatments of crude - Topping, vacuum distillation.

Unit 2
Thermal cracking, visbreaking and coking, catalytic cracking, fluid bed and hydro cracking, reforming, chemical reforming and catalytic reforming, polymerization, alkylation, hydrogenation isomerisation, cyclization.

Treatment processes: Sweatening, desalting, hydrogen treatment, hydrodesulfurisation process, solvent extraction of kerosene, stabilization of gasoline. Lube oil manufacture - solvent dewaxing, solvent extraction, propane deasphalting, and treatment, clay treatment, hydro finishing, hydrotreatment, lube oil, additives and asphalt boiling.

UNIT 3
Petroleum products: LPG Motor spirit, aviation gasoline, kerosene, aviation turbine fuel, white spirit, and solvents, diesel fuel, gas oil, fuel oil, petroleum coke, petroleum waxes, lubricating oil and bitumen. Petrochemicals - Olefines, acetylene, propylene, butadiene, isoprene, aromatics, benzene, xylene etc. Methanol, formaldehyde, chloromethane, ethylene oxide, ethanol amine, acetone, cumene, phenol, styrene, phthalicanhydride.

TEXTBOOKS:

**REFERENCE:**

N. K. Sinha - ‘Petroleum Refining & Petrochemicals’

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**15MEC255**  
**POWER PLANT ENGINEERING**  
**3 0 0 3**

**Unit 1**  
Hydrological data - capacity and type - selection - General layout and types of hydro electric Power Plants.

General layout of diesel power plant and their components - Types of plant layouts - comparison of diesel plant with thermal plant.

Comparison and types of gas turbine power plants and their components, combined gas and steam power plants - Advantages of gas turbine plant over diesel and thermal plants.

**Unit 2**  
General components of Nuclear reactors - types of reactors - location safety and economics of nuclear plants - comparison with thermal power plants.

Steam power plant layout and components - Modern steam generators - types - functions of super heater - Preheater - economizer and air heater.

**Unit 3**  
Fuels and combustion - Fuel preparation and burning, grates, burners draft, combustion calculations, Boiler Trial, Fuel handling systems, Ash handling methods, Gas cleaning methods and dust collection.

Types of condensers - cooling towers - Water treatment methods economics of power plant operation - Instrumentation and control - variable load operation and economics.

**Course Outcomes**

- 15MEC255.1 Select a suitable location for a power plant
- 15MEC255.2 Analyze the performance of thermal power plant
- 15MEC255.3 Design fuel handling and ash handling methods in thermal and nuclear power plants
- 15MEC255.4 Design chimney, cooling towers and condensers for power plants

**TEXTBOOKS:**


**REFERENCES:**
15MEC256  REFRIGERATION AND AIR CONDITIONING  3003

Unit 1


Unit 2


Selection and balancing of system components - Graphical method.

Psychrometry: Moist air behaviour - Psychrometric chart - Different Psychrometric process analysis.

Unit 3


Course Outcomes

15MEC256.1 Identify the suitability of refrigeration systems
15MEC256.2 Select refrigerants and components like evaporator, compressor, condenser, expansion devices etc. based on operational characteristics
15MEC256.3 Design various components for refrigeration and air-conditioning applications using fundamentals of heat and mass transfer principles
15MEC256.4 Evaluate the performance of each component in an air-conditioning or refrigeration system
15MEC256.5 Calculate cooling load for given requirements

TEXTBOOK:
REFERENCES:

15MEC257 RENEWABLE SOURCES OF ENERGY 3 0 0 3

Unit 1

Wind energy: Principles of wind power, site characteristics, Wind rows diagram, types of wind turbines – construction, working and performance characteristics, synchronization of wind energy with the grid.

Unit 2
Bio-energy: Methanation: Methanogenic bacteria, process of methanation, variables affecting the process, popular designs of bio gas plant – construction and working. Feed stock preparation. Application: Biomethanation of agro waste, animal waste and process industry waste – sugar industry, sago industry, etc,

Thermal: Pyrolysis, gasification process, variables affecting the process, types of gasifiers, construction and working of gasifiers. Application: Gasification of biomass, process industry waste viz. - paper mill, waste cotton mill, saw mill, etc,

Unit 3
Ocean energy: Tidal: Types of energy harnessing techniques, turbines – construction, working and performance characteristics. Ocean thermal: Open cycle, closed cycle, Components of ocean thermal power plant, working and challenges.

Fuel cells: Principle of working of Hydrogen, Carbon Monoxide, fuel cell etc.

Course Outcomes

15MEC257.1 Evaluate the performance of solar thermal energy systems
15MEC257.2 Design and performance evaluation of wind energy conversion systems
15MEC257.3 Identify a suitable bio-energy conversion method for industrial applications
15MEC257.4 Identify the challenges in ocean energy resources

TEXTBOOK:

REFERENCES:
15MEC258 TURBOMACHINERY 3003

Unit 1

Dimensional analysis, Dimensionless parameters and their physical significance, specific speed, Hydraulic Pumps: Centrifugal Pumps – Some definitions - Pump output and Efficiencies - Effect of Vane angle – Cavitation - Pump Characteristics - Multistage pumps.

Unit 2

Elementary cascade theory, cascade nomenclature, compressor cascade, turbine cascade, cascade efficiency. Dimensional analysis of compressible flow machines, stalling and surging.

Unit 3
Centrifugal Compressors: Constructional details - Stage Pressure rise - Stage Pressure Coefficient - Stage Efficiency - Degree of Reaction - Various Slip factors - Introduction to Fans and Blowers, Working principle, Fan laws, Performance Characteristics.

Axial flow Compressors: general expression for degree of reaction; velocity triangles for different values of degree of reaction, Blade loading and flow coefficient, Static pressure rise, Workdone factor.


Course Outcomes
15MEC258.1 Apply the concepts of energy transformation in turbo machines
15MEC258.2 Analyze the performance of different pumps and hydraulic & steam turbines
15MEC258.3 Evaluate the performance of axial and centrifugal compressors
15MEC258.4 Identify the challenges in ocean energy resources

TEXTBOOKS:

REFERENCES:

15MEC261 ADVANCED CASTING TECHNOLOGY 3 0 0 3

Unit 1
Melt processing techniques for ferrous and non-ferrous alloys such as stainless steels, nickel, titanium alloys. Vacuum melting equipment and practice.
Elementary aspects of pattern and mould design using CAD softwares. Resin-bonded mould and core making processes and machines. Special casting processes and their applications - low pressure die casting, investment casting, squeeze casting, thixo-forming. Illustrations of automotive and aerospace applications.

Unit 2
Gating and riser design - principles of fluid flow, governing equations, heat transfer applied to casting solidification, governing equations, boundary conditions for different casting methods, concept of directional solidification, gating and risers, application of simulation methods. Use of casting software in solving practical problems.

Unit 3
Casting defects and remedies. Inspection methods - visual, penetrant, magnetic, metallurgical, X - ray and Gamma ray radiography and Mechanization and Automation.

TEXTBOOK:

REFERENCE BOOKS:

15MEC262 ADVANCED MANUFACTURING PROCESSES 3 0 0 3

Unit 1
Non-traditional manufacturing processes - chemical machining – electro chemical machining - ultrasonic machining
- physical setup, metal removal rate, process parameters, process capabilities, and applications.

Non-traditional manufacturing processes - electrical discharge machining - wire EDM - abrasive flow machining - physical setup, metal removal rate, process parameters, process capabilities, and applications

**Unit 2**
High-speed machining: high performance machining of components. Application of HSM, improved material removal rate, surface finish and integrity, accuracy, economic considerations.

**Unit 3**
Modern grinding technologies, high speed and high performance grinding. Hard machining using single point tools. Laser applications in manufacture: Cutting, welding, surface treatment, automation and in-process sensing.

**TEXTBOOK:**
Serope Kalpakjian and Steven R. Schmid - 'Manufacturing Engineering and Technology' - Prentice Hall – 2013 - 7th Edition

**REFERENCE BOOKS:**

**15MEC263 ADVANCED MATERIALS AND PROCESSES  3 0 0 3**

**Unit 1**

**Unit 2**
Aerospace Alloys: High strength Aluminium and Magnesium alloys, Nickel and Cobalt based Superalloys, Titanium alloys, their structures, structure-property relationships, heat treatment. Directional solidification and single crystal turbine blades. Case studies.

**Unit 3**
Smart Materials: Concept of shape memory, crystal structure, phase transformation mechanism and characteristics, properties, classification, applications.

Nanomaterials: properties, classification, characterization, materials behaviour, fabrication and applications.

**Course Outcomes**
15MEC263.1 Interpret the properties and structure of composite and advanced material
15MEC263.2 Identify the appropriate fabrication technique for a composite and aerospace alloys
15MEC263.3 Examine the different behaviour of materials for aerospace applications
15MEC263.4 Summarize the properties and applications of smart and nano-materials

TEXTBOOKS:

REFERENCES:

15MEC264 ADVANCED METROLOGY AND SENSING SYSTEMS

Unit 1

Unit 2

Unit 3
Edge detection techniques, Normalization, Grey scale correlation – Reflectance map concepts; surface roughness and texture characterization - photogrammetry. Application of Machine Vision in inspection - Measurement of length, diameters, Surface roughness - automated visual inspection - 3D and dynamic feature extraction. On-line Quality
control: On-line feedback quality control variable characteristics - control with measurement interval, one unit, and multiple units control systems for lot and batch production.

**TEXTBOOKS / REFERENCES:**
3. John A. Bosch, Giddings, and Lewis Dayton - ‘Coordinate Measuring Machines and Systems’
   Marcel Dekker - 1999

**15MEC265 ADVANCED WELDING TECHNOLOGY 3003**

**Unit 1**
Overview of welding processes and their classification, types of joints, edge preparation, weld symbols, weld nomenclature, bead geometry, power density, heat sources - Gaussian distribution of heat flux, welding techniques - linear and orbital. Arc characteristics. Voltage-current characteristics. Types of welding manipulators and their applications.

Advanced welding processes: submerged arc, TIG, MIG, electro-slag, ultrasonic, electron beam and laser beam welding. Case studies and applications - industrial, automotive and aerospace.

**Unit 2**

Solidification behaviour of fusion weld: structural zones, epitaxial growth, weld pool shape and columnar grain structures. Weldability of metals - steels, stainless steels, aluminium, copper, nickel and titanium alloys.

**Unit 3**

Welding defects - causes and remedies. Methods of testing weldments - mechanical, pressure and leak testing. Inspection methods - visual, penetrant, magnetic, ultrasonic, x-ray and gamma radiography. Use of imaging techniques for online monitoring.

**Course Outcomes**

15MEC265.1 Understand various welding processes, Joints and Symbols
15MEC265.2 Select Power Sources and Parameters
15MEC265.3 Understand the Heat Distribution during welding
15MEC265.4 Model Heat transfer during welding
15MEC265.5 Understand the solidification process after welding
15MEC265.6 Identify welding defects

TEXTBOOKS:

REFERENCES:

15MEC266 CNC MACHINES 3003

Unit 1
Introduction: Definition of automation, types of automation, Definition of NC, basic components of NC system, the NC procedure, NC Coordinate system, NC motion control systems, Interpolators – linear, circular and parabolic, applications of numerical control.

Features of CNC Machine Tools
Structure, Spindle design, spindle bearings, spindle drives, feed drives – DC servo motors, stepper motors and AC servo motors, actuation systems – recirculating ball screws and anti-friction guide ways, feed-back devices – optical rotary encoders and linear scales.

CNC Machining center developments, turning center developments, high speed CNC machine tools, automatic tool changers.

Manual Programming
Turning center programming: Axes system, ISO standards for coding, tool function, speed function, feed function, miscellaneous functions, rapid positioning, linear interpolation, circular interpolation, thread cutting, canned cycles

Unit 2
Machining center programming: axes system, tool function, speed function, feed function, miscellaneous functions, rapid positioning, linear interpolation, circular interpolation, tool length compensation, canned cycles for drilling, tapping and boring, cutter radius compensation.
Computer Aided Part Programming
APT language structure, Geometry statements, Motion statements, Post processor & auxiliary statements, MACROs, complete part programming in APT.

Unit 3
CNC Tooling
Turning tool geometry, modular tooling systems for turning, collet chucks, end mill adapters, morse taper adapters, boring heads and tapping heads, milling tooling systems, tool presetting, work holding devices - vices, grid plates, pneumatic and hydraulic clamps.

Assembly Techniques
Guide ways, ball screws and nut, feedback elements, spindle bearings.

Testing of CNC Machine Tools
Introduction, verification of technical specifications, functional aspects, verification during idle running, verification of machine tool accuracy and work piece accuracy, metal removal capability test, safety aspects.

TEXTBOOKS:

REFERENCES:

15MEC267 COMPOSITE MATERIALS AND PROCESSING 3 0 0 3

Unit 1
Types of reinforcements, their mechanical properties and functions - ceramics, glass, carbon, boron, silicon carbide, metal, aramid. Forms of reinforcements - particulate, fibre, filaments, whiskers, flakes. Pre-fabricated forms - preforms, prepegs, fabrics, honeycomb.

Type of matrix, its mechanical properties and functions - polymers (thermosets and thermoplastics), metals, ceramics, glass and carbon. Basic principles in the design of composites and selection of matrix and reinforcement. Bonding mechanisms.

Unit 2
Anisotropic Behaviour and relationship between structure-mechanical properties.

Mechanical testing - tensile, compressive, Intra-laminar shear, Inter-laminar shear and fracture.

lay-up, consolidation and solidification.

Unit 3

Metal and ceramic matrix composites - wettability of reinforcement to matrix and bonding, methods of manufacturing reinforcements with intermediate wetting layer.


TEXTBOOKS:

REFERENCES:

15MEC268 METAL FORMING TECHNOLOGY 3 0 0 3

Unit 1

Unit 2

Deep drawing
– tube drawing – analysis, residual stresses.

Unit 3
Special Forming Methods: Stretch forming – press brake forming – explosive forming
– electro hydraulic forming – magnetic pulse forming – super plastic forming – electro forming – fine blanking - Isothermal forging – HERF.

TEXTBOOK:

REFERENCES:

15MEC269 MICRO-MANUFACTURING 3 0 0 3

Unit 1
Micromachining – definition - principle of mechanical micromachining - Classification of micromachining and nanofinishing processes - Molecular dynamics simulations of machining at atomic scale.


Unit 2

Unit 3

TEXTBOOKS:

REFERENCES:

15MEC270 MODERN PRACTICES IN PRODUCT DESIGN AND MANUFACTURE

Unit 1
Creativity & Innovation: Aesthetics – Industrial design concepts – capturing customer voice – New product development – QFD.


Unit 2

Unit 3

Recent Advances in Product Development methods and strategies: Concurrent Engineering - Total approach to product development – Collaborative design - Product Data Management – PLM – CPC – Understanding of various software application packages available in the market for various phases of the product life cycle – Design for
Environment – Product Costing - Design for Six sigma - Design FMEA.

**TEXTBOOKS:**
2. Groover M. and Zimmers - ‘CAD-CAM, Computer Aided Design and Manufacturing’ - Prentice Hall of India, New Delhi, - 2013

**REFERENCES:**

**15MEC271 NON-DESTRUCTIVE TESTING 3 0 0 3**

**Unit 1**


**Unit 2**

**Unit 3**

**TEXTBOOKS:**

**REFERENCE:**
15MEC272 PRODUCT COST ESTIMATION 3 0 0 3

Unit 1
Cost estimation: Importance and aims of cost estimation - functions of estimation - difference between estimating and costing - importance of preparing realistic estimates - estimating procedure.

Elements of cost, Objectives - elements of costs - ladder of cost - determination of material cost - labour cost - expenses.

Unit 2
Analysis of overhead expenses, Distribution of overhead costs – depreciation - causes of depreciation - methods of calculating depreciation.

Estimation of machining time, Calculation of machining time for lathe operations-estimation of drilling time on drilling machine - estimation of time for shaping, planning, milling and grinding.

Unit 3
Costing for metal forming and fabrication processes, Estimation of cost in welding-estimation in forging shop - cost estimation of foundry work.

Course Outcomes

15MEC272.1 Identify the various cost elements involved in total cost of the product.
15MEC272.2 Apply appropriate methods for calculating depreciation.
15MEC272.3 Estimate the cost of manufacturing a component by welding, casting and forging operations.
15MEC272.4 Calculate the time taken for various machining operations.

TEXTBOOKS:

REFERENCES:
Unit 1
Introduction: Review of statistics and probability. Quality related costs, contemporary quality engineering philosophy, Quality systems and international standards and 6 Sigma. Control charts for variables: X-bar and R charts, X-bar and S charts; Control charts for individual measurements; Exponentially Weighted Moving Average (EWMA) and Deviation (EWMD) charts.

Unit 2


Unit 3


TEXTBOOKS:

REFERENCES:
SIMULATION MODELING OF MANUFACTURING SYSTEMS

Unit 1

Introduction to Simulation softwares.


Unit 2

Model Building of Discrete systems: Modelling Paradigms - Modelling of Structural elements and Operational elements – Modelling issues – Model Verification and Validation.

Unit 3
Applications of Simulation in Manufacturing – Manufacturing Modelling Techniques – Modelling Material Handling system – Model building exercises using Arena - Case study.

Simulation output analysis: Design of Simulation Experiments: Determination of warm up period, Run length, Number of replications - Statistical analysis of simulation output – Terminating and Non-Terminating Simulations – Comparing alternative system designs – Variance reduction Techniques – Simulation Optimization.

TEXTBOOKS:

REFERENCES:
Unit 1


Unit 2

Profit and revenue maximization: Optimal input combination. Total revenue maximization.

Unit 3

Operations Research techniques in managerial economics: Inventory models. Theory of games. Decision theory, Risk and Uncertainty, Measuring risk, Consumer behavior and risk aversion, Decision making under uncertainty with complete ignorance

Course Outcomes

15MEC331.1 Describe the role of economics in the decision making process and evaluate the cost effectiveness of individual engineering projects
15MEC331.2 Utilize the demand and supply model to analyze real world examples.
15MEC331.3 Appraise different models of the market and its economy.

TEXTBOOKS:
Webster T. J. - ‘Managerial Economics- Theory and Practice’ - Elsevier - 2004

REFERENCE BOOKS:

Unit 1

Unit 2

Unit 3

Course Outcomes
15MEC332.1 Understand the concepts of cost and pricing of goods and appraise project proposals
15MEC332.2 Design and analyze manufacturing and service processes and to measure the work performed.
15MEC332.3 Understand and analyze the key issues of supply chain Management.
15MEC332.4 Understand the application of lean manufacturing tools and six sigma concepts.
15MEC332.5 Select appropriate plant location and their layout methods.
15MEC332.6 Create capacity plan, aggregate plan, schedule, ERP & MRP systems.

TEXTBOOKS:

REFERENCES:
Unit 1


Unit 2

Unit 3


Mergers and Takeovers - International trade.

CO1 Apply time value concept of money and used for investment criteria decisions
CO2 Evaluate risk and return for various alternatives of an investment.
CO3 Apply the capital budgeting techniques and estimate the investment decisions
CO4 Utilize working capital management, cash and liquidity management and financial statements.

TEXTBOOK:

REFERENCES:
1. Denzi Watson & Antony Head - ‘Corporate Finance- Principles and Practice’ - Pearson Education Asia, - 2002 - 2nd Edition
Work System: Elements of work, maintenance of machines, interaction, effect of working conditions and environment, physical and mental fatigue.

Productivity: Productivity, factors affecting production, Measurement of productivity.

Work Study: Definition and scope of work study; Areas of application of work study in industry; Human aspects of work study.

Method Study: Information collection, recording techniques, and processing aids; critical examination; development, installation and maintenance of improved methods.

Unit 2
Motion Economy and Analysis: Principles of motion economy; Motion analysis; Micromotion and Memomotion study; Therbligs and SIMO charts; Normal work area and design of work places; Basic parameters and principles of work design.

Work Measurement: Work measurement techniques; Calculation of standard time, work sampling and predetermined Motion time systems.

Wages and Incentive Schemes: Introduction, wage payment of direct and indirect labour, wage payment plans and incentives, various incentive plans, incentives for indirect labour

Unit 3
Plant Layout: Concept of plant layout, types of layout; factors affecting plant layout, work station design, factors considered in designing a work station.

Material Handling: Introduction and functions of material handling equipment, selection of material handling equipment for different requirements, safety requirements


Course Outcomes

" 15MEC334.1 " Add value to the organization through appropriate industrial engineering methods and tools.

" 15MEC334.2 " Develop an integrated system which includes people, materials, information, equipment, and environment

" 15MEC334.3 " Apply various types of engineering work measurement techniques for analyzing the task.

"15MEC334.4 " Apply systematic layout planning technique and work design principle based on ergonomics for effective material handling

TEXTBOOKS:

136

Edition

REFERENCE BOOKS:

15MEC335 LEAN MANUFACTURING 3 0 0 3

Unit 1
Introduction to Lean and Factory Simulation: History of Lean and comparison to other methods - The 7 Wastes, their causes and the effects - An overview of Lean Principles / concepts / tools - Stockless Production.


Unit 2
Value Stream Mapping – Current state: Preparation for building a Current State Value Stream Map - Building a Current State Map (principles, concepts, loops, and methodology) - Application to the factory Simulation scenario.

Unit 3
Value Stream Mapping – Future State: Key issues in building the Future State Map
- Process tips in building the map and analysis of the customer loop, supplier loop, manufacturing loop and information loop - Example of completed Future State Maps

Course Outcomes
15MEC335.1 Identify key requirements and concepts in lean manufacturing.
15MEC335.2 Utilize the various lean tools in industry to improve the productivity.
15MEC335.3 Predict the value addition using value stream mapping concept.
15MEC335.4 Practice lean manufacturing concepts in industries to enhance the productivity.

TEXTBOOKS:

REFERENCES:
2. Rother M. and Shook J. - ‘Learning to See’ - The Lean Enterprise Institute, Brookline, USA
15MEC336 MANAGERIAL STATISTICS 3 0 0 3

Unit 1
Quantitative methods: Basic terminology in probability, probability rules, conditions of statistical dependence and independence, Bayes Theorem, Discrete Random Variables review of probability distributions, measure of central tendency.

Sampling and sampling distributions: Introduction to sampling, random sampling, design of experiments, introduction to sampling distributions.

Estimation: point estimates, interval estimates and confidence intervals, calculating interval estimates of mean from large samples, using t test, sample size estimation.

Unit 2
Testing hypothesis: Introduction, basic concepts, testing hypothesis, testing when population standard deviation is known and not known, two sample tests.

Chi-square and analysis of variance: introduction, goodness of fit, analysis of variance, inferences about a population variation.

Unit 3
Regression and correlation: Estimation using regression line, correlation analysis, finding multiple regression equation, modelling techniques,

Non parametric methods and time series and forecasting: Sign test for paired data, rank sum test, rank correlation, Kolmogrov – smirnov test, variations in time series, trend analysis, cyclic variation, seasonal variation and irregular variation. Decision theory: Decision tree analysis.

TEXTBOOKS:

REFERENCES:

15MEC337  MARKETING MANAGEMENT   3 0 0 3

Unit 1
Marketing Process: Definition, Marketing process, dynamics, needs, wants and demands, value and satisfaction, marketing concepts, environment, mix. Philosophies, selling versus marketing, organizations, industrial versus consumer marketing, consumer goods, industrial goods, product hierarchy.

Buying Behaviour and Market Segmentation: Major factors influencing buying behaviour, buying decision process, business buying behaviour. Segmenting consumer and business markets, market targeting.

Unit 2
Product Pricing and Marketing Research: Objectives, pricing, decisions and pricing methods, pricing management. Introduction, uses, process of marketing research.

Unit 3
Marketing Planning and Strategy Formulation: Components of marketing plan-strategy formulations and the marketing process, implementations, portfolio analysis, BCG, GEC grids.

Advertising Sales Promotion and Distribution: Characteristics, impact, goals, types, and sales promotions - point of purchase - unique selling proposition. Characteristics, wholesaling, retailing, channel design, logistics, and modern trends in retailing.

Course Outcomes

15MEC337.1 Illustrate key marketing concepts, theories and techniques for analyzing a variety of marketing situations
15MEC337.2 Identify the dynamic nature of the environment in which marketing decisions are taken and appreciate the implication for marketing strategy determination and implementation
15MEC337.3 Develop the ability to carry out a research project that explores marketing planning and strategies for a specific marketing situation
15MEC337.4 Understand the need and importance of sales promotions and make use of advertising
15MEC337.5 Illustrate the importance of modern trends in retailing and marketing logistics

TEXTBOOKS:

REFERENCES:

15MEC338 OPERATIONS MANAGEMENT 3 0 0 3

Unit 1


Unit 2

Quality engineering: TQM, Six sigma concepts - Lean manufacturing, ISO standards.

Unit 3
Forecasting: Forecasting system - Judgment methods, Time series methods.


TEXTBOOKS:

REFERENCES:
15MEC339  PROJECT MANAGEMENT  3003

Unit 1


Unit 2
Scheduling with limited resources: Resource Planning - Resource allocation - Project Schedule Compression - Project Scheduling Software. Precedence Diagrams - Decision CPM - Generalized Activity Networks - GERT.

Unit 3

Course Outcomes
15MEC339.1 Appraise the selection and initiation of individual projects and its portfolios in an enterprise.
15MEC339.2 Analyse the project planning activities that predict project costs, time schedule and quality.
15MEC339.3 Develop processes for successful resource allocation, communication and risk management.
15MEC339.4 Evaluate project execution and control techniques that results in successful project completion.

TEXTBOOK:

REFERENCES:

15MEC340  SUPPLY CHAIN MANAGEMENT  3003

Unit 1
Introduction: Introduction to SCM - the complexity and key issues in SCM – Location strategy – facility location decisions – single facility and multiple location models.

salesman problems – exact and heuristic methods.

Unit 2
Inventory: Inventory Management and risk pooling - managing inventory in the SC. Value of Information - bullwhip effect - lead time reduction.

Supply Chain Integration: Supply chain integration - distributed strategies - push versus pull systems.


Unit 3

Course Outcomes
15MEC340.1 Analyze the complexity and key issues in supply chain management
15MEC340.2 Evaluate single and multiple facility location problems, logistics network configuration, vehicle routing and scheduling models
15MEC340.3 Analyze inventory management models and dynamics of the supply chain
15MEC340.4 Develop the appropriate supply chain through distribution requirement planning and strategic alliances
15MEC340.5 Identify the issues in global supply chain management, procurement and outsourcing strategies

TEXTBOOK:
2. Christopher M. - ‘Logistics and Supply Chain Management: Strategies for Reducing Cost and Improving Service’ – PH - 1999

REFERENCES:

15MEC341 TOTAL QUALITY MANAGEMENT 3 0 0 3

Unit 1
Unit 2
Customer satisfaction – Customer retention - Employee involvement - Performance appraisal - Continuous process improvement - Supplier partnership - Performance measures. Seven tools of quality.

Statistical fundamentals - Control Charts for variables and attributes - Process capability - Concept of six sigma - New seven management tools - Benchmarking.

Unit 3
Quality function deployment (QFD) - Taguchi quality loss function - Total Productive Maintenance (TPM) - FMEA.


TEXTBOOK:

REFERENCES:

SCIENCE ELECTIVES

15CHY231 ADVANCED POLYMER CHEMISTRY 3 0 0 3

Unit 1

Unit 2
Solid-state irradiation polymerization - Atom transfer radical polymerization - PlasmaPolymerization - Zwitterionic Polymerization - Isomerization polymerization - Polymer supported solid phase reactions - Merrifield method.

Polymer degradation and stabilization: Mechanism of different types of degradation - Commonly used antidegradants and the mechanism of their stabilization.

Unit 3
Polymer solutions: Criteria for solubility - Heat of Dissolution and Solubility parameters - Conformation of polymer

TEXTBOOKS:

REFERENCES:
5. Jayadev Sreedhar and Govariker, “Polymer Chemistry”.

15CHY232 BIOMATERIALS SCIENCE 3003

Unit 1
Introduction: Bulk properties, Surface properties and characterization - polymers, silicone biomaterials, medical fibres and biotextiles - Smart polymers - bioresorbable and bioerodible materials - natural materials, metals and ceramics - physicochemical surface modification.

Biocompatibility concepts: Introduction to biocompatibility - cell material interaction – types of materials - toxic, inert, bioactive - long term effects of materials within the body - cell response.

Unit 2
Chemical and biochemical degradation of polymers - degradation of metals and ceramics - calcification of biomaterials.

Host reactions and their evaluation: Inflammation and foreign body response - adaptive immunity - systemic toxicity and hypersensitivity - blood coagulation and blood materials interactions - device related infections.

Unit 3
Biological testing of biomaterials: Invitro and invivo assessment of tissue compatibility - evaluation of blood materials interaction - microscopy in biomaterials.

Practical aspects of biomaterials: Bioelectrodes, biomedical sensors and biosensors - sterilization of implants - implant failure - implant retrieval and evaluation - legal aspects, ethical issues and regulation aspects.

TEXTBOOK:
REFERENCES:

15CHY233 CATALYTIC CHEMISTRY 3003

Unit 1
Catalysis: Introduction, Industrial applications. Rates of reactions - equilibrium, energy of activation and the catalyst’s role, Elementary reactions in catalytic transformations homogeneous and heterogeneous catalysis.

Catalysis in solutions: Acid-base catalysis - catalysis in the gas phase, catalysis in dilute aqueous solution, catalysis in concentrated strong acid solutions, catalysis by bases, catalysis by metal ions, catalysis by electron transfer, organometallic catalysis, catalysis in Ziegler Natta/Metallocene/Metathesis polymerization.

Unit 2
Catalysis by macromolecules, Phase transfer catalysis.

Catalysis by Enzymes: Introduction - kinetics of enzyme catalyzed reaction, catalysis through enzyme, organic catalysis, metalloenzyme catalysis, supported enzymes. Industrial applications of enzyme catalyst.

Catalysis by Polymers: Attachment of catalytic groups to polymer supports, Adsorption and the Kinetics of polymer-catalyzed reactions.

Unit 3
Catalysis in polymer gels, bifunctional and multifunctional catalysis, porous polymers, Applications of polymer catalysis.


TEXTBOOKS:

REFERENCES:
Unit 1
Chemistry of Engineering Plastics: Preparation, properties and applications of ABS, polycarbonates, epoxy resins - polyamides - Nylon and Kevlar.


Unit 2

Unit 3
Functional electro active polymers: Conjugated polymers - synthesis, processing and doping of conjugated polymers: polyacetylene, polyaniline, polythiophene, poly (p-phenylenevinylene) - ionically conducting polymers - applications of conjugated polymers. Semi-conducting, poly ferrocene - photo resist optical fibers and sensors, photo chromic & thermo chromic materials.


High energy materials: Preparation, properties and application of ammonium nitrate (AN), NH4NO3, ammonium perchlorate (AP), NH4ClO4, ammonium dinitramide (AND), NH4N(NO2)2, hydrazinium nitroformate (HNF), N2H5C(NO2)3 etc.

TEXTBOOKS:

REFERENCES:
15CHY235

Unit 1
Chemical materials in Electronics and Electrical Engineering: Structural correlation to behavior of conducting polymers, Semi-conducting polymers - properties of organic polymers containing metal groups such as poly ferrocene - optical fibers - definition, principle and structure - characteristics of optical fibre - photo resist optical fibre - advantages of optical fibre - liquid crystalline - peizo and pyroelectric polymers - magnetic materials, hard and soft magnets – sensors (voltametric).


Unit 2

Chemistry of Engineering Plastics: Preparation, properties and applications of ABS, Polycarbonates, Epoxy resins - Polyamides - Nylon and Kevlar.

Photochemistry in Electronics: Photochemical reactions - laws of absorption (Grothers-Draper law - Stark-Einstein’s law) - Quantum efficiency - photochemical decomposition of HI and HBr - and Quantum yield.

Unit 3
Florescence and Phosphorescence - chemiluminescence - photo sensitization.

Chemistry of Toxic Materials and Toxicology: Principles of Toxicology - Volatile poisons - Gases CO, hydrocyanic acid - H2S - PH3 - CO2 - SOx - NOx - Heavy metals - lead, arsenic, mercury, antimony, barium, bismuth, selenium, zinc, thallium - Pesticides - Food poisoning - Drug poisoning - barbiturates - narcotics - ergot - LSD - alkaloids - Radioactive Toxicology - Radiation hazards.

TEXTBOOK:

REFERENCE:

15CHY236

146
Introduction: Introduction to Nanomaterials: Size dependence of properties - Surface to volume ratio and Quantum confinement. Microscopic techniques to study nano structures - SEM, AFM - TEM and STM - Raman spectroscopy.

Synthesis of Nanomaterials: Synthetic approaches: Colloidal Self-Assembly (Self-assembled monolayers - SAMs) and electrostatic self-assembly, electrochemical methods, sol-gel deposition.

Unit 2
Langmuir-Blodgett (LB) technique, chemical vapour deposition, plasma arcing and ball milling.

Carbon nanostructures: Carbon Clusters: Fullerenes, structure, synthesis, alkali doped C60 - superconductivity in C60, applications of fullerenes. Carbon nanotubes: Classification, properties, synthesis, characterization, and potential applications, growth mechanism of carbon nanotubes.

Other Nanostructures: Quantum Dots: Preparation, properties and applications of Au, CdS and CdSe quantum dots,

Unit 3
Fabrication and applications of conducting polymer nanotubes, TiO2 and metallic nanotubes.

Molecular Electronics and Machines: Molecular electronics: Working of Molecular and supramolecular switches, transistors and wires. Molecular machines: Working of Molecular motors, rotors, cars, elevators and valves.

Textbooks:

References:
Unit 1
Introduction to Toxicology: Definition - scope - history - relationship to other sciences - dose-response relationship - sources of toxic compounds - Classes of Toxicants - broad overview of toxicant classes such as metals, agricultural chemicals, food additives - contaminants, toxins, solvents, drugs, and cosmetics - history, exposure route, and toxicity of the non-essential metals - cadmium, lead, and mercury - medical treatment of metal poisoning - classes of agricultural chemicals - Toxins - source, including microbial, fungal, algal, plant and animal - examples - Brief discussions - food additives and contaminants - solvents - therapeutic drugs - drugs of abuse - combustion products - cosmetics.

Unit 2
Exposure Classes, Toxicants in Air, Water, Soil, Domestic and Settings: Occupational Air, water and soil as primary media for human exposure to various classes of chemical toxicants in environmental, domestic, and occupational settings - historic and present status of air pollution and air quality - introduction to the major classes of soil and water pollutants - sources, exposure routes and potential adverse health effects - Classes of occupational toxicants - route of exposure and permissible levels - specific examples of concern.

Unit 3
Toxicant Analysis and Quality Assurance Principles: Introduction to procedures, principles and operation of analytical laboratories in toxicology. Summary of the general policies - analytical laboratory operation, analytical measurement systems, quality assurance (QA) - quality control (QC) procedures.


TEXTBOOK:

REFERENCES:
Introduction to surfaces, interfaces and colloids: Molecular origin, Surface phenomena and structure of interfaces, Surfactants structure, colloids in action - shapes and size distribution, Types of interaction forces - Physical and Chemical interaction, Classification of physical forces - Vander Waals force, electrostatic forces.


Unit 2
Interfaces between Condensed Phases - W etting, The interfaces between condensed phases in two-component systems, Adsorption at interfaces between condensed phases.

Thermodynamics - Adsorption, energy consideration of physical adsorption vs chemisorptions, Gibbs adsorption equation, Langmuir isotherm, BET isotherm, adsorption at solid-liquid interfaces. Emulsions - formation and stability, HLB number, PIT (Phase Inversion Temperature) foams, aerosols, Microemulsions, vesicles, micelles and membranes - applications of various colloidal systems.

Unit 3
Characterization of Colloids, Rheological properties - Classification, Interfacial rheology, Interfacial tension, Electrochemistry of interfaces - Electric double layer.

Stability of charge stabilized colloids, DLVO theory, Hamaker constant, Boltzmann distribution, Debye length, specific ion adsorption, stern layer, electrostatic, steric and electrosteric stabilization, zeta potential, surface tension, wetting and spreading, contact angle - Young’s modulus, practical application - solid surfaces - surface mobility, characteristics and formation.

**TEXTBOOKS:**


**REFERENCES:**


Introduction: Stability, symmetry, homogeneity and quantization as the requirements of natural changes - Born-Haber cycle – Energetic – kinetics - Principles of spectra.

Computational techniques: Introduction to molecular descriptors, computational chemistry problems involving iterative methods, matrix algebra, Curve fitting.


Introduction to Quantum mechanics - Schrodinger equation - Position and momentum - MO formation - Operators and the Hamiltonian operator - The quantum oscillator - Oscillator Eigen value problems - Quantum numbers - labeling of atomic electrons.

Unit 2
Molecular Symmetry: Elements of symmetry - Point groups - Determination of point groups of molecules.
Huckel’s MO theory: Approximate and exact solution of Schrodinger equation - Expectation value of energy - Huckel’s theory and the LCAO approximation - Homogeneous simultaneous equations - Secular matrix - Jacobi method - Eigen vectors: Matrix as operator - Huckel’s coefficient matrix - Wheeland’s method - Hoffmann’s EHT method - Chemical applications such as bond length, bond energy, charge density, dipole moment, Resonance energy.

Unit 3
Self consistent fields: Elements of secular matrix - Variational calculations - Semi empirical methods - PPP self consistent field calculation - Slater determinants - Hartree equation - Fock equation – Roothaan - Hall equation - Semi empirical models and approximations.

Ab-initio calculations: Gaussian implementations – Gamess - Thermodynamic functions - Koopman’s theorem - Isodesmic reactions, DFT for larger molecules - Computer aided assignments/mini projects with softwares - Introduction to HPC in Chemical calculations.

Molecular modelling software engineering - Modeling of molecules and processes - Signals and signal processing in Chemistry - QSAR studies and generation of molecular descriptors - Applications of chemical data mining - Familiarization with open source softwares useful for molecular modeling - Introduction to molecular simulation - M.D. simulation.

Course Outcome

CO01: Get to understand the structure of molecules using symmetry.
CO02: Understanding Quantum mechanical approach to calculate the energy of a system.
CO03: Applying mathematical knowledge and quantum mechanical approach in finding out the characteristics-reactivity, stability, etc., of the molecule.
CO04: To get a brief idea about molecular mechanics based chemical calculations.
CO05: To get an idea about general methodology of molecular modeling.
TEXTBOOKS:

REFERENCES:

15CHY241 ELECTROCHEMICAL ENERGY SYSTEMS 3 0 0 3 AND PROCESSES

Unit 1
Background Theory: Origin of potential - electrical double layer - reversible electrode potential - standard hydrogen electrode - emf series - measurement of potential - reference electrodes (calomel and silver/silver chloride) indicator and ion selective electrodes - Nernst equation - irreversible processes - kinetic treatment - Butler-Volmer equation - Overpotential, activation, concentration and IR overpotential - its practical significance - Tafel equation and Tafel plots - exchange current density and transfer coefficients.

Unit 2
Batteries: Primary batteries: The chemistry, fabrication and performance aspects, packing classification and rating of the following batteries: (The materials taken their function and significance, reactions with equations, their performance in terms of discharge, capacity, and energy density to be dealt with). Zinc-carbon (Leclanche type), zinc alkaline (Duracell), zinc/air, zinc-silver oxide batteries; lithium primary cells - liquid cathode, solid cathode and polymer electrolyte types and lithium-ferrous sulphide cells (comparative account).

Secondary batteries: ARM (alkaline rechargeable manganese) cells, Lead acid and VRLA (valve regulated (sealed) lead acid), nickel-cadmium, nickel-zinc, nickel-metal hydride batteries, lithium ion batteries, ultra thin lithium polymer cells (comparative account). Advanced Batteries for electric vehicles, requirements of the battery - sodium-beta and redox batteries.

Unit 3

Electrochemical Processes: Principle, process description, operating conditions, process sequence and applications of Electroforming – production of waveguide and plated through hole (PTH) printed circuit boards by electrodeposition; Electroless plating of nickel, copper and gold; Electropolishing of metals; Anodizing of
aluminium; Electrochemical machining of metals and alloys.

**Course Outcomes**

CO01: Understand the fundamental concepts of electrochemistry through electrode potential and reaction kinetics
CO02: Learn the application of the electrochemical principles for the functioning and fabrication of industrial batteries and fuel cells
CO03: Acquire knowledge in solving numerical problems on applied electrochemistry
CO04: Analysis and practical problem solving in fabrication of batteries and fuel cells
CO05: Application of concepts and principle in industrial electrochemical processes
CO06: Evaluation of comprehensive knowledge through problem solving

**TEXTBOOKS:**

**REFERENCES:**

**15CHY242 ENVIRONMENTAL CHEMISTRY 3 0 0 3**

**Unit 1**
Air and air pollution (earth’s atmosphere): Regions - ozone - CFC and other chemicals - catalytic decomposition of ozone - ‘ozone hole’ formation - Air pollution due to gas emission from industries - Atmospheric aerosols – dust, combustion products, aerosol concentration and lifetimes - Automobile exhausts, smog and effects - Acid rain - chemistry of acid rain, roll of meteorology, greenhouse gases and global warming - air pollution due to jet engines.


**Unit 2**
Aerobic processes - wastewater treatment systems (brief description only) - anaerobic and aerobic - sewage treatment,
primary, secondary and tertiary processes - water reuse and recycle. Eutrophication of lakes, nitrogen and phosphorus in effluents - Drinking water standards - sources - fluoride and arsenic in water, purification, sterilization - chemistry of chlorination - water purification for domestic use - reverse osmosis - nano filters and membranes.

Industrial Pollution and its control: Industrial pollution and waste waters from various types of industries - environmental pollution due to paper mills, textile mills etc., and its control. Solid waste disposal - methods - solid waste from mining and metal production and its disposal - Electrochemical treatment of pollution control, electro-coagulation and flocculation - Green chemical processes and green solvents - reaction conditions to control industrial pollution.

Unit 3
Other types of pollution: Soil pollution - agricultural pollution - use of chemical fertilizers - Organic chemicals and environment, dioxins and furans - chemistry of some of the pesticides, insecticides and herbicides, ill effects due to uncontrolled use - Bulk storage of hazardous chemicals and disasters, Radioactive pollution, radiation units, sources - exposure and damage - safety standards - radioactive wastes and their disposal - Toxicological substances, testing of toxic substance, enzyme inhibition and biochemical effects of toxic chemicals on humans.

Sampling and Measurements of Pollutants: Sampling and analysis techniques of air pollutants (brief outline only) - analysis of particulate matter and lead - Sampling and measurements of water pollutants - organic loadings, phosphates and nitrogen compounds - monitoring of water quality - water test kits, various analytical methods (brief outline only).

TEXTBOOKS:

REFERENCES:

15CHY243 FUELS AND COMBUSTION 3 0 0 3
Course Objectives: To provide the basic knowledge about fuels, rocket propellants and explosives.

Course Outcomes

CO01: Understand the types of fuels and variation in their properties

CO02: Able to analyze the fuel content

CO03: Obtain knowledge in identifying a proper fuel as per the requirement

CO04: Ability to know the preparation and working of propellants and explosives

Skill: This course enables the student to gain skill in identifying fuel, analyzing and categorize the application of it.

Unit 1
Fuels - Solid fuels - Classification, preparation, cleaning, analysis, ranking and properties - action of heat, oxidation, hydrogenation, carbonization, liquefaction and gasification.

Liquid fuels – Petroleum - origin, production, composition, classification, petroleum processing, properties, testing - flow test, smoke points, storage and handling.


Unit 2
Gaseous fuels - Types, natural gas, methane from coal mine, water gas, carrier gas, producer gas, flue gas, blast furnace gas, biomass gas, refinery gas, LPG - manufacture, cleaning, purification and analysis. Fuels for spark ignition engines, knocking and octane number, anti knock additives, fuels for compression engines, octane number, fuels for jet engines and rockets.

Flue gas analysis by chromatography and sensor techniques.

Unit 3

Rocket propellants and Explosives - classification, brief methods of preparation, characteristics; storage and handling.

TEXTBOOK:

REFERENCE:

15CHY244 GREEN CHEMISTRY AND TECHNOLOGY 3003

Objectives

1. Understand the principles of green chemistry and its contribution to the development of sustainable products
2. Possess knowledge of the migration from a hydrocarbon-based economy to carbohydrate-based economy
3. Evaluate the deficiencies of traditional process and acknowledge the invent of new processes
4. Distinctly map the culmination of academic research to industrial chemistry

Course Outcomes

CO01: Understand the evolving concept of Green Chemistry and its application to the manufacture of sustainable products
CO02: Appreciate the need for Renewable energy and Feed stock along with carbon sequestration through the fundamentals of Green Chemistry Techniques
CO03: Develop a coherence to evaluate systematic deficiencies in traditional Chemical science process and products
CO04: Undertake a purposeful Journey through the microscopic domain of academic research to the macroscopic domain of Industrial chemistry

Unit 1
Our environment and its protection, chemical pollution and environmental regulations, environmental chemistry, pollution prevention strategies, challenges to the sustainability of chemical industry, Pollution Prevention Act 1990, USA, Green Chemistry and its 12 principles, toxicity of chemicals, material safety data sheet (MSDS), concept of zero pollution technologies, atom economy, functional toxicity vs non-functional toxicity, alternative solvents, energy minimization, microwave and sonochemical reactions, renewable feed stock, carbon dioxide as a feed stock.

Unit 2
Greener strategies of the synthesis of ibuprofen synthesis, teriphthalic acid etc. phase behaviour and solvent attributes of supercritical CO2, use of supercritical carbon dioxide as a medium chemical industry, use of ionic liquids as a synthetic medium, gas expanded solvents, superheated water, etc. Synthesis of various chemicals from bio mass, polycarbonate synthesis and CO2 fixation, green plastics, green oxidations, etc.

Unit 3
Processes involving solid catalysts – zeolites, ion exchange resins, Nafion/silica nano composites and enhanced activity. Polymer supported reagents, green oxidations using TAML catalyst, membrane reactors. Green chemistry
in material science, synthesis of porous polymers, green nanotechnology.

REFERENCES:

8. Hand Book of Green Chemistry and Technology; by James Clarke and Duncan Macquarrie; Blakwell Publishing.

15CHY245 INSTRUMENTAL METHODS OF ANALYSIS 3 0 0 3

Unit 1

Separation Techniques: Brief out line of column, paper and thin layer chromatography - Ion exchange methods - principle and application – HPLC.

Unit 2
Gas chromatography - principle and applications – gel chromatography.


Unit 3

Thermal and Diffraction techniques: Principles and applications of DTG - DTA - DSC - X-ray - Electron Diffraction Studies - SEM, TEM.

Course Outcome

CO01: To develop an understanding of principle and working of the range of instrumental methods in analytical chemistry
CO02: To provide an understanding and skills in contemporary methods of separation and appropriate selection of instruments for the successful analysis of chemical compounds
CO03: To impart skills in the scientific method of planning, conducting, reviewing, reporting experiments and
problem solving in chemical analysis.

**TEXTBOOKS:**

**REFERENCES:**

**15CHY246 MEDICINAL ORGANIC CHEMISTRY 3003**

**Unit 1**

Physicochemical properties in relation to biological action: solubility, partition coefficient, dissociation constant, hydrogen bonding, ionization, drug shape, surface activity, complexation, protein binding, molar refractivity, bioisosterism - Stereo chemical aspects of drug action-stereo isomerism-optical isomerism.

**Unit 2**
Enzymes and hormones: Enzymes - nomenclature, classification and characteristics of enzymes - mechanism of enzyme action, factors affecting enzyme action, cofactors and co-enzymes, enzyme inhibition, enzymes in organic synthesis. Hormones and vitamins - representative cases.

Medicinal agents from natural products: Natural products as therapeutic agents, medicinal plants, animal products as medicine, isolation methods of alkaloids, terpenes, anti-oxidants.

**Unit 3**
Medicinal agents: Medicinal agents belonging to steroids, polypeptides, modified nucleic acid bases, sulphonamide and sulpha drugs, antibiotics, antifungal, antisepsics and disinfectants, anaesthetics, antihypertensive drugs, analgesics, histamine and anti-histamine agents.

**TEXTBOOKS:**
REFERENCES:

15CHY247 MODERN POLYMER COMPOSITES 3 0 0 3

Unit 1

Unit 2
Fiber reinforced polymer composites (FRPs): Basic rule of mixtures, stress-strain relationships. Tailoring of structural properties through laminar-sequencing and choice of fiber fractions/fiber orientations, to meet design requirements. Mechanical behavior of FRP composites: Fiber controlled and matrix dependent properties. Fibre volume fraction, tensile, shear, compressive, flexural, thermo elastic and off-axis responses of lamina and laminates - notched strength - fracture toughness - nondestructive testing. Effect of environmental conditions on properties.

Unit 3
Composite precursors: SMCs, DMCs, BMCs prepreg materials and their choice in specific applications. Fabrication processes for FRP Composites: hand layup, spray up, vacuum bag moulding, compression moulding, filament winding, braiding, pultrusion, RTM, RIM, RRIM, RFI, autoclave moulding, injection moulding etc. Room temperature and hot curing of composites, Nanocomposites: Introduction; Nanoscale Fillers – Clay, POSS, CNT, nanoparticle fillers; Processing into nanocomposites; Modification of interfaces; Properties. Applications. Joining composite elements and repairs, Recycling of polymer composites.

TEXTBOOKS:

REFERENCES
15CHY248

Unit 1
Introduction to organic chemistry: Lewis structure and formal charges of organic compounds - electro negativities and dipoles, resonances, aromaticity and anti aromaticity - equilibrium, tautomerism and hyper conjugation - acidity and basicity - pKa, nucleophiles and electrophiles - hydrogen bonding - different types of organic reaction - addition, substitution, elimination and rearrangement - oxidations and reductions - general principles of writing organic reaction mechanism - reactive intermediates.

Reaction of nucleophiles and bases: Nucleophilic substitution - SN1 and SN2 reactions, nucleophilic substitution at aliphatic sp2 carbon and aromatic carbon - nucleophilic addition to carbonyl compounds - addition of grignard and organo lithium reagents - reactions of nitrogen containing nucleophiles with aldehyde and ketones - aldol condensation.

Unit 2
Michael and 1,4-addition reaction - Favorskii rearrangement - benzilic acid rearrangement - reaction mechanism in basic media - Mannich reaction - enols and enolates.

Reaction involving acids and other eletrophiles: Carbocations - formation and rearrangements - cationic rearrangement involving electron deficient nitrogen atom - Beckmann rearrangement - Curtius, Lossen and Schmidt rearrangement - electrophilic additions - acid catalyzed reaction of carbonyl compounds - hydrolysis of carbocyclic acid derivatives - electrophilic aromatic substitution - carbenes and benzynes - Baeyer-Villeger reactions - Dienone-phenol rearrangement - pinacol rearrangement.

Unit 3
Radical and radical ions: Formation of radicals, radical chain processes, radical addition, reaction with and without cyclisation - fragmentation reaction - rearrangement of radicals - SRN 1 reaction - radical ions - Birch reduction - Hofmann-Loffler-Freytag reaction - Barton reaction - McMurry reaction.


TEXTBOOK:

REFERENCES:
15CHY249 ORGANIC SYNTHESIS AND STEREOCHEMISTRY  3 0 0 3

Unit 1
Nomenclature of Organic compounds: Polyenes, Alkynes with and without functional groups by IUPAC nomenclature. Aromatic and Heteroaromatic systems - nomenclature of heterocycles having not more than two hetero atoms such as oxygen, sulphur, nitrogen.

Stereochemistry: Tacticity, R/S system of nomenclature of central and axial molecules.

Unit 2
Atropisomerism - isomerism of biphenyls - allenes and spiranes - ansa compounds - Geometrical isomerism, E, Z Isomerism. Asymmetric synthesis.

Conformational Analysis: Optical activity and chirality - Conformational Analysis of cyclic and acyclic system - Conformational effects on reactivity of acyclic systems only.

Unit 3

TEXTBOOKS:

REFERENCES:

15CHY250 POLYMER MATERIALS AND PROPERTIES  3 0 0 3

Unit 1

Unit 2
Manufacturing, mechanical, thermal, electrical and chemical properties and applications of commodity plastics - PE, PP, PVC, PS, Engineering plastics - ABS, PC, PMMA, polyamide, polyacetal, PET, PBT, PTFE, High performance
polymer - PES, PEI, PEEK, conducting polymer.

Unit 3
Thermoset materials - PF, UF, MF, epoxy and unsaturated polyester resin, Rubber - natural rubber, synthetic rubber - SBR, PB, nitrile, chloroprene, butyl, silicone - compounding and additives.

TEXTBOOKS:

REFERENCE BOOKS:

15CHY251 POLYMERS FOR ELECTRONICS 3003

Unit 1

Unit 2
Photoconductive polymers: Charge carriers, charge injectors, charge transport, charge trapping. Polymers for optical data storage - principles of optical storage, polymers in recording layer.

Nonlinear optics: NLO properties and NLO effects, wave guide devices, polymer optical fibers - through plane modulators.

Unit 3

Liquid crystalline polymers: Fundamentals and process, liquid crystalline displays - Applications.

TEXTBOOK:

REFERENCES:

15CHY252  SOLID STATE CHEMISTRY  3 0 0 3

Unit 1

Unit 2
Electrical and Magnetic Properties: Development of free electron theory to band theory of solids - metals and their properties; semiconductors - extrinsic and intrinsic, Hall effect; Insulators - dielectric, ferroelectric, pyroelectric and piezoelectric properties and the relationship between them. Dia, para, ferro, ferri, antiferro and antiferri magnetic types - selected magnetic materials such as spinels, garnets and perovskites, superconductors.


Unit 3

Fourier synthesis - definition, applications of fourier synthesis in crystal structure analysis of S-Tetrazine. Structure of Rutile, Fluorite, Antifluorite, Zinc blende, Wurtzite, diamond and graphite.

REFERENCES:
15CHY331 BATTERIES AND FUEL CELLS 3003

Course Objective: To provide sound knowledge on the application of electrochemistry in energy storage systems.

Course Outcome

CO01: Understand the fundamental concepts of electrochemistry through electrode potential and reaction kinetics
CO02: Learn the application of the electrochemical principles for the functioning and fabrication industrial batteries and fuel cells
CO03: Analysis of practical problem solving in fabricating batteries and fuel cells
CO04: Evaluation of comprehensive knowledge through problem solving

Unit 1

Background Theory: Origin of potential - electrical double layer - reversible electrode potential - standard hydrogen electrode - emf series - measurement of potential - reference electrodes (calomel and silver/silver chloride) indicator and ion selective electrodes - Nernst equation - irreversible processes - kinetic treatment - Butler-Volmer equation - Overpotential, activation, concentration and IR overpotential - its practical significance - Tafel equation and Tafel plots - exchange current density and transfer coefficients.

Unit 2

Batteries: Primary batteries: The chemistry, fabrication and performance aspects, packing classification and rating of the following batteries: (The materials taken their function and significance, reactions with equations, their performance in terms of discharge, capacity, and energy density to be dealt with). Zinc-carbon (Leclanche type), zinc alkaline (Duracell), zinc/air batteries; Lithium primary cells - liquid cathode, solid cathode and lithium-ferrous sulphide cells (comparative account).

Secondary batteries: Lead acid and VRLA (valve regulated (sealed) lead acid), nickel-cadmium, nickel-zinc, nickel-metal hydride batteries, lithium ion batteries, ultrathin lithium polymer cells (comparative account). Advanced Batteries for electric vehicles, requirements of the battery - sodium-beta and redox batteries.

Unit 3

Fuel Cells: Description, working principle, anodic, cathodic and cell reactions, fabrication of electrodes and other components, applications, advantages, disadvantages and environmental aspects of the following types of fuel cells: Proton Exchange Membrane Fuel Cells, alkaline fuel cells, phosphoric acid, solid oxide, molten carbonate, direct methanol fuel cells.

Membranes for fuel cells: Nafion – Polymer blends and composite membranes; assessment of performance – recent developments.


TEXTBOOKS:

REFERENCES:

15CHY332 CORROSION SCIENCE 3003

Unit 1
Basic principles: Free energy concept of corrosion - different forms of corrosion - Thermodynamic & Kinetic aspects of corrosion: The free energy criterion of corrosion possibility - Mechanism of Electrochemical corrosion - Galvanic and Electrochemical series and their significance.

Corrosion Control: Materials selection - metals and alloys - metal purification - non metallic - changing medium.

Unit 2
Anodic and cathodic protection methods - Coatings - metallic and other inorganic coatings - organic coatings - stray current corrosion - cost of corrosion control methods.

Corrosion protection by surface treatment: CVD and PVD processes - Arc spray - Plasma spray - Flame spray.

Corrosion Inhibitors: Passivators - Vapour phase inhibitor.

Unit 3
Stress and fatigue corrosion at the design and in service condition - control of bacterial corrosion.


Course Outcome:

CO01: Development of skill in identifying the nature and type of corrosion
CO02: Understanding the mechanism of various types of corrosion
CO03: Analysing the problem and find out a solution to combat corrosion in any sort of environment.

CO-PO Mapping

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164
TEXTBOOKS:

REFERENCES:

15PHY230 ADVANCED CLASSICAL DYNAMICS 3 0 0 3

Unit 1
Introduction to Lagrangian dynamics

Survey of principles, mechanics of particles, mechanics of system of particles, constraints, D'Alembert's principle and Lagrange's equation, simple applications of the Lagrangian formulation, variational principles and Lagrange's equations, Hamilton's principles, derivation of Lagrange's equations from Hamilton's principle, conservation theorems and symmetry properties.

Unit 2
Central field problem

Two body central force problem, reduction to the equivalent one body problem, Kepler problem, inverse square law of force, motion in time in Kepler's problem, scattering in central force field, transformation of the scattering to laboratory system, Rutherford scattering, the three body problem.

Rotational kinematics and dynamics

Kinematics of rigid body motion, orthogonal transformation, Euler's theorem on the motion of a rigid body.
Unit 3
Angular momentum and kinetic energy of motion about a point, Euler equations of motion, force free motion of rigid body.

Practical rigid body problems

Heavy symmetrical spinning top, satellite dynamics, torque-free motion, stability of torque-free motion - dual-spin spacecraft, satellite maneuvering and attitude control - coning maneuver - Yo-yo despin mechanism - gyroscopic attitude control, gravity-gradient stabilization.

Course Outcomes

CO1 - Able to use the Lagrangian formalism to solve simple dynamical system
CO2- Able to understand Hamiltonian formalism and apply this in solving dynamical systems
CO3- Able to apply Lagrangian formalism in bound and scattered states with specific reference to Kepler’s laws and Scattering states
CO4- Able to solve problems in the Centre of Mass frame and connect it to Laboratory Frame of Reference
CO5- Understand and solve problems in rigid body rotations applying of Euler’s equations.

CO-PO Mapping

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TEXTBOOKS:

OBJECTIVE:
To equip the students with the knowledge on different kinds of biomaterials and other medical need, basic research, and to provide an overview of theory and practice of biomaterials.

Unit 1

Quantum mechanics – Schrodinger’s time dependent and independent equations – Pauli’s exclusion principle – ionization energy – electron affinity – chemical binding


Definition and classification of bio-materi-als, mechanical properties, visco-elasticity, wound-healing process, Application of biomaterial for the human body, body response to implants, blood compatibility. Implementation problems - inflammation, rejection, corrosion, structural failure. Surface modifications for improved compatibility.

Unit 2

Bioceramics, Biopolymers, Metals, ceramics and composites in medicine: Properties, applications, suitability & modifications required for certain applications.


Unit 3


TEXTBOOKS AND REFERENCES:


15PHY234  INTRODUCTION TO COMPUTATIONAL PHYSICS  3 0 0 3

Unit 1
Differentiation: Numerical methods, forward difference and central difference methods, Lagrange’s interpolation method.
Integration: Newton - cotes expression for integral, trapezoidal rule, Simpsons’s rule, Gauss quadrature method.

Unit 2

Unit 3

TEXTBOOK:
Rubin H Landau & Manuel Jose Paez Mejia, “Computational Physics”, John Wiley & Sons

REFERENCES:
Suresh Chandra, “Computer Applications in Physics”, Narosa Publishing House, New Delhi M Hijroth Jensen, Department of Physics, University of Oslo, 2003 (Available in the Web)

15PHY238 ELECTRICAL ENGINEERING MATERIALS 3 0 0 3
Unit 1
Conducting materials: The nature of chemical bond, crystal structure Ohm’s law and the relaxation time, collision time, electron scattering and resistivity of metals, heat developed in a current carrying conductor, thermal conductivity of metals, superconductivity.

Semiconducting materials: Classifying materials as semiconductors, chemical bonds in Si and Ge and it’s consequences, density of carriers in intrinsic semiconductors, conductivity of intrinsic semiconductors, carrier densities in n type semiconductors, n type semiconductors, Hall effect and carrier density.

Unit 2
Magnetic materials: Classification of magnetic materials, diamagnetism, origin of permanent, magnetic dipoles in matter, paramagnetic spin systems, spontaneous magnetization and Curie Weiss law, ferromagnetic domains and coercive force, anti ferromagnetic materials, ferrites and it’s applications.

Unit 3
Dielectric materials: Static dielectric constant, polarization and dielectric constant, internal field in solids and liquids, spontaneous polarization, piezoelectricity.

PN junction: Drift currents and diffusion currents, continuity equation for minority carriers, quantitative treatment of the p-n junction rectifier, the n-p-n transistor.

Course Outcomes
CO1: To understand the nature of interaction between atoms in crystalline solid materials that determines their dielectric, magnetic and electrical properties.
CO2: Analyze the relation between the macroscopic dielectric constant and the atomic structure of an insulator.
CO3: Fundamental concepts of magnetic fields required to illustrate the magnetic dipoles. This forms the basis to understand the magnetic properties of dia, para, ferro, antiferro and ferri magnetic materials.

CO4: Fundamentals concerned with conduction mechanism in metals and superconductors.

CO5: Understand the basics for classification of materials based on its conductivity, nature of chemical bonds in Si and Ge, carrier density, energy band structure and conduction mechanism in intrinsic and extrinsic semiconductors.

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**TEXTBOOK:**


**REFERENCES:**


**15PHY239 ELECTROMAGNETIC FIELDS AND WAVES 3 0 0 3**

**Unit 1**

Electrostatics: Coulombs law and electric field intensity, field due to a continuous volume charge distribution, field of a line charge, field of sheet of charge, electric flux density, Gauss’s law, application of Gauss’s law, Maxwell’s first equation.

Poisson’s and Laplace’s equations: The potential field of a point charge, potential field of a system of charges: conservative property, potential gradient, the dipole.
Unit 2

Poisson’s and Laplace’s equations, uniqueness theorem, examples of the solution of Laplace’s equation, solution of Poisson’s equation.

Electromagnetics: Biot Savart law, magnetic flux and magnetic flux density, scalar and vector magnetic potentials, derivation of steady magnetic field laws, Faraday’s laws, displacement current, Maxwells equations in point and integral form, retarded potentials

Unit 3

Electromagnetic waves: EM wave motion in free space, wave motion in perfect dielectrics, plane wave in lossy dielectrics, Poynting vector and power consideration, skin effect, reflection of uniform plane waves, standing wave ratio.

Transmission line equations, line parameters - examples, dipole radiation, retarded potentials, electric dipole radiation.

TEXTBOOK:


REFERENCES:


15PHY240 ELECTRONIC MATERIALS SCIENCE 3 0 0 3

Unit 1

Types of bonding in solids, Crystallography and crystalline defects: Crystallography, Directions and planes, Crystalline defects, line defects, Planar defects, Volume defects; Binary and Ternary Phase Diagrams: Lever rule and
phase rule, Eutectic, peritectic and Eutectoid systems, Applications of Phase diagrams; Basic Quantum Physics - atomic structure. Use of band theory and occupation statistics to explain existence and basic properties of metals and nonmetals. Working of Semiconductor Devices using band diagrams and their electrical characteristics: pn junctions, BJT, MOSFET.

Unit 2

Use of band theory to explain optoelectronic properties of materials and optoelectronic devices: LEDs, Solar Cells, Lasers, pin diodes, photodiodes; Magnetic properties and Superconductivity: Magnetic moments and Magnetic Permeability, types of magnetism, saturation magnetization, magnetic domains, soft and hard magnetic materials, superconductivity and its origin, Giant Magneto Resistance, Josephson effect, Energy band diagrams and Magnetism, Applications of magnetic materials - Magnetic recording materials, etc.

Unit 3


TEXTBOOK:


REFERENCE:


15PHY241 LASERS IN MATERIAL PROCESSING 3 0 0 3

Unit 1

Basic optical theory: Nature of electromagnetic radiation, interaction of radiation with matter, reflection, refraction, polarization, laser fundamentals, laser beam characteristics, beam quality (laser cavity modes), Q-switching, mode locking, continuous wave, types of lasers, energy and power.
Laser interaction with materials: Optical properties of materials, laser interaction with metals, insulators, semiconductors, polymers and biological materials.


Unit 2

Laser cutting and drilling: Mechanism for inert gas and oxygen-assisted cutting, factors controlling cut quality and kerf width. Laser assisted drilling.

Laser welding: Introduction to laser keyhole welding and contrast with conduction limited welding, applications.

Direct laser fabrication (DLF): Laser sintering & laser rapid manufacturing, comparison with rapid prototyping. Main potential and limitations of DLF for direct fabrication and for the production of novel engineering materials and structures.

Unit 3

Laser forming: Mechanisms involved, including thermal temperature gradient, buckling, upsetting. Applications in alignment and straightening and in rapid production processes.

Scope of application of laser materials processing: focused on industrial application of laser in materials processing including laser welded tailored blanks.

Laser safety: Introduction to safety procedures in the use of lasers, including wavelength effects and laser safety standards.

REFERENCES:

Unit 1
Introduction to semiconductor fabrication – scaling trends of semiconductor devices; crystal structure of semiconductor materials, crystal defects, phase diagrams and solid solubility; physics of Czochralski growth of single crystal silicon, Bridgeman method for GaAs, float zone process; diffusion science: Ficks laws of diffusion, atomistic models of diffusion, dopant diffusion mechanisms; kinetics of thermal oxidation, Deal-Grove Model, nitridation of silicon, structure and characteristics of oxides, effect of dopants on oxidation kinetics, dopant redistribution;

Unit 2
Physics of ion implantation: Coulombic scattering and projected range, nuclear and electronic stopping, channeling, implantation damage removal, dopant activation by rapid thermal annealing; principles of optical lithography – optics and diffraction, light sources and spatial coherence, physics of pattern transfer, nodulation transfer function; chemistry of lithographic processes: organic and polymeric photoresists, developing and exposure, contrast; principles of non-optical lithography: electron beam, X-ray lithography, resists, sources; etching: Chemistry of wet etching, plasma physics, chemistry of plasma etching and reactive ion etching; chemical mechanical polishing.

Unit 3
Vacuum science: Kinetic theory of gases, gas flow and conductance, vacuum pumps and seals; deposition of thin films: physics of sputtering and evaporation, step coverage and morphology of deposited films, chemical vapor deposition:
chemical equilibrium and law of mass action, gas flow and boundary layers, types of CVD, plasma assisted CVD; thermodynamics of epitaxial growth, types molecular beam epitaxy, isolation and contact formation – LOCOS and trench, silicides, metallization with Al and Cu; process Integration: CMOS, bipolar process flow.

TEXTBOOK:
Stephen Campbell, Science and Engineering of Microelectronic Fabrication, Oxford University Press, 2001

REFERENCE:


15PHY245  NUCLEAR ENERGY: PRINCIPLES AND APPLICATIONS  3 0 0 3

Unit 1


Fission and fusion: The fission process, energetic of fission, byproducts of fission, energy from nuclear fuels. Fusion reactions, electrostatic and nuclear forces, thermo nuclear reactions in plasma. Energetics of fusion. Comparison of fusion and fission reactions.

Unit 2

Neutron chain reactions and nuclear power: Criticality and multiplication, factors governing the multiplication, neutron flux and reactor power, reactor types and reactor operations. Methods of heat transmission and removal, steam generation and electric power generation, waste heat disposal.

Unit 3

Breeder reactors and fusion reactors: The concept of breeding nuclear fuel, isotope production and consumption, fast breeder reactor, breeding and uranium sources. Technical problems in the functioning of fusion reactor, requirements for practical fusion reactors, magnetic confinement, inertial confinements and other fusion concepts. Prospects of fusion power.

Radiation protection and waste disposal: Biological effects of radiation, radiation dose units, protective measures, internal exposure, and radon problem. Nuclear fuel cycle and waste classification, spent fuel storage and transportation, high level waste disposal, low level waste disposal.

TEXTBOOK:

REFERENCES:

1. David Bodansky, Nuclear Energy: principles, practices and prospects, Springer Verlag

15PHY247  PHOTOVOLTAICS  3 0 0 3
Unit 1
Introduction to semiconductors: Semiconductors: concept of electron and holes, conduction in semiconductors and concentration of charge carriers in semiconductors. Direct and indirect band gap semiconductors (quantum mechanical treatment). Extrinsic semiconductors: n-type, p-type & compensation doping, carrier concentration; PN junction - concept of bands at PN junction, junction under forward and reverse biases (conceptual).

Unit 2

Unit 3
Advanced Solar cell technologies (III Generation): Alternatives to conventional Si based solar cells - Thin film solar cells, Hetero junction solar cells, Tandem solar cells: material properties, fabrication and stability (includes nano scale devices). Organic solar cells.

TEXTBOOK:

REFERENCES:


15PHY248 PHYSICS OF LASERS AND APPLICATIONS 3003

Unit 1
Review of some basic concepts and principle of laser.


Unit 2
Properties of LASERS
Gain mechanism, threshold condition for PI (derivation), emission broadening - line width, derivation of FWHM natural emission line width as deduced by quantum mechanics - additional broadening process: collision broadening, broadening due to dephasing collision, amorphous crystal broadening, Doppler broadening in laser and broadening in gases due to isotope shifts. Saturation intensity of laser, condition to attain saturation intensity.

Properties – coherency, intensity, directionality, monochromaticity and focussibility. LASER transition – role of electrons in LASER transition, levels of LASER action: 2 level, 3 level and 4 level laser system.

Unit 3
Types of LASERS

Liquid chemical and dye LASERS. Semiconductor LASER: Principle, characteristics, semiconductor diode LASERS, homo-junction and hetero-junction LASERS, high power semiconductor diode LASERS.

Applications in Communication field:
LASER communications: Principle, construction, types, modes of propagation, degradation of signal, analogue communication system, digital transmission, fiber optic communication.

Applications of LASERS in other fields:

Course Outcomes
CO 1- Understand, Comprehend and acquaint with concepts of NanoPhysics
CO2- To familiarize the material’s property changes with respect to the dimensional confinements.
CO3- Acquire knowledge on the modern preparation process and analysis involved in the nanomaterial’s research
CO4- To learn about the technological advancements of the nano-structural materials and devices in the engineering applications
REFERENCES:

15PHY250 QUANTUM PHYSICS AND APPLICATIONS 3 0 0 3

Unit 1

Unit 2
Bosons and Fermions - symmetric and antisymmetric wavefunctions - elements of statistical physics: density of states, fermi energy, Bose condensation - solid state physics: Free electron model of metals, elementary discussion of band theory and applications to semiconductor devices.
Einstein coefficients and light amplification - stimulated emission - optical pumping and laser action.

Unit 3
Nuclear physics: nuclear properties - binding energy and mass formula - nuclear decay with applications - theory of alpha decay - nuclear forces – fission - principle of nuclear reactor - elementary particles - leptons, hadrons, quarks, field bosons - the standard model of elementary particles.

TEXTBOOK:

A Beiser, Perspectives in Modern Physics, McGraw Hill
REFERENCES:


15PHY251 THIN FILM PHYSICS 3003

Unit 1

Defects in thin film: General concepts, nature of defect, microscopic defect and dislocation. Boundary defects. Defect and energy states - donar acceptor levels, trap and recombination centers, excitons, phonons.

Unit 2
Properties of thin film: Optical behaviors: transmission, reflection, refractive index, photoconductivity, and photoluminescence.

Unit 3
Electrical behaviors: sheet resistivity, electron mobility and concentration, Hall effect, conduction in MIS structure.
Mechanical behaviors: stress, adhesion, hardness, stiffness.
Applications of thin films in various fields: Antireflection coating, FET, TFT, resistor, thermistor, capacitor, solar cell, and MEMs fabrication of silicon wafer: Introduction, preparation of the silicon wafer media, silicon wafer processing steps.

TEXTBOOK:

REFERENCES:


15PHY331 ASTRONOMY 3003

Unit 1
Astronomy, an Observational Science: Introduction - Indian and Western Astronomy

Unit 2
Observational Astronomy

Observing the Universe - The classic Newtonian telescope - The Cassegrain telescope - Catadioptric telescopes - The Schmidt camera - The Schmidt–Cassegrain telescope - The Maksutov–Cassegrain telescope - Active and adaptive optics - Some significant optical telescopes - Gemini North and South telescopes - The Keck telescopes - The South Africa Large Telescope (SALT) - The Very Large Telescope (VLT) - The Hubble Space Telescope (HST) - The future of optical astronomy - Radio telescopes - The feed and low noise amplifier system - Radio receivers - Telescope designs - Large fixed dishes - Telescope arrays - Very Long Baseline Interferometry (VLBI) - The future of radio astronomy - Observing in other wavebands – Infrared – Sub-millimetre wavelengths - The Spitzer space telescope - Ultraviolet, X-ray and gamma-ray observatories - Observing the universe without using electromagnetic radiation - Cosmic rays - Gravitational waves.

Unit 3
Superclusters - The structure of the universe - Cosmology – the Origin and Evolution of the Universe - The expansion of the universe - The cosmic microwave background - The hidden universe: dark matter and dark energy - The Drake equation - The Search for Extra Terrestrial Intelligence (SETI) - The future of the universe.

**TEXTBOOK:**
Introduction to Astronomy and Cosmology, Ian Morison, Wiley (UK), 2008

**REFERENCE BOOK:**

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15PHY333 CONCEPTS OF NANOPHYSICS AND NANOTECHNOLOGY

**Unit 1**

Introduction

Introduction to nanotechnology, comparison of bulk and nanomaterials – change in band gap and large surface to volume ratio, classification of nanostructured materials. Synthesis of nanomaterials - classification of fabrication methods – top down and bottom up methods.

Concept of quantum confinement and phonon confinement


**Unit 2**

Tools for characterization:


Nanoscale materials – properties and applications:
Carbon nanostructures – structure, electrical, vibration and mechanical properties. Applications of carbon nanotubes

**Unit 3**

Field emission and shielding – computers – fuel cells – chemical sensors – catalysis

– mechanical reinforcement. Quantum dots and Magnetic nanomaterials – applications.

Nanoelectronics and nanodevices:

Impact of nanotechnology on conventional electronics. Nanoelectromechanical systems (NEMSs) – fabrication (lithography) and applications. Nanodevices - resonant tunneling diode, quantum cascade lasers, single electron transistors – operating principles and applications.

**TEXTBOOKS:**


**15PHY335 MEDICAL PHYSICS 3003**

**Unit 1**

Ultrasonics - production methods and properties - acoustic impedance - Doppler velocimetry - echo cardiography – resolution – speckle - ultrasound imaging - therapeutic use of ultrasound - use in diagnostics of cardiac problems.


**Unit 2**

Nuclear medicine - principles of nuclear physics – natural radioactivity, decay series, type of radiation and their applications, artificially produced isotopes and its application, accelerator principles; Nuclear Isomerism, internal conversion - ideal energy for radiotherapy based on interactions. Radionuclide used in medicine - radioisotope production – dosimetry – safety - radiation hazards – PET.
Nuclear magnetic resonance physics - magnetic moment – magnetization – relaxation - nuclear magnetic resonance spectroscopy.

Unit 3

Nuclear magnetic resonance imaging (MRI) – principle - chemical shift - magnetic resonance signal induction and relaxation - pulse sequencing and spatial encoding.

TEXTBOOK:


REFERENCE BOOKS

1. Glasser. O. Medical Physics Vol.1, 2, 3 Book Publisher Inc Chicago, 1980

15PHY338 PHYSICS OF SEMICONDUCTOR DEVICES

Unit 1

Introduction: Unit cell, Bravais lattices, crystal systems, crystal planes and Miller indices, symmetry elements. Defects and imperfections – point defects, line defects, surface defects and volume defects.


Unit 2

Theory of semiconductors: Intrinsic and extrinsic semiconductors, band structure of semiconductors, carrier concentration in intrinsic and extrinsic semiconductors, electrical conductivity and conduction mechanism in

Theory of p-n junctions – diode and transistor: p-n junction under thermal equilibrium, forward bias, reverse bias, carrier density, current, electric field, barrier potential. V-I characteristics, junction capacitance and voltage breakdown.

Unit 3


Modern semiconducting devices: CCD - introduction to nano devices, fundamentals of tunneling devices, design considerations, physics of tunneling devices.

TEXTBOOKS:


REFERENCES:


Unit 1

Practical astronomy - telescopes and observations & techniques – constellations, celestial coordinates, ephemeris.

Celestial mechanics - Kepler’s laws - and derivations from Newton’s laws.

Sun: Structure and various layers, sunspots, flares, faculae, granules, limb darkening, solar wind and climate.

Unit 2
Stellar astronomy: H-R diagram, color-magnitude diagram - main sequence - stellar evolution

– red giants, white dwarfs, neutron stars, black holes - accretion disc - Schwartzchild radius - stellar masses Saha–Boltzman equation - derivation and interpretation.

Variable stars: Cepheid, RR Lyrae and Mira type variables - Novae and Super novae. Binary and multiple star system - measurement of relative masses and velocities. Interstellar clouds - Nebulae.

Unit 3
Galactic astronomy: Distance measurement - red shifts and Hubble’s law – age of the universe, galaxies – morphology - Hubble’s classification - gravitational lens, active galactic nuclei (AGNs), pulsars, quasars.


Cosmology: Comic principles, big bang and big crunch – cosmic background radiation - Nucleo-synthesis - plank length and time, different cosmic models - inflationary, steady state. Variation of G. anthropic principle.

COURSE OUTCOMES (CO):
After completion of the course students should be able to

CO1: Get a broad knowledge of scientific and technical methods in astronomy and astrophysics.
CO2: Apply mathematical methods to solve problems in astrophysics.
CO3: Develop critical/logical thinking, scientific reasoning and skills in the area of modern
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REFERENCES:

5. ‘Stellar Astronomy’ by K. D Abhayankar.

15PHY535 EARTH'S ATMOSPHERE 3 0 0 3

Unit 1

Earth's atmosphere: overview and vertical structure. Warming the earth and the atmosphere: temperature and heat transfer; absorption, emission, and equilibrium; incoming solar energy. Air temperature: daily variations, controls, data, human comfort, measurement. Humidity, condensation, and clouds: circulation of water in the atmosphere; evaporation, condensation, and saturation; dew and frost; fog.

Unit 2

Cloud development and precipitation: atmospheric stability & determining stability, cloud development and stability,

Unit 3

Air masses, fronts, and mid-latitude cyclones. Weather forecasting: acquisition of weather information, forecasting methods and tools, forecasting using surface charts. Thunderstorms: ordinary (air-mass) thunderstorms, mesoscale convective complexes, floods and flash floods, distribution of thunderstorms, lightning and thunder. Tornadoes: severe weather and Doppler radar, waterspouts.

Unit 4

Hurricanes (cyclones, typhoons): tropical weather; anatomy, formation, dissipation and naming of hurricanes. Air pollution: a brief history, types and sources, factors that affect air pollution, the urban environment, acid deposition. Global climate: climatic classification; global pattern of climate.

Unit 5

Climate change: possible causes; carbon dioxide, the greenhouse effect, and recent global warming. Light, colour, and atmospheric optics: white and colours, white clouds and scattered light; blue skies and hazy days, red suns and blue moons; twinkling, twilight, and the green flash; the mirage; halos, sundogs, and sun pillars; rainbows; coronas and cloud iridescence.

TEXTBOOK:


REFERENCE:


15PHY536 EARTH’S STRUCTURE AND EVOLUTION 3 0 0 3

Unit 1
Introduction: geologic time; earth as a system, the rock cycle, early evolution, internal structure & face of earth, dynamic earth. Matter and minerals: atoms, isotopes and radioactive decay; physical properties & groups of minerals; silicates, important nonsilicate minerals, resources. Igneous rocks: magma, igneous processes, compositions & textures; naming igneous rocks; origin and evolution of magma, intrusive igneous activity, mineral resources and igneous processes.

Unit 2

Volcanoes and volcanic hazards: materials extruded, structures and eruptive styles, composite cones and other volcanic landforms, plate tectonics and volcanic activity. Weathering and soils: earth’s external processes; mechanical & chemical weathering, rates; soils, controls of formation, profile, classification, human impact, erosion, weathering and ore deposits. Sedimentary rocks: the importance and origins of sedimentary rocks; detrital & chemical sedimentary rocks, coal, converting sediment into sedimentary rock; classification & structures, nonmetallic mineral & energy resources. Metamorphism and metamorphic rocks: metamorphic textures, common metamorphic rocks, metamorphic environments & zones.

Unit 3


Unit 4

Shorelines: coastal zone, waves & erosion, sand movement, shoreline features & stabilization; erosion problems along U.S. coasts, hurricanes, coastal classification, tides. Earthquakes and earth’s interior: faults, seismology, locating the source of an earthquake, measuring intensity, belts and plate boundaries, destruction, damage east of the Rocky Mountains, earthquake prediction, earth’s interior. Plate tectonics: continental drift, divergent boundaries, convergent boundaries, transform fault boundaries, testing the plate tectonics model, the breakup of Pangaea, measuring plate motion, what drives plate motions, plate tectonics in the future.

Unit 5

Origin and evolution of the ocean floor: continental margins, features of deep-ocean basins, anatomy of oceanic ridge, oceanic ridges and seafloor spreading, nature of oceanic crust, continental rifting, destruction of oceanic lithosphere.
Crustal deformation and mountain building: structures formed by ductile & brittle deformation, mountain building at subduction zones, collisional mountain belts, fault-block mountains, vertical movements of the crust. Geologic time: time scales, relative dating, correlation of rock layers; dating with radioactivity, the geologic time scale, difficulties in dating. Earth’s evolution: birth of a planet, origin of the atmosphere and oceans, Precambrian (formation of continents); Phanerozoic (formation of modern continents & earth’s first life); Paleozoic (life explodes); the Mesozoic (dinosaurs); Cenozoic era (mammals). Global climate change: climate & geology, climate system, detecting change; atmospheric basics & heating the atmosphere; natural & human causes; carbon dioxide, trace gases, and climate change; climate-feedback mechanisms, aerosols, some possible consequences.

TEXTBOOK:


REFERENCE:


15PHY540 NON-LINEAR DYNAMICS 3 0 0 3

Unit 1

Introduction: examples of dynamical systems, driven damped pendulum, ball on oscillating floor, dripping faucet, chaotic electrical circuits.

One-dimensional maps: the logistic map, bifurcations in the logistic map, fixed points and their stability, other one-dimensional maps.

Non-chaotic multidimensional flows: the logistic differential equation, driven damped harmonic oscillator, Van der Pol equation, numerical solution of differential equations.

Dynamical systems theory: two-dimensional equilibrium and their stability, saddle points, are contraction and expansion, non-chaotic three-dimensional attractors, stability of two-dimensional maps, chaotic dissipative flows.

Unit 2

Lyapunov exponents: for one- and two-dimensional maps and flows, for three-dimensional flows, numerical
calculation of largest Lyapunov exponent, Lyapunov exponent spectrum and general characteristics, Kaplan-Yorke dimension, numerical precautions.

Strange attractors: general properties, examples, search methods, probability of chaos and statistical properties of chaos, visualization methods, basins of attraction, structural stability.

Bifurcations: in one-dimensional maps and flows, Hopf bifurcations, homoclinic and heteroclinic bifurcations, crises.

Hamiltonian chaos: Hamilton’s equations and properties of Hamiltonian systems, examples, three-dimensional conservative flows, symplectic maps.

Unit 3
Time-series properties: examples, conventional linear methods, a case study, time-delay embeddings.

Nonlinear prediction and noise-reduction: linear predictors, state-space prediction, noise reduction, Lyapunov exponents from experimental data, false nearest neighbours.

Fractals: Cantor sets, curves, trees, gaskets, sponges, landscapes.

Calculations of fractal dimension: similarity, capacity and correlation dimensions, entropy, BDS statistic, minimum mutual information, practical considerations.

Fractal measure and multifractals: convergence of the correlation dimension, multifractals, examples and numerical calculation of generalized dimensions.

Non-chaotic fractal sets: affine transformations, iterated functions systems, Mandelbrot and Julia sets.

Spatiotemporal chaos and complexity: examples, cellular automata, coupled map lattices, self-organized criticality.

TEXTBOOK:

REFERENCES:
15PHY542 OPTOELECTRONIC DEVICES 3003

Unit 1

Basics of semiconductor optics: Dual nature of light, band structure of various semiconductors, light absorption and emission, photoluminescence, electroluminescence, radioactive and non-radiative recombination, wave trains.

Unit 2
Semiconductor light-emitting diodes: Structure and types of LEDs and their characteristics, guided waves and optical modes, optical gain, confinement factor, internal and external efficiency, semiconductor heterojunctions, double-heterostructure LEDs.

Semiconductor lasers: Spontaneous and stimulated emission, principles of a laser diode, threshold current, effect of temperature, design of an edge-emitting diode, emission spectrum of a laser diode, quantum wells, quantum-well laser diodes.

Unit 3
Semiconductor light modulators: Modulating light (direct modulation of laser diodes, electro-optic modulation, acousto-optic modulation), isolating light (magneto-optic isolators), inducing optical nonlinearity (frequency conversion, switching).

Semiconductor light detectors: I-V characteristics of a p-n diode under illumination, photovoltaic and photoconductive modes, load line, photocells and photodiodes, p-i-n photodiodes, responsivity, noise and sensitivity, photodiode materials, electric circuits with photodiodes, solar cells.

REFERENCES:


HUMANITIES ELECTIVES

15CUL230 ACHIEVING EXCELLENCE IN LIFE - 2002
AN INDIAN PERSPECTIVE

OBJECTIVES: The course offers to explore the seminal thoughts that influenced the Indian Mind on the study of human possibilities for manifesting excellence in life. This course presents to the students, an opportunity to study the Indian perspective of Personality Enrichment through pragmatic approach of self analysis and application.

Unit 1
Goals of Life – Purusharthas
What are Purusharthas (Dharma, Artha, Kama, Moksha); Their relevance to Personal life; Family life; Social life & Professional life; Followed by a Goal setting workshop;

Yogic way of Achieving Life Goals – (Stress Free & Focused Life)
Introduction to Yoga and main schools of Yoga; Yogic style of Life & Time Management (Work Shop);

Experiencing life through its Various Stages
Ashrama Dharma; Attitude towards life through its various stages (Teachings of Amma);

Unit 2
Personality Development
What is Personality – Five Dimensions – Pancha Kosas (Physical / Energy / Mental / Intellectual / Bliss); Stress Management & Personality; Self Control & personality; Fundamental Indian Values & Personality;

Learning Skills (Teachings of Amma)
Art of Relaxed Learning; Art of Listening; Developing ‘Shraddha’ – a basic qualification for obtaining Knowledge;

Communication Skills - An Indian Perspective;

Unit 3
Developing Positive Attitude & Friendliness - (Vedic Perspective);

Achieving Work Excellence (Karma Yoga by Swami Vivekananda & teachings based on Amma);
Leadership Qualities – (A few Indian Role models & Indian Philosophy of Leadership);

REFERENCE BOOKS:
1. Awaken Children (Dialogues with Sri Mata Amritanandamayi) Volumes 1 to 9
2. Complete works of Swami Vivekananda (Volumes 1 to 9)
3. Mahabharata by M. N Dutt published by Parimal publications – New Delhi (Volumes 1 to 9)
4. Universal message of Bhagavad-Gita (An exposition of Gita in the light of modern thought and Modern needs) by Swami Ranganathananda. (Vols.1 to 3)
7. Art of Man Making - Swami Chinmayananda published by Chinmaya Mission, Bombay
10. Yoga In Daily Life - Swami Sivananda – published by Divine Life Society
12. All about Hinduism – Swami Sivananda - Published by Divine Life Society
15. Valmiki Ramayana – Four volumes- published by Parimal Publications, Delhi
17. Mind Sound Resonance Technique (MSRT) Published by Swami Vivekananda Yoga Prakashana, Bangalore.
18. Yoga & Memory - Dr H R Nagendra & Dr. Shirley Telles, published by Swami Vivekananda Yoga Prakashana, Bangalore.

15CUL231 EXCELLENCE IN DAILY LIFE 2002

Unit 1
1. The anatomy of ‘Excellence’. What is ‘excellence’? Is it judged by external factors like wealth?
2. The Great Flaw. The subject-object relationship between individual and world. Promote subject enhance excellence.
3. To work towards excellence, one must know where he is. Our present state...
   An introspective analysis. Our faculties within.

Unit 2
4. The play of the mind. Emotions – convert weakness into strength.
5. The indispensible role of the intellect. How to achieve and apply clear thinking?
7. Increase Productivity, reduce stress..work patterning.
Unit 3
8 The art of right contact with the world. assessment, expectations.
9 Myths and Realities on key issues like richness, wisdom, spirituality.
10 Collect yourself, there is no time to waste. The blue-print of perfect action.

REFERENCES:
The Bhaja Govindam and the Bhagavad Gita.

15CUL232 EXPLORING SCIENCE AND TECHNOLOGY 2002 IN ANCIENT INDIA

OBJECTIVES: This course offers a journey of exploration through the early developments in India of astronomy, mathematics, technologies and perspectives of the physical world. With the help of many case studies, the students will be equipped to understand concepts as well as actual techniques.

Unit 1
1. General introduction: principles followed and sources;
2. Astronomy & mathematics from the Neolithic to the Indus civilization;
3. Astronomy & mathematics in Vedic literature;
4. Vedanga Jyotisha and the first Indian calendars;
5. Shulba Sutras and the foundations of Indian geometry;

Unit 2
6. Astronomy & mathematics in Jain and Buddhist literature;
7. The transition to the Siddhantic period; Aryabhata and his time;
8. The Aryabhatiya: concepts, content, commentaries;
9. Brahmagupta and his advances; 10. Other great Siddhantic savants;
11. Bhaskara II and his advances;

Unit 3
12. The Kerala school of mathematics;
13. The Kerala school of astronomy;
14. Did Indian science die out?;
15. Overview of recent Indian scientists, from S. Ramanujan onward;
16. Conclusion: assessment and discussion;

TEXTBOOK:
OBJECTIVES: This course offers the foundation necessary to understand Eastern approaches to psychology and spirituality. The course includes experiential components centering on meditation and spiritual practice.

Unit 1
Introduction
Introduction to Modern Psychology
A short history of Modern Psychology - Major Schools of Modern Psychology - The three major forces in Western Psychology - Freudian Psychoanalysis; Behaviourism; Humanistic Psychology.

Introduction to Indian Psychology
What is Yoga? - Rise of Yoga Psychology tradition - Various schools of Yoga Psychology - Universal Goal of all Yoga-schools.

Patanjali Yoga Sutra – 1

Patanjali Yoga Sutra – 2

Unit 2
Patanjali Yoga Sutra – 3
Two formulae - Necessity of Abhyasah and Vairagayah - Foundation of Abhyasah - Foundation of Vairagayah.

Patanjali Yoga Sutra – 4

Patanjali Yoga Sutra – 5
Main obstacles in the path of Yoga - other obstructions - removal of obstacles by one – pointedness; by controlling Prana - by observing sense experience - by inner illumination - by detachment from matter - by knowledge of dream and sleep - by meditation as desired.

Patanjali Yoga Sutra – 6
How to make mind peaceful? - Cultivating opposite virtues: happiness – friendliness - misery – compassion - virtue
– gladness - vice – indifference.

Patanjali Yoga Sutra – 7

Unit 3
Patanjali Yoga Sutra – 8

Patanjali Yoga Sutra – 9

Patanjali Yoga Sutra – 10
Asanam – Pranayamah - various kinds of Pranayamah - Pratyaharah - Mastery over the senses.

Report review
Conclusion

REFERENCES:

• The course book will be “The four chapters of Freedom” written by Swami Satyananda Saraswati of Bihar School of Yoga, Munger, India.
• “The message of Upanishads” written by Swami Ranganathananda. Published by Bharathiya Vidya Bhavan.
• Eight Upanishads with the commentary of Sankaracharya, Translated by Swami Gambhirananda, Published by Advaita Ashram, Uttaranjal.
• ‘Hatha Yoga Pradipika’ Swami Muktibodhananda, Yoga Publications Trust, Munger, Bihar, India

15ENG230 BUSINESS COMMUNICATION 1 0 2 2

Course Objectives

To introduce business vocabulary
To introduce business style in writing and speaking
To expose students to the cross-cultural aspects in a globalised world
To introduce the students to the art of persuasion and negotiation in business contexts

Course Outcomes
CO1: Familiarize and use appropriate business vocabulary and etiquettes in verbal communication in the professional context

CO2: Understand organizational structures, pay structures and performance assessments

CO3: Apply language skills in drafting various business documents and other necessary communications in the business context

CO4: Understand and address cross cultural differences in the corporate environment

CO5: Participate in planned and extempore enactments of various business situations

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Syllabus

Unit 1:

Business Vocabulary - Writing: Drafting Notices, Agenda, and Minutes - Reading: Business news, Business articles

Unit 2:

Writing: Style and vocabulary - Business Memorandum, letters, Press Releases, reports – proposals – Speaking: Conversational practice, telephonic conversations, addressing a gathering, conducting meetings
Unit 3:
Active Listening: Pronunciation – information gathering and reporting - Speaking: Cross-Cultural Issues, Group Dynamics, negotiation & persuasion techniques

Activities

Case studies & role-plays

Books recommended:


15ENG231 INDIAN THOUGHT THROUGH ENGLISH 1 0 2 2

OBJECTIVES: To expose the students to the greatness of Indian Thought in English; to develop a sense of appreciation for the lofty Indian Thought; to develop an understanding of the eclectic Indian psyche; to develop an understanding about the societal changes in the recent past.

Unit 1 Poems
Rabindranath Tagore’s Gitanjali (1-10); Nizzim Ezekiel’s Enterprise; A. K. Ramanujam’s Small-Scale Reflections on a Great House.

Unit 2 Prose
Khushwant Singh’s The Portrait of a Lady; Jhumpa Lahiri’s Short Story - Interpreter of Maladies.

Unit 3 Drama and Speech
Vijay Tendulkar’s Silence, the Court is in Session; Motivational speeches by Jawaharlal Nehru/ S. Radhakrishnan / A. P. J. Abdul Kalam’s My Vision for India etc. (any speech).

REFERENCES:


**15ENG232 INSIGHTS INTO LIFE THROUGH ENGLISH LITERATURE 1 0 2 2**

**OBJECTIVES:** To expose the students to different genres of Literature; to hone reading skills; to provide deeper critical and literary insights; to enhance creative thinking; to promote aesthetic sense.

**Unit 1 Poems**

**Unit 2 Short Stories**

**Unit 3 Prose**

**Practicals:**
Role plays: The Proposal, Chekov / Remember Ceaser, Gordon Daviot / Final Solutions, Mahesh Dattani, Book reviews, Movie reviews.

**SUGGESTED READING:** *The Old Man and the Sea*, Hemingway / Any one of the novels of R. K. Narayan, etc.

**15ENG233 TECHNICAL COMMUNICATION 1 0 2 2**

**Course Objectives:**

To introduce the students to the elements of technical style
To introduce the basic elements of formal correspondence
To introduce technical paper writing skills and methods of documentation
To improve oral presentation skills in formal contexts

**Course Outcomes:** After the completion of the course the student will be able to:
CO1 | Understand and use the basic elements of formal correspondence and methods of documentation

CO2 | Learn to edit technical content for grammatical accuracy and appropriate tone and style

CO3 | Use the library and internet resources for research purposes

CO4 | Demonstrate the ability to communicate effectively through group mock-technical presentations and other activities

Mapping of course outcomes with program outcomes:

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Syllabus:

Unit 1

Unit 2
Different kinds of written documents: Definitions - descriptions- instructions-recommendations- manuals - reports – proposals; Formal Correspondence: Letter Writing including job applications with Resume

Unit 3
Technical paper writing: Library research skills- documentation style - document editing – proof reading - formatting
Practice in oral communication: Practice in Oral communication and Technical presentations

References


15ENG234 INDIAN SHORT STORIES IN ENGLISH 1 0 2 2

OBJECTIVES: To help the students learn the fine art of story writing; to help them learn the techniques of story telling; to help them study fiction relating it to the socio-cultural aspects of the age; to familiarize them with different strategies of reading short stories; to make them familiar with the morals and values held in high esteem by the ideals of Indianness.

Unit 1

Unit 2

Unit 3
Masti Venkatesha Iyengar: The Curds-Seller; Manohar Malgonkar: Upper Division Love; Romila Thapar: The Spell; Premchand: The Voice of God.

TEXT:

REFERENCE;

15FRE230 PROFICIENCY IN FRENCH LANGUAGE (LOWER) 1 0 2 2

Unit 1 Population - Identity
How to introduce yourself (name, age, address, profession, nationality); Numbers; How to ask questions;

Grammar – Pronouns - subjects; Regular verbs of 1st group (er) in the present; Être (to be) and avoir (to have) in the present; Interrogative sentence; Gender of adjectives.

Unit 2 The suburbs - At the train station
Introduce someone; Buy a train ticket or a cinema ticket; Ask for information; Official time; Ask for a price; The city
(church, town hall, post office…)

Grammar – Pronouns - subjects (continuation); Gender of adjectives (continuation); Plural of nouns and adjectives; Definite and indefinite articles; Interrogative adjectives; I would like (Je voudrais).

Unit 3 Paris and the districts - Looking for a room
Locate a room and indicate the way; Make an appointment; Give a price; Ordinal numbers; Usual time; Ask for the time.

Grammar - Imperative mode; Contracted articles (au, du, des); negation.

TEXTBOOK:
Metro St Michel - Publisher: CLE international

15FRE231 PROFICIENCY IN FRENCH LANGUAGE (HIGHER) 1022

Unit 1 The first room of a student
A party to celebrate the 1st room; Description of a room; furniture; Locate objects: prepositions (devant, derrière, dans…), Read advertisement; Appreciation (I like, I prefer,).

Grammar - Perfect past tense with avoir; Possessive adjectives (mon, ton, son…); Demonstrative adjectives (ce, cet, cette); Yes (oui, si).

Unit 2 Small jobs
Conversation on the phone; Give Time indications; Answer a job offer; Describe a job; Suggest a meeting time.

Grammar - Perfect past tense with être and avoir (continuation); Possessive adjectives (notre, votre, leur); Prepositions (à, pour, avec …); Pronoun as direct object (le, la, l’, les).

Unit 3 University Restaurant
Inquiry; Express an opinion; Ask questions (continuation); Food, meals, taste, preferences; Nutrition, diet, choose a menu or diet, Expression of quantities (beaucoup, peu).

Grammar - Partitif (expressing quantity) (du, de la, pas de…); Comparison (plus …que, moins….que, autant …que); Interrogation (continuation), inversion, Est-ce que, qu’est-ce que?.

TEXTBOOK:
Metro St Michel - Publisher: CLE International
Unit 1
Greetings; Introducing one-self (formal and informal context), saying their name, origin, living place, occupation.

Numbers 1-100; Saying the telephone number.

Countries and Languages.

Grammar: Structure – W - Questions and Yes/No questions and statements, personal pronouns, verb conjugations. Articles.

Vocabulary: Professions.

Unit 2
Giving the personal details. Name, age, marital status, year of birth, place of birth, etc.

Numbers till 1000. Saying a year.

Alphabets – spelling a word.

Filling up an application form; In the restaurant – making an order.

Grammar: Definite, indefinite and negative article in nominative. Accusative: indefinite and negative Article

Vocabulary: Food items

Unit 3
Numbers above 1000. Orientation in Shopping plazas: asking the price, where do I find what, saying the opinion.

Grammar: Accusative – definite article. Adjectives and plural forms.

Vocabulary: Furniture and currencies.

Unit 1
Shopping and orientation in supermarket; Conversation between the customer and salesman; Where one finds what in supermarket; Asking for requests and suggestions.

Grammar: Dative of personal pronouns. Imperative form.

Vocabulary: Consumables and measurements;
Appointments; Work and leisure time activities; Time, weekdays, months and seasons; saying the date; fixing up an appointment.

Grammar: Model verbs; Prepositions with time and place; Ordinal numbers.

Vocabulary: Leisure activities, weekdays, months and seasons.

Unit 3
Family and household; Family and relations; household and daily routine.

Grammar: Possessive articles; Divisible and indivisible verbs.

Vocabulary: Family circle; Household articles.

15GER232 PROFICIENCY IN GERMAN LANGUAGE (LOWER) 1022
To have an elementary exposure to German language; specifically
3. to have some ability to understand simple spoken German, and to be able to speak it so as to be able to carry on life in Germany without much difficulty (to be able to do shopping, etc.);
4. to be able to understand simple texts, and simple forms of written communication;
5. to have a basic knowledge of German grammar;
6. to acquire a basic vocabulary of 500 words;
7. to be able to translate simple letters with the use of a dictionary; and
8. to have some familiarity with the German life and culture.
(This will not be covered as part of the regular classroom teaching; this is to be acquired by self-study.)

Some useful websites will be given.

15GER233 PROFICIENCY IN GERMAN LANGUAGE (HIGHER) 1022
The basic vocabulary and grammar learned in the earlier course is mostly still passive knowledge. The endeavour of this course is to activate this knowledge and develop the skill of communication.

Topics are: Airport, railway station, travelling; shopping; invitations, meals, meeting people; around the house; the human body; colours; professions.

Past and future tenses will be introduced. Applying genitive, dative and accusative.

Some German culture. Films.
To teach Hindi for effective communication in different spheres of life: Social context, Education, Research & Media.

**Course Outcomes:** After the completion of the course the student will be able to:

- CO1 Gain knowledge about the nature and culture of Hindi language
- CO2 Understand the structural aspects of Hindi language
- CO3 Apply the knowledge of the grammatical structures to communicate in Hindi
- CO4 Analyse the social significance of modern literature.
- CO5 Develop the ability to translate a given text to Hindi

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<th>Course Outcomes</th>
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**Syllabus**

**Unit-1**

Introduction to Hindi Language, National Language, Official Language, link Language etc.. S Introduction to Hindi language, Devanagari script and Hindi alphabet.

Shabda Bhed, Roopanhtar ki Drishti se- Bhasha – Paribhasha aur Bhed - Sangya - Paribhasha Aur Bhed- Sangya ke Roopanhtar- kriya.

**Unit-2**

Common errors and error corrections in Parts of Speech with emphasis on use of pronouns, Adjective and verb in different tenses – Special usage of adverbs, changing voice and conjunctions in sentences, gender& number - General
vocabulary for conversations in given context – understanding proper pronunciation – Conversations, Interviews, Short speeches.

**Unit -3**

**Poems** – Kabir Ist 8 Dohas, Surdas 1st 1 Pada; Tulsidas 1st 1 Pada; Meera 1st 1 Pada

**Unit- 4**

Letter writing – personal and Formal – Translation from English to Hindi

**Unit- 5**

Kahani – Premchand : Kafan, Abhilasha, Vidroh, Poos ki rath, Juloos

**Text Books** :

1. Prem Chand Ki Sravashrestha Kahaniyam: Prem Chand ; Diamond Pub Ltd. New Delhi
2. Vyavaharik Hindi Vyakaran ,Anuvad thaha Rachana : Dr. H. Parameswaran, Radhakrishna publishing House, New Delhi

**15HIN111 HINDI II 1 0 2 2**

Appreciation and assimilation of Hindi Literature - both *drishya* and *shravya* - using the best specimens provided as anthology.

**Course Outcomes:** After the completion of the course the student will be able to:

| CO1 | Understand the grammatical structures of Hindi |
| CO2 | and the post modern trends of literature |
| CO3 | Critical thinking and writing skills |
| CO4 | and analyse different literary and audio-visual material |
| CO5 | Fundamental knowledge of Hindi in formal and informal writing |

**Mapping of course outcomes with program outcomes:**

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<th>Course Outcomes</th>
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### Syllabus:

#### Unit - 1

Kavya Tarang:- Dhumil ke Anthim Kavitha[Poet-Dhumil], Dhabba[Poet-Kedarnath Singh], Proxy[Poet-Venugopal], Vakth[Poet-Arun Kamal], Maachis[Poet-Suneeta Jain].

#### Unit - 2

Communicative Hindi - Moukhik Abhivyakthi

#### Unit - 3

Audio- Visual –Media in Hindi – Movies like Tare Zameen par , Paa, Black etc., appreciation and evaluation . News reading and presentations in Radio and TV channels in Hindi .

#### Unit - 4

Gadya Manjusha –Budhapa , Kheesa, Sadachar ka Thavis

#### Unit - 5


### Text Books:

2. Gadya Manjusha: Editor: Govind , Jawahar Pustakalay , Mathura
3. Prem Chand Ki Srvasiontha Kahaniyam: Prem Chand ; Diamond Pub Ltd. New Delhi

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**15HUM230**  
**EMOTIONAL INTELLIGENCE  2002**

**Unit 1**
Emotional Intelligence: Concept of Emotional Intelligence, Understanding the history and origin of Emotional Intelligence, Contributors to Emotional Intelligence, Science of Emotional Intelligence, EQ and IQ, Scope of Emotional Intelligence.

Unit 2

Unit 3
Emotional Intelligence at Work place: Importance of Emotional Intelligence at Work place? Cost–savings of Emotional Intelligence, Emotionally Intelligent Leaders, Case Studies Measuring Emotional Intelligence: Emotionally Intelligence Tests, Research on Emotional Intelligence, Developing Emotional Intelligence.

REFERENCES:

15HUM231 GLIMPSES INTO THE INDIAN MIND:THE GROWTH OF MODERN INDIA 2002

Unit 1
Introduction
General Introduction; ‘His + Story’ or ‘History’ ?; The concepts of ‘nation’, ‘national identity’ and ‘nationalism’; Texts and Textualities: Comparative Perspectives.

Unit 2
Selected writings / selections from the complete works of the following authors will be taken up for study in a chronological order:
Raja Ram Mohan Roy; Dayananda Saraswati; Bal Gangadhar Tilak; Rabindranath Tagore;

Unit 3
Selected writings / selections from the complete works of the following authors will be taken up for study in a chronological order:
Swami Vivekananda; Sri Aurobindo; Ananda K. Coomaraswamy; Sister Nivedita; Mahatma Gandhi; Jawaharlal Nehru; B.R. Ambedkar; Sri Chandrasekharendra Saraswati, the Paramacharya of Kanchi; Dharampal; Raja Rao; V.S. Naipaul.

Conclusion.
REFERENCES:
5. Tilak, Bal Gangadhar. The Orion / Arctic Home in the Vedas.
6. Tagore, Rabindranath. The History of Bharatavarsha / On Nationalism / Greater India.

Unit 1
Introduction
A peep into India’s glorious past
Ancient India – the vedas, the vedic society and the Sanatana Dharma – rajamandala and the Cakravartins – Ramarajya – Yudhisthira’s ramarajya; Sarasvati – Sindhu Civilization and the myth of the Aryan Invasion; Classical India – Dharma as the bedrock of Indian society – Vaidika Brahmanya Dharma and the rise of Jainism and Buddhism – the sixteen Mahajanapadas and the beginning of Magadhan paramountcy – Kautilya and his Arthasastra – Chandragupta Maurya and the rise of the Mauryan empire – Gupta dynasty Indian art and architecture – classical sanskrit literature – Harsavardhana; Trade and commerce in classical and medieval India and the story of Indian supremacy in the Indian ocean region; The coming of Islam – dismantling of the traditional Indian polity – the Mughal empire – Vijayanagara samrajya and days of Maratha supremacy.

Unit 2
India’s contribution to the world: spirituality, philosophy and sciences
Indian Philosophy – the orthodox (Vaidika) and the heterodox (atheistic) schools; Ramayana and Mahabharata; Bhagavad Gita; Saints and sages of India; Ancient Indian medicine: towards an unbiased perspective; Ancient Indian mathematics; Ancient Indian astronomy; Ancient Indian science and technology.

The arrival of Europeans, British paramountcy and colonization
What attracted the rest of the world to India?; India on the eve of the arrival of European merchants; The story of colonization and the havoc it wrecked on Indian culture and civilization; Macaulay and the start of the distortion of Indian education and history; Indian economy – before and after colonization: a brief survey; The emergence of modern India.

Unit 3
Women in Indian society
The role and position of women in Hindu civilization; Gleanings from the Vedas, Brihadaryaka Upanishad, Saptasati Devi Mahatmyam, Ramayana, Mahabharata, Manusmriti, Kautilya’s Arthasastra and Mrichchhakatikam of Sudraka; The role and position of Indian women vis-a-vis Islam and European cultures; The great women of India.

Modern India
The national movement for freedom and social emancipation; Swami Vivekananda, Sri Aurobindo, Rabindranath Tagore; Understanding Mahatma Gandhi; A new nation is born as a republic – the pangs of birth and growth; India since Independence – the saga of socio-political movements; Problems facing the nation today; Globalization and Indian Economy; Bharatavarsha today and the way ahead: Regeneration of Indian National Resources.

Conclusion
The Wonder that was India; The ‘politics’ and ‘purpose’ of studying India.

REFERENCES:
11. The Cultural Heritage of India. Kolkata: Ramakrishna Mission Institute of Culture.
15. Tagore, Rabindranath. The History of Bharatavarsha / On Nationalism / Greater India.
19. Aurobindo, Sri. The Indian Renaissance / India’s Rebirth / On Nationalism.
27. Danino, Michel. The Invasion That Never Was.
34. Dutt, R. C. The Economic History of India. London, 1902.

15HUM233 GLIMPSES OF INDIAN ECONOMY AND POLITY  2 0 0 2

Unit 1
Introduction
General Introduction; Primitive man and his modes of exchange – barter system; Prehistoric and proto-historic polity and social organization.

Ancient India – up to 600 B.C.
Early India – the vedic society – the varnashramadharma – socio-political structure of the various institutions based on the four purusartras; The structure of ancient Indian polity – Rajamandala and Cakravartins – Prajamandala; Socio-economic elements from the two great Epics – Ramayana and Mahabharata – the concept of the ideal King (Sri Rama) and the ideal state (Ramarajya) – Yudhisthira’s ramarajya; Sarasvati - Sindhu civilization and India’s trade links with other ancient civilizations; Towards chiefdoms and kingdoms – transformation of the polity: kingship – from gopati to bhupati; The mahajanapadas and the emergence of the srenis – states and cities of the Indo-Gangetic plain.

Unit 2
Classical India: 600B.C. – 1200 A.D.
The rise of Magadha, emergence of new religions – Buddhism and Jainism – and the resultant socio-economic impact; The emergence of the empire – the Mauryan Economy and Kautilya’s Arthasastra; of Politics and trade – the rise of the Mercantile Community; Elements from the age of the Kushanas and the Great Guptas; India’s maritime trade; Dharma at the bedrock of Indian polity – the concept of Digvijaya: dharma-vijaya, lobha-vijaya and asura-vijaya; Glimpses into the south Indian economies: political economies of the peninsula – Chalukyas, Rashtrakutas and Cholas

Medieval India: 1200 A.D. – 1720 A.D.
Advent of Islam – changes in the social institutions; Medieval India – agrarian economy, non-agricultural production and urban economy, currency system; Vijayangara samrajya and maritime trade – the story of Indian supremacy in the Indian Ocean region; Aspects of Mughal administration and economy; The Maratha and other provincial economies.

Unit 3
Modern India: 1720 - 1947

the Indian market and economy before the arrival of the European traders; Colonisation and British supremacy (dismantling of everything that was ‘traditional’ or ‘Indian’) – British attitude towards Indian trade, commerce and economy and the resultant ruining of Indian economy and business – man-made famines – the signs of renaissance: banking and other business undertakings by the natives (the members of the early Tagore family, the merchants of Surat and Porbander, businessmen of Bombay, etc. may be referred to here) – the evolution of the modern banking system; Glimpses into British administration of India and administrative models; The National movement and nationalist undertakings in business and industry: the Tatas and the Birlas; Modern India: the growth of large-scale industry – irrigation and railways – money and credit – foreign trade; Towards partition – birth of two new nations – division of property; The writing of the Indian Constitution – India becomes a democratic republic – a new polity is in place.

Independent India – from 1947

India since Independence – the saga of socio-political movements; Indian economy since Independence – the fiscal system – the five year plans – liberalisation – the GATT and after; Globalisation and Indian economy; Impact of science and (new/ emerging) technology on Indian economy; Histories of select Indian business houses and business entrepreneurship.

Conclusion

REFERENCES:

1. The Cultural Heritage of India. Kolkata: Ramakrishna Mission Institute of Culture.
15. Raychaudhuri, Tapan and Irfan Haib, eds. The Cambridge Economic History of India. Volume

15HUM234 HEALTH AND LIFE STYLE 1022
Unit 1 Introduction to Health
Health is wealth; Role of lifestyle habits on health; Importance of adolescence; Stages, Characteristics and changes during adolescence; Nutritional needs during adolescence why healthy lifestyle is important for adolescence. Eating Habits - eating disorders, skipping breakfast, junk food consumption.

Practicals - Therapeutic Diets

Unit 2 Food and Nutritional Requirements during Adolescence
Fluid intake; nutrition related problems; lifestyle related problems, Role of physical activity; resting pattern and postures, Personal habits – alcoholism, and other tobacco products, electronic addiction etc

Practicals - Ethnic Foods

Unit 3 Need for a Positive Life Style Change
Peer pressure & procrastination, Stress, depression, suicidal tendency, Mini project review and viva, Whole portions revision.

Practical - Cooking without Fire or Wire- healthy Snacks

TEXTBOOKS:

REFERENCE BOOKS:
WHO Report on Adolescent Health: 2010

15HUM235 INDIAN CLASSICS FOR THE TWENTY-FIRST CENTURY 2002
Unit 1  
Introductory study of the Bhagavad Gita and the Upanishads.

Unit 2  
The relevance of these classics in a modern age.

Unit 3  
Goals of human life - existential problems and their solutions in the light of these classics etc.

REFERENCE:  
The Bhagavad Gita, Commentary by Swami Chinmayananda

15HUM236  
INTRODUCTION TO INDIA STUDIES  
2 0 0 2

PREAMBLE: This paper will introduce the students to the multiple dimensions of the contribution of India to the fields of philosophy, art, literature, physical and social sciences. The paper intends to give an insight to the students about the far-reaching contributions of India to world culture and thought during the course of its long journey from the hoary antiquity to the present times. Every nation takes pride in its achievements and it is this sense of pride and reverence towards the achievements that lays the foundation for its all-round progress.

Unit 1  
A brief outline of Indian history from prehistoric times to the present times.

Contributions of India to world culture and civilization: Indian Philosophy and Religion; Art and Literature; Physical and Social Sciences.

Unit 2  
Modern India: Challenges and Possibilities.

Scientific and technological progress in post-independence era; Socio-cultural and political movements after independence; Challenges before the nation today - unemployment – corruption – degradation of cultural and moral values - creation of a new system of education; Creation of a modern and vibrant society rooted in traditional values.

Unit 3  
Modern Indian Writing in English: Trends in Contemporary Indian Literature in English.

TEXTBOOK:  
Material given by the Faculty

BACKGROUND LITERATURE:  
1 Selections from The Cultural Heritage of India, 6 volumes, Ramakrishna Mission Institute of Culture (Kolkata) publication.
2 Selections from the Complete Works of Swami Vivekananda, Advaita Ashrama publication.
<table>
<thead>
<tr>
<th>No.</th>
<th>Title</th>
<th>Author(s)</th>
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<tbody>
<tr>
<td>3</td>
<td>Invitations to Indian Philosophy</td>
<td>T. M. P. Mahadevan, University of Madras, Chennai.</td>
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<td>4</td>
<td>Outlines of Indian Philosophy</td>
<td>M. Hiriyanna, MLBD</td>
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<td>5</td>
<td>An Advanced History of India</td>
<td>R. C. Majumdar et al, Macmillan</td>
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<tr>
<td>6</td>
<td>India Since 1526</td>
<td>V. D. Mahajan, S. Chand &amp; Company</td>
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<td>7</td>
<td>The Indian Renaissance</td>
<td>Sri Aurobindo</td>
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<td>8</td>
<td>India’s Rebirth</td>
<td>Sri Aurobindo</td>
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<td>On Nationalism</td>
<td>Sri Aurobindo</td>
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<td>11</td>
<td>Eternal Values for a Changing Society</td>
<td>Swami Ranganathananda, Bharatiya Vidya Bhavan</td>
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<td>Universal Message of the Bhagavad Gita</td>
<td>Swami Ranganathananda, Advaita Ashrama</td>
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<td>Awaken Children: Conversations with Mata Amritanandamayi</td>
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<td>14</td>
<td>Indian Aesthetics</td>
<td>V. S. Seturaman, Macmillan</td>
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<td>15</td>
<td>Indian Philosophy of Beauty</td>
<td>T. P. Ramachandran, University of Madras, Chennai.</td>
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<td>16</td>
<td>Web of Indian Thought</td>
<td>Sister Nivedita</td>
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<td>Essays on Indian Nationalism</td>
<td>Anand Kumaraswamy</td>
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<td>Comparative Aesthetics, Volume 2</td>
<td>Kanti Chandra Pandey, Chowkhamba, Varanasi</td>
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<td>19</td>
<td>The Invasion That Never Was</td>
<td>Michel Danino</td>
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<td>Girish Karnard, OUP</td>
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<td>Naga-Mandala</td>
<td>Girish Karnard, OUP</td>
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**15HUM237 INTRODUCTION TO SANSKRIT LANGUAGE AND LITERATURE 2002**

**OBJECTIVES:** To familiarize students with Sanskrit language; to introduce students to various knowledge traditions in Sanskrit; to help students appreciate and imbibe India’s ancient culture and values.

**Unit 1**
Sanskrit Language – Vakya Vyayahara - Introduction to Sanskrit language
- Devanagari script and Sanskrit alphabet - Vowels and Consonants – Pronunciation

**Unit 2**
Language Studies - Role of Sanskrit in Indian & World Languages.

**Unit 3**
Unit 4
Introduction to Sanskrit Technical Literature – Astronomy – Physics – Chemistry – Botany – Engineering –
Aeronautics – Ayurveda – Mathematics – Medicine – Architecture - Tradition of Indian Art – Administration –
Agriculture.

Unit 5
Indology Studies – Perspectives and Innovations.

TEXTBOOKS AND REFERENCE BOOKS:
1. Vakya Vyavahara - Prof. Vempaty Kutumba Sastri, Rashtriya Sanskrit Sansthan, New Delhi
2. The Wonder that is Sanskrit - Dr. Sampadananda Mishra, New Delhi

15HUM238 NATIONAL SERVICE SCHEME 2002

Unit 1
Introduction to Basic Concepts of NSS: History, philosophy, aims and objectives of NSS, Emblem, flag, motto, song,
badge etc., Organisational structure, roles and responsibilities of various NSS functionaries.

NSS Programmes and Activities: Concept of regular activities, special campaigning, Day Camps, Basis of adoption
of village / slums, methodology of conducting survey, financial pattern of the scheme, other youth
programme/schemes of GOI, Coordination with different agencies, Maintenance of the Diary.

Unit 2
Volunteerism and Shramdan: Indian Tradition of volunteerism, Needs and importance of volunteerism, Motivation
and Constraints of volunteerism, Shramdan as part of volunteerism, Amalabharatam Campaign, Swatch Bharath.

Unit 3
Understanding youth: Definition, profile and categories of youth, Issues, challenges and opportunities for youth,
Youth as an agent of social change.

Youth and Yoga: History, philosophy and concept of Yoga, Myths and misconceptions about Yoga, Different Yoga
traditions and their impacts, Yoga as a preventive and curative method, Yoga as a tool for healthy life style.

Unit 4
Youth Development Programmes in India: National Youth Policy, Youth development programmes at the national
level, state level and voluntary sector, youth-focused and youth-led organizations.

Youth and Crime: Sociological and psychological factors influencing youth crime, Peer mentoring in preventing
crimes, Awareness about Anti-Ragging, Cyber Crime and its prevention, Juvenile Justice.

Unit 5
Environmental Issues: Environment conservation, enrichment and sustainability, climate change, waste management,
rain water harvesting, energy conservation, waste land development.
15HUM239  PSYCHOLOGY FOR EFFECTIVE LIVING  2002

Course Objectives

1. To help students acquire the basic knowledge of behavior and effective living
2. To create an awareness of the hazards of health compromising behaviours
3. To develop and strengthen the tools required to handle the adversities of life

Course Outcome

CO 1: Understand the basic concepts of Behavioral Psychology
CO 2: Demonstrate self reflective skills through activities
CO 3: Apply the knowledge of psychology to relieve stress
CO 4: Analyse the adverse effects of health compromising behaviours.
CO 5: Evaluate and use guided techniques to overcome and cope with stress related problems.

CO-PO Mapping

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Syllabus

Unit 1

SELF AWARENESS & SELF MOTIVATION

Unit 2

THE NATURE AND COPING OF STRESS
Definition of stress, stressors, eustress, distress-PTSD-stress among college students- stress assessment-coping with stress-progressive muscle relaxation-RET-guided imagery-bio feedback-religious and spiritual way of coping with stress

Unit 3

APPLICATION OF HEALTH PSYCHOLOGY

Health compromising behaviors-smoking and alcoholism-biological and psychological effects of addiction-deaddiction-behavior modifications-CBT in handling problem behavior-cancer risks-AIDS.

Text Book(s)

V.D.Swaminathan&K.V.Kaliappan, Psychology for Effective living-An introduction to Health

Reference(s)


15HUM240 PSYCHOLOGY FOR ENGINEERS 2002

Course Objectives

1. To strengthen the fundamental knowledge of human behavior
2. To strengthen the ability to understand the basic nature and behavior of humans in organizations as a whole
3. To connect the concepts of psychology to personal and professional life

Course Outcome

CO 1: Understand the fundamental processes underlying human behavior such as learning, motivation, individual differences, intelligence and personality.
CO 2: Apply the principles of psychology in day-to-day life for a better understanding of oneself and others.
CO 3: Apply the knowledge of Psychology to improve study skills and learning methods
CO 4: Apply the concepts of defense mechanisms to safeguard against abusive relationships and to nurture healthy relationships.

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Unit 1

**PSYCHOLOGY OF ADOLESCENTS**

Psychology-definition-scope-adolescence-characteristics-developmental tasks-physical and psychological changes-interests-family relationships-emotions-peer pressure-positive and Negative effects of peer pressure-types of friends-choice of friends

Unit 2

**LEARNING, MEMORY AND STUDY SKILLS**

Definitions-Classical conditioning-Operant conditioning-Insight learning-reinforcement-its principles and its effects-role of reward and punishment in learning-forgetting-causes-techniques for improving study skills-Mnemonics-Intelligence-Emotional and social intelligence

Unit 3

**ATTENTION & PERCEPTION**

Definition-types of attention-span of attention-division of attention-factors determining attention-perception-difference between sensation and perception-laws of perception-errors in perception-illusion and hallucination

**Text Book(s)**

*S.K.Mangal General Psychology, Sterling Publishers Pvt.Ltd.2007*

**Reference(s)**

1. *Elizabeth B. Hurlock, Developmental Psychology - A Life span approach, 6th edition*


15HUM241 SCIENCE AND SOCIETY – AN INDIAN PERSPECTIVE 2002
Unit 1
Introduction
Western and Indian views of science and technology
Introduction; Francis Bacon: the first philosopher of modern science; The Indian tradition in science and technology: an overview.

Unit 2
Indian sciences
Introduction; Ancient Indian medicine: towards an unbiased perspective; Indian approach to logic; The methodology of Indian mathematics; Revision of the traditional Indian planetary model by Nilakantha Somasutvan in circa 1500 AD.

Science and technology under the British rule
Introduction; Indian agriculture before modernization; The story of modern forestry in India; The building of New Delhi

Unit 3
Science and technology in Independent India
Introduction; An assessment of traditional and modern energy resources; Greenrevolution: a historical perspective; Impact of modernisation on milk and oilseeds economy; Planning without the spirit and the determination.

Building upon the Indian tradition
Introduction; Regeneration of Indian national resources; Annamahatmyam and Annam Bahu Kurvita: recollecting the classical Indian discipline of growing and sharing food in plenty and regeneration of Indian agriculture to ensure food for all in plenty.

Conclusion

REFERENCES:
18. The Cultural Heritage of India. Kolkata: Ramakrishna Mission Institute of Culture.

* The syllabus and the study material in use herein has been developed out of a ‘summer programme’ offered by the Centre for Policy Studies (CPS), Chennai at the Indian Institute of Advanced Study (IIAS), Rashtrapati Nivas, Shimla, sometime ago. The same has been very kindly made available to us by Professors Dr M.D. Srinivas (Chairman) and Dr J.K. Bajaj (Director) of the CPS.

15HUM242 THE MESSAGE OF BHAGAVAD GITA 2002

Unit 1
Introduction: Relevance of Bhagavad Gita today – Background of Mahabharatha.

Arjuna Vishada Yoga: Arjuna’s Anguish and Confusion – Symbolism of Arjuna’s Chariot.


Unit 2
Karma Yoga: Yoga of Action – Living in the Present – Dedicated Action without Anxiety over Results - Concept of Swadharma.

Dhyana Yoga: Tuning the Mind – Quantity, Quality and Direction of Thoughts – Reaching Inner Silence.

Unit 3


TEXTBOOKS / REFERENCES:
THE MESSAGE OF THE UPAnishads 2002

OBJECTIVES: To give students an introduction to the basic ideas contained in the Upanishads; and explores how their message can be applied in daily life for achieving excellence.

Unit 1
An Introduction to the Principal Upanishads and the Bhagavad Gita - Inquiry into the mystery of nature - Sruti versus Smrti - Sanatana Dharma: its uniqueness - The Upanishads and Indian Culture - Upanishads and Modern Science.

Unit 2
The challenge of human experience & problems discussed in the Upanishads – the True nature of Man – the Moving power of the Spirit – The Message of Fearlessness – Universal Man - The central problems of the Upanishads – Ultimate reality – the nature of Atman - the different manifestations of consciousness.

Unit 3
Upanishad Personalities - episodes from their lives and essential teachings: Yajnavalkya, Aruni, Uddalaka, Pippalada, Satyakama Jabala, Svetaketu, Nachiketas, Upakosala, Chakrayana Ushasti, Raikva, Kapila and Janaka. Important verses from Upanishads - Discussion of Sage Pippalada’s answers to the six questions in Prasnopanishad.

REFERENCES:
1. The Message of the Upanishads by Swami Ranganathananda, Bharatiya Vidya Bhavan
2. Eight Upanishads with the commentary of Sankaracharya, Advaita Ashrama
3. Indian Philosophy by Dr. S. Radhakrishnan, Oxford University Press
4. Essentials of Upanishads by R L Kashyap, SAKSI, Bangalore
5. Upanishads in Daily Life, Sri Ramakrishna Math, Mylapore.
7. Upanishad Ganga series – Chinmaya Creations

UNDERSTANDING SCIENCE OF 1022 FOOD AND NUTRITION

Course Objectives:

- To introduce the significance of food, nutrients, locally available food resources, synergetic food combinations, good cooking methods and importance of diversity in foods
- To understand nutritional imbalances and chronic diseases associated with the quality of food.
- To gain awareness about the quality of food - Organic food, genetically modified food, adulterated food, allergic food, food poisoning and food safety.
- To understand food preservation processing, packaging and the use of additives.
Course Outcome:

CO1: Acquire knowledge about the various food and food groups

CO2: Understand nutritional imbalances and chronic diseases prevailing among different age groups.

CO3: Understand the significance of safe food and apply the food safety standards

CO4: Demonstrate skills of food processing, preservation and packaging methods with or without additives

CO5: Evaluate the quality of food based on the theoretical knowledge of Food and Nutrition

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3. **UNIT III: INTRODUCTION TO FOOD BIOTECHNOLOGY**: Future foods- Organic foods and genetically modified foods, Fortification of foods, bio fortification of foods, value addition of foods, functional foods, nutraceuticals, weaning foods/supplementary. Processing and preservation of foods, applications of food technology in daily life, and your prospects associated with food industry – Nanoparticles, biosensors, advanced research.

**Reference Books:**

15JAP230 PROFICIENCY IN JAPANESE LANGUAGE (LOWER)  1 0 2 2

This paper will introduce the basics of Japanese language. Students will be taught the language through various activities like writing, reading, singing songs, showing Japanese movies etc. Moreover this paper intends to give a thorough knowledge on Japanese scripts that is Hiragana and Katakana. Classes will be conducted throughout in Japanese class only. Students will be able to make conversations with each other in Japanese. Students can make self-introduction and will be able to write letters in Japanese. All the students will be given a text on Japanese verbs and tenses.

Students can know about the Japanese culture and the lifestyle. Calligraphy is also a part of this paper. Informal sessions will be conducted occasionally, in which students can sing Japanese songs, watch Japanese movies, do Origami – pattern making using paper.

15JAP231 PROFICIENCY IN JAPANESE LANGUAGE (HIGHER)  1 0 2 2

Students will be taught the third and the most commonly used Japanese script, Kanji. Students will be taught to write as well as speak.

Students will be given detailed lectures on Calligraphy.

This version of the course includes a new project where the students should make a short movie in Japanese language selecting their own topics.

By the end of the semester they the students will master the subject in all means. They will be able to speak Japanese as fluently as they speak English. Students will be encouraged to write stories and songs in Japanese language themselves.

15KAN101                        KANNADA I                      1 0 2 2

OBJECTIVES: To enable the students to acquire basic skills in functional language; to develop independent reading skills and reading for appreciating literary works; to analyse language in context to gain an understanding of vocabulary, spelling, punctuation and speech.

Unit 1
Adalitha Kannada: bhashe, swaroopa, belavanginya kiru parichaya Paaribhaashika padagalu
Vocabulary Building

224
Unit 2
Prabhandha – Vyaaghra Geethe - A. N. Murthy Rao
Prabhandha – Baredidi…baredidi, Baduku mugiyuvudilla allige…- Nemi Chandra Paragraph writing –
Development: comparison, definition, cause & effect Essay – Descriptive & Narrative

Unit 3
Mochi – Bharateepriya
Mosarina Mangamma – Maasti Venkatesh Iyengar
Kamalaapurada Hotelnalli – Panje Mangesh Rao Kaanike – B. M. Shree
Geleyanobbanige bareda Kaagada – Dr. G. S. Shivarudrappa Moodala Mane – Da. Ra. Bendre
Swathantryada Hanate – K. S. Nissaar Ahmed

Unit 4
Letter Writing - Personal: Congratulation, thanks giving, invitation, condolence

Unit 5
Reading Comprehension; nudigattu, gaadegalu

Speaking Skills: Prepared speech, pick and speak

REFERENCES:
5. H. S. Krishna Swami Iyangar – Adalitha Kannada – Chetana Publication, Mysuru
7. Nemi Chandra – Badhuku Badalisabahuda – Navakarnataka Publication
8. Sanna Kathegalu - Prasaranga, Mysuru University , Mysuru
10. K. S. Nissar Ahmed – 75 Bhaavageetegalu – Sapna Book House (P) Ltd.
11. Dr. G. S. Shivarudrappa – Samagra Kavya – Kamadhenu Pustaka Bhavana

OBJECTIVES: To enable the students to acquire basic skills in functional language; to develop independent reading skills and reading for appreciating literary works; to develop functional and creative skills in language; to enable the students to plan, draft, edit & present a piece of writing.

Unit 1
Official Correspondence: Adhikrutha patra, prakatane, manavi patra, vanijya patra

Unit 2
Nanna Hanate - Dr. G. S. Shivarudrappa
Mankuthimmana Kaggada Ayda bhagagalu – D. V. Gundappa (Padya Sankhye 5, 20, 22, 23, 25, 44, 344, 345, 346,
601)
Ella Marethiruvaga - K. S. Nissaar Ahmed Saviraru Nadigalu – S Siddalingayya

Unit 3

Unit 4
Sarva Sollegala turttu Maha Samelana - Beechi
Swarthakkaagi Tyaga - Beechi

Unit 5
Essay writing: Argumentative & Analytical
Précis writing

REFERENCES:
1. H. S. Krishnaswami Iyangar – Adalitha Kannada – Chetan Publication, Mysuru
2. Dr. G. S. Shivapurappa – Samagra Kavya. - Kamadhenu Pustaka Bhavana
4. K. S. Nissar Ahmed – 75 Bhaavageetegalu – Sapna book house
5. Dr. Da. Ra. Bendre – Saayo Aata – Shri Maata Publication

15MAL101 MALAYALAM I 1 0 2 2

Course Objectives:
To teach Malayalam for effective communication in different spheres of life:- Social context , Education, Research & Media

Course Outcome :After the completion of the course the student will be able to:

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<th>Understand and inculcate philosophical thoughts and practices</th>
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<td>Understand and appreciate the post modern trends of literature.</td>
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<td>CO3</td>
<td>Analyse the literary texts and comprehend the cultural diversity of Kerala</td>
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<td>CO4</td>
<td>Distinguish the different genres in Malayalam literature</td>
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<td>CO5</td>
<td>Demonstrate the ability to effectively communicate in Malayalam</td>
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CO-PO Mapping Mapping of course outcomes with program outcomes:
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Unit 1

Ancient poet trio: Adhyatmaramayanam, LakshmanaSwanthanam (Lines: valsasoumitre... mungikidakayal), Ezhuthachan - Medieval period classics – Jnanappana (Lines: kalaminnu... vilasangalingane), Poonthanam.

Unit 2


Unit 3

Short stories from period 1/2/3: Poovanpazham- VaikaomMuhammedBasheer-Literary & Cultural figures of Kerala and about their literary contributions.

Unit 4

Literary Criticism: BharathaParyadanam-VyasanteChiri–Ithihasa studies-KuttikrishnaMararu- Outline of literary Criticism in Malayalam Literature-Introduction to KuttikrishnaMararu& his outlook towards literature &life.

Unit 5

Error-free Malayalam: 1. Language; 2. Clarity of expression; 3. Punctuation-Thettillatha

Malayalam – Writing-a. Expansion of ideas; b. Precis Writing; c. Essay Writing; d. Letter writing; e. Radio Speech; f. Script/Feature/Script Writing; g. News Editing; h. Advertising; i. Editing; j. Editorial Writing; k. Critical appreciation of literary works (Any one or two as an assignment).

REFERENCES:


### 15MAL111  MALAYALAM II  1022

**Course Objectives**

➢ To appreciate the aesthetics and understand the cultural implications in Malayalam Literature
➢ To enhance creative thinking in Malayalam
➢ To equip the students to read and write effectively in Malayalam
➢ To acquire pronunciation skills

**Course Outcome:**

After the completion of the course the student will be able to:

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<th>CO1</th>
<th>Understand the different cultural influences in linguistic translation</th>
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<td>Identify and appreciate the Romantic elements of modern literature</td>
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<td>CO3</td>
<td>Analyze the genre of autobiographical writing</td>
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<td>CO4</td>
<td>Critically evaluate the significance of historical, political and socio-cultural aspects in literature</td>
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<td>Demonstrate good writing skills in Malayalam</td>
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Unit 1

Ancient poet trio: Kalayanasougandhikam,(Lines: kallummarangalum... namukkennarikavrikodara), KunjanNambiar - Critical analysis of his poetry-Ancient Drama: Kerala Sakunthalam (Act 1), Kalidasan (Transilated by Attor Krishna Pisharody).

Unit 2


Unit 3


Unit 4

Part of an autobiography/travelogue: KannerumKinavum, Chapter: Valarnnuvarunnoratmavu, V.T.Bhattathirippadu-Socio-cultural literature-historical importance.

Unit 5

Error-free Malayalam-1.Language; 2.Clarity of expression; 3.Punctuation-Thettillatha Malayalam-Writing-
   a. Expansion of ideas;b. PrécisWriting;c. Essay Writing; d. Letter writing;e. RadioSpeech;f. Script/Feature/ScriptWriting;g. NewsEditing;h. Advertising;i. Editing;
   j. EditorialWriting; k. Critical appreciation of literary works (Any one or two as an assignment).

REFERENCES:

OBJECTIVES: To familiarize students with Sanskrit language and literature; to enable them to read and understand Sanskrit verses and sentences; to help them acquire expertise for self-study of Sanskrit texts and communication in Sanskrit; to help the students imbibe values of life and Indian culture as propounded in scriptures.

Unit 1
Introduction to Sanskrit language, Devanagari script - Vowels and consonants, pronunciation, classification of consonants, conjunct consonants, words – nouns and verbs, cases – introduction, numbers, Pronouns, communicating time in Sanskrit. Practical classes in spoken Sanskrit

Unit 2
Verbs- Singular, Dual and plural – First person, Second person, Third person.

Tenses – Past, Present and Future – Atmanepadi and Parasmaipadi - karthariprayoga

Unit 3
Words for communication, slokas, moral stories, subhashithas, riddles (from the books prescribed)

Unit 4
Selected slokas from Valmiki Ramayana, Kalidasa’s works and Bhagavad Gita.

Ramayana – chapter VIII - verse 5, Mahabharata - chapter 174, verse -16, Bhagavad Gita – chapter - IV verse 8, Kalidasa’s Sakuntalam Act IV – verse 4

Unit 5
Translation of simple sentences from Sanskrit to English and vice versa.

ESSENTIAL READING:
4. Praveshaha; Publisher: Samskrita bharati, Aksharam, 8th cross, 2nd phase, girinagar, Bangalore - 560 085
5. Sanskrit Reader I, II and III, R. S. Vadyar and Sons, Kalpathi, Palakkad
6. Prakriya Bhashyam written and published by Fr. John Kunnappally
7. Sanskrit Primer by Edward Delavan Perry, published by Ginn and Company Boston
5. Sabdamanjari, R. S. Vadyar and Sons, Kalpathi, Palakkad
6. Namalinganusasanam by Amarasimha published by Travancore Sanskrit series
7. Subhashita Ratna Bhandakara by Kashinath Sharma, published by Nirnayasagar press

OBJECTIVES: To familiarize students with Sanskrit language and literature; to enable them to read and understand
Sanskrit verses and sentences; to help them acquire expertise for self-study of Sanskrit texts and communication in Sanskrit; to help the students imbibe values of life and Indian culture as propounded in scriptures.

Unit 1
Seven cases, indeclinables, sentence making with indeclinables, Saptha karakas.

Unit 2

Unit 3
Words and sentences for advanced communication. Slokas, moral stories (Pancatantra) Subhashitas, riddles.

Unit 4
Introduction to classical literature, classification of Kavyas, classification of Dramas - The five Mahakavyas, selected slokas from devotional kavyas - Bhagavad Gita
– chapter - II verse 47, chapter - IV verse 7, chapter - VI verse 5, chapter - VIII verse 6, chapter - XVI verse 21, Kalidasa’s Sakuntala act IV – verse 4, Isavasyopanishat 1st Mantra, Mahabharata chapter 149 verses 14 - 120, Neetisara chapter - III

Unit 5
Translation of paragraphs from Sanskrit to English and vice versa.

ESSENTIAL READING:
1. Praveshaha; Publisher: Samskrita bharati, Aksharam, 8th cross, 2nd phase, girinagar, Bangalore -560 085
2. Sanskrit Reader I, II and III, R. S. Vadhyar and Sons, Kalpathi, Palakkad
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5. Sabdamanjari, R. S. Vadyar and Sons, Kalpathi, Palakkad
6. Namalinganusasanam by Amarasimha published by Travancore Sanskrit series

15SWK230 CORPORATE SOCIAL RESPONSIBILITY 2002

Unit 1
Understanding CSR - Evolution, importance, relevance and justification. CSR in the Indian context, corporate strategy. CSR and Indian corporate. Structure of CSR - In the Companies Act 2013 (Section 135); Rules under Section 13; CSR activities, CSR committees, CSR policy, CSR expenditure CSR reporting.

Unit 2
CSR Practices & Policies - CSR practices in domestic and international area; Role and contributions of voluntary organizations to CSR initiatives. Policies; Preparation of CSR policy and process of policy formulation; Government expectations, roles and responsibilities. Role of implementation agency in Section 135 of the Companies Act, 2013. Effective CSR implementation.

Unit 3
Project Management in CSR initiatives - Project and programme; Monitoring and evaluation of CSR Interventions. Reporting - CSR Documentation and report writing. Reporting framework, format and procedure.

REFERENCES:

15SWK231 WORKPLACE MENTAL HEALTH 2002

Unit 1
Mental Health – concepts, definition, Bio-psycho-social model of mental health. Mental health and mental illness, characteristics of a mentally healthy individual, Signs and symptoms of mental health issues, presentation of a mentally ill person.

Work place – definition, concept, prevalence of mental health issues in the work place, why invest in workplace mental health, relationship between mental health and productivity, organizational culture and mental health. Case Study, Activity.

Unit 2

Unit 3
Strategies of Help and Care: Positive impact of work on health, Characteristics of mentally healthy workplace, Employee and employer obligations, Promoting mental health and well being - corporate social responsibility (CSR), an inclusive work environment, Training and awareness raising, managing performance, inclusive recruitment, Supporting individuals-talking about mental health, making reasonable adjustments, Resources and support for employees - Employee Assistance Programme / Provider (EAP), in house counsellor, medical practitioners, online resources and telephone support, 24 hour crisis support, assistance for colleagues and care givers, Legislations. Case
Study, Activity.

REFERENCES:
3. Canadian Mental Health Association, Ontario “Workplace mental health promotion, A how to guide”wmhp.cmhaontario.ca/
6. Mental Health Act 1987 (India) www.tnhealth.org/mha.htm
7. Persons with disabilities Act 1995 (India) socialjustice.nic.in
8. The Factories Act 1948 (India) www.caaa.in/Image/19ulabourlawshb.pdf

15TAM101          TAMIL I                      2002
Course Objectives

- To introduce the students to different literature- Sangam literature, Epics, Bhakthi literature and modern literature.
- To improve their ability to communicate with creative concepts, and also to introduce them to the usefulness of basic grammatical components in Tamil.

Course Outcomes

CO 1: To understand the Sangam literature
CO 2: To understand the creative literature
CO 3: To understand the literary work on religious scriptures
CO 4: To improve the communication and memory skills
CO 5: To understand the basic grammar components of Tamil language and their usage and applications.
CO 6: Understand creative writing aspects and apply them.

CO-PO Mapping

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Syllabus

Unit 1


Unit 2

tiṉai ilakkiyamum nītiyilakkiyamum - patiṇenkilkkanaṅkku nūlkal toṭarpāṇa piṟa ceytiṅa - tirukkuṟaḷ (aṆpu, paṆpu, kalvi, olukkam, naṟpu, vāymai, kēḷvi, ceṉaṅṇi, periyāraituṉaṅkōṭal, vilippuṉarvu pēṟa atikārattil uḷḷa ceytiṅa. Arāṅkūḷaḷ: Ulakanīti (1-5) – ēlāti (1,3,6). - Cittarkaḷ: Kaṭuveli cittar pāṭalkal (aṅantak kalippu –1, 4, 6, 7, 8), maṟṟum akappēy cittar pāṭalkal (1-5).

Unit 3

tamīḷ ilakkaṅam: Vākkiya vakaikaḷ – taṉviṇai piṟaṉviṇai – nēṟkkūṟu ayaṟkūṟu
Unit 4


Unit 5

tamiḻ moli āyvil kaṇiṅi payāṟṟupatu. - Karuttu parimāṟram - viḷampara moḷiyamaippu – pēccu - nāṭakam paṭṭaippu - cīruṅkatāi, katai, putiṇam paṭṭaippu.

Textbooks:

➢ http://Www.tunathamizh.tom/2013/07/blog0post_24.html
➢ Mu. Varattāṟaṅ “tamiḻ ilakkiya varalāṟu” cāḥitya aṟakamiṃ papliṅkēsāṅs, 2012
➢ nā. Vāṅamāmalai, “tamiḻar nāṭṭuppaṭṭalkal” niyū ceṅcürü puttaka veliyiṭṭakam 1964, 2006

15TAM111 TAMIL II 2002

Course Objectives

• To learn the history of Tamil literature.
• To analyze different styles of Tamil Language.
• To strengthen the creativity in communication, Tamil basic grammar and use of computer on Tamil Language.

Course Outcomes

CO 1: Understand the history of Tamil literature.

CO 2: Apply practical and comparative analyses on literature.

CO 3: Understand thinai literature, literature on justice, Pathinenkeelkanaku literature.

CO 4: Understand the tamil scholars’ service to Tamil language and society.

CO 5: Understand components of Tamil grammar and its usage

CO 6: Understand creative writing aspects and apply them
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Syllabus

Unit 1


Unit 2

tiṉai ilakkiyamum nītiyilakkiyamum - patiṅkaṅkikkaṅkaṅku nūlkāl tōṭarpāṅa pira ceytiṅaḷ - tirukkuṟṟaḷ (aṟpu, paṟṟu, kalvi, oḷukkam, naṭpu, vāymai, kēḻvi, ceynṇi, periyāraituṅkkōtāl, vilippunaruṉ pēŋga atikārattil uḷḷa ceytiṅaḷ. Aranūḷkaḷ: Ulakanīti (1-5) – ēḷāti (1,3,6). - Cittarkaḷ: Kaṭuveli cittar pāṭalkaḷ (aṅnantak kalippu –1, 4, 6, 7, 8), marrum akappēy cittar pāṭalkaḷ (1-5).

Unit 3

tamiḻ ilakkaṇam: Vākkiya vakaikal – tiṉai piraviṅai – nērkkūṟṟu ayarkūṟṟu

Unit 4

Unit 5

tamiḷ moḷi āyvil kaṇiṅi payaṅpāṭu. - Karuttu parimāṛṛam - vilampara moḷiyamaippu – pēccu - nāṭakam paṭaippu - cirukatai, katai, putiṅam paṭaippu.

Text Books / References


http://Www.tunathamizh.tom/2013/07/blog0post_24.html

Mu.Varatarācaṅ “tamiḷ ilakkiya varalāḷu” cāhitya akaṭēmi papḷikēsanaṅ, 2012

