**Sri Krishna College of Engineering and Technology**

**An Autonomous Institution, Affiliated to Anna University**

**Coimbatore – 641 008**

## DEPARTMENT OF MECHANICAL ENGINEERING


CURRICULUM AND SYLLABI

**B.E. MECHANICAL ENGINEERING**

# (R2011)

## Vision

Our department aims to set up centers of excellence in innovating design and testing, composite materials, automation, automotive technology and green fuels.

## Mission

To produce world class mechanical engineering graduates by promoting core technical competency blended with advanced computing skills, so as to empower them to the expectation of the industries in our country and abroad and also to impart the interpersonal skills and make them realize the values of life.

## Programme Educational Objectives

PEO 1: To provide students with a sound foundation in the mathematical, scientific and engineering fundamentals necessary to formulate, solve and analyze mechanical engineering problems.

PEO 2: To develop the ability among students to synthesize data and technical concepts for solving real time problems.

PEO 3: To provide opportunity for students to work as part of teams on multidisciplinary projects with good communication and interpersonal skills in the areas like automation, composite materials, automotive technology, green fuels etc.,

PEO 4: To prepare students for successful careers in industry that meet the needs of Indian and multinational companies and to inculcate the entrepreneurial skills.

## Programme Outcomes

Graduates will demonstrate

(a) An ability to apply knowledge of mathematics, science, and engineering

(b) An ability to design and conduct experiments, as well as to analyze and interpret data

(c) An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and Sustainability

(d) An ability to function on multidisciplinary teams (Our interpretation of multidisciplinary teams includes teams of individuals with similar educational backgrounds focusing on different aspects of a project as well as teams of individuals with different educational backgrounds)

(e) An ability to identify, formulate, and solve engineering problems

(f) An understanding of professional and ethical responsibility

(g) An ability to communicate effectively

(h) Students will have the wide knowledge to understand the impact of engineering solutions in a global, economic, environmental, and societal context

(i) A recognition of the need for, and an ability to engage in life-long learning (Our interpretation of this includes teaching students that the underlying theory is important because the technology changes, coupled with enhancing their self-learning ability).

(j) A knowledge of contemporary issues (Our interpretation of this includes presenting students with issues such as the impact of globalization, the outsourcing of both engineering and other support jobs as practiced by modern international companies).

(k) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

(l) An ability to fabricate real time mechanical systems and test its worthiness.

**SRI KRISHNA COLLEGE OF ENGINEERING AND TECHNOLOGY**

**DEPARTMENT OF MECHANICAL ENGINEERING**

**CURRICULUM AND SYLLABUS -REGULATIONS 2011**

| S.NO | CODE | COURSE | HOURS/WEEK | | | CREDITS | MAXIMUM MARKS | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | | CA | FE | TOTAL |
| **SEMESTER - 1** | | **THEORY** | | | | | | | |
| 1 | 11USL101 | Communication Skills – I | 3 | 0 | 1 | 3 | 40 | 60 | 100 |
| 2 | 11USM101 | Engineering Mathematics - I | 3 | 1 | 0 | 4 | 40 | 60 | 100 |
| 3 | 11USP101 | Physics for Mechanical Sciences | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 4 | 11USC101 | Chemistry for Mechanical Sciences | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 5 | 11UAK101 | Engineering Mechanics | 3 | 1 | 0 | 4 | 40 | 60 | 100 |
| 6 | 11UAK102 | Engineering Drawing | 1 | 0 | 3 | 3 | 40 | 60 | 100 |
| 7 | 11UAK103 | History of Science and Technology | 1 | 0 | 0 | 1 | 100 | - | 100 |
| **PRACTICAL** | | | | | | | | | |
| 1 | 11USH111 | Physical science lab - I | 0 | 0 | 3 | 1 | 40 | 60 | 100 |
| 2 | 11UCK103 | Computing Practices Lab | 2 | 0 | 2 | 3 | 40 | 60 | 100 |
| 3 | 11UAK104 | Engineering Practices Lab | 0 | 0 | 3 | 2 | 40 | 60 | 100 |
| | | TOTAL | 19 | 2 | 12 | 27 | 460 | 540 | 1000 |

| S.NO | CODE | COURSE | HOURS/WEEK | | | CREDITS | MAXIMUM MARKS | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | | CA | FE | TOTAL |
| **SEMESTER - 2** | | **THEORY** | | | | | | | |
| 1 | 11USL201 | Communication Skills – II | 3 | 0 | 1 | 3 | 40 | 60 | 100 |
| 2 | 11USM201 | Engineering Mathematics - II | 3 | 1 | 0 | 4 | 40 | 60 | 100 |
| 3 | 11UCK204 | 'C' Programming | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 4 | 11USC201 | Environmental Science and Engineering | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 5 | 11USP201 | Material Science | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 6 | 11UAK202 | Basics of Civil Engineering | 2 | 0 | 0 | 2 | 40 | 60 | 100 |
| **PRACTICAL** | | | | | | | | | |
| 1 | 11USH211 | Physical science lab - II | 0 | 0 | 3 | 1 | 40 | 60 | 100 |
| 2 | 11UCK202 | 'C' Programming Lab | 0 | 0 | 3 | 2 | 40 | 60 | 100 |
| 3 | 11UAK205 | Computers Aided Drafting and Modeling Laboratory | 0 | 0 | 3 | 2 | 40 | 60 | 100 |
| | | TOTAL | 17 | 1 | 10 | 23 | 360 | 540 | 900 |

| S.NO | CODE | COURSE | HOURS/WEEK | | | CREDITS | MAXIMUM MARKS | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | | CA | FE | TOTAL |
| **SEMESTER - 3** | | **THEORY** | | | | | | | |
| 1 | 11USM302 | Transforms and Partial Differential Equations | 3 | 1 | 0 | 4 | 40 | 60 | 100 |
| 2 | 11UAK301 | Engineering Thermodynamics | 3 | 1 | 0 | 4 | 40 | 60 | 100 |
| 3 | 11UAK302 | Fluid Mechanics and Machinery | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 4 | 11UAK303 | Engineering Metallurgy | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 5 | 11UAK304 | Strength of Materials | 3 | 1 | 0 | 4 | 40 | 60 | 100 |
| 6 | 11UFK311 | Electrical Drives and Control | 3 | 1 | 0 | 4 | 40 | 60 | 100 |
| **PRACTICAL** | | | | | | | | | |
| 1 | 11UAK305 | Fluid Mechanics and Machinery Lab | 0 | 0 | 3 | 2 | 40 | 60 | 100 |
| 2 | 11UAK306 | Strength of Materials Lab | 0 | 0 | 3 | 2 | 40 | 60 | 100 |
| 3 | 11UAK307 | Computer Aided Machine Drawing Lab | 1 | 0 | 3 | 3 | 40 | 60 | 100 |
| | | TOTAL | 19 | 4 | 9 | 29 | 360 | 540 | 900 |

| S.NO | CODE | COURSE | HOURS/WEEK | | | CREDITS | MAXIMUM MARKS | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | | CA | FE | TOTAL |
| **SEMESTER - 4** | | **THEORY** | | | | | | | |
| 1 | 11USM402 | Probability Theory and Numerical Methods | 3 | 1 | 0 | 4 | 40 | 60 | 100 |
| 2 | 11UAK401 | Thermal Engineering | 3 | 1 | 0 | 4 | 40 | 60 | 100 |
| 3 | 11UAK402 | Manufacturing Technology – I | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 4 | 11UAK403 | Kinematics of Machinery | 3 | 1 | 0 | 4 | 40 | 60 | 100 |
| 5 | 11UAK404 | Metrology and Total Quality Management | 3 | 0 | 1 | 3 | 40 | 60 | 100 |
| 6 | 11UBK411 | Microprocessors and Microcontrollers | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| **PRACTICAL** | | | | | | | | | |
| 1 | 11UAK405 | IC Engines Lab | 0 | 0 | 3 | 2 | 40 | 60 | 100 |
| 2 | 11UFK493 | Electrical Engineering Lab | 0 | 0 | 3 | 2 | 40 | 60 | 100 |
| 3 | 11UBK419 | Microprocessor Lab | 0 | 0 | 3 | 2 | 40 | 60 | 100 |
| | | TOTAL | 18 | 3 | 10 | 27 | 360 | 540 | 900 |

| S.NO | CODE | COURSE | HOURS/WEEK | | | CREDITS | MAXIMUM MARKS | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | | CA | FE | TOTAL |
| **SEMESTER - 5** | | **THEORY** | | | | | | | |
| 1 | 11UAK501 | Automobile Engineering | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 2 | 11UAK502 | Design of Machine Elements | 3 | 1 | 0 | 4 | 40 | 60 | 100 |
| 3 | 11UAK503 | Dynamics of Machinery | 3 | 1 | 0 | 4 | 40 | 60 | 100 |
| 4 | 11UAK504 | Industrial Automation | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 5 | 11UAK505 | Manufacturing Technology - II | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 6 | 11UAK506 | Gas Dynamics and Jet Propulsion | 3 | 1 | 0 | 4 | 40 | 60 | 100 |
| **PRACTICAL** | | | | | | | | | |
| 1 | 11UAK507 | Pneumatics and Hydraulics Lab | 0 | 0 | 3 | 2 | 60 | 40 | 100 |
| 2 | 11UAK508 | Dynamics Lab | 0 | 0 | 3 | 2 | 60 | 40 | 100 |
| 3 | 11UAK509 | Manufacturing Technology Lab | 0 | 0 | 3 | 2 | 60 | 40 | 100 |
| | | TOTAL | 18 | 3 | 9 | 27 | 420 | 480 | 900 |

| S.NO | CODE | COURSE | HOURS/WEEK | | | CREDITS | MAXIMUM MARKS | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | | CA | FE | TOTAL |
| **SEMESTER - 6** | | **THEORY** | | | | | | | |
| 1 | 11UAK601 | CAD / CAM / CIM | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 2 | 11UAK602 | Design of Transmission System | 3 | 1 | 0 | 4 | 40 | 60 | 100 |
| 3 | 11UAK603 | Heat and Mass Transfer | 3 | 1 | 0 | 4 | 40 | 60 | 100 |
| 4 | 11UAK604 | Finite Element Analysis | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 5 | 11UAK605 | Industrial Engineering And Operations Research | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 6 | 11UAK606 | Industrial Psychology and Work Ethics | 2 | 0 | 0 | 2 | 40 | 60 | 100 |
| **PRACTICAL** | | | | | | | | | |
| 1 | 11UAK607 | Heat Transfer Lab | 0 | 0 | 3 | 2 | 60 | 40 | 100 |
| 2 | 11UAK608 | CAD / CAM / CIM Lab | 0 | 0 | 3 | 2 | 60 | 40 | 100 |
| 3 | 11UAK609 | Mini Project | 0 | 0 | 3 | 2 | 60 | 40 | 100 |
| | | TOTAL | 17 | 2 | 9 | 25 | 420 | 480 | 900 |

| S.NO | CODE | COURSE | HOURS/WEEK | | | CREDITS | MAXIMUM MARKS | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | | CA | FE | TOTAL |
| **SEMESTER - 7** | | **THEORY** | | | | | | | |
| 1 | 11UAK701 | Mechatronics (with Lab) | 2 | 0 | 2 | 3 | 40 | 60 | 100 |
| 2 | 11UAK702 | Engineering Economics and Cost Analysis | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 3 | 11UAK703 | Tool Design | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 4 | 11UAK704 | Power plant Engineering | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 5 | | Elective - I | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 6 | | Elective - II | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| **PRACTICAL** | | | | | | | | | |
| 1 | 11UAK706 | Project work Phase - I | 0 | 0 | 8 | 4 | 60 | 40 | 100 |
| 2 | 11UAK707 | Comprehension and Technical Seminar | 0 | 0 | 3 | 2 | 60 | 40 | 100 |
| 3 | 11UAK708 | Computer Aided Engineering Lab | 0 | 0 | 3 | 2 | 60 | 40 | 100 |
| | | TOTAL | 17 | 0 | 16 | 26 | 420 | 480 | 900 |

| S.NO | CODE | COURSE | HOURS/WEEK | | | CREDITS | MAXIMUM MARKS | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | | CA | FE | TOTAL |
| **SEMESTER - 8** | | **THEORY** | | | | | | | |
| 1 | 11UAK801 | Industrial Robotics | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 2 | | Elective - III | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 3 | | Elective - IV | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| **PRACTICAL** | | | | | | | | | |
| 1 | 11UAK802 | Project work Phase - II | 0 | 0 | 24 | 12 | 60 | 40 | 100 |
| | | TOTAL | 9 | 0 | 24 | 21 | 180 | 220 | 400 |

**TOTAL: 205 CREDITS**

L – Lecture T – Tutorial P – Practical C - Credit

CA– Continuous Assessment FE- Final Exam

**LIST OF ELECTIVES**

| S.NO | CODE | COURSE | HOURS/WEEK | | | CREDITS | MAXIMUM MARKS | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | | CA | FE | TOTAL |
| **ELECTIVES I & II** | | | | | | | | | |
| 1 | 11UAE701 | Advanced Strength of Materials | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 2 | 11UAE702 | Product Design | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 3 | 11UAE703 | Industrial Design | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 4 | 11UAE704 | Production Planning and Cost Estimation | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 5 | 11UAE705 | MEMS / Nano Technology | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 6 | 11UAE706 | Foundry and Welding Technology | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 7 | 11UAE707 | Nuclear Engineering | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 8 | 11UAE708 | Refrigeration and Air Conditioning | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 9 | 11UAE709 | Production Planning and Control | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 10 | 11UAE710 | Automotive Design | 2 | 1 | 1 | 3 | 40 | 60 | 100 |
| 11 | 11UAE711 | Business Concepts | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 12 | 11UAE712 | Design for Manufacturing and Assembly | 3 | 0 | 0 | 3 | 40 | 60 | 100 |

| S.NO | CODE | COURSE | HOURS/WEEK | | | CREDITS | MAXIMUM MARKS | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | | CA | FE | TOTAL |
| **ELECTIVES III & IV** | | | | | | | | | |
| 1 | 11UAE801 | Ergonomics | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 2 | 11UAE802 | Product Development | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 3 | 11UAE803 | Modern Manufacturing Methods | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 4 | 11UAE804 | Plant Layout and Material Handling Systems | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 5 | 11UAE805 | Rapid Prototyping and Rapid Tooling | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 6 | 11UAE806 | Renewable Energy Sources | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 7 | 11UAE807 | Energy Engineering | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 8 | 11UAE808 | Computational Fluid Dynamics | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 9 | 11UAE809 | Marketing Management | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 10 | 11UAE810 | Fire and Industrial Safety | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 11 | 11UAE811 | Total Quality Management | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 12 | 11UAE812 | Turbo Machinery | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 13 | 11UAE813 | Reliability Engineering | 3 | 0 | 0 | 3 | 40 | 60 | 100 |

## 11USL101 COMMUNICATION SKILLS - I

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 1 | 3 |

**Course Objectives**

- To improve the language proficiency of the students in English with emphasis on LSRW skills and equip them to study academic subjects with greater facility with theoretical and practical components of the English syllabus.

**Course Outcomes**

- Improve their vocabulary and appropriate usage of words in different academic and professional contexts.
- Familiarize with different rhetorical functions of technical English.
- Develop strategies that could be adopted while reading texts.
- Speak effectively in English in real-life and career-related situations.
- Acquire knowledge in academic and professional writing.

**UNIT I - LISTENING SKILLS** **9**

Listening for general content - Listening to fill up information - Intensive listening. Listening for specific purpose

**UNIT II - SPEAKING SKILLS** **9**

Introducing oneself in various situations - Describing objects, situation and people Asking questions - Narrating incidents - Just a minute sessions - Day to Day Conversations - Debates

**UNIT III - READING SKILLS** **9**

Skimming the text - Understanding the gist of an argument - Inferring lexical and contextual meaning - Understanding discourse features - Recognizing coherence/ sequencing of sentences.

**UNIT IV - WRITING SKILLS** **9**

Paragraph writing - Extended Definition – Transcoding -Formal and informal letter Note making - Editing a passage- itinerary- instructions.

**UNIT V - LANGUAGE FOCUS** **9**

Articles – Parts of speech – Tenses – Voice - Gerunds and infinitives – concord- modal verbs- definitions-‘ wh’ questions- comparative adjectives- Conditionals - Nominal compounds - Word formation – Prefixes and Suffixes/ one form to another form - Synonyms and Antonyms

**TOTAL HOURS: 45**

**TEXT BOOKS**


1. Department of Humanities and Social Sciences, Anna University ‘English for Engineers and Technologists’, Combined Edition Volume I and II, Chennai: Orient Longman Private Limited, 2006.
2. Murphy, “Murphy’s English Grammar”, Cambridge University Press.


**REFERENCES**


1. Bhaskaran and Horsburgh, “Strengthen Your English”, , Oxford University Press.
2. Francis Soundararaj, “Speaking and Writing for Effective Business Communication”, MacMillan, India Ltd., 2007.
3. Robert J. Dixon, ‘Everyday Dialogues in English’, Prentice-Hall of India Ltd., 2006.
4. John Seely, ‘The Oxford Guide to Writing and Speaking’, Oxford.

**11USM101 ENGINEERING MATHEMATICS - I**

**(**Common to all branches**)**

| L | T | P | C |
|---|---|---|---|
| 3 | 1 | 0 | 4 |

**Course Objectives**

- To provide strong foundation to the students to expose various emerging new areas of applied mathematics and appraise them with their relevance in Engineering and Technological field.

**Course Outcomes**

- Identify and solve algebraic Eigen value problems and find the extreme values of the given function.
- Diagonalise the matrix which would render the Eigen solution procedure to many engineering problems.
- Understand and apply differentiation and integration techniques to solve engineering problems.
- Apply the knowledge of differential equation in order to solve the engineering problems like electric circuits and bending of beams.

**PREREQUISITE:**

- Matrices – rank of matrix, Linear dependence and linear independence
- Differential Calculus – Differentiation of Implicit functions, parametric functions
- Ordinary Differential equations – Basic terminologies like definition, formation, meaning of solution, variable and separable method, linear differential equations.

**UNIT I– LINEAR ALGEBRA** **9**

Euclidean n-space – Vector spaces – Subspaces – Linear combinations – Linear dependence and independences – Basis and dimensions – Applications to matrices: Rank of a matrix, Inner product spaces – Example of inner product spaces – Cauchy-Schwarz inequality– Orthonormal bases – Gram Schmidtt process.

**UNIT II – MATRICES** **9**

Characteristic equation – Eigen values and eigen vectors of a real matrix – Properties – Cayley-Hamilton theorem (excluding proof) – Orthogonal transformation of a symmetric matrix to diagonal form – Quadratic form – Reduction of quadratic form to canonical form by orthogonal transformation

**UNIT III – APPLICATIONS OF DIFFERENTIAL CALCULUS** **9**

Curvature in Cartesian co-ordinates – Centre and radius of curvature – Circle of curvature – Evolutes – Envelopes.

**UNIT IV – FUNCTIONS OF SEVERAL VARIABLES** **9**

Partial derivatives – Total derivatives – Differentiation of implicit functions – Jacobians – Taylor's expansion – Maxima and Minima – Method of Lagrangian multipliers.

**UNIT V – ORDINARY DIFFERENTIAL EQUATIONS** **9**

Higher order linear differential equations with constant coefficients – Method of variation of parameters – Cauchy's and Legendre's linear equations – Simultaneous first order linear equations with constant coefficients – Applications to Engineering problems.

**Theory: 45 Tutorial: 15 Total Hours: 60**

**TEXT BOOKS:**

1. Erwin Kreyszig, "Advanced Engineering Mathematics", 8th Edition, Wiley India, 2006.
2. Grewal. B.S, "Higher Engineering Mathematics", 40th Edition, Khanna Publications, Delhi,
(2007).

**REFERENCES:**

1. Ramana B.V, "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, (2007).
2. Glyn James, "Advanced Engineering Mathematics", 7th Edition, Wiley India, (2007).
3. Jain R.K and Iyengar S.R.K," Advanced Engineering Mathematics", 3rd Edition, Narosa Publishing House Pvt. Ltd., (2007).

## 11USP101 PHYSICS FOR MECHANICAL SCIENCES

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Objectives**

- To provide strong foundation to the students to expose various emerging areas of Applied Physics and appraise them with their relevance in Engineering and technological field.

**Course Outcomes**

- Understand the working principles and applications of modern devices and technologies based on LASER and Fiber optics.
- Gain the basic concepts of quantum physics
- Apply the thermodynamics laws in engineering application and design the heat engine having greater efficiency
- Understand the thermal properties of the materials.
- Get an exposure for the basics of Vacuum technology

**UNIT I: LASER TECHNOLOGY AND FIBER OPTICS** **9**

Introduction, Principle – Spontaneous emission, Stimulated emission, Population Inversion, Pumping mechanisms - Types of Laser – He-Ne Laser, $CO_2$ , Semiconductor Laser. Applications – Lasers in Microelectronics, Drilling, Welding, Heat Treatment, Cutting and Holography. Principle, Modes of Propagation, Fabrication Techniques – Rod & Tube method, Crucible-Crucible Technique - Classification based on Materials, Refractive Index Profile and Modes. Splicing, Losses in Optical fiber. Light Sources for fiber Optics. Detectors, Fiber Optical Communication links.

**UNIT II: QUANTUM PHYSICS AND MICROSCOPY** **9**

Development of quantum theory, Dual Nature of Matter and Radiation – de-Broglie wavelength, Uncertainty Principle, Schrodinger equation – Time dependent, Time independent. Particle in a box. Limitation of Optical Microscopy, Electron Microscopy, Transmission Electron Microscope, Scanning Transmission Electron Microscope and Application

**UNIT III: HEAT AND THERMODYNAMICS** **9**

Thermal conductivity – Forbe's and Lees disc methods. Radial flow of heat. Thermal conductivity of rubber and glass. Laws of thermodynamics. Concepts of entropy. Carnot cycle as heat engine and refrigerator, carnot theorem, ideal Otto and diesel engines.

**UNIT IV: THERMAL PROPERTIES** **9**

Introduction – Coefficient of thermal expansion, heat capacity, thermal conduction mechanisms, thermal stresses. Applications – bimetallic strip, thermal insulations, thermal shock resistance, tempered glass, ceramic – to – metal joints, cryogenic materials.

**UNIT V: VACUUM TECHNOLOGY** **9**

Introduction – Concept of Vacuum – Throughput – Pumping speed – pumping speed, effective pumping, speed and conductance - Types of Pumps – working principle and construction of rotary pump, Diffusion pump – operation of pressure gauges – pressure range, Measurement of Vacuum using Pirani Gauge & Penning Gauges, merits and limitations. Working of a vacuum system applications and scope

**TOTAL HOURS: 45**

**TEXT BOOKS:**

1. M.N. Avadhanulu and PG Kshirsagar, 'A Text book of Engineering Physics', S.Chand and company, Ltd., New Delhi, 2005.
2. Rao V.V., Ghosh T.B and Chopra K.L, " Vacuum Science and Technology", Allied Publishers limited, New Delhi, 1998.

**REFERENCES:**

1. William D Callister, Jr "Material Science and Engineering" John wiley and Sons, New York, 2007
2. Jayakumar, S "Materials Science", RK Publishers, Coimbatore 2006.
3. Richard Wolfson, "Essential University Physics", Pearson Education ,Volume I & II

## 11USC101 CHEMISTRY FOR MECHANICAL SCIENCES

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Objectives**

- To provide strong foundation to the students to expose various emerging new areas of applied chemistry and appraise them with their relevance in Engineering and technological field.

**Course Outcomes**

- Understand the nature and properties of different materials and importance in day today life
- Understand the properties, preparation and uses of different macromolecules used in everyday life
- Analyse and apply the properties and uses of electrochemicals and corrosive agents in the society
- Understand the principle, and applications of different engineering materials.

**UNIT I - CHEMISTRY IN EVERYDAY LIFE** **9**

Applications of Chemistry in health and hygiene – Chemicals in medicines – analgesics, antiseptics, antacids, disinfectants –Chemicals in food preservatives – artificial sweetening agents –Water quality parameter and standards -types of hardness –estimation by EDTA method-characteristic of portable water –domestic water treatment –disinfection methods-Chlorination –UV treatment – Ozonation –desalination –reverse osmosis.

**UNIT II- FUELS AND COMBUSTION** **9**

Classification of fuels – calorific value – characteristics of good fuel- Theoretical calculation of calorific value – solid fuels –coal – classification of coal by rank- analysis of coal- metallurgical coke – types of carbonization- manufacture of metallurgical coke – liquid fuel – petroleum – refining of petroleum –manufacture of synthetic petrol- knocking- octane number and cetane number- gaseous fuel- water gas- LPG- producer gas-CNG .

**UNIT III - ELECTROCHEMISTRY AND CORROSION SCIENCE** **9**

Electrochemical cells - single electrode potential –Measurement of emf - Reference electrode-standard hydrogen electrode-Calomel electrode - glass electrode and measurement of pH-Corrosion – chemical corrosion- electrochemical corrosion- galvanic corrosion – differential corrosion- Protective coatings –Electroplating of gold - Electroless plating- anodizing-Electrochemical machining of metals and alloys.

**UNIT IV - POLYMERS AND COMPOSITES** **9**

Introduction- classification of Polymers- polymerisation types –thermo plastic and thermosetting –free radical mechanism polymerization -Engineering plastics – classification – compounding of plastics- moulding methods- injection-compression-extrusion and blow moulding- Rubber – vulcanization of rubber- Synthetic rubber ( Butyl rubber and SBR)-Composites – definition – types- polymer composites – metal composites – ceramic composites-fibre reinforcing materials.

**UNIT V - ENGINEERING MATERIALS** **9**

Introduction Refractories – classification– Properties – (Refractoriness, RUL, dimensional stability, Porosity, thermal spalling) –Abrasive –classification –natural and synthetic abrasive – silicon carbide and boron carbide – Lubricants – mechanism of lubrication – liquid lubricants – properties – Viscosity Index, flash and fire points – cloud and pour points – oiliness – Solid lubricants – graphite , Molybdenum disulphide.

**TOTAL HOURS: 45**

**TEXT BOOKS:**

1. Jain P.C & Monika Jain, “Engineering Chemistry”, Dhanpat Rai Publishing Co Ltd, New Delhi.
2. Dr. Dara S.S & Dr. Umare S.S, “Engineering Chemistry”, S .Chand &
3. Company Ltd, New Delhi.

**REFERENCES:**

1. Steven S. Zumdahl and Susan A. Zumdahl “Chemistry” Houghton Mifflin Seventh Edition 2009.
2. Dr.Sivakumar R and Dr Sivakumar N, “Engineering Chemistry”,Tata Graw-Hill Publishing Company, New Delhi, 2009.
3. Dr. Ramachandran T, Dr Venkataraman H, Dr. Magudeswaran P N, “Chemistry for Engineers”, Vijay Nicole imprints Private Limited, Chennai.

## 11UAK101 ENGINEERING MECHANICS

| L | T | P | C |
|---|---|---|---|
| 3 | 1 | 0 | 4 |

**Course Objectives**

- Analyse the static equilibrium of systems of forces in two and three dimensions
- Determine the forces experienced by components of common engineering structures such as simple frames and beams
- Describe and analyse the motion of particles along with forces and the application of impulse-momentum and work-energy principles in simple mechanical systems.

**Course Outcomes**

- Define and illustrate the basic concepts of force system
- Identify the resultant force, moment and geometrical properties of 2D and 3D objects
- Examine the resistance force of particles and objects for Impending Motion
- Determine the Displacement, velocity and acceleration of particles and objects.

**UNIT – I BASICS & STATICS OF PARTICLES** **9**

Units and Dimensions, Law of Mechanics Vector Operations, Coplanar forces, Resolution and composition of forces, Equilibrium of a particle, Forces in space, Equilibrium of particle in space, Application to simple problems.

**UNIT – II STATICS OF RIGID BODIES** **9**

**Rigid Bodies:**

Moment of a force about a point, resultant of coplanar non concurrent force systems, Free body Diagram - Types of supports and reactions, Equilibrium of rigid bodies in two dimensions, problems in beams and simple frames.

**Friction:**

Types of friction - Laws of Coulomb Friction, simple problems, ladder friction, screw and belt friction, Theory of rolling friction.

**UNIT – III PROPERTIES OF SURFACES AND SOLIDS** **9**

Determination of centroid and centre of gravity of composite sections and solid objects using standard formulae. Area moment of inertia, parallel axis and perpendicular axis theorems, polar moment of inertia, problems on composite sections (comprises rectangle, triangle, circle and semi circle only), Product of inertia, Principal moments of inertia (Not for examination), Mass moment of Inertia of plates and composite bodies using standard formulae.

**UNIT – IV DYNAMICS OF PARTICLES** **9**

Displacement, velocity, and acceleration - their relationship, Relative motion, Curvilinear motion, Newton's second law, Dynamic equilibrium, Work Energy equation of particles, Principles of impulse and momentum, application to simple problems. Direct central impact of elastic bodies.

**UNIT – V ELEMENTS OF RIGID BODY DYNAMICS** **9**

Translation and rotation of rigid bodies – Velocity and acceleration – General plane motion

**L = 45 T = 15 TOTAL HOURS: 60**

**TEXT BOOKS:**

1. S.Rajasekaran, G. Sankarasubramanian, “Fundamentals of Engineering Mechanics”, Vikas, Publishing House pvt. Ltd., New Delhi.
2. M.S. Palanichamy, S. Nagan, “Engineering Mechanics – Statics and Dynamics”, Tata McGraw Hill, publishing Company, New Delhi, 2008.

**REFERENCES:**

1. Dr. N. Kottiswaran, “Engineering Mechanics – Statics and Dynamics”, Sri Balaji Publication, Erode - 638003
2. Beer F.P and Johnson E.R., “Vector Mechanics for Engineers – Statics and Dynamics”, Tata Graw-Hill Publishing Company Ltd., New Delhi, 2001.
3. R.C. Hibbeler, “Engineering Mechanics” , Pearson education Asia Pvt. Ltd.

## 11UAK102 ENGINEERING DRAWING

| L | T | P | C |
|---|---|---|---|
| 1 | 0 | 3 | 3 |

**Course Objectives**

- To develop in students the technical drafting skills of the engineering drawing concepts, ideas and design of engineering products using drafting instruments and expose them to existing technical drawings standards.

**Course Outcomes**

- Understand the concepts of engineering drawing
- Construct basic and intermediate geometry
- Interpret engineering drawing
- Apply visualization skills for developing new products

**Concepts and conventions (not for examination)** **1**

Use of drafting instruments – Size, layout and folding of drawing sheets – Lettering and dimensioning

**UNIT – I CURVES USED IN ENGINEERING PRACTICES** **9**

Conics – Construction of ellipse, Parabola and hyperbola by eccentricity method – Construction of cycloid, epicycloids and hypocycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves.

**UNIT – II PROJECTION OF POINTS, SRAIGHT LINES AND PLANES** **9**

General principles of orthographic projection - First angle projection – layout views - Projection of points - Projection of straight lines – Parallel and inclined to both planes. Projection of planes – Inclined to one reference plane.

**UNIT – III PROJECTION OF SOLIDS** **9**

Projection of simple solids like prisms, pyramids, cylinder and cone when the axis to the solids is perpendicular and inclined to one plane by change of position method.

**UNIT – IV SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES** **9**

Sectioning of simple solids with their axes in vertical position by cutting planes inclined to one reference plane and perpendicular to the other – True shape of section. Need for development of surfaces - Development of lateral surfaces of simple and truncated solids – Prisms, pyramids, cylinders and cones.

**UNIT – V ISOMETRIC AND ORTHOGRAPHIC PROJECTIONS** **9**

Principles of isometric projection – isometric scale – isometric projections of simple solids, truncated prisms, pyramids, cylinders and cones. Free hand sketching of multiple views from pictorial views of objects

**Self study topic: Plane surface inclined to both reference planes.**

**L = 15 P = 45 TOTAL HOURS: 60**

**TEXT BOOKS:**


1. K.Venugopal, V. Prabu Raja, "Engineering Graphics", New Age International Publishers, 2010
2. K.V. Natarajan, "A textbook of Engineering Graphics" , Dhanlaksmi publishers, Chennai, 2006


**REFERENCES:**


1. Basant Agarwal and Agarwal C.M., "Engineering Drawing", Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.
2. K. R. Gopalakrishnana, "Engineering Drawing" (Vol. I & II), Subhas Publications, 1998.
3. Shah, M.B., and Rana, B.C., "Engineering Drawing", Pearson Education, 2005.

## 11UAK103 HISTORY OF SCIENCE AND TECHNOLOGY

| L | T | P | C |
|---|---|---|---|
| 1 | 0 | 0 | 1 |

**Course objectives**

- To expose the students the evolution and growth of mechanical engineering over several centuries.

**Course Outcomes**

- Observe the necessity of mechanical engineering.
- Paraphrase the evolution of mechanical engineering.
- Discover the growth of mechanical engineering.

History and evolutionary concepts in Mechanical Engineering in

1. Manufacturing Technology and Design over the years (7)
2. Thermal Engineering and Transportation Technology over the years (7)

**TOTAL HOURS: 14**

**TEXT BOOKS:**


1. Richard Shelton Kirby et al., 'Engineering in History', Dover Publications.
2. James. E. McClellan and Herald Dorn, Science and Technology in World History', The John Hopkins University press.

## 11USH111 PHYSICAL SCIENCE LABORATORY - I

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 3 | 1 |

**AIM**

- To provide exposure to the students with hands-on experience on scientific equipments

**Course Objective**

- To provide exposure to the students with hands-on experience on scientific equipments

**Course Outcomes**

- Get a basic idea of diode and LASER.
- Familiarize the concepts of Ultrasonic
- Get a basic idea about the analysis of hardness, amount of $Ca^{2+}$ and $Mg^{2+}$ , presence of alkalinity in water.
- Get a basic idea about the handling of instruments like pH meter and conductivity meter for the estimation of unknown concentration of acids.

### PHYSICS LABORATORY I

1. i) Particle size determination using diode laser.
   ii) Determination of laser parameters – Wavelength and angle of divergence
   iii) Determination of acceptance angle in an optical fiber.
1. Determination of Band gap of a Semi conducting material.
2. Characteristics of LDR
3. Determination of thermal conductivity of a bad conductor – Lee's disc method.
4. Determination of Hysteresis Loss of a Ferro-magnetic material.
5. Determination of Young's modulus of the material – Non uniform bending.

**DEMONSTRATION:**

1. Optical phenomena using Laser.

### CHEMISTRY LABORATORY-I

1. Determination of pH of strong acid by pH metry
2. Conductometric titration of strong acid with strong base.
3. Estimation of HCl and $CH_3COOH$ by Conductometric titration.
4. Potentiometric titration of Ferrous ion using Potassium dichromate.
5. Determination of Electrode Potential of an electrode.
6. Estimation of Iron by Spectrophotometry.

| | | L | T | P | C |
|---|---|---|---|---|---|
| **11UCK103** | **COMPUTING PRACTICES LABORATORY** | **2** | **0** | **2** | **3** |

**Course Objectives**

- To enable the students to create technical reports, spread sheets and presentations

**Course Outcome**

- Solve specific problems with the application packages in C programming

**A) WORD PROCESSING**

- Document creation, Text manipulation with Scientific notations.
- Table creation, Table formatting and Conversion.
- Mail merge and Letter preparation.
- Drawing - flow Chart

**B) SPREAD SHEET**

- Chart - Line, XY, Bar and Pie.
- Formula - formula editor.
- Spread sheet - inclusion of object, Picture and graphics, protecting the document and sheet.
- Sorting and Import / Export features.

**C) PRESENTATION**

- Creating a Demo Presentation (Getting Started)
- Enhancing the slides (Changing the slide background, apply design templates to a presentation,

Format the text in the slides, Modify the layout of a slide)

- Inserting Objects into a slide (Inserting Graph, Organizational Chart, Word Art, Clip Art)
- Using Autoshapes to create a drawing, Group and Ungroup Objects, Emboss Objects)
- Enhancing (Apply Build Effects, Animation Effects, Transition Effects, Specify a Time period for transition and build effects, Rehearse slide timings)
- Add Action Items and minutes of the meeting during the slide show
- Modify the slide setup to match presentation requirements, Preview slides in grey Scale, Print

Slides, notes pages, outline and handouts

**TOTAL HOURS: 30**

| | | L | T | P | C |
|---|---|---|---|---|---|
| **11UAK205** | **ENGINEERING PRACTICES LABORATORY** | **0** | **0** | **3** | **2** |

**Course Objectives**

- To provide fundamental knowledge and hands on experience to the students on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering.

**Course Outcome**

- Understand, Remembering and classify the tools and equipments used in welding, plumbing, Wood work and Sheet metal work.
- Understand and follow the standard safety measures during experimentation.
- Understand the various classifications of power construction tools.
- Apply the engineering knowledge to produce the model as per the given diagram.

**GROUP A (MECHANICAL & CIVIL)**

**MECHANICAL ENGINEERING PRACTICE**

**Sheet Metal:** Study of tools, equipments and safety precautions, Different types of joints - knocked up, double grooving joints, Model making –Tray and Funnel.

**Welding:** Arc welding practice - butt joint, lap joints and tee joints, Demonstration of gas welding.

**CIVIL ENGINEERING PRACTICE**

**Plumbing:** Preparation of plumbing line sketches for (i) water supply lines (ii) sewage lines, Cutting and threading of PVC pipes**,** Basic pipe connection using valves, taps, couplings, unions, reducers, elbows in household fitting.

**Wood Work:** Sawing, planing, making common joints like T joint, dovetail joint, etc. using power tools, Study of joints in door panels and wooden furniture.

**Basic Construction Tools:** Demonstration of power tools like rotary hammer, demolition hammer, hand drilling machine, etc.

**GROUP B (ELECTRICAL & ELECTRONICS)**

**ELECTRICAL ENGINEERING PRACTICE**

Safety aspects of electrical wiring, Basic household wiring using switches, fuse, indicator-lamp, etc., Preparation of wiring diagrams, Stair case light wiring, Fluorescent lamp wiring, Measurement of electrical quantities – voltage, current, power and energy, Study of iron-box, fan with regulator, Measurement of resistance to earth of an electrical equipment.

**ELECTRONICS ENGINEERING PRACTICE**

Study of electronic components and equipments, Resistor color coding, Soldering simple electronic circuits and checking continuity, Assembling electronic components on a small PCB and testing, Study of telephone, FM radio, low-voltage power supplies, Emergency lamp, UPS.

**Examination Pattern:** The Examination is to be conducted for both groups A & B, allotting 1½ for each group.

**TOTAL HOURS: :45**

## 11SHL201 COMMUNICATION SKILLS - II

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 1 | 3 |

**Course Objectives**

- To make students confident to express themselves fluently and appropriately in social and professional contexts and enhance their written communication in business context

**Course Outcome**

- Improve their vocabulary and appropriate usage of words.
- Familiarize with different rhetorical functions of technical English.
- Speak effectively in English in real-life and career-related situations.
- Acquire knowledge in academic and professional writing.

**UNIT I - BASIC COMMUNICATION THEORY** **9**

Importance of communication -Stages of communication - Modes of communication - Barriers to Communication - Difference between Verbal and Non Verbal communication - Body Language - Psychological and cultural influence on communication

**UNIT II - LISTENING AND ANALYSIS** **9**

Listening to technical and Non technical material - Intensive listening - Note taking - Cloze Listening - Listening and interpreting the missing texts - Listening to lectures and speeches - Listening to discussions and explanations - Telephonic listening

**UNIT III - BUSINESS CORRESPONDENCE** **9**

Report writing - Recommendations - Memoranda – Notice - Minutes of meeting - Letters and Emails (pertaining to business situations) - Resume and Job applications- advertisements- checklists- technical essays.

**UNIT IV - ORAL COMMUNICATION** **9**

Basics of Phonetics - Presentation Skills - Role-plays - Group Discussions - Short Extempore - Debates - Conversation Practices.

**UNIT V - LANGUAGE FOCUS** **9**

Introduction to technical writing - spelling - Error detection – cause and effect- structures expressing purposes- prepositions- sequencing of words- Punctuation - Idioms and phrases - American and British Words - One word Substitutes (Technical) - Foreign Phrases

**Total Hours: 45**

**TEXT BOOKS:**


1. Asraf M Rizvi, “Effective Technical Communication” Tata McGraw.2005
2. Department of Humanities and Social Sciences, Anna University ‘English for Engineers and Technologists’, Combined Edition Volume I and II, Chennai: Orient Longman Private Limited, 2006.


**REFERENCES:**


1. Boove, Counter R et al “Business Communication Today”, Pearsons Education,2002.
2. Jod O connor, “Better Pronunciation”, Cambridge Paperback, 2008.

**11USM201 ENGINEERING MATHEMATICS - II**

**(**Common to all branches**)**

| L | T | P | C |
|---|---|---|---|
| 3 | 1 | 0 | 4 |

**Course Objective**

- To provide strong foundation to the students to expose various emerging new areas of applied mathematics and appraise them with their relevance in Engineering and Technological field.

**Course Outcome**

- Understand the three dimensional shapes sphere , Cone and Cylinders
- Understand the concepts of double, triple integrals and apply them in finding the area and volume.
- Understand vector differentiation, line, surface and volume integrals and applied in Green's, Stoke's and Gauss Divergence theorems.
- Understand analytic functions, conformal mapping and apply Cauchy's integral formula and Residue theorem to evaluate real integrals

**PREREQUISITE:**

i) Three dimensional analytical geometry – Direction cosines and Direction ratios, equation of straight line and plane.

ii) Integration – Evaluation of single integrals – Definite integrals and its properties.

iii) Vector algebra – position vector – Dot and Cross product – Properties.

iv) Definition – examples – Modulus and amplitude form – Demovire's theorem – properties of complexvariable.

**UNIT I – THREE DIMENSIONAL ANALYTICAL GEOMETRY** **9**

Equation of a sphere – Plane section of a sphere – Tangent Plane – Equation of a cone –Right circular cone – Equation of a cylinder – Right circular cylinder.

**UNIT II – INTEGRAL CALCULUS** **9**

Double integration – Cartesian and polar coordinates – Change of order of Integration – Triple integration in Cartesian co-ordinates – Area as double integral – Volume as triple integral –Beta and Gamma integrals – Properties – Simple problems.

**UNIT III –VECTORCALCULUS** **9**

Gradient – Divergence and Curl – Directional derivative – Irrotational and Solenoidal vector fields – Vector integration: Green's theorem in a plane – Gauss divergence theorem – stokes' theorem(excluding proofs) – Simple applications involving cubes and rectangular parallelepiped**.**

**UNIT IV – COMPLEX VARIABLES** **9**

Functions of a complex variable – Analytic functions – Necessary conditions and Sufficient conditions(excluding proofs) – Cauchy - Riemann equation – Harmonic and orthogonal properties of analytic function – Harmonic conjugate – Construction of analytic functions – Conformal mapping: $w = c+z$, $w = cz$, $w = 1/z$ and Bilinear Transformation.

**UNIT V – COMPLEX INTEGRATION** **9**

Complex integration – Statement and applications of Cauchy's integral theorem and Cauchy's integral formula – Cauchy's and Jordan's Lemma(statement only) – Classification of singularities – Calculus of residues – Residue theorem – Application of residue theorem to evaluate real integrals along unit circle and semi-circle.

**Total hours: 45 + 15**

**TEXT BOOKS:**

1. Erwin Kreyszig, “Advanced Engineering Mathematics”, 8th Edition, Wiley India, 2006.
2. Grewal. B.S, “Higher Engineering Mathematics”, 40th Edition, Khanna Publications, Delhi, (2007).

**REFERENCES:**

1. Ramana B.V, “Higher Engineering Mathematics”, Tata McGraw Hill Publishing Company, New Delhi, 2007.
2. Glyn James, “Advanced Engineering Mathematics”, 3rd Edition, Wiley India, 2007.
3. Jain R.K and Iyengar S.R.K, “Advanced Engineering Mathematics”, 3rd Edition, Narosa Publishing House Pvt. Ltd., 2007.
4. George, B Thomas J.R. and Ross L. Finney, “Calculus and Analytical Geometry”, 10th Edition, Addison Wesley, 2000.

## 11UCK204 C PROGRAMMING

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Objectives**

- To learn the control structures of C language
- To write programs using Functions & Pointers
- To use different data types and multi-dimensional arrays in programs
- To write programs using structures and files

**Course Outcome**

- Understand the concepts of computing and methods of problem solving
- Develop programming skill in C language.

**GETTING STARTED**

What is a Programming Language – What is a compiler - What is C – Getting started with C – The first C Program – Compilation and Execution – Receiving input – C instructions – Control instructions in C

**UNIT I - DECISION CONTROL STRUCTURE** **9**

Decisions – if statement – if..else statement – Use of Logical operators – conditional operators.

**UNIT II - LOOP & CASE CONTROL STRUCTURE** **9**

Loops – while loop – for loop – Odd loop – break statement – continue statement – do .. while loop – Decisions using switch – switch vs if else ladder – goto statement

**UNIT III - FUNCTIONS & POINTERS** **9**

What is a function? – Passing values between functions – scope rule of functions – Calling convention - Advanced features of functions – function declaration and prototypes – call by value and call by reference - An Introduction to Pointers – Pointer Notations – Back to function calls – Conclusions – Recursion – Recursion and Stack.

**UNIT IV - DATA TYPES & ARRAYS** **9**

Integers(long, short, signed and unsigned) – Chars (Signed and unsigned) – Floats and doubles – Few More issues on data types – storage classes in C – What are arrays – more on arrays – Pointers and Arrays – Two Dimensional Arrays – Array of Pointers – Three Dimensional Array.

**UNIT V - STRUCTURES & FILES** **9**

Why use structures – array of structure - additional features of structures – Uses of Structures – Data Organization – File operations – Counting Characters, Tabs, Spaces, - A file copy program – File opening modes – String I/O in Files – Text Files and Binary Files – Low level Disk I/O – I/O under windows.

**TOTAL HOURS : 45**

**REFERENCES**


1. Yashavant P. Kanetkar, "Let Us C", BPB Publications, 10th Edition, 2009
2. B. W. Kernighan, Dennis M. Ritchie, "The C Programming Language", Pearson Education, 2003.

## 11USC201 ENVIRONMENTAL SCIENCE AND ENGINEERING

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Objective**

- To learn the basic and create awareness of environment and ecology.
- To know about the role of an individual in preserving the natural resources and about the various legislations, acts and NGO's that aims to control pollution.

**Course Outcome**

- Understand and remember the concept of ecology, environment and importance of Natural resources.
- To understand the various environmental issues prevailing in the society and can analyse the causes
- Executing the gained knowledge to prevent pollution.
- Applying the knowledge gained about the interrelation between human and Environment for a sustainable development.

**UNIT I - ENVIRONMENT & ECOSYSTEM** **9**

Introduction – Components of the environment – People, society and environment – Need for public awareness – Scope and importance – Environmental problems and sustainable development. Ecosystem – Concept – Ecosystem degradation – Structure and functions of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Water cycle – Carbon cycle – Oxygen cycle – Nitrogen cycle – Energy cycle – Food chain – Food web – Ecological pyramid – Types of ecosystem – Forest – Grassland – Desert – Aquatic ecosystem- Case Studies in current scenario.

**UNIT II - BIODIVERSITY & NATURAL RESOURCES** **9**

Biodiversity – Introduction – Ecosystem, Species & Genetic diversity – Biogeographical classification of India – Value of biodiversity – Hotspots of biodiversity – Threats to biodiversity – Conservation of biodiversity. Resources – Introduction – Renewable & Non-renewable resources – Forest resource – deforestation – timber extraction – Water resources – Flood – Drought – Dam – Conflict over water – Food resource – Changes & effects by modern agricultural practices – Overgrazing – Land resource – landslide – Biomass – Some non-renewable sources – Mineral resources – Alternate energy sources- Case Studies in current scenario.

**UNIT III - POLLUTION** **9**

Pollution – Classification of pollutants – Cause, Source, Effect and Control measures - Air pollution – Causes, types & sources of air pollutant – Effect of air pollutants – Control of air pollution – Water pollution – Source and effects - Thermal pollution – Radioactive pollution – Marine pollution – Pesticidal pollution – Groundwater pollution – Land pollution – Sources and effects of soil pollutant – Solid waste – Methods of solid waste disposal – Soil degradation – Solid waste management – Recovery and conversion methods – Noise pollution – Sources, effects and control measures – An Introduction to E-Waste Management- Case Studies in current scenario.

**UNIT IV - LEGAL ACTS & MAJOR ENVIRONMENTAL CONCERNS** **9**

Environmental legislations – Acts – Water act – Air act – Environment act – Land act – Wildlife protection act – Forest acts – Functions of CPCB & SPCB. Water conservation – Rainwater harvesting – Reducing water demand – Watershed management. Disaster – Tsunami – Bhopal gas disaster – Minamata tragedy – Polythene – Disaster management – Nuclear accident – Flood,

Earthquake, Cyclone and Landslide. Major issues in environment – Climate change, Global warming, Acid rain and Ozone layer depletion- Case Studies in current scenario.

**UNIT V - HUMAN POPULATION & ENVIRONMENT**

**9**

Population - Population explosion – Effects of population growth on resources – Urbanization - Family welfare programme – Environment and human health – Climate & health, Infectious & water related diseases, Cancer & environment – Human rights – Equity – Nutrition, health and human rights – HIV/AIDS – Women and child welfare - Role of information technology in protecting the environment – Role of individual in the prevention of pollution – Role of NGO's in protecting the environment- Case Studies in current scenario.

**TOTAL NO. OF HOURS: 45**

**TEXT BOOKS:**


1. Anubha Kaushik and C P Kaushik 'Environmental Science and Engineering' Third Edition, New age International (P) Limited, Publisher 2008. New Delhi
2. Aloka Debi, "Environmental Science and Engineering", Universities Press, 2008. (UNIT – 1, 2, 3,4,5).


**REFERENCES:**


1. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2006. (UNIT – 4: Major issues in environment)
2. Gilbert M. Masters, 'Introduction to Environmental Engineering and Science', Second Edition, Pearson Education, 2004.
3. Tyler Miller, Jr., 'Environmental Science, Brooks/Cole a part of Cengage Learning, 2006.

**11USP201 MATERIAL SCIENCE**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Objectives**

- To give an exposure to the students on materials and their applications in the field of Technology, and also to create awareness towards the impact of the materials.

**Course Outcome**

- Classify the different types of crystal structure
- Understand the basic concepts of failures of materials
- Get an exposure for the basics of electrical properties of the conducting materials
- Explain the fundamentals of composite materials
- Gain the basic concept of advanced and Nano materials

**UNIT I - CRYSTAL STRUCTURE** **9**

Definition of a Crystal – Crystal classification - Unit Cell – Bravais Lattice – Miller Indices – Bragg's Law – Determination of Crystal structure by Debye Scherrer method - Crystal imperfections – Point, Line and Surface imperfections - Burger Vector

**UNIT II - MECHANICAL PROPERTIES OF MATERIALS** **9**

Elastic deformation – Tensile Properties – Plastic deformation – Plasticity – Ductility, Dislocation and strengthening mechanisms – viscoelastic deformation – Maxwell model – Voigt –Kelvin model – creep method to increase creep resistance, Fracture – fatigue – method to increase Fatigue Resistance.

**UNIT III - METALS AND ALLOYS** **9**

Drude Lorentz theory of electrical conduction, Wiedmann Franz law, Band theory of solids, Factors affecting resistivity of metals- temperature alloying, magnetic field and strain. Application of conductors – Strain gauges, transmission lines, Conducting materials, precision resistors, heating elements and resistance thermometer.

**UNIT IV - COMPOSITIES** **9**

Definition, Function of matrix and reinforcement in composites. Classifications of composites based on reinforcement. Types of composite materials – polymer, metallic and ceramic matrix composites (qualitative). Law of mixtures. Comparison with conventional materials. Applications in surgery, sports equipment.

**UNIT V - ADVANCED MATERIALS:** **9**

Nanophase materials – Synthesis Technique, Properties, Applications, Shape Memory Alloy (SMA) – Characteristics, Properties of NiTi alloy, Application, Advantages and Disadvantages of SMA. Metallic glasses – Preparation, Properties and Applications Introduction to nano materials - synthesis – plasma arcing – chemical vapour deposition – solgels – electrodeposition – ball milling - properties of nanoparticles and applications. Carbon nanotubes: fabrication – arc method – pulsed laser deposition – chemical vapour deposition - structure – properties and applications

**TOTAL HOURS: 45**

**TEXT BOOKS:**


1. William D Callister, Jr "Material Science and Engineering" John wiley and Sons, New York, 2007.
2. Leonid V Azaroff and James J Brophy, " electronic Processes in Materials", McGraw hill Co, New York, 1991.


**REFERENCES:**


1. Jayakumar, S "Materials Science", RK Publishers, Coimbatore 2006.
2. Raghavan, V. "Materials Science and Engineering – A First Course" Prentice Hall of India, New Delhi 2004.
3. Palanisamy P.K, "Materials Science". SCITECH Publications, Chennai, 2002.

## 11UAK202 BASICS OF CIVIL ENGINEERING

| L | T | P | C |
|---|---|---|---|
| 2 | 0 | 0 | 2 |

**Course Objectives**

- Learning and understanding of the basic civil engineering principles that are used in our day to day real life activities.

**Course Outcome**

- Get exposed to the basics of civil engineering areas like construction materials, construction practices, surveying.

**UNIT I - SURVEYING** **9**

Surveying: Objects – types – classification – principles – measurements of distances – angles – leveling – determination of areas – illustrative examples.

**UNIT II - CIVIL ENGINEERING MATERIALS** **9**

Civil Engineering Materials: Bricks – stones – sand – cement – concrete – steel sections.

**UNIT III - FOUNDATIONS** **9**

Foundations: Structural foundation, Machinery foundation and foundation for special structures, Types, Bearing capacity – Requirement of good foundations.

**UNIT IV - SUPERSTRUCTURE** **9**

Superstructure: Brick masonry – stone masonry – beams – columns – lintels –roofing – flooring – plastering.

**UNIT V - BRIDGES, DAMS, INTERIOR DESIGN AND LANDSCAPING** **9**

Bridges and Dams: Types, importance and benefits. Basics of Interior Design and Landscaping.

**TOTAL HOURS: 45**

**TEXT BOOKS:**


1. Shanmugam G and Palanichamy M S, “Basic Civil and Mechanical Engineering”, Tata McGraw Hill Publishing Co., New Delhi, (1996).
2. Ramamrutham. S, “Basic Civil Engineering”, Dhanpat Rai Publishing Co. (P) Ltd. (1999).


**REFERENCES:**


1. Palanichamy M S, “Basic Civil Engineering”, Tata McGraw Hill Publishing Co., New Delhi, (2000).
2. Neil S. Grigg, “Civil Engineering Practice in the Twenty-First Century : Knowledge and Skills for Design and Management”, American Society of Civil Engineers,( 2001)
3. Seetharaman S. “Basic Civil Engineering”, Anuradha Agencies, (2005).

## 11USH211 PHYSICAL SCIENCE LABORATORY - II

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 3 | 1 |

**AIM**

- To provide exposure to the students with hands-on experience on scientific equipments

**Course outcome**

- Perform experiments on semiconductors, thermal conductivity, optics, elasticity and viscosity of liquids.
- Demonstrate the understanding of wavelength, band gap, thermal conductivity, Young's modulus and viscosity.
- Gain knowledge to find band gap of semiconductors, thermal conductivity of a bad conductor, wave length of various colours in mercury spectrum using grating, Young's modulus of a material and viscosity of a liquid.
- Estimate the different water quality parameters (chloride, DO) and also to estimate the metals like Cr, ferrous ion and copper for industrial applications.

### PHYSICS LABORATORY II

1. Comparative resistivities of alloy and metal – Meter Bridge.
2. Determination of efficiency of a solar cell.
3. Characteristics of photodiode.
4. Determination of lattice constant X-ray powder photograph.
5. Determination of Rigidity modulus- Torsion Pendulum
6. Determination of Young's modulus of the material – Non uniform bending
7. Determination of Velocity of Ultrasonic waves – Ultrasonic Interferometer

### CHEMISTRY LABORATORY - II

1. Estimation of hardness of water by EDTA method.
2. Estimation of Calcium ions and Magnesium ions by EDTA method.
3. Estimation of alkalinity of water sample.
4. Determination of Chloride in water by Argentometric method.
5. Determination of Dissolved Oxygen in waste water using Winkler's titrimetry method.
6. Estimation of copper in brass by EDTA.

## 11UCK202 C PROGRAMMING LAB

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 3 | 2 |

**Course Objective**

- To gain mastery over the C language

**Course Outcome**

- Solve specific problems with the application packages in C programming

**List of Programs / Experiments can be setup by the faculty with the following**

1. Programming concepts involving I/O statements.
2. Programming concepts involving conditional statements.
3. Programming concepts involving looping statements.
4. Programming concepts involving functions.
5. Programming concepts involving Arrays (1D, 2D).
6. Programming concepts involving Pointers.
7. Programming concepts involving Structures.
8. Programming concepts involving Files.

Note: The above programs will be tuned to the various fundamental principles in the specific engineering branches

**TOTAL HOURS : 45**

## 11UAK205 COMPUTERS AIDED DRAFTING AND MODELING LABORATORY

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 3 | 2 |

**Course Objectives**

- To provide fundamental knowledge and hands on experience to the students on various basic skills in Civil, and Mechanical Engineering drafting and modeling using softwares.

**Course Outcome**

- Recall the concepts of engineering drawing.
- Interpret the manual drafting skills into computer drafting
- Identify the standard procedure to create a model.
- Simplify the procedure to create a model.

**List of Exercises using software capable of Drafting and Modeling**

1. Study of capabilities of software for Drafting and Modeling – Coordinate systems (absolute, relative, polar, etc.) – Creation of simple figures like polygon and general multi-line figures.
2. Drawing of a Title Block with necessary text and projection symbol.
3. Drawing of curves like parabola, spiral, involutes using B- spline or cubic spline.
4. Drawing of front view and top view of simple solids like prism, pyramid, cylinder, cone, etc, and dimensioning.
5. Drawing front view, top view and side view of objects from the given pictorial views (eg. V-block, Base of a mixie, Simple stool, Objects with hole and curves).
6. Drawing of a plan of residential building (Two bed rooms, kitchen, hall, etc.)
7. Drawing of a simple steel truss.
8. Drawing sectional views of prism, pyramid, cylinder, cone, etc,
9. Drawing isometric projection of simple objects.
10. Creation of 3-D models of simple objects and obtaining 2-D multi-view drawings from 3-D model.

**Note: Plotting of drawings must be made for each exercise and attached to the records written by students.**

**11USM302 TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS**

**(**Common to MECH & MCT**)**

| L | T | P | C |
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**Course Objective**

- To provide strong foundation to the students to expose various emerging new areas of applied mathematics and appraise them with their relevance in Engineering and Technological field.

**Course Outcome**

- Formulate and solve the partial differential equations
- Interpret Fourier series solutions to the engineering problems
- Apply analytical and numerical methods to solve wave and heat equation with boundary conditions
- Use Fourier transforms techniques to evaluate integrals

**PREREQUISITE:**

Limit concepts, Integration, Periodic function, Basic terminologies of odd and even functions.

**UNIT I - FOURIER SERIES** **9**

Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Complex form of Fourier Series – Parseval's identity – Harmonic Analysis.

**UNIT II – FOURIER TRANSFORMS** **9**

Fourier integral theorem (without proof) – Fourier transform pair – Sine and Cosine transforms – Properties – Transforms of simple functions – Convolution theorem– Parseval's identity.

**UNIT III - PARTIAL DIFFERENTIAL EQUATIONS** **9**

Formation of partial differential equations – Lagrange's linear equation – Solutions of standard types of first order partial differential equations - Linear partial differential equations of second and higher order with constant coefficients-Classification of PDE-Method of separation of variables.

**UNIT IV - APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS** **9**

Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two-dimensional equation of heat conduction (Insulated edges excluded) – Fourier series solutions in Cartesian coordinates.

**UNIT V - LAPLACE TRANSFORMS** **9**

Laplace transforms – Conditions for existence – Transform of elementary functions – Basic properties – Transform of derivatives and integrals – Transform of unit step function and impulse functions – Transform of periodic functions. Definition of Inverse Laplace transform as contour integral – Convolution theorem (excluding proof) – Initial and Final value theorems – Solution of linear ODE of second order with constant coefficients using Laplace transformation techniques.

**L=45 T=15 TOTAL HOURS: 60**

**TEXT BOOKS:**


1. Grewal, B.S, 'Higher Engineering Mathematics' 40th Edition, Khanna Publishers, Delhi, (2007)
2. Erwin Kreyszig 'Advanced Engineering Mathematics', Eighth edition - Wiley India (2007).


**REFERENCES :**


1. Ramana.B.V. 'Higher Engineering Mathematics' Tata Mc-Graw Hill Publishing Company limited, New Delhi (2007).
2. Glyn James, 'Advanced Modern Engineering Mathematics', Third edition - Pearson Education (2007).
3. Bali.N.P and Manish Goyal 'A Textbook of Engineering Mathematics', Seventh Edition, Laxmi Publications (P) Ltd. (2007).

## 11UAK301 ENGINEERING THERMODYNAMICS

| L | T | P | C |
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**Course Objectives**

- To achieve an understanding of principles of thermodynamics and to be able to use it in accounting for the bulk behaviour of the simple physical systems.
- To provide in-depth study of thermodynamic principles, thermodynamics of state, basic thermodynamic relations, Principle of Psychrometry & Properties of pure substances.

**Course Outcome**

- Understand the concepts of continuum, system, control volume, thermodynamic properties, thermodynamic equilibrium, work and heat.
- Apply the laws of thermodynamics to analyze boilers, heat pumps, refrigerators, heat engines, compressors and nozzles.
- Evaluate the performance of steam power cycles and refrigerators.
- Evaluate properties of pure substances and gas mixtures.

**UNIT 1 - BASIC CONCEPT AND FIRST LAW** **9**

Basic concepts - concept of continuum, macroscopic approach, Thermodynamic systems - closed, open and isolated. Property, state, path and process, quasi-static process, work, modes of work, Zeroth law of thermodynamics – concept of temperature and heat. Concept of ideal and real gases. First law of thermodynamics – application to closed and open systems, internal energy, specific heat capacities, enthalpy, steady flow process with reference to various thermal equipments.

**UNIT II - SECOND LAW** **9**

Second law of thermodynamics – Kelvin's and Clausius statements of second law. Reversibility and irreversibility. Carnot theorem, Carnot cycle, reversed carnot cycle, efficiency, COP. Thermodynamic temperature scale, Clausius inequality, concept of entropy, entropy of ideal gas, principle of increase of entropy – availability.

**UNIT III - PROPERTIES OF PURE SUBSTANCE AND STEAM POWER CYCLE** **9**

Properties of pure substances – Thermodynamic properties of pure substances in solid, liquid and vapour phases, phase rule, P-V, P-T, T-V, T-S, H-S diagrams, PVT surfaces, thermodynamic properties of steam. Calculations of work done and heat transfer in nonflow and flow processes. Standard Rankine cycle, Reheat and regenerative cycle.

**UNIT IV- IDEAL AND REAL GASES AND THERMODYNAMIC RELATIONS** **9**

Gas mixtures – properties ideal and real gases, equation state, Avagadro's Law, Vander Waal's equation of state, compressibility factor, compressibility chart – Dalton's law of partial pressure, exact differentials, T-D relations, Maxwell's relations, Clausius Clapeyron equations, Joule – Thomson coefficient.

**UNIT V - PSYCHROMETRY** **9**

Psychrometry and psychrometric charts, property calculations of air vapour mixtures. Psychrometric process – Sensible heat exchange processes. Latent heat exchange processes. Adiabatic mixing, evaporative cooling.

**L=45 T=15 TOTAL HOURS: 60**

(Use of standard thermodynamic tables, Mollier diagram, Psychometric chart and Refrigerant property tables are permitted)

**TEXT BOOKS**


1. Nag.P.K., “Engineering Thermodynamics”, Tata McGraw-Hill,New Delhi, 1998.
2. Mahesh M. Rathore, “ Thermal Engineering”, TMCH 2010.


**REFERENCES**


1. Cengel, ‘Thermodynamics – An Engineering Approach’ Third Edition – 2003 – Tata McGraw Hill, New Delhi.
2. Holman.J.P., “Thermodynamics”, 3rd Ed. McGraw-Hill, 1995.
3. Arora C.P, “ Thermodynamics”, Tata McGraw-Hill, New Delhi, 2003.

## 11UAK302 FLUID MECHANICS AND MACHINERY

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course objectives**

- Develop an understanding of fluid mechanics in engineering as well as a variety of other fields. Learn to use control volume analysis to develop basic equations and to solve problems.
- Learn to use dimensional analysis to design physical or numerical experiments and to apply dynamic similarity.
- Learn to apply conservation of laws to flow through pipes and hydraulic machines

**Course Outcome**

- Understand the basic properties of fluid.
- Apply the various methods available for the boundary layer separation.
- Calculate the dependent and independent parameters for a model of fluid flow.
- Design pumps and turbines for suitable application.

**UNIT I - FLUID STATICS** **9**

Dimensions and units - Fluid properties - Pascal's law and Hydrostatic equation - Forces on plane surfaces - Pressure measurement- Bernoulli's equations and Applications.

**UNIT II - BOUNDARY LAYER AND FLOW THROUGH PIPES** **9**

Laminar flows through pipes and between plates - Hagen Poiseuille equation - Turbulent flow - Darcy Weisbach formula - Boundary layer concepts - Major and minor losses of flow in circular pipes – Pipes in series and in parallel.

**UNIT III - SIMILITUDE AND MODEL STUDY** **9**

Dimensional analysis - Rayleigh's method - Buckingham π theorem - similitude and models - Scale effect and distorted models.

**UNIT IV - TURBINES** **9**

Impact of jets on fixed and moving plane and curved plates - Impulse, Francis and Kaplan turbines - Constructional details, Velocity triangles, Power and efficiency calculations, Unit and specific speed, Performance characteristics, Selection of water turbines.

**UNIT V - PUMPS** **9**

Centrifugal pumps - Velocity triangles, Work done by impellor, Efficiencies, Specific speed, Cavitation, Performance characteristics.

Reciprocating pumps - Indicator diagram, work saved by fitting air vessels, Performance characteristics. Theory of Gear, Vane and Jet pumps.

**TOTAL HOURS: 45**

**TEXT BOOKS:**


1. Kumar K.L., "Engineering Fluid Mechanics ", Eurasia Publishing House (P) Ltd., New Delhi, 1995.
2. R K Rajput, "Hydraulic Machines", S. Chand & Co Ltd.


**REFERENCES:**


1. Streeter, Victor L. and Wylie, Benjamin E., " Fluid Mechanics ", McGraw-Hill Ltd., 1998.
2. Bansal, R.K. "Fluid Mechanics and hydraulic Machines", Laxmi Publications (P) Ltd., New Delhi
3. Jagdish Lal, "Hydraulic Machines", Metropolitan book Co. Pvt Ltd.

## 11UAK303 ENGINEERING METALLURGY

| L | T | P | C |
|---|---|---|---|
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**Course Objective**

- To impart knowledge on the structure, properties, treatment, testing and applications of metals and non-metallic materials so as to identify and select suitable materials for various engineering applications.

**Course Outcome**

- List the different materials and its properties, application of materials.
- Understand the phase diagrams, phase rule
- Apply the heat treatment processes to modify the properties
- Examine the properties of materials

**UNIT I - CONSTITUTION OF ALLOYS AND PHASE DIAGRAMS** **9**

Constitution of alloys – Solid solutions, substitutional and interstitial – phase diagrams, Isomorphous, eutectoid, eutectic, peritectic, and peritectroid reactions, Iron – Iron carbide equilibrium diagram. Classification of steel and cast Iron, microstructure, properties and applications.

**UNIT II - HEAT TREATMENT** **9**

Definition – Full annealing, stress relief, recrystallisation and spheroidizing –normalising, hardening and tempering of steel. Isothermal transformation diagrams – cooling curves superimposed on I.T. diagram, CCR - Hardenability, Jominy end quench test – Austempering, martempering – case hardening - carburising, nitriding, cyaniding, carbonitriding, flame and induction hardening.

**UNIT III - MECHANICAL PROPERTIES AND TESTING** **9**

Mechanism of plastic deformation, slip and twinning – Types of fracture – Testing of materials under tension, compression and shear loads – Hardness tests (Brinell, Vickers and Rockwell), Impact test - Izod and Charpy, Fatigue and creep tests, fracture toughness tests.

**UNIT IV - FERROUS AND NON FERROUS METALS** **9**

Effect of alloying elements on steel (Mn, Si, Cr, Mo, V, Ti & W) - stainless and tool steels – HSLA - maraging steels – Cast Irons - Grey, White malleable, spheroidal – Graphite, Alloy cast irons, Copper and Copper alloys - Brass, Bronze and Cupronickel – Aluminum and Al-Cu alloy – precipitation hardening– Bearing alloys.

**UNIT V - POWDER METALLURGY** **9**

Introduction – scope of powder metallurgy, characterization of metal powders, physical properties – particle size and shape determination – powder manufacturing – compaction and sintering – powder metallurgy products.

**TOTAL HOURS: 45**

**TEXT BOOKS:**


1. Kenneth G.Budinski and Michael K.Budinski “Engineering Materials” Prentice-Hall of India Private Limited, 4th Indian Reprint, 2002.
2. Vijaya. M.S. and G. Rangarajan, “Material Science”, Tata McGraw-Hill , 2007.


**REFERENCES:**


1. William D Callister “Material Science and Engineering”, John Wiley and Sons 2007.
2. O.P. Khanna , “A text book of Materials Science and Metallurgy”, Khanna Publishers, 2003.
3. Sidney H Avner, “ Introduction to Physical Metallurgy”, Tata McGraw-Hill , 1997.

## 11UAK304 STRENGTH OF MATERIALS

| L | T | P | C |
|---|---|---|---|
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**Course Objectives**

- To gain knowledge of simple stresses, strains and deformation in components due to external loads.
- To assess stresses and deformations through mathematical models of beams, twisting bars or combinations of both.
- Effect of component dimensions and shape on stresses and deformations are to be understood.
- The study would provide knowledge for use in the design courses.

**Course Outcome**

- Demonstrates the basic concepts and terminologies of strength of materials.
- List the various kinds of stress, strain and moduli
- Analyze and design various structural members (like bar, beam, and shaft).
- Discover the principal stresses, hoop and longitudinal stresses

**UNIT I - STRESS, STRAIN AND DEFORMATION OF SOLIDS** **9**

Rigid and Deformable bodies – Strength, Stiffness and Stability – Stresses; Tensile, Compressive and Shear – Deformation of simple and compound bars under axial load – Thermal stress. Elastic constants – Strain energy and unit strain energy – Strain energy in uniaxial loads.

**UNIT II - BEAMS – LOADS AND STRESSES** **9**

Types of beams: Supports and Loads – Shear force and Bending Moment in beams – Cantilever Simply supported and Overhanging beams – Stresses in beams – Theory of simple bending. Stress variation along the length and in the beam section – Effect of shape of beam section on stress induced – Shear stresses in beams – Shear flow.

**UNIT III - TORSION** **9**

Analysis of torsion of circular bars – Shear stress distribution – Bars of Solid and hollow circular section – Stepped shaft – Twist and torsion stiffness – Compound shafts – Fixed and simply supported shafts – Application to close-coiled helical springs – Maximum shear stress in spring section – Deflection of helical coil springs under axial loads – Design of helical coil springs – stresses in helical coil springs under torsion loads

**UNIT IV - BEAM DEFLECTION AND COLUMNS** **9**

Elastic curve of Neutral axis of the beam under normal loads – Evaluation of beam deflection and slope : Double integration method, Macaulay Method, and Moment-area Method –Columns – End conditions – Equivalent length of a column – Euler equation – Slenderness ratio – Rankine formula for columns

**UNIT V - ANALYSIS OF STRESSES IN TWO DIMENSIONS** **9**

Biaxial state of stresses – Thin cylindrical and spherical shells – Deformation in thin cylindrical and spherical shells – Biaxial stresses at a point – Stresses on inclined plane – Principal planes and stresses – Mohr's circle for biaxial stresses – Maximum shear stress - Strain energy in bending and torsion.

**L=45 T=15 TOTAL HOURS: 60**

**TEXT BOOKS**


1. Popov E.P, "Engineering Mechanics of Solids", Prentice-Hall of India, New Delhi, 1997.
2. Beer F. P. and Johnston R, "Mechanics of Materials", McGraw-Hill Book Co, Third Edition, 2002.


**REFERENCES:**


1. Nash W.A, "Theory and problems in Strength of Materials", Schaum Outline Series, McGraw-Hill Book Co, New York, 1995
2. Kazimi S.M.A, "Solid Mechanics", Tata McGraw-Hill Publishing Co, New Delhi, 1981
3. Singh D.K "Mechanics of Solids" Pearson Education 2002.

## 11UFK311 ELECTRICAL DRIVES AND CONTROL

| L | T | P | C |
|---|---|---|---|
| 3 | 1 | 0 | 4 |

**Course Objectives**

- To understand the basic concepts of different types of electrical machines and their performance.
- To study the different methods of starting D.C motors and induction motors.
- To study the conventional and solid-state drives

**Course Outcome**

- Explain elements of motor, Types of Electric Drives, Factors influencing the choice of electrical drives
- Explain power rating for drive motors, loading, and draw characteristics curves, and solve simple problems for characteristics study.
- Explain Braking of Electrical motors, Types of DC Motor starters, Types of AC motors starters, DOL starter, Y-Δ starter and Auto transformer starter, rotor resistance starter and control circuits for shunt and series motors.
- Express knowledge on various Speed control of DC and Ac motors

**UNIT I - INTRODUCTION** **8**

Basic Elements – Types of Electric Drives – factors influencing the choice of electrical drives – heating and cooling curves – Loading conditions and classes of duty – Selection of power rating for drive motors with regard to thermal overloading and Load variation factors.

**UNIT II - DRIVE MOTOR CHARACTERISTICS** **9**

Mechanical characteristics – Speed-Torque characteristics of various types of load and drive motors – Braking of Electrical motors – DC motors: Shunt, series and compound - single phase and three phase induction motors.

**UNIT III - STARTING METHODS** **8**

Types of D.C Motor starters – Typical control circuits for shunt and series motors – Three phase squirrel cage and slip ring induction motors.

**UNIT IV - CONVENTIONAL AND SOLID STATE SPEED CONTROL OF D.C. DRIVES** **10**

Speed control of DC series and shunt motors – Armature and field control, Ward- Leonard control system - Using controlled rectifiers and DC choppers –applications.

**UNIT V - CONVENTIONAL AND SOLID STATE SPEED CONTROL OF A.C. DRIVES** **10**

Speed control of three phase induction motor – Voltage control, voltage / frequency control, slip power recovery scheme – Using inverters and AC voltage regulators – applications**.**

**L=45 T=15 TOTAL HOURS: 60**

**TEXT BOOKS:**


1. Vedam Subrahmaniam, “Electric Drives (concepts and applications)”, Tata McGraw-Hill, 2001
2. Nagrah.I.J. & Kothari.D.P, “Electrical Machines”, Tata McGraw-Hill, 1998.


**REFERENCES:**


1. Pillai.S.K “A first course on Electric drives”, Wiley Eastern Limited, 1998
2. M.D.Singh, K.B.Khanchandani, “Power Electronics”, Tata McGraw-Hill, 1998
3. H.Partab, “Art and Science and Utilisation of electrical energy”, Dhanpat Rai and Sons, 1994.

## 11UAK305 FLUID MECHANICS AND MACHINERY LABORATORY

| L | T | P | C |
|---|---|---|---|
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**Course Objectives**

- To supplement the theoretical knowledge gained in fluid mechanics and machinery with practical testing for determining the fluid properties and different parameters.

**Course Outcome**

- Measure the various fluid properties.
- Design components interacting with fluid flow.
- Select pumps and turbines for various applications.
- Minimize the various losses in the pipe connections.

**LIST OF EXPERIMENTS**

1. Determination of the Coefficient of discharge of given Orifice meter.
2. Determination of the Coefficient of discharge of given Venturi meter.
3. Calculation of the rate of flow using Rota meter.
4. Determination of friction factor for a given set of pipes.
5. Conducting experiments and drawing the characteristic curves of centrifugal pump / submergible pump
6. Conducting experiments and drawing the characteristic curves of reciprocating pump.
7. Conducting experiments and drawing the characteristic curves of Gear pump.
8. Conducting experiments and drawing the characteristic curves of Pelton wheel.
9. Conducting experiments and drawing the characteristics curves of Francis turbine.
10. Conducting experiments and drawing the characteristic curves of Kaplan turbine.

**TOTAL HOURS: 45**

## 11UAK306 STRENGTH OF MATERIALS LAB

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 3 | 2 |

**Course Objectives**

- To supplement the theoretical knowledge gained in Mechanics of Solids with practical testing for determining the strength of materials under externally applied loads.

**Course Outcome**

- Evaluate Young Modulus, torsional strength, hardness, tensile strength and compressive strength of given specimens.
- Develop theoretical understanding of the mechanical properties of materials by performing experiments.
- Infer the structure of materials based on microscopic examination.
- Determine the behavior of structural elements, such as bars & beams subjected to tension, compression, shear and bending by means of experiments.

**LIST OF EXPERIMENTS**

1. Tension test on a mild steel rod
2. Double shear test on Mild steel and Aluminium rods
3. Torsion test on mild steel rod
4. Impact test on metal specimen – Charpy's and Izod's test
5. Hardness test on metals - Brinell and Rockwell Hardness Number
6. Deflection test on beams
7. Compression test on helical springs
8. Strain Measurement using Rosette strain gauge
9. Effect of hardening- Improvement in hardness and impact resistance of steels.
10. Compression test on timber.
11. Tempering- Improvement Mechanical properties Comparison
    (i)Unhardened specimen
    (ii)Quenched Specimen and
    (iii)Quenched and tempered specimen.
12. Microscopic Examination of (i) Hardened samples (ii) Hardened and tempered samples.

**TOTAL HOURS: 45**

## 11UAK307 COMPUTER AIDED MACHINE DRAWING LAB

| L | T | P | C |
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**Course Objectives**

- To develop skills in drafting machine components and assemblies.
- To develop skills in creating three dimensional modeling.

**Course Outcome**

- Develop skills in drafting machine components and assemblies.
- Develop skills in creating three dimensional modeling.
- Impart knowledge on how to prepare drawings for various mechanical components using any commercially available 3D modeling software's
- Ability to compare and assemble these parts in industry-standard plan form and produce hardcopies ready for distribution

**Production Drawing:-**
Introduction – Types –Preparation of working drawings

**Fits and Tolerance:-**
Fits and tolerance - allocation of fits for various mating parts - tolerance data sheet - tolerance table preparation - Geometric tolerance.

**Blue Print Reading :-**
Blue print reading with examples.

**ASSEMBLY DRAWINGS (USING 2D APPLICATION PACKAGES)**
Preparation of assembled views given part details for components by using CAD packages.

Suggested Assemblies:
Shaft couplings – Rigid and flexible couplings , Cotters and Pin Joints , Bearings – Foot step bearing, Plummer block, Engine parts – Stuffing box, Connecting rod .Machine tool parts – Clapper block , Machine vice, Screw jack , etc

**3D MODELING**
Introduction to 3D Modeling, Creation of 3D modeling of simple components using modeling software.

**TOTAL HOURS: 45**

**REFERENCES:**


1. BHATT.N.D. and PANCHAL.V.M., "Machine Drawing", Charotar Publishing House, 388001, 38th Edition, 2003.
2. "P.S.G. Design Data Book", PSG College of Tech., Coimbatore.
3. Luzadder,Warren.J., and Duff, Jon.M. "Fundamentals of Engineering Drawing", Prentice Hall India Pvt. Ltd.

**11USM402 PROBABILITY THEORY AND NUMERICAL METHODS**

(II B.E. MECH – Fourth Semester)

| L | T | P | C |
|---|---|---|---|
| 3 | 1 | 0 | 4 |

**Course Objectives**

- To provide strong foundation to the students to expose various emerging new areas of applied mathematics and appraise them with their relevance in Engineering and Technological field.

**Course Outcome**

- Understand to handle situations involving single random variable
- Apply the probability concepts in solving engineering problems
- Apply numerical method techniques to find the solution of ordinary differential equations
- Apply numerical methods to solve algebraic, transcendental and simultaneous equations

**UNIT I - PROBABILITY AND RANDOM VARIABLE** **9**

Axioms of probability - Conditional probability - Total probability - Bayes theorem - Random variable - Probability mass function - Probability density functions – Properties - Moments - Moment generating functions and their properties.

**UNIT II - STANDARD DISTRIBUTIONS** **9**

Binomial, Poisson, Geometric, Negative Binomial, Uniform, Exponential, Erlang, Gamma, Weibull and Normal distributions and their properties - Functions of a random variable.

**UNIT III - NUMERICAL SOLUTION OF EQUATIONS** **9**

Solution of equation - Fixed point iteration : x=g(x) method – Newton's method – Regula Falsi method, Solution of linear system by Gaussian elimination and Gauss-Jordon methods – Iterative methods - Gauss-Seidel methods

**UNIT IV - INTERPOLATION AND APPROXIMATION** **9**

Lagrangian Polynomials – Divided differences - Newton's forward and backward difference formulas– Interpolating with a cubic spline.

**UNIT V - NUMERICAL DIFFERENTIATION AND INTEGRATION** **9**

Differentiation using interpolation formulae –Numerical integration by trapezoidal and Simpson's 1/3 and 3/8 rules – Romberg's method – Two and Three point Gaussian quadrature formulas – Double integrals using trapezoidal and Simpson's rules

**L=45 T=15 TOTAL HOURS: 60**

**TEXT BOOKS:**


1. Gerald C.F. and Wheate, P.O. "Applied Numerical Analysis", Edition, Pearson Education Asia, New Delhi.
2. Lipschutz,. S and Schiller. J, "Schaum's outlines - Introduction to Probability and Statistics", McGraw-Hill, New Delhi, 1998.


**REFERENCES:**


1. Walpole, R. E., Myers, R. H. Myers R. S. L. and Ye. K, "Probability and Statistics for Engineers and Scientists", Seventh Edition, Pearsons Education, Delhi , 2002.
2. Gupta, S.C, and Kapur, J.N., "Fundamentals of Mathematical Statistics", Sultan Chand, Ninth Edition , New Delhi ,1996.
3. P. Kandasamy, K. Thilagavathy and K. Gunavathy, 'Numerical Methods', S.Chand Co. Ltd., New Delhi, 2003.

## 11UAK401 THERMAL ENGINEERING

| L | T | P | C |
|---|---|---|---|
| 3 | 1 | 0 | 4 |

**Course Objectives**

- To develop an understanding of various thermal machines used in energy conversion process such as IC engines, Compressors, Turbines, Air conditioning and heat exchangers.

**Course Outcome**

- Analyze air standard cycles applied in prime movers.
- Understand combustion phenomena, working and performance of IC Engines through thermodynamic cycles.
- Analyze power plant and impulse and reaction turbo machines for energy transfer
- Understand the principles and applications of refrigeration systems and analyze air-conditioning processes using the principles of psychrometry.

**UNIT I - GAS POWER CYCLES** **9**

Otto, Diesel, Dual, Brayton, Lenoir, Stirling, Ericson cycles and Air standard efficiencies.

**UNIT II - IC ENGINES** **9**

Classification of IC engines, Combustion phenomenon, timing diagram, ignition and fuel injection system, Tests for prediction of the various performance factors of IC engines.

**UNIT III - STEAM POWER CYCLES AND TURBINES** **9**

Simple Rankine cycle, reheat and Regeneration. Steam flow through nozzles. Steam turbine, impulse and reaction compounding, velocity diagram, reheat factor and governing methods, performance estimation.

**UNIT IV - AIR COMPRESSORS** **9**

Classifications – Reciprocating and Rotary types. Effect of clearance volume, types of coolers – performance characteristics.

**UNIT V - REFRIGERATION AND AIR CONDITIONING** **9**

Fundamentals of refrigeration – COP – Vapour Compression and Vapour Absorption Systems – refrigerants, performance estimation,- types of air conditioning systems – air handling and distribution system, cooling and heating load estimation.

**L: 45 T: 15 TOTAL HOURS: 60**

**TEXT BOOKS:**


1. Mahesh M. Rathore “Thermal Engineering”, Tata McGraw Hill, 2010.
2. R.K.Rajput “Thermal Engineering”, Laxmi Publications, 8th edition, 2010.


**REFERENCES:**


1. Sankar B.K. “Thermal Engineering” Tata McGraw Hill, 2008.
2. Gora C.P. “refrigeration and air conditioning” Tata McGraw Hill, 2008.
3. V.Ganesan “Internal combustion engines” Tata McGraw Hill.

## 11UAK402 MANUFACTURING TECHNOLOGY - I

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course objectives**

- To have a complete understanding about various Manufacturing processes used for converting raw materials into finished products

**Course Outcome**

- Acquire knowledge of metal casting process, sand casting defects and its causes
- Understand arc, gas, solid state and resistance welding processes
- Analyze the effect of process parameters on special forming processes.
- Understand the various polymer processing techniques and its applications

**UNIT I - METAL FORMING** **9**

Elastic and Plastic deformation – Hot and Cold working Processes – rolling – forging – extrusion – wire and tube drawing – Machines and equipment for the processes.

**UNIT II - SHEET METAL WORKING** **9**

Shearing mechanism – blanking – piercing – punching – trimming – Forming Processes – bending – cup drawing – coining – embossing – Presses for sheet metal working – Progressive, compound and combination dies - High energy rate forming processes.

**UNIT III - METAL CASTING** **9**

Patterns – types of patterns – sand casting – green and dry sand casting process – Cores – types of cores – core prints – Gating and Risering system – Special molding processes – Carbon dioxide molding process – Investment casting processes – Die casting processes – Shell molding processes – Full mold processes – Squeeze casting processes. Casting defects – causes and remedies.

**UNIT IV - METAL JOINING** **9**

Welding – classification – Arc welding processes – Gas welding processes – TIG welding – Resistance welding – working principle of spot, seam and projection welding.
Soldering and brazing – methods – fluxes used.

**UNIT V - MANUFACTURING OF PLASTIC COMPONENTS** **9**

Introduction – types of plastics – characteristics of the forming and shaping processes – moulding of thermo plastics – working principles and typical applications of injection moulding – plunger and screw machines – compression moulding, transfer moulding – typical industrial applications – introduction to blow moulding – rotational moulding – film moulding – extrusion – thermo forming – bonding thermo plastics.

**TOTAL HOURS : 45**

**TEXT BOOKS:**


1. Hajra Choudry, " Elements of Workshop Technology", Vol. I , Asia Publishing House, 1992.
2. Rand R.K., Gupta S.C., " Production Technology", Khanna Publishers, 1994.


**REFERENCES:**


1. http://nptel.iitm.ac.in
2. Heine, R.W., Loper, C.R., and Rosenthal, P.C., "Principles of Metal Casting", 2nd Edition, Tata Mc Graw Hill Pub. Co. Ltd., 1997.

## 11UAK403 KINEMATICS OF MACHINERY

| L | T | P | C |
|---|---|---|---|
| 3 | 1 | 0 | 4 |

**Course Objectives**

- To understand the basic concepts of kinematics.
- To understand various mechanisms.
- To understand the concepts of cam, gears and gear trains, and friction applications.

**Course Outcome**

- Define the principles of kinematic pairs, chains and their classification, DOF, inversions of mechanisms
- Evaluate the Position, velocity and acceleration of planar mechanisms
- Construct the cam profile for specified motion profiles
- Discover the various gear tooth terminologies.
- Analyze the effect of friction in various elements

**UNIT 1**

**INTRODUCTION:**

DEFINITIONS: Link or element, kinematic pairs, degrees of freedom, Grubler's criterion (without derivation), Kinematic chain, Mechanism, structure, Mobility of Mechanism, Inversion, Machine.

**KINEMATIC CHAINS AND INVERSIONS**:

Inversions of Four bar chain; Single slider crank chain and Double slider crank chain.

**MECHANISMS:** Quick return motion mechanisms-Drag link mechanism, Whitworth mechanism and Crank and slotted lever Mechanism.Straight line motion mechanisms – Peaucellier's mechanism and Robert's mechanism. Intermittent Motion mechanisms – Geneva mechanism and Ratchet and Pawl mechanism. Toggle mechanism, Pantograph,

**UNIT 1I - VELOCITY AND ACCELERATION ANALYSIS OF MECHANISMS**

Velocity and acceleration analysis of Four Bar mechanism, slider crank mechanism and Simple Mechanisms Relative velocity and acceleration of particles in a common link, relative velocity and accelerations of coincident Particles on separate links-(Graphical Method Only) Coriolis component of acceleration. Angular velocity and angular acceleration of links, velocity of rubbing.

**UNIT-III - KINEMATICS OF CAM**

Classifications – Displacement diagrams – Parabolic , simple harmonic and cycloidal motions – Graphical construction of displacement diagrams and layout of cam profile- circular and tangent cams- Pressure angle and undercutting

**UNIT-IV - GEARS DRIVES**

Gear terminology, law of gearing, Characteristics of involute action, Path of contact, Arc of contact, Contact ratio, Interference in involute gears, Methods of avoiding interference, Back lash

Gear trains – simple, compound, reverted and epicyclic gear trains

**UNIT-V - FRICTION**

Friction :-Dry friction – Friction in screw jack – plate clutches, Belt and rope drives, selection of belt drive- types of belt drives, V-belts, materials used for belt and rope drives, velocity ratio of

belt drives, slip of belt, creep of belt, tensions for flat belt drive, angle of contact, centrifugal tension, maximum tension of belt.

**L: 45 T: 15 TOTAL HOURS: 60**

**TEXT BOOKS:**


1. S.S.Rattan, "Theory of Machines", Tata McGraw Hill Publishing company Ltd., New Delhi, 2007.
2. Dr.R.K.Bansal and Dr.J. S. Brar, "A Text book of Theory of Machines", Laxmi publications, 2011.
3. R S Khurmi and Gupta.J.K, "Theory of Machines", Eurasia Publishing House (Pvt.), 2003


**REFERENCES:**


1. Ambekar A.G., "Mechanisms and Machine Theory", Prentice Hall of India, New Delhi, 2007.
2. Thomas Bevan, "Theory of Machines", CBS Publishers and Distributors, 1984, 3rd Edition.
3. Shigley J.E and Uicker J.J., "Theory of Machines and Mechanisms", McGraw Hill Inc., 3rd Edition 1995.

## 11UAK404 METROLOGY AND TOTAL QUALITY MANAGEMENT

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 1 | 3 |

**Course Objectives**

- To understand the principles of metrology and measurements, methods of measurement and its application in manufacturing industries.
- To understand the basic concepts in TQM and its implementation

**Course Outcome**

- Understand the principle of metrology and measurements
- Identify methods and devices for various geometric features of different parts
- Understand the basic concepts in TQM and its implementation
- Apply various TQM tools and quality system for case studies

**UNIT I - LINEAR AND ANGULAR MEASUREMENT** **11**

Generalized measurement system-units and standards-definition of metrology - concept of interchangeability and selective assembly -Linear measuring instruments: vernier caliper, vernier height gauge, vernier depth gauge, micrometer, slip gauges and classification, limit gauges- types – Taylor's principle of gauge design-Comparators: Mechanical, pneumatic, electrical and electronic types, applications. Angular measurements: -Sine bar, Bevel protractor-types, Autocollimator and Angle Dekkor

**UNIT II - SCREW THREAD, GEAR AND FORM MEASUREMENT** **8**

Measurement of screw threads-terminology-effective diameter- wire methods, thread micrometer, thread gauges- floating carriage micrometer, measurement of gears-terminology - tooth thickness-constant chord method, base tangent method-Parkinson gear testing machine – surface finish measurements, straightness, flatness and roundness measurements.

**UNIT III - LASER AND ADVANCES IN METROLOGY** **8**

Precision instruments based on laser-Principles- laser interferometer-application in linear, angular measurements and machine tool metrology, Coordinate measuring machine (CMM) - constructional features – types, applications – machine vision systems

**UNIT IV - TQM PRINCIPLES** **9**

Basic concepts and principles of TQM, customer satisfaction and perception of quality – Juran trilogy, PSDA cycle, 5S, Kaizen, seven tools of quality

**UNIT V - TQM TOOLS AND QUALITY SYSTEMS** **9**

Statistical fundamentals, process capability, concept of Six sigma, Quality function deployment (QFD), Tauguchi quality loss function, FMEA – stages of FMEA, ISO 9000 and other quality systems

**TOTAL HOURS: 45**

**TEXT BOOKS:**


1. Jain R.K., "Engineering Metrology", Khanna Publishers, 2005
2. Dale H. Besterfield,, et al., "Total Quality Management", Pearson Education, Asia, 1999


**REFERENCES:**


1. Gupta I.C, "Engineering Metrology", Dhanpat rai Publications, 2005
2. Tayal A.K, "Instrumentation and Mechanical Measurements", Galgotia Publications 2000.
3. Bureau of Indian Standards, ISO 9000:2000, Quality management, 2001

**11UBK411 MICROPROCESSOR AND MICROCONTROLLERS**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Objectives**

- To study the architecture and Instruction set of 8085 and 8086
- To develop assembly language programs in 8085 and 8086.
- To design and understand multiprocessor configurations
- To study different peripheral devices and their interfacing to 8085/8086.
- To study the architecture and programming of 8051 microcontroller.

**Course Outcome**

- Be confident in the basics of latest technology of microprocessor and microcontrollers.
- Develop concepts of intelligent systems and implement them using Microcomputer
- Learn to appreciate the theoretical development, reduce intimidation, and grasp the powers of reasoning
- Tackle even more difficult problems with confidence

**UNIT I - INTRODUCTION TO 8085** **9**

Introduction, Architecture, Register structure, Memory Addressing, Addressing modes, Typical programming examples, delay routines, Instruction Timing and Execution, Programming I/O, Interrupt systems.

**UNIT II - INTRODUCTION TO 8086** **9**

Introduction, Architecture, Addressing modes, Instruction sets, Assembler dependent instructions, Assembler pseudo instructions, Programmed I/O, 8089, 8086, Interrupts, DMA, System timings.

**UNIT III - INTRODUCTION TO PERIPHERALS** **9**

Parallel verses serial transmission, synchronous and asynchronous serial data transmission, interfacing to Hex decimal key board, CRT interface, printer interface, floppy disk interface and DMA controller. Interface Standards: RS232 C, RS 422, RS423, serial interfaces, current loops,

**UNIT IV - INTRODUCTION TO MICROCONTROLLER** **9**

PIC 16XXX series processor, Introduction, Architecture, I/O ports, parallel slave port, Timer/ Counters. Applications: ADC, EEPROM based data memory, watch dog timer, Reference voltage module, comparator module, CCP module.

**UNIT V - MICROPROCESSOR BASED SYSTEMS DESIGN, DIGITAL INTERFACING** **9**

Interfacing to alpha numeric displays, interfacing to liquid crystal display (LCD 16 x 2 line), high power Devices and Optical motor shaft encoders, stepper motor interfacing, Analog interfacing and industrial control, microcomputer based smart scale, industrial process control system, Robotics and Embedded control.

**TOTAL HOURS: 45**

**TEXT BOOKS**


1. M.Rafiquzzaman “Micro processors Theory and Applications”, Prentice-Hall of India Private Limited, Third Edition, 2005.
2. T.R. Padmanabhan, “Introduction to Microcontrollers and their Applications”, Narosa Publishing House Private Limited, First Edition, 2007.


**REFERENCES**


1. Ramesh Gaonkar, “Microprocessor Architecture, Programming and Applications with the 8085”, Penram International Publishing (India) Private Limited, Fifth Edition, 2002.
2. Douglas.V.Hall, “Microprocessors and Interfacing”, Tata McGraw Hill Publishing Company Limited, Second Edition, 2006.
3. Han-Way Huang ,”PIC Micro Controller an Introduction to Software and Hardware Interfacing” Thomson Publishers, Third Edition 2005.

## 11UAK405 IC ENGINE LABORATORY

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 3 | 2 |

**Course Objectives**

- Familiarize students with the terminologies associated with Internal Combustion Engines.

**Course Outcome**

- Conduct constant speed and variable speed tests on IC engines and interpret their performance.
- Estimate energy distribution by conducting heat balance test on IC engines.
- Demonstrate and apply the knowledge in areas of thermal sciences with relevance to devices such as engines, pumps, and compressors, etc.
- Interpret and analyse the results obtained during experiments in terms of performance of these thermal engineering devices.

**LIST OF EXPERIMENTS**

1. Study of Internal Combustion engines and various loading devices.
2. Valve Timing and Port Timing diagrams.
3. Performance Test on 4 – stroke Diesel Engine with Mechanical loading.
4. Performance Test on 4 – stroke Diesel Engine with Electrical loading.
5. Performance Test on 4 – stroke Diesel Engine with Hydraulic loading.
6. Heat Balance test on 4 – stroke Diesel Engine with Electrical Loading.
7. Morse Test on Multi-cylinder Petrol Engine with Hydraulic Loading.
8. Retardation Test on a Diesel Engine.
9. Determination of Flash Point and Fire Point-Open cup apparatus.
10. Performance test on two stage air compressor.
11. Performance test on Centrifugal blower.
12. Determination of Viscosity –Red wood Viscometer.
13. Determination of Viscosity –Say Bolt Viscometer.
14. Test on Open circuit wind tunnel.

**TOTAL HOURS: 45**

## 11UFK493 ELECTRICAL ENGINEERING LABORATORY

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 3 | 2 |

**Course Objectives**

- To supplement the theoretical knowledge gained in Electrical Drives and Control.

**Course Outcome**

- Make electrical circuits for testing of electrical machines.
- Carry out testing of electrical machines like motors, generators, starters and transformer for obtaining performance characteristics.

**LIST OF EXPERIMENTS**

1. Load test on DC Shunt & DC Series motor
2. O.C.C & Load characteristics of DC Shunt and DC Series generator
3. Speed control of DC shunt motor
4. Load test on single phase transformer
5. Open circuit and Short circuit Test on a single phase transformer
6. Regulation of an alternator by EMF & MMF methods.
7. V curves and inverted V curves of synchronous Motor
8. Load test on three phase squirrel cage Induction motor
9. Speed control of three phase slip ring Induction Motor
10. Load test on single phase Induction Motor.
11. Study of DC & AC Starters

**TOTAL HOURS: 45**

## 11UBK419 MICROPROCESSOR LABORATORY

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 3 | 2 |

**Course Obectives**

- To perform simple arithmetic operations using assembly language program.
- To write an assembly language program using the control instructions.
- To write an assembly language program to convert Analog input to Digital output and Digital input to Analog output.
- To demonstrate use of control logic instructors and the access of parallel port.
- To study various digital & linear integrated circuits used in simple system configuration.
- To test of ICs by using verification of truth table of basic ICs.
- Minimization of functions using K-map implementation and combination Circuit.
- Realizing code conversion of numbers of different bar.
- Design and implementation of 4 bit modulo counters, shift register and Op-Amp application.
- Realization of circuit for digital conversions.
- Demonstration of circuit for communication application

**Course Outcome**

- Able to understand the working of 8085.
- Will enhance students programming skills.
- Gain knowledge on peripheral interfacing with 8085 microprocessor.

**LIST OF EXPERIMENTS**

1. Simple arithmetic operations: Multi precision addition / subtraction / multiplication/ division.
2. Programming with control instructions: Increment / Decrement, Ascending /Descending order, Maximum / Minimum of numbers, rotate instructions, Hex /ASCII / BCD code conversions.

3. Interface Experiments:
   A/D Interfacing.

   D/A Interfacing.
   Traffic light controller
   Stepper motor

4. Interface Experiments:
   Simple experiments using 8251, 8279, 8254, 8255, 8253.

**TOTAL HOURS: 45**

**REFERENCE**

1. R.S. Gaonkar, 'Microprocessor Architecture Programming and Applications', Wiley Eastern Ltd., New Delhi, 1995.

## 11UAK501 AUTOMOBILE ENGINEERING

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Objectives**

- To impart knowledge at an advanced level in automobile engineering field.

**Course Outcome**

- Recall various IC engine terminologies and their systems
- Understand the transmission and control systems of a vehicle and demonstrate the case model.
- Study of autotronics systems in a modern vehicle
- Understand the emission control techniques and alternate fuel

**CHASSIS AND IC ENGINES** **10**

Introduction: Types of chassis layout with reference to power plant locations and drive. Vehicle frames, various types – Vehicle body terminology.

Introduction and classification of engine -Basic engine components, functions, materials and constructions.

Layout of petrol fuel feed system - Types of fuel feed system- simple carburetor- Petrol injection system –MPFI - Trouble shooting.

Layout of diesel fuel feed system-single and double acting fuel feed pump- Diesel injection system – CRDI - Trouble shooting.

**TRANSMISSION LINES AND AXLES** **10**

**Power train:** Clutch types, Single plate, Multi plate, Semi Centrifugal, Centrifugal, Fluid coupling - Gear box types, Sliding mesh, constant mesh, synchronize, epicyclic - over drive- transfer case - gear changing mechanism - Trouble shooting.

**Drive Line:** Universal joints and Propeller shaft types - Effect of driving thrust and torque reactions, Hotch Kiss drive, torque tube drive and radius rods.

**Final Drive Differential:** Types of final drive - Differential unit - Trouble shooting.

**Front and Rear axle:** Types of front and rear axle - Constructions details.

**VEHICLE CONTROL SYSTEMS** **10**

**Steering System:** Steering system, Ackermann principle of steering, steering linkages - Wheel geometry - Steering gears types - Power steering types- Trouble shooting.

**Suspension system**: Types of springs - leaf, coil and Torsion bar - Telescopic type suspension- Air suspension- Trouble shooting.

**Brake system**: braking system types, mechanical brake, hydraulic brake, wheel cylinder, master cylinder, tandem master cylinder, disc brake, air brake -Antilock brake system- Trouble shooting.

**Wheels and Tyres:** Types of wheels - Types of Tyres, tubes – Construction – tyre rotation.

**AUTOTRONICS** **8**

**Electrical systems in Automobile:** Starting system circuit, starter drive mechanism - charging system circuit, battery, generator, regulator, alternator- working principle only- Ignition system circuits, types - Lighting system circuits and other accessories.

**Electronics systems in Automobile:** Electronic engine management system – Electronic stability control - Electronically controlled suspension - Electronically controlled braking system - Security and warning system -Vehicle motion control.

**EMISSION CONTROL AND ALTERNATE FUELS** **7**

**Emission control techniques:** SI and CI Engine emission and its control – evaporative emission, crankcase blow by, exhaust emission – supercharger and turbo charger.

**Alternate fuels:** Alternate fuels for petrol and diesel engines – natural gas – LPG – gasohol-biodiesel – hydrogen fuels- electricity as fuel- hybrid- fuel cells.

**TOTAL HOURS: 45**

**MINI PROJECT, PRACTICAL AND CASE STUDY (for internal assessment only)**

**Mini project:** Automotive Components fabrication (or) Design and fabrication of any one sub system of a vehicle.

**Note:-** usage of SAE INDIA Latest BAJA, SUPRA and Effi- Cycle event rule book.

**Practical:** Dismantling, overhauling and assembling of engine and transmission components.

**Case study:** Different types of vehicle technical specifications – modern mechanism working principle.

**MANUFACTURING, SERVICE AND MAINTENANCE OF AUTOMOBILE COMPONENTS (content beyond the syllabus)**

Vehicle components manufacturing methods and steps - Servicing and maintenance procedure for different types of vehicle.

**TEXT BOOKS**


1. Anil chhikara, "Automobile engineering Vol-1 &2" Tech India Publications, New Delhi, 2006.
2. Kirpal Singh, “Automobile Engineering”, Vol. 1&2, Standard Publishers, Delhi.


**REFERENCES**


1. Srinivasan. S, “Automobile Mechanics”, 2nd edition, TATA McGraw Hill, 2003.
2. Crouse and Anglin, “Automotive Mechanics”, 9th Edition, Tata McGraw Hill, 2003.
3. Julian Happian-Smith “ Introduction to Modern Vehicle Design” , Publisher: Society of Automotive Engineers Inc.2002.

## 11UAK502 DESIGN OF MACHINE ELEMENTS

| L | T | P | C |
|---|---|---|---|
| 3 | 1 | 0 | 4 |

**Course Objectives**

- To familiarize the various steps involved in the Design Process.
- To understand the principles involved in evaluating the shape and dimensions of a component to satisfy functional and strength requirements.
- To encourage the usage of standard practices and standard data.

**Course Outcome**

- Interpret the concept of principal stress, theories of failure and fatigue load.
- Design shafts, keys and couplings for the power transmission and choose the bearing for given scenario
- Design joints including riveted, bolted and welded joints for the fabrication process.
- Design the flywheel and spring for energy storage.

**STEADY STRESSES AND VARIABLE STRESSES IN MACHINE MEMBERS** **9**

Introduction to the design process - factor influencing machine design, selection of materials based on mechanical properties – Direct, bending and torsional stress equations – Impact and shock loading – calculation of principle stresses for various load combinations, eccentric loading – Design of curved beams – crane hook and 'C' frame - Factor of safety - theories of failure – stress concentration – design for variable loading – Soderberg, Goodman and Gerber relations.

**DESIGN OF SHAFTS, KEYWAYS AND COUPLINGS** **9**

Design of solid and hollow shafts based on strength, rigidity and critical speed – Design of keys and key ways - Design of rigid and flexible couplings.

**DESIGN OF FASTNERS, JOINTS AND LEVERS** **9**

Threaded fasteners - Design of bolted joints including eccentric loading, Knuckle joints, Design of welded joints - theory of bonded joints. Design of levers

**DESIGN OF SPRINGS AND FLYWHEELS** **9**

Design of helical, leaf and torsional springs under constant and variable loads - Design of flywheels considering stresses in rims and arms for engines and punching machines.

**SELECTION AND DESIGN OF BEARINGS** **9**

Selection of bearings – sliding contact and rolling contact types. – Cubic mean load – Design of journal bearings – Sommerfeld number and Mckees equation –calculation of bearing dimensions.

**L=45 T=15 TOTAL HOURS : 60**

**Note:** Use of PSG Design Data Book is permitted in the examination.

**TEXT BOOKS:**


1. Shigley J.E and Mischke C. R., "Mechanical Engineering Design", Sixth Edition, Tata McGraw-Hill , 2003.
2. Bhandari V.B, "Design of Machine Elements", Second Edition, Tata McGraw-Hill Book Co, 2007.


**REFERENCES:**


1. R.S.Khurmi and J.K.GUPTA " A Text Book of Machine Design", S.Chand Publications, 2005.
2. Orthwein W, "Machine Component Design", Jaico Publishing Co, 2003.
3. Spotts M.F., Shoup T.E "Design and Machine Elements" Pearson Education, 2004.

## 11UAK503 DYNAMICS OF MACHINERY

| L | T | P | C |
|---|---|---|---|
| 3 | 1 | 0 | 4 |

**Course Objectives**

- To understand the methods of statics and dynamic force analysis
- To understand the balancing of rotating and reciprocating masses
- To understand the basics of vibrating systems
- To understand the automatic control of mechanisms used for governing of mechanical systems in various applications through transfer function

**Course Outcome**

- Characterize and Design Flywheels.
- Solve and analyze the balancing problems in rotating and reciprocating masses.
- Analyze and Design of Centrifugal Governor and Brakes.
- Determine the Gyroscopic Effects in ships and Automobiles.
- Understand Free and Torsional vibrations of single degree freedom systems.

**FORCE ANALYSIS** **9**

Rigid body dynamics in general plane motion, equation of motion, Inertia force and torque, D'Alembert's principle, Dynamic force analysis in reciprocating engines, turning moment diagrams – Size of Flywheels in engines and punch press.

**BALANCING** **9**

Static and dynamic balancing, balancing of rotating masses – single and two plane balancing, balancing machines, balancing of reciprocating masses, partial balancing and its effects in locomotive engines, balancing of radial engines using direct and reverse crank concept.

**MECHANISMS FOR CONTROLS** **9**

Automatic control – Block diagrams, first and second order system response and transfer function of Watt, Porter, Proell and Hartnell governors, characteristics, controlling force (self study).

Gyroscopic couple - Gyroscopic stabilization - Gyroscopic effects in ships and automobiles

**BRAKES AND DYNAMOMETERS** **9**

Types of brakes – Block, band, band and block brakes

Types of dynamometers, prony brake, rope brake and belt transmission dynamometers

**VIBRATION** **9**

Basic features of vibratory systems – idealized models – single degree of freedom – Free longitudinal vibration, Transverse vibrations of beams with concentrated and distributed loads - Dunkerly's and Raleigh's methods. Critical speeds of shafts, torsional vibrations - two and three rotor systems. Forced damped vibration due to harmonic excitation and Vibration Isolation & Transmissibility (theory only). Vibration measurement. Signature analysis (self study - Not for examination)

**L = 45 T = 15 TOTAL HOURS: 60**

**TEXT BOOKS**


1. S.S. Rattan., Theory of Machines (Third edition), Tata McGraw Hill Education Private Limited , New Delhi, 2009.
2. Sadhu Singh "Theory of Machines" Pearson Education, 2002.


**REFERENCES**


1. R. S. Khurmi, "Theory of Machines", S. Chand & Company Ltd.
2. Ghosh A. and Mallick A.K., "Theory of Mechanisms and Machines", Affiliated East- West Press Pvt. Ltd., New Delhi, 1988.
3. Shigley J.E. and Uicker J.J., "Theory of Machines and Mechanisms", McGraw-Hill, Inc., 1995.

## 11UAK504 INDUSTRIAL AUTOMATION

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course objective:**

- To understand the concept of sensors, controllers and pneumatic systems.

**Course Outcome**

- Understand the fundamentals of automation
- Identify the symbols of hydraulic and pneumatic components
- Design a pneumatic circuit by using CASCADE and KV method
- Develop PLC programs for a given task
- Apply different valves for various application

**INTRODUCTION TO AUTOMATION** **9**

Historical perspective of industrial automation- Origin- Evolution, Current and Future trends- Components of industrial automation systems and their functionalities, soft and hard automation- Low cost automation. Principle of material handling system, conveyors – Types, AS/RS, AGV's, Robots in assembly automation, FMS.

**ELEMENTS OF HYDRAULIC AND PNEUMATIC SYSTEMS** **9**

Pneumatic Vs Hydraulics- Compressors- Types- Symbols of elements- Cylinders- types- Valves- Pressure control – Pressure relief, Compound relief valve. Flow control – Needle, Gate and Globe valve. Direction control valve- 3/2, 4/2 and 4/3. Unloading valve, sequence valve, counter balance valve, pressure reducing valve with application circuit. Filter- Regulator- Lubricator- Accumulator- Intensifier- Electrical control solenoid valves- Relays.

**DESIGN OF HYDRAULIC AND PNEUMATIC SYSTEMS** **9**

Pumping theory – Pump classification – Gear pump, Vane Pump, piston pump, construction and working of pumps. Circuit design- General approach- Travel step diagram- Cascade method- KV map method- Modern safety concept in pneumatic automation.

**INDUSTRIAL AUTOMATION CONTROL** **9**

Programmable Logic Controllers- Evolution- Architecture- Scanning principle- I/O modules- ladder diagram- arithmetic instructions- comparison instructions- Programming the PLC for simple application-Servo valves, proportional valves, time delay valve, quick exhaust valve.

**CIRCUITS AND APPLICATIONS** **9**

Synchronizing circuits – Tie cylinders, series piping, and matching pumps. Automatic cylinder reciprocating circuit both hydraulic and pneumatic system, two hand safety circuit, speed control circuits, Pneumo hydraulic circuit. Shuttle Valve with application circuit (OR & AND logic)

**TOTAL HOURS: 45**

**TEXT BOOKS:**


1. Anthony Espisito, "Fluid Power with Application", Pearson Education Private Limited, Fifth Edition, First Indian Reprint, 2003.
2. R.Srinivasan, "Hydraulic and Pneumatic Controls", Vijay Nicole Publication, 2004.
3. Petruzella, "Programmable Logic Controllers", Tata Mc Graw Hill Publication,2010.


**REFERENCES:**


1. Khushdeep Goyal and Deepak Bhandari "Industrial automation and Robotics", S.K.Kataria & sons publication, 2011.
2. Jon Steneroson, "Fundamentals of Programmable Logic Controllers, Sensors and Communication" ,Prentice Hall, 2004
3. Dick Caro, "Automation Network Selection- The instrumentation Systems and Automation Society", 2004.

## 11UAK505 MANUFACTURING TECHNOLOGY – II

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Objectives:**

- To understand the working principle of machine tools such as lathe, shaper, milling machines, drilling machines, grinding machines
- To understand the basic concepts of computer numerical control (CNC) machine tool and CNC programming.

**Course Outcome**

- List the different manufacturing processes available
- Select a machining process for a particular application.
- Understand the working principle of various machine and cutting tool
- Understand the basic concept of CNC part programming

**THEORY OF METAL CUTTING** **9**

Introduction: material removal processes, types of machine tools – theory of metal cutting: chip formation, orthogonal cutting, cutting tool materials, tool wear, tool life, surface finish, cutting fluids.

**CENTRE LATHE AND SPECIAL PURPOSE LATHES** **9**

Centre lathe, constructional features, cutting tool geometry, various operations, taper turning methods, thread cutting methods, special attachments, machining time and power estimation. Capstan and turret lathes – automats – single spindle, Swiss type, automatic screw type, multi spindle - Turret Indexing mechanism, Bar feed mechanism.

**GENERAL PURPOSE MACHINE TOOLS** **9**

Reciprocating machine tools: shaper, planer, slotter - milling: types, milling cutters, operations - hole making: drilling - quill mechanism, reaming, boring, tapping - broaching machines: broach construction – push, pull surface and continuous broaching machines.

**ABRASIVE PROCESSES AND GEAR CUTTING** **9**

Abrasive processes: grinding wheel – specifications and selection, types of grinding process – cylindrical grinding, surface grinding, centre-less grinding – honing, lapping, super finishing, polishing and buffing, abrasive jet machining - Gear cutting, forming, generation, shaping, hobbing.

**CNC MACHINE TOOLS AND PART PROGRAMMING** **9**

Numerical control (NC) machine tools – CNC: types, constructional details, special features – design considerations of CNC machines for improving machining accuracy – structural members – slide ways –linear bearings – ball screws – spindle drives and feed drives. Part programming fundamentals – manual programming – computer assisted part programming.

**TOTAL HOURS: 45**

**TEXT BOOKS**


1. Hajra Choudry, "Elements of Work Shop Technology – Vol. II", Media Promoters. 2002
2. HMT – "Production Technology", Tata McGraw-Hill, 1998.


**REFERENCES**


1. Rao, P.N. "Manufacturing Technology", Metal Cutting and Machine Tools, Tata McGraw–Hill, New Delhi, 2003.
2. P.C. Sharma, "A Text Book of Production Engineering", S. Chand and Co. Ltd, IV edition, 1993.
3. Shrawat N.S. and Narang J.S, 'CNC Machines', Dhanpat Rai & Co., 2002.

## 11UAK506 GAS DYNAMICS AND JET PROPULSION

| L | T | P | C |
|---|---|---|---|
| 3 | 1 | 0 | 4 |

**Course Objectives**

- To understand the basic difference between incompressible and compressible flow
- To study the phenomenon of shock waves and its effect on flow
- To gain basic knowledge about jet propulsion

**Course Outcome**

- Understand the behaviour of compressible fluid flow.
- Analysis the properties of fluid when the fluid flow through variable area ducts such as nozzles and diffusers
- Assess the flow in constant area with friction and heat transfer.
- Evaluate the variation in fluid flow parameters with the occurrence of Shocks and understand the concept of propulsion and working principle of jet engines.

**COMPRESSIBLE FLOW – FUNDAMENTALS** **8**

Energy and momentum equations for compressible fluid flows, various regions of flows, reference velocities, stagnation state, velocity of sound, critical states, mach number, critical Mach number, types of waves, Mach cone, Mach angle, effect of Mach number on compressibility.

**FLOW THROUGH VARIABLE AREA DUCTS** **9**

Isentropic flow through variable area ducts, T-s, h-s diagrams for nozzle and diffuser flows, area ratio as a function of Mach number, mass flow rate through nozzles and diffusers, effect of friction in flow through nozzles.

**FANNO AND RAYLEIGH FLOW** **10**

Flow in constant area ducts with friction (Fanno flow) - Fanno curves and Fanno flow equation, variation of flow properties, variation of Mach number with duct length. Isothermal flow with friction in constant area ducts

Flow in constant area ducts with heat transfer (Rayleigh flow), Rayleigh line and Rayleigh flow equation, variation of flow properties, maximum heat transfer, normal shock in Fanno and Rayleigh flows.

**NORMAL SHOCK** **8**

Governing equations, variation of flow parameters like static pressure, static temperature, density, stagnation pressure and entropy across the normal shock, Prandtl-Meyer equation, impossibility of shock in subsonic flows, flow in convergent and divergent nozzle with shock, flows with oblique shock (elementary treatment only).

**PROPULSION** **10**

Aircraft propulsion- types of jet engines-energy flow through jet engines, study of turbojet engine components-diffuser, compressor, combustion chamber, turbine and exhaust systems, performance of turbo jet engines-thrust, thrust power, propulsive and overall efficiencies, thrust augmentation in turbo jet engines, ram jet and pulse jet engines.

**L=45 T=15 TOTAL HOURS: 60**

**TEXT BOOKS**


1. Yahya.S.M., 'Fundamentals of Compressible flow" , New Age International (P) Ltd., New Delhi, 1996.
2. Balachandran.P, "Fundamentals of Compressible fluid dynamics", Prentice – Hall of India (P) Ltd., New Delhi, 2007.


**REFERENCES**


1. Patrich.H.Oosthvizen, Willam E.Carscallen, "Compressible fluid flow", McGraw-Hill, 1997.
2. Ganesan .V., "Gas Turbines", Tata McGraw-Hill, New Delhi,1999
3. Rathakrishnan.E, " Gas Dynamics" , Prentice Hall of India, New Delhi, 2001

## 11UAK507 PNEUMATICS AND HYDRAULICS LAB

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 3 | 2 |

**Course Objectives**

- To supplement the principles learnt in hydraulics and pneumatics.
- To understand how certain measuring devices are used for different pneumatic and hydraulic systems.

**Course Outcome**

- Identify the symbol of hydraulic and pneumatic components
- Simulate hydraulic and pneumatic circuits using Automation studio and Fluidsim software
- Actuate hydraulic and pneumatic circuits using real components
- Design different pneumatic circuits using sequence, cascade and KV map method
- Understand and Develop PLC programs for a given task

**LIST OF EXPERIMENTS**

1. Design and testing of hydraulic circuits using FluidSim and Automation Studio Software.
   - i) Pressure control
   - ii) Flow control
   - iii) Direction control
   - iv) Design of circuit with programmed logic sequence, using an optional PLC in hydraulic Electro hydraulic Trainer.

2. Design and testing of pneumatic circuits using FluidSim and Automation Studio Software.
   - i) Pressure control
   - ii) Flow control
   - iii) Direction control
   - iv) Circuits with logic controls
   - v) Circuits with timers
   - vi) Circuits with multiple cylinder sequences in Pneumatic Electro pneumatic Trainer.

3. Modeling and analysis of basic electrical, hydraulic, and pneumatic systems using LABVIEW software.
4. Circuits with multiple cylinder sequences in Electro pneumatic using PLC.

**TOTAL HOURS: 45**

## 11UAK508 DYNAMICS LABORATORY

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 3 | 2 |

**Course Objectives**

- To supplement the principles learnt in Dynamics of Machinery.
- To understand how certain measuring devices are used for dynamic testing.

**Course Outcome**

- Understanding the method of balancing masses.
- Classify and compare the types and applications of governor.
- Demonstrate the critical speed of the shaft.
- Calculate Mass Moment of Inertia of Flywheel and Connecting Rod
- Estimate the natural frequency of a system.

**LIST OF EXPERIMENTS**

1. Governors – Study of the characteristics for Watt and Porter governors
2. Governors – Study of the characteristics for Proell and Hartnell governors
3. Motorised Gyroscope - Determination the mass moment of inertia of the disc
4. Whirling of shaft - Determination of critical speed of shafts.
5. Balancing of reciprocating masses.
6. Balancing of rotating masses.
7. Determination the moment of inertia of connecting rod and flywheel using compound pendulum
8. Determination of transverse frequency of beam
9. Determination of transmissibility ratio using vibrating table.
10. Vibrating system – determination of natural frequency torsional vibration of single rotor system and natural frequency of given spring mass system in free longitudinal vibrations
11. Vibrating system – determination of natural frequency of undamped equivalent spring mass system
12. Vibrating system - damping coefficient of the damped torsional vibrations

**TOTAL HOURS: 45**

## 11UAK509 MANUFACTURING TECHNOLOGY LAB

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 3 | 2 |

**Course Objectives**

- To provide hands-on experience to the students on various manufacturing processes using general and special purpose machines.

**Course Outcome**

- Outline theory of metal cutting and working principles of machine tools
- Identify manufacturing components, surface finishing processes and gear manufacturing
- Interpret the economics of machining

**PART A: BASIC MACHINING AND MANUFACTURING PRACTICES**

**LATHE**

1.1. Facing, plain turning, step turning and taper turning
1.2. Thread cutting and knurling

**WELDING EXCERCISES**

2.1. Gas Welding

**PREPARATION OF SAND MOULD**

3.1. Mould with solid / split patterns

**PART B: GENERAL PURPOSE MACHINES AND STUDY EXERCISES**

**MACHINING**

4.1 Slot milling using milling machine
4.2 Drilling, reaming and tapping using radial/pillar drilling machine
4.3 Surface grinding
4.4 Keyway cutting using slotter
4.5 Dovetail (external/internal) cutting using shaper

**STUDY EXERCISES**

5.1 Demonstration of Injection Moulding Machine
5.2 Demonstration of gear cutting using gear hobbing machine
5.3 Study of Planer Machine

**TOTAL HOURS: 45**

## 11UAK601 CAD/CAM/CIM

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Objectives**

- To impart knowledge at an advanced level in CAD/CAM/CIM.

**Course Outcome**

- Understand geometric transformation techniques in CAD
- Model engineering components using solid modeling techniques
- Develop CNC programs to manufacture industrial components
- Illustrate the elements of an automated manufacturing environment

**COMPUTER AIDED DESIGN AND GEOMETRIC MODELING** **9**

Introduction – CAD definition – design process – CAD activities – benefits and scope of CAD.
**Geometric modeling techniques:** wire frame, surface, solid modeling – Introduction to finite element methods – procedure of finite element analysis (brief description only).

**CNC MACHINE TOOLS AND COMPONENTS** **9**

Numerical control – development of NC – DNC – CNC and adaptive control systems –– distinguishing features of turning and machining center – design considerations of NC machine tools.CNC EDM machine – Coordinate measuring machines: construction, working principles and specifications – maintenance of CNC machines.
Structure, drive kinematics, gear box, main drive, feed drive, selection of timing belts and pulleys, spindle bearing arrangement and installation. Recirculating ball screw, linear motion guide ways, tool magazines, ATC, APC, chip conveyors, tool turrets.

**CNC CONTROL SYSTEM AND PART PROGRAMMING** **9**

Pneumatic and hydraulic control system. Open loop and closed loop control system, microprocessor based CNC system, description of hardware and software interpolation system, feedback devices: encoders – linear and rotary transducers – in-process probing.
NC dimensioning – reference points – machine zero, work zero, tool zero and tool offsets, compensation. Coordinate system – types of motion control: point-to-point, paraxial and contouring – Types of NC part programming – G and M codes - turning and milling part programming examples - interpolation – macro – subroutines – canned cycles – mirror images.

**INTEGRATION OF CAD/CAM ORGANIZATION** **9**

Sequential Engineering – Concurrent Engineering - Product Development Cycle - Process planning – structure of a typical CAPP – types of CAPP : variant type, generative type - aggregate production planning – Master Production Schedule (MPS) – capacity planning – Materials Requirement Planning (MRP I) – Enterprises resources planning(ERP) –Manufacturing Resources Planning (MRP II) – just in time manufacturing philosophy

**CONCEPTS OF CIM** **9**

Evolution of CAD/CAM and CIM - Integration of CNC machines in CIM environment, Introduction to FMS, RMS, AS/RS, AGV, Robotic systems- Group Technology- method of developing part family, classification and coding (OPITZ & MICLASS) - fundamentals of networking, networking concepts, devices-CIM implementation.

**TOTAL HOURS: 45**

**MINI PROJECT (for internal assessment only)**

**Mini project:** Design / manufacturing / fabrication of any one sub system of a mechanical elements / parts by using CAD/CAM/CIM approach.

**TEXT BOOKS**

1. Mikell P. Groover, Automation, Production Systems, and Computer-Integrated Manufacturing, 2nd Edition, Reprint 2002, Pearson Education Asia.
2. P.Radhakrishnan, S.Subramanyam and V.Raju, CAD/CAM/CIM, New Age International, 3rd. 2008.

**REFERENCES**

1. P.N.Rao, CAD/CAM Principles and Applications, 2002, Tata Mc Graw Hill Publishing Company Ltd.
2. Ibrahim Zeid, Mastering CAD/CAM, Special Indian Edition 2007, Tata McGraw-Hill Publishing Company Ltd., New Delhi.
3. Yoram Koren, Computer control of manufacturing systems, International Edition 1983, McGraw Hill Book Co.

## 11UAK602 DESIGN OF TRANSMISSION SYSTEMS

| L | T | P | C |
|---|---|---|---|
| 3 | 1 | 0 | 4 |

**Course Objectives**

- To gain knowledge on the principles and procedure for the design of power transmission components.
- To learn to use standard data and catalogues.

**Course Outcome**

- Interpret the basic design concepts of transmission system.
- Select standard data's from design data book and manufactures catalog.
- Estimate the stresses in the transmission elements.
- Apply the standard design procedure and design transmission element

**DESIGN OF TRANSMISSION SYSTEMS FOR FLEXIBLE ELEMENTS** **9**

Design of V belts and pulleys – Design of flat belts and pulleys – Design of timing belts (self study) - Design of transmission chains and sprockets.

**SPUR GEARS AND PARALLEL AXIS HELICAL GEARS** **9**

Gear Terminology-Speed ratios and number of teeth-Force analysis in spur gears -Tooth stresses - Dynamic effects - Fatigue strength - Factor of safety - Gear materials – Module and face width-Power rating calculations based on strength and wear considerations - Parallel axis helical gears – Pressure angle in the normal and transverse plane- Equivalent number of teeth-forces and stresses. Estimating the size of the helical gears.

**BEVEL AND WORM GEARS** **9**

Straight bevel gear: Tooth terminology, tooth forces and stresses, equivalent number of teeth. Estimating the dimensions of pair of straight bevel gears. Worm Gear: Merits and demerits-terminology. Thermal capacity, materials-forces and stresses, efficiency, estimating the size of the worm gear pair.

**DESIGN OF GEAR BOXES** **9**

Geometric progression - Standard step ratio - Ray diagram, kinematics layout -Design of sliding mesh gear box -Constant mesh gear box – Synchromesh gear box (self study) - Design of multi speed gear box.

**DESIGN OF POWER SCREWS, CLUTCHES AND BRAKES** **9**

Power screws: Types of threads-Applications-Design of screw jacks, Design of Clutches: Plate clutches–Axial clutches-Cone clutches, Internal expanding rim clutches. Brakes: Design of internal and external shoe brakes, Band brakes, Disc brakes (self study).

**L=45 T=15 TOTAL HOURS : 60**

**Mini Project**: Design and fabrication of a simple transmission system

**Note**:

1. Self study topics are not for examination
2. Usage of P.S.G Design Data Book is permitted in the University examination.

**TEXT BOOKS**


1. Shigley J.E and Mischke C. R., "Mechanical Engineering Design", Sixth Edition, Tata McGraw-Hill , 2003.
2. Prabhu. T.J., "Design of Transmission Elements", Mani Offset, Chennai, 2000.


**REFERENCES**


1. Bhandari, V.B., "Design of Machine Elements", Tata McGraw-Hill Publishing Company Ltd., 1994.
2. Hamrock B.J., Jacobson B., Schmid S.R., "Fundamentals of Machine Elements", McGraw-Hill Book Co., 1999.

## 11UAK603 HEAT & MASS TRANSFER

| L | T | P | C |
|---|---|---|---|
| 3 | 1 | 0 | 4 |

**Course Objectives**

- To understand the theoretical and analytical concepts underlying the modes of heat transfer
- To understand the concepts underlying the types of mass transfer

**Course Outcomes:**

- Classify the mode of heat transfer and analyse the composite wall, cylinder, spheres, fins by conduction.
- Apply the concepts of forced convection and free convection analyse the problem over plates and cylinders.
- Analyse the problems in boiling, condensation and heat exchangers.
- Analyse the radiation shield for heat transfer and understand the concepts of mass transfer.

**CONDUCTION** **9**

Basic Concepts – Mechanism of Heat Transfer – Conduction, Convection and Radiation – Fourier Law of Conduction - General Differential equation of Heat Conduction –– Cartesian and Cylindrical Coordinates – One Dimensional Steady State Heat Conduction – Conduction through Plane Wall, Cylinders and Spherical systems – Composite Systems – Conduction with Internal Heat Generation – Extended Surfaces – Unsteady Heat Conduction – Lumped Analysis – Use of Heislers Chart.

**CONVECTION** **9**

Basic Concepts –Heat Transfer Coefficients – Boundary Layer Concept – Types of Convection – Forced Convection – Dimensional Analysis – External Flow – Flow over Plates, Cylinders and Spheres – Internal Flow – Laminar and Turbulent Flow – Combined Laminar and Turbulent – Flow over Bank of tubes – Free Convection – Dimensional Analysis – Flow over Vertical Plate, Horizontal Plate, Inclined Plate, Cylinders and Spheres.

**PHASE CHANGE HEAT TRANSFER AND HEAT EXCHANGERS** **9**

Nusselts theory of condensation-pool boiling, flow boiling, correlations in boiling and Condensation. Types of Heat Exchangers – Heat Exchanger Analysis – LMTD Method and NTU - Effectiveness – Overall Heat Transfer Coefficient – Fouling Factors.

**RADIATION** **9**

Basic Concepts, Laws of Radiation – Stefan Boltzman Law, Kirchoffs Law –Black Body Radiation –Grey body radiation -Shape Factor Algebra – Electrical Analogy – Radiation Shields – Introduction to Gas Radiation.

**MASS TRANSFER** **9**

Basic Concepts – Diffusion Mass Transfer – Fick's Law of Diffusion – Steady state Molecular Diffusion – Convective Mass Transfer – Momentum, Heat and Mass Transfer Analogy – Convective Mass Transfer Correlations.

**L=45 T=15 TOTAL HOURS : 60**

**TEXT BOOKS:**

1. Sachdeva R C, "Fundamentals of Engineering Heat and Mass Transfer" New Age International, 1995.
2. Frank P. Incropera and David P. DeWitt, "Fundamentals of Heat and Mass Transfer", John Wiley and Sons, 1998.

**REFERENCES:**

1. Nag P.K, " Heat Transfer", Tata McGraw-Hill, New Delhi, 2002
2. Holman J.P "Heat and Mass Transfer" Tata McGraw-Hill, 2000.
3. Kothandaraman C.P "Fundamentals of Heat and Mass Transfer" New Age International, New Delhi, 1998

## 11UAK604 FINITE ELEMENT ANALYSIS

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Objectives**

- To expose the core concepts of FEA and apply them for solving 1D and 2D problems

**Course Outcome**

- Recall the historical background behind analyzing various elements and to tell about various techniques involved in FEM.
- Differentiate and solve problems in bars, beams and truss elements.
- Classify and formulate elemental equations in two dimensional problems.
- Classify and analyze scalar and vector variable problems.
- Formulate and measure the values of elemental matrices in two dimensional problems.

**INTRODUCTION** **9**

Historical background – Relevance of FEA to design problems, Application to the continuum – Discretisation – Matrix approach, Matrix algebra – Gaussian elimination – Governing equations for continuum – Classical Techniques in FEM – Weighted residual method – Ritz method, Galerkin method.

**ONE DIMENSIONAL PROBLEM** **9**

Finite element modeling – Coordinates and shape functions – Potential energy approach– Element matrices and vectors – Assembly for global equations – Boundary conditions – Higher order elements - Shapes functions – Applications to axial loadings of rods – Extension to plane trusses – Bending of beams – Finite element formulation of stiffness matrix and load vectors – Assembly to Global equations –boundary conditions – Solutions and Post processing – Example Problems - Solution of heat transfer problems using 2 noded 1D bar elements.

**TWO DIMENSIONAL PROBLEMS – SCALAR VARIABLE PROBLEMS** **9**

Finite element modeling – CST element – Element equations, Load vectors and boundary conditions – Assembly – Application to heat transfer using 3noded triangular elements – Examples.

**TWO DIMENSIONAL PROBLEMS – VECTOR VARIABLE PROBLEMS** **9**

Vector Variable problems – Elasticity equations – Plane Stress, Plane Strain and Axisymmetric problems – Formulation – element matrices – Assembly – boundary conditions and solutions Examples.

**ISOPARAMETRIC ELEMENTS FOR TWO DIMENSIONAL PROBLEMS** **9**

Natural coordinates, Iso parametric elements, Four node quadrilateral element– Shape functions – Element stiffness matrix and force vector – Numerical integration – Stiffness integration – Displacement and Stress calculations – Examples.

Self Study Topic: Basics of CFD and applications

**TOTAL HOURS: 45**

**TEXT BOOKS**


1. Chandrupatla T.R., and Belegundu A.D., “Introduction to Finite Elements in Engineering”, Pearson Education 2002, 3rd Edition.
2. Logan D.L., “A First course in the Finite Element Method”, Third Edition, Thomson Learning, 2002.


**REFERENCES**


1. Rao S.S., “The Finite Element Method in Engineering”, Pergammon Press, 1989.
2. David V Hutton “Fundamentals of Finite Element Analysis”2004. McGraw-Hill Int. Ed.
3. Reddy J.N., “An Introduction to Finite Element Method”, McGraw-Hill International Student Edition, 1985.

## 11UAK605 INDUSTRIAL ENGINEERING AND OPERATIONS RESEARCH

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Objectives**

- To create awareness about basic Industrial Engineering concepts.
- To understand and apply operations research techniques to industrial operations.

**Course Outcome**

- Understand the concepts/types of organization, plant layout and materials handling system.
- Formulate and solve engineering and managerial situations as LPP.
- Formulate and solve engineering and managerial situations as Transportation and Network problems.
- Solve engineering and managerial situations as Replacement and machine sequencing problems.
- Solve engineering and managerial situations as Inventory and Queuing models.

**ORGANIZATIONAL PRODUCTIVITY, PLANT LAYOUT AND MATERIALS HANDLING 9**

Principles of organization, Development of Organizational charts like line, staff, line and staff & functional types. Basics of productivity improvement and work study. Plant location: Type of layouts and principles of facility layout and Material handling systems.

**LINEAR PROGRAMMING MODELS 9**

Formation of an LP model- graphical solution – simplex algorithm – artificial variables technique. Transportation models: Feasible solutions (North west corner method- Least cost method – Vogels' approximation method) and Optimal solution by –MODI method.

**NETWORK MODELS 9**

Shortest route – minimal spanning tree - maximum flow models – Project networks- PERT and CPM -critical path scheduling.

**REPLACEMENT MODELS AND SCHEDULING 9**

Replacement of items that deteriorate with time – value of money changing with time –not changing with time – optimum replacement policy – individual and group replacement. Sequencing problem: models with n jobs with 2 machines – problem with n jobs with 3 machines. Scheduling rules.

**INVENTORY MODELS AND QUEUING THEORY 9**

Inventory Models – EOQ and EBQ Models (With and without shortages). Queuing models – queuing systems and structures –single server and multi-server models.

**TOTAL HOURS: 45**

**Self study topics:** Study of Operations Research software like Excel-optimization, LINGO, and CPLEX etc.

**TEXT BOOKS**


1. Taha H.A, "Operation Research", Pearson Education sixth edition, 2003
2. Khanna O.P, Industrial Engg. & Management, Dhanpat Rai & Sons, 1980.


**REFERENCES**


1. Hira and Gupta " Problems in Operations Research", S.Chand and Co Ltd, ,2008.
2. Wagner, "Operations Research", Prentice Hall of India, 2000.
3. Paneerselvam R., Operations Research, Prentice Hall of India, Fourth Print, 2008.

## 11UAK606 INDUSTRIAL PSYCHOLOGY AND WORK ETHICS

| L | T | P | C |
|---|---|---|---|
| 2 | 0 | 0 | 2 |

**Course Objectives**

- Familiarize students with aspects of industrial and organizational psychology, such as attitudes and behaviors of employees and employers; interpersonal relationships at work.
- Expose students to the complex processes of motivation and leadership; organizational and individual performance.
- To understand the principles of moral values, issues and decisions in engineering practice, the professional rights and responsibilities.

**Course Outcome**

- Match the student's aspects to the industrial and organizational psychology such as attitudes and behaviors of employees and employers to create interpersonal relationships at work.
- Expose students to the complex processes of motivation and leadership for organizational and individual performance.
- Understand the principles of moral values, professional rights and responsibilities.
- Apply the professional ethics and values to the organization to reach the goals

**INDUSTRIAL PSYCHOLOGY** **9**

Introduction to Industrial Psychology – Definitions & Scope **-** characteristics Major influences on industrial Psychology- Scientific management and human relations – Time and Motion Study – Nature and Characteristics, use of Therbligs, Principles.

**INDIVIDUAL IN WORKPLACE AND WORK ENVIRONMENT** **9**

Motivation and Job satisfaction, stress management. Organizational culture, Leadership & group dynamics Work Environment & Engineering Psychology-fatigue. Boredom, accidents and safety. Job Analysis, Recruitment and Selection – Reliability & Validity of recruitment tests.

**ENGINEERING ETHICS** **9**

Senses of 'Engineering Ethics' - variety of moral issued - types of inquiry – moral dilemmas - moral autonomy - Kohlberg's theory - Gilligan's theory - consensus and controversy – Models of Professional Roles - theories about right action - Self-interest - customs and religion - uses of ethical theories. Professional values: definition and concept (self study)

**ENGINEERING AS SOCIAL EXPERIMENTATION** **9**

Engineering as experimentation - engineers as responsible experimenters - codes of ethics – a balanced outlook on law - the challenger case and its safety issue

**SAFETY, RESPONSIBILITIES AND RIGHTS** **9**

Safety and risk - assessment of safety and risk - risk benefit analysis and reducing risk - Three Mile Island, chernobyl and safe exits. Collegiality and loyalty - respect for authority - collective bargaining - confidentiality - conflicts of interest - occupational crime - professional rights - employee rights – whistle blowing - discrimination.

**TOTAL HOURS: 45**

**TEXT BOOKS**

1. Miner J.B. (1992) Industrial/Organizational Psychology. N Y : McGraw Hill.
2. Mike Martin and Roland Schinzinger, "Ethics in engineering", McGraw Hill, New York 1996.

**REFERENCES**

1. Blum M. L. , and Naylor J. C. Industrial Psychology, CBS Publishers and Distributors, New Delhi, 1984
2. Govindarajan M, Natarajan S, Senthil Kumar V. S, " Engineering Ethics", Prentice Hall of India, New Delhi, 2004.
3. Charles D. Fleddermann, "Engineering Ethics", Pearson Education/ Prentice Hall, New Jersey, 2004 (Indian Reprint now available)

## 11UAK607 HEAT TRANSFER LABORATORY

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 3 | 2 |

**Course Objectives**

- To supplement the principles learnt in Heat Transfer.

**Course Outcome**

- Identify the principles of heat transfer in practical conditions.
- Estimate the performance of heat exchanger.
- Assess the performance of study on refrigeration and air conditioning systems.
- Troubleshoot existing engineering heat transfer systems and create more energy efficient systems.

**LIST OF EXPERIMENTS**

**Heat Transfer**

1. Thermal conductivity measurements by guarded plate method.
2. Thermal conductivity of pipe insulation using lagged pipe apparatus.
3. Natural convection heat transfer from a vertical cylinder.
4. Forced convection inside tube.
5. Heat Transfer from Pin-fin (Natural & Forced convection modes).
6. Determination of Stefan- Boltzmann constant.
7. Determination of Emissivity of a grey surface.
8. Effectiveness of parallel flow heat Exchanger.
9. Effectiveness of Counter flow heat Exchanger.

**Refrigeration and Air conditioning**

1. Study of Refrigeration and Air conditioning systems.
2. Determination of COP of a Refrigeration system.
3. Determination of COP of an air conditioning system.

**TOTAL HOURS: 45**

## 11UAK608 CAD / CAM / CIM LAB

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 3 | 2 |

**Course Objectives**

- To gain knowledge about CAD Modelling Packages
- To gain knowledge about the CAM programming and CIM software.

**Course Outcome**

- Sketch the complex geometries of machine components in CAD Modelling Packages
- Create complex engineering assemblies using appropriate assembly constraints
- Develop G and M codes for machining processes and tool path generation
- Apply knowledge about flexible manufacturing system

**CAD:-**

1. Introduction to the basics of CAD modelling software (Solidworks / Pro-E / Inventor)
2. Modelling, Assembly and preparation of assembled views for the part details. BOM and tolerance data sheets Preparation.
3. Suggested Assemblies: - Shaft couplings, Cotter joints, Pipe joints, Jigs & fixtures, Engine parts, miscellaneous machine elements.

**CAM:-**

1. Manual part programming (Using G and M Codes) in CNC lathe - Part programming for Linear and Circular interpolation - Using standard canned cycles for Turning, Facing, Taper turning, Chamfering, Grooving and Thread cutting – tool path generation.
2. Manual part programming (using G and M codes) in CNC milling - Part programming for Linear, Circular interpolation and Contour motions - Using standard canned cycles for Slot, Peck drilling, Drilling, and Boring Operation – tool path generation.
3. Draw the part drawing for turning and machining center operations – Simulation – Generate the part program by using Edge CAM/Master CAM soft ware.
4. Machining of turning and machining center components.

**CIM:-**

1. Flexible Manufacturing System design for manufacturing and assembly work stations using software.

**TOTAL HOURS: 45**

## 11UAK609 MINI PROJECT

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 3 | 2 |

Students could join (maximum 3) together, form a small team and execute a simple project in the area of Design, Analysis, Fabrication, and Thermal Engineering relevant to Mechanical Engineering field under the guidance of a faculty.

The mini project shall be submitted in a report form and should be presented before a committee constituted by the Head of the Institution, which shall evaluate the project work done for 100 marks.

The committee will consist of head of the department, the supervisor of the mini project and two senior faculty member of the department.

**Course Outcome:**

- Identify the various components of mechanical systems
- Understand the basic concepts of Design and manufacturing
- Able to design analysis and fabricate the mechanical systems
- Find out the Applications of mechanical system.

## 11UAK701 MECHATRONICS

| L | T | P | C |
|---|---|---|---|
| 2 | 0 | 2 | 3 |

**Course Objectives**

- To impart knowledge on the pace of changes in the mechatronics systems.

**Course Outcome**

- Model, analyze and control engineering systems.
- Identify sensors and actuators to monitor and control the behavior of a process or product.
- Develop PLC programs for a given task.
- Evaluate the performance of mechatronic systems

**INTRODUCTION** **9**

Definition, Key elements, Mechatronics approach for Design process, Concept of Siemens Totally Integrated Architecture. Industrial Networking, HMI systems and Wireless controls.

**SENSORS AND APPLICATIONS** **9**

Mechatronic control in automated manufacturing, Traditional Vs Mechatronics approach, Integrated product design, General principle- Sensor for motion and position measurement- Force sensor- Pressure sensor- Torque sensor – Tactile sensor - Temperature sensor- Ultrasonic sensor- Piezoelectric sensor. Application of sensors in modern industry

**SYSTEM INTERFACING AND CONTROLLERS** **9**

Introduction-selection of interface cards-DAQ card-single channel-multichannel- RS232 communication- IEEE 488 standard interface -Ethernet switch. PLC- Role of PLC in automated manufacturing- Architecture of PLC- Advantages- Types of PLC- Types PLC Programming- Simple process control programs using relay ladder logic and Boolean logic methods- PLC arithmetic functions.

**ACTUATORS FOR MECHATRONICS SYSTEM** **9**

Types of actuators and their working principles, control valves, direction, pressure and flow, comparison of hydraulic, pneumatic and electrical actuators - Pneumatic elements, electro pneumatic system, circuit design, examples, hydraulic elements, electro hydraulic system, cascade method.

**REAL TIME INTERFACING** **9**

Introduction of data acquisition and control system, Overview of I/O process, Interfacing of various sensors, Architecture of a Virtual instrument and its relation to the operating system. Case study – Pick and Place robot, automatic car parking system and other applications.

**TOTAL HOURS: 30+15=45**

**TEXT BOOK**


1. Sabrie soloman, “Sensors and control system in Manufacturing” McGraw Hill, Inc, 1994
2. HMT, “Mechatronics”, Tata mcGraw Hill Publications, 2005.


**REFERENCES**


1. Bradley. D.A, Dawson.D., Buru.N.C. and Loader.A.J., “Mechatronics”, Chapman and Hall,1993
2. Sanjay Gupta and Joseoh John, ”Virtual Instrumentation using Lab VIEW” Tata McGraw Hill Publications,2005.
3. Peter Rohner and Gordron Smith, “Pneumatic Control for Industrial Automation”, John wiley and sons, 1987.

## 11UAK702 ENGINEERING ECONOMICS AND COST ANALYSIS

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Objectives**

- To learn about the basics of economics and cost analysis related to engineering so as to take economically sound decisions.

**Course Outcome**

- Understand the concepts of engineering economics in make or buy decisions, and comparison of alternates.
- Analyse engineering and managerial situations as Time Value of Money.
- Select economically best alternate in present worth, future worth and annual equivalent method.
- Solve managerial problems as maintenance, replacement and depreciation problems.

**INTRODUCTION TO ECONOMICS** **9**

Introduction to Economics- Law of supply and demand, Concept of Engineering Economics – Engineering efficiency, Economic efficiency, Scope of engineering economics- Element of costs, Marginal cost, Marginal Revenue, Sunk cost, Opportunity cost, Break-even analysis, Elementary economic Analysis – Material selection, Design selection and Process planning.

**VALUE ENGINEERING** **9**

Value engineering – Function, aims, Value engineering procedure. Interest formulae and their applications – Make or Buy decisions. Time value of money, Single payment compound amount factor, Single payment present worth factor, Equal payment series sinking fund factor, Equal payment series payment Present worth factor- equal payment series capital recovery factor- Uniform gradient series annual equivalent factor, Effective interest rate, Examples in all the methods.

**CASH FLOW ANALYSIS** **9**

Methods of comparison of alternatives – Present worth method (Revenue dominated cash flow diagram), Future worth method (Revenue dominated cash flow diagram, cost dominated cash flow diagram), Annual equivalent method (Revenue dominated cash flow diagram, cost dominated cash flow diagram), Rate of return method, Examples in all the methods.

**REPLACEMENT AND MAINTENANCE ANALYSIS** **9**

Replacement and Maintenance analysis – Types of maintenance, types of replacement problem, determination of economic life of an asset, Replacement of an asset with a new asset – capital recovery with return and concept of challenger and defender, Simple probabilistic model for items which fail completely.

**DEPRECIATION** **9**

Depreciation- Introduction, Straight line method of depreciation, declining balance method of depreciation-Sum of the years digits method of depreciation, sinking fund method of depreciation/ Annuity method of depreciation, service output method of depreciation- Evaluation of public alternatives- introduction, Examples, Inflation adjusted decisions – procedure to adjust inflation, Examples on comparison of alternatives and determination of economic life of asset.

**TOTAL HOURS: 45**

**TEXT BOOKS**

1. Panneer Selvam, R, “Engineering Economics”, Prentice Hall of India Ltd, New Delhi, 2001.
2. Donald.G. Newman, Jerome.P.Lavelle, “Engineering Economics and analysis” Engg. Press, Texas, 2002.

**REFERENCES**

1. Chan S.Park, “Contemporary Engineering Economics”, Prentice Hall of India, 2002.
2. Degarmo, E.P., Sullivan, W.G and Canada, J.R, “Engineering Economy”, Macmillan, New York, 1984.
3. Grant.E.L., Ireson.W.G., and Leavenworth, R.S, “Principles of Engineering Economy”, Ronald Press, New York,1976.

## 11UAK703 TOOL DESIGN

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Objectives**

- The course is intended to give an exposure on different cutting tools, clamping and fixing methods and jigs used for different operations like turning, boring, milling, drilling, etc.
- It also gives exposure to piercing and blanking operations along with mould design.

**Course Outcome**

- Describe basic tool geometry, mechanism of metal cutting, new tool, tool life, cutting force.
- Design cutting tools, Jigs, fixtures and Press tools and give the assembly drawing with dimensions and part list.
- Design tools and dies which can later be used to simulate the machining and forming processes to verify the design.
- Analyze various circuits in the injection moulding process by applying the advanced tool design procedure.

**DESIGN OF CUTTING TOOLS** **9**

Brief history of metal cutting process - design of single point cutting tools for turning, boring, shaping, planning and slotting, design of multi point cutting tools - milling cutters, drills, reamers, taps and dies, classification of multipoint cutting tools – simple problems.

**JIGS AND FIXTURES** **9**

Principles of location – Locating methods and devices – Redundant Location – Principles of clamping – Mechanical actuation – pneumatic and hydraulic actuation. Standard parts – Drill bushes and Jig buttons –Design and development of jigs and fixtures for given component- Types of Jigs – Post, Turnover, Channel, latch, box, pot, angular post jigs, Indexing jigs – General principles of milling, lathe and grinding fixtures – Assembly, inspection and welding fixtures – Modular fixturing systems.

**PRESS WORKING TERMINOLOGIES & ELEMENTS OF CUTTING DIES** **9**

Press Working Terminologies - operations – Types of presses – press accessories – Computation of press capacity – Strip layout – Material utilization – Shearing action – Clearances – Press Work Materials – Design of various elements of compound and progressive dies - Die Block – Punch holder, Die set, guide plates – Stops – Strippers – Pilots.

**BENDING, FORMING AND DRAWING DIES** **9**

Difference between bending, forming and drawing – Blank development for above operations – Types of Bending dies – Press capacity – Spring back – knockouts – direct and indirect – pressure pads – Ejectors – Variables affecting metal flow in drawing operations – draw die inserts – draw beads- ironing – Design and development of bending, forming and drawing dies.

**DESIGN OF MOULDS** **9**

Types of moulds and dies for various processing methods - Mould and die design concept and materials. Injection Mould Design - Basics of mould construction - Methodical Mould Design - Design of Feed System, Ejection System - Venting - Design of Cooling system.

**TOTAL HOURS: 45**

**Note:**

- PSG design data book is permitted in the exam.

**TEXT BOOKS:**

1. Joshi, P.H. "Jigs and Fixtures", Second Edition, Tata McGraw Hill Publishing Co., Ltd., New Delhi, 2004.
2. Donaldson, Lecain and Goold "Tool Design", III rd Edition Tata McGraw Hill, 2000.

**REFERENCES:**

1. Kempster, "Jigs and Fixture Design", Hoddes and Stoughton – Third Edition 1974.
2. Joshi, P.H. "Press Tools" – Design and Construction", Wheels publishing, 1996.
3. Hoffman "Jigs and Fixture Design" – Thomson Delmar Learning, Singapore, 2004.

## 11UAK704 POWER PLANT ENGINEERING

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Objectives**

- To provide a general perspective of Power Plant Engineering indicating the role of mechanical engineers in their operation and maintenance.

**Course Outcome**

- Understand the working of different power plants.
- Identify the working of various power plant components.
- Examine the performance of diesel power plant and gas turbine power plant
- Understand the economics of different power plants

**INTRODUCTION TO POWER PLANTS & BOILERS** **9**

Layout of Steam, Hydel, Diesel, MHD, Nuclear and Gas Turbine Power Plants - Combined Power Cycles – Comparison and Selection, Load Duration Curves. Steam Boilers and Cycles – High Pressure and Super Critical Boilers – Fluidised Bed Boilers

**STEAM POWER PLANT** **9**

Fuel and Ash Handling, Combustion Equipment for burning coal, Mechanical Stokers, Pulveriser, Electrostatic Precipitator, Draught – different types, Surface Condenser Types, Cooling Towers

**NUCLEAR AND HYDEL POWER PLANTS** **9**

Nuclear Energy – Fission, Fusion Reaction, Types of Reactors, pressurized water reactor, Boiling Water Reactor, Waste Disposal and safety. Hydel Power Plant – Essential Elements, Selection of Turbines, Governing of Turbines-Micro Hydel developments.

**DIESEL AND GAS TURBINE POWER PLANT** **9**

Types of Diesel Plants, Components, Selection of Engine Type, Applications Gas Turbine Power Plant – Fuels - Gas Turbine Material – Open and Closed Cycles – Reheating – Regeneration and Intercooling – Combined Cycle.

**OTHER POWER PLANTS AND ECONOMICS OF POWER PLANTS** **9**

Geo thermal –OTEC – Tidel - Pumped storage - Solar thermal central receiver system. Cost of Electric Energy – Fixed and operating Costs – Energy Rates – Types of Tariffs – Economics of load sharing, comparison of economics of various power plants.

**TOTAL HOURS: 45**

**TEXT BOOKS**


1. P.K. Nag, “Power Plant Engineering”, Tata McGraw – Hill Publishing Company Ltd., Third Edition, 2007.
2. Frederick T. Morse, “Power Plant Engineering”, Affiliated East-West-Press Private Ltd., New Delhi 1953.


**REFERENCES**


1. Culp Jr., A.W., “Principles of Energy Conversion”, McGraw-Hill, 1985.
2. Domkundwar, S., “Power Plant Engineering”, Dhanpat Rai & Sons, 1988. 4. Wakil, M.M., Power Plant Technology, Tata McGraw-Hill, 1985.
3. Thomas C. Elliott, “Standard Handbook of Powerplant Engineering”, Kao Chen and Robert C. Swanekamp, McGraw – Hill, 1998, Second Edition.

## 11UAK706 PROJECT WORK PHASE – I

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 8 | 4 |

1. The students are expected to get formed into a team of convenient groups of not more than 4 members on a project.
2. Every project team shall have a guide who is the member of the faculty of the institution. Identification of student group and their faculty guide has to be completed within the first two weeks from the day of beginning of 7th semester.
3. The group has to identify and select the problem to be addressed as their project work; make through literature survey and finalize a comprehensive aim and scope of their work to be done.
4. 25% of the total work to be done for the project work has to be completed by end of 7th semester.
5. A mini project report (of the phase-I) to this effect has to be submitted by each student group.
6. One mid semester review and another end semester review of the progress of the project work have to be conducted by a team of faculty (minimum 3 and a maximum of 5) along with their faculty guide as a member of the faculty team.
7. The same team of faculty will evaluate the project phase-I report. This evaluation will form 50% of the continuous assessment mark. The remaining 50% of the assessment mark will be given at the end of the 7th semester, at the time of submitting Phase-I project report.

**Course Outcome**

- Identify the domain for undertaking the project work
- Select the technical problem and decide in-house or industrial project
- Collect research papers related to the project undertaken through literature survey
- Develop design methodology for executing the project
- Plan for fabricating the designed item using various resources.

## 11UAK707 COMPREHENSION AND TECHNICAL SEMINAR

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 3 | 2 |

**COMPREHENSION**

The objective of comprehension is to provide opportunity for the student to revise the fundamental knowledge acquired during the earlier semesters and apply to real life problems.
The student is expected to take up objective and other types of testing processes and provhis/her understanding of the fundamentals.

**TECHNICAL SEMINAR**

1. It is mandatory that each student will give individually a seminar on exclusive topic.
2. During the seminar session each student is expected to prepare and present a topic on engineering/ technology, for duration of not less than 30 minutes.
3. Also, the student has to submit a hard copy of the technical topic, in the form of a report consisting of a title page, Introduction, body chapters and a conclusion with references, running to not less than 20 pages; this will be evaluated by the faculty coordinator/guide.
4. In a session of three periods per week, 5 students are expected to present the seminar.
5. In 13 weeks all students of the class would have completed giving the seminar.
6. For every 10 students or for different area of their branch specialization, a faculty guide is to be allotted and he / she will guide and monitor the progress of the student and maintain attendance also.
7. Students are encouraged to use various teaching aids such as over head projectors, power point presentation and demonstrative models.
8. This will enable them to gain confidence in technical presentation skills and to face the placement interviews.

**Course Outcome**

- To provide opportunity for the student to revise the fundamental knowledge acquired during the earlier semesters
- Apply to real field work problems
- Hands on the experience to the students to enhance the presentation skills.

**EVALUATION PROCEDURE**

| | Subject Area | No. of Tests and duration | No. of objective type questions for each test | Weightage Marks | Mark | Total Marks |
|---|---|---|---|---|---|---|
| **Comprehension** | Design Engineering[a] | 3 tests each 1½ hr | 100 | 20 | 75 | 100 |
| | Thermal & Fluid Engineering[b] | 3 tests each 1½ hr | 100 | 20 | | |
| | Materials and Manufacturing Engineering[c] | 3 tests each 1½ hr | 100 | 20 | | |
| | Design, Thermal, Fluid and Manufacturing Engineering | 1 test 3 hours | 200 | 15 | | |
| **Technical Seminar** | On topics relevant to Mechanical Engineering field | | | 25 | 25 | |

(a) Engineering Mechanics, Kinematics and Dynamics of Machines, Mechanics of Materials and Design of machine elements, etc.

(b) Engineering Thermodynamics, Thermal Engineering, Fluid Mechanics and Machinery, Heat and Mass Transfer etc.

(c) Materials Science, Engineering Metallurgy, Machine Tool Engineering, Production Processes, Metrology and Measurements, Computer Aided manufacturing, etc.

**11UAK708 COMPUTER AIDED ENGINEERING LABORATORY**

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 3 | 2 |

**Course Objectives**

- To get hands on practice about the applications and latest developments in Mechanical Simulation software and Analysis software.

**Course Outcome**

- Understand the simulation of various processes.
- Understand the Working Principles of all governing equations.
- Identify the different mode of thermal analysis.
- Find out the Application of mode and harmonic analysis.

**LIST OF EXPERIMENTS**

**SIMULATION** using Simulation software like C, C++, ANSYS , ADAMS, MATLAB.

1. Simulation of Air conditioning system with condenser temperature and evaporator temperatures as input to get COP using C /MAT Lab.
2. Simulation of Hydraulic / Pneumatic cylinder using C / MAT Lab.
3. Simulation of cam and follower mechanism using C / MAT Lab.
4. Simulation of Mechanical annealing system used to maximize a function.
5. Simulation of Mechanical annealing system used to minimize a function

**ANALYSIS** using FEA Packages like ANSYS/NASTRAN etc,

1. Stress analysis of a plate with a circular hole.
2. Stress analysis of rectangular L bracket
3. Stress analysis of an axi-symmetric component
4. Stress analysis of beams (Cantilever, Simply supported, Fixed ends)
5. Mode frequency analysis of beams (Cantilever, Simply supported, Fixed ends)
6. Harmonic analysis of a 2D component
7. Thermal stress analysis of a 2D component

i. Conductive heat transfer analysis of a 2D component
ii. Convective heat transfer analysis of a 2D component
iii. Combined heat transfer analysis of a 2D component

**TOTAL HOURS: 45**

## 11UAK801 INDUSTRIAL ROBOTICS

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Objectives**

- To introduce the basic concepts, parts of robots and types of robots.
- To make the student familiar with the various drive systems for robot, sensors and their applications in robots, programming of robots.
- To discuss about the various applications of robots, justification, implementation and safety of robot.

**Course Outcome**

- Understand the basic fundamentals of robots
- Differentiate various robot drive system and robot grippers
- Model forward and inverse kinematics of robot manipulators
- Programme and design intelligent robots using sensors for industrial applications

**FUNDAMENTALS OF ROBOT** **9**

Robot – Definition – Robot Anatomy – Co-ordinate Systems, Work Envelope, types and classification – Specifications – Pitch, Yaw, Roll, Joint Notations, Speed of Motion, Pay Load – Robot Parts and Their Functions – Need for Robots – Different Applications

**ROBOT DRIVE SYSTEMS AND END EFFECTORS** **9**

Pneumatic Drives – Hydraulic Drives – Mechanical Drives – Electrical Drives – D.C. Servo Motors, Stepper Motor, A.C. Servo Motors – Salient Features, Applications and Comparison of all these Drives. End Effectors – Grippers – Mechanical Grippers, Pneumatic and Hydraulic Grippers, Magnetic Grippers, Vacuum Grippers; Two Fingered and Three Fingered Grippers; Internal Grippers and External Grippers; Selection and Design Considerations

**ROBOT KINEMATICS** **9**

Forward Kinematics, Inverse Kinematics and Differences; Forward Kinematics and Reverse Kinematics of Manipulators with Two, Three Degrees of Freedom (In 2 Dimensional), Four Degrees of Freedom (In 3 Dimensional) – Deviations and Problems

**ROBOT SENSORS and ROBOT ECONOMICS** **9**

Transducers and sensors-Sensors in robot-Tactile sensor-Proximity and range sensors-Sensing joint forces- Robotic vision system- Image Gripping-Image processing and analysis-Image segmentation-Pattern recognition- Training of vision system. Implementation of Robots in Industries – Various Steps. Economic Analysis of Robots – Pay back Method, EUAC Method, Rate of Return Method. Safety Considerations for Robot Operations.

**ROBOT PROGRAMMING, ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS** **9**

Teach Pendant Programming, Lead through programming, Robot programming Languages – VAL Programming – Motion Commands, Sensor Commands, End effecter commands, and Simple programs. Artificial intelligence-Basics-Goals of artificial intelligence-AI techniques-problems representation in AI-Problem reduction and solution techniques-Application of AI and KBES in robots

**Self study topic:** Robot applications in Medical field and Space Programmes.

**TOTAL HOURS: 30 + 15 = 45**

**TEXT BOOK**

1. M.P.Groover, “Industrial Robotics–Technology, Programming and Applications”, McGraw-Hill, 2001.
2. K.S.Fu, R.CGonzalez and C.S.G. Lee, “Robotics control, Sensing, Vision and intelligence”, McGraw Hill, 1987.

**REFERENCES**

1. Deb S.R., “Robotics Technology and Flexible Automation”, Tata McGraw-Hill Publishing Co.,Ltd., 1994.
2. Klafter R.D., Chmielewski T.A. and Negin M., " Robot Engineering An Integrated approach ", Prentice Hall of India, New Delhi, 1994.
3. Yoram Koren, “Robotics for Engineers”, McGraw-Hill Book Co., 1992.

## 11UAK802 PROJECT WORK PHASE – II

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 24 | 12 |

1. The students are expected to get formed into a team of convenient groups of not more than 4 members on a project.
2. Every project team shall have a guide who is the member of the faculty of the institution. Identification of student group and their faculty guide has to be completed within the first two weeks from the day of beginning of the semester.
3. The group has to identify and select the problem to be addressed as their project work; make through literature survey and finalize a comprehensive aim and scope of their work to be done.
4. No change of guide or team members will be permitted after one month (unless the faculty or student has left the college). Head of the department is made responsible to ensure this.
5. 24 periods per week shall be allotted in the time table and this time shall be utilized by the students to receive the directions from the guide, for library reading, laboratory work, computer analysis or field work as assigned by the guide and also to present in periodical seminars on the progress made in the project.
6. The progress of the project is to be evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department.
7. Each student shall finally produce a comprehensive report covering background information, literature survey, problem statement, project work details and conclusion. This final report shall be typewritten form as specified in the guidelines of the institution.
8. The project work is evaluated jointly by external and internal examiners constituted by the institution based on oral presentation and the project report.

**Course Outcome**

- Identify and define the real time problem related to engineering domain.
- Gather information related to the real time problem.
- Arrive at solutions by integrating other engineering elements also if required.
- Update themselves with the latest technology and validate their project
- Document their work for presentation with appropriate technical/cost details.

## 11UAE701 ADVANCED STRENGTH OF MATERIALS

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Objectives**

- To analyze the unsymmetrical bending.
- To analyze the torsional stresses in thin walled tubes.
- To analyze the stresses in circular and rectangular plates.

**Course Outcome**

- Define various principles related to elasticity.
- Discuss the fundamentals of mechanics of materials under various loading conditions.
- Solve problems in unsymmetrical bending, torsion in non – circular section, stress in flat plates and contact stresses.
- Calculate area of stress, strain and deformation for 3-D problems.

**ELASTICITY** **9**

Stress – Strain relation and General equation of elasticity in cartesian, polar and spherical coordinates- differential equation of equilibrium – compact ability – boundary conditions, representations of three dimensional stress of a tension – generalized Hooke's law – St.Vennant's principle – Plane strain, plane stress – Airy's stress function. Hear Centre:Location of shear centre for various sections – shear flow.

**UNSYMMETRICAL BENDING** **9**

Stresses and deflection in beams subjected to unsymmetrical loading – Kern of a section. Curved flexural members - circumferential and radial stresses – deflection and radial curved beam with re-strained ends – closed ring subjected to concentrated load and uniform load – chain link and crane hooks.

**THICK CYLINDERS AND ROTATING DISKS** **9**

Thick walled cylinder subjected to internal and external pressures – Shrink fit joints – Stresses due to rotation – Radial and tangential stresses in solid disc and ring of uniform thickness and varying thickness – allowable speed. – Rotating shafts and cylinders.

**TORSION OF NON CIRCULAR SECTIONS** **9**

Torsion of rectangular cross section – St.Vennant Theory – elastic membrane analogy Prandtl's stress function – Torsional stresses in hollow thin walled tubes.

**STRESSES IN FLAT PLATES** **9**

Stresses in circular and rectangular plates due to various types of loading and end conditions – Buckling of plates. Theory of contact stresses – methods of computing contact stresses deflection of bodies in point and line contact – applications.

**TOTAL HOURS : 45**

**TEXT BOOKS**


1. Arthur P.Boresi and Richard J.Schmidt, "Advanced Mechanics of Materials",John, Willey & Sons, Inc., 2003.
2. Srinath.L.S., Advanced Mechanics of Solids, Tata McGraw Hill PublishingCompany Limited, 2003


**REFERENCES**


1. Arthur P.Boresi and Omar M.Siseborttom, "Advanced Mechanics of Materials",John, Willey International Education, 1985.
2. Robert,D.Cook, Wareen.C.Yound, "Advanced Mechanics of Materials", Macmillon Publishers Company, 1985.
3. KrishnaRaju, N., Gururaja,D.R., Advanced Mechanics of Solids and Structures,Narosa Publishing House, 1997.

## 11UAE702 PRODUCT DESIGN

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Objectives**

- To understand the concepts of product specification and product architecture
- To understand the principles of industrial design and prototyping

**Course Outcome**

- Apply principles of concurrent engineering in product design.
- Prepare materials layout plan.
- Classify different types of product model.
- Identify product life cycle management strategies and organize intelligent information system for product design.

**INTRODUCTION** **9**

Product Development process – Product development organizations, Gather raw data – Interpret raw data- organize the needs into a hierarchy – Relative importance of the needs. Product life cycle management - concepts, benefits, value addition to customer. Life cycle models- creation of projects and roles, users and project management, system administration, access control and its use in life cycle.

**PRODUCT SPECIFICATIONS** **9**

Establishing the product specifications– Target specifications – Refining specifications, concept generation-Clarify the problem – Search internally – Search externally – Explore systematically.

**PRODUCT ARCHITECTURE** **9**

Concept selection- Screening – scoring, Product architecture – Implication of architecture – Establishing the architecture – Related system level design issues.

**INDUSTRIAL DESIGN** **9**

Need for industrial design – Impact of industrial design – Industrial design process – Management of industrial design process – Assessing the quality of industrial design, design for manufacturing- cost considerations, Impact of DFM decisions on other factors.

**PRINCIPLES OF PROTOTYPING AND ECONOMIC ANALYSIS** **9**

Principles of prototyping – Planning for prototypes, economics of product development projects, Elements of economic analysis – Base – Case financial model – Sensitivity analysis – Influence of the quantitative factors.

**TOTAL HOURS :45**

**TEXT BOOKS**

1. Karal, T.Ulrich steven D.Eppinger, Product Design and Development, McGraw Hill, International Editions, 2003.
2. Charles Gevirtz Developing New products with TQM, McGraw Hill International Editions, 1994.

**REFERENCE**

1. S.Rosenthal, Effective Product Design and Development, Irwin, 1992.

## 11UAE703 INDUSTRIAL DESIGN

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Objectives**

- To understand the concept of work place design, environmental conditions and their applications.

**Course Outcome**

- Understand the concept of workplace design
- Identify human control of system
- Interpret environmental conditions
- Infer Human Factors application

**INTRODUCTION** **9**

Definition, human technological system, multidisciplinary engineering approach, human-machine system, manual, mechanical, automated system, human system reliability, conceptual design, advanced development, detailed design and development, human system modeling.

**INFORMATION INPUT AND HUMAN OUTPUT** **9**

Input and processing, text, graphics, symbols, codes, visual display of dynamic information, auditory, tactual, olfactory displays, speech communications-Physical work, manual material handling, motor skill, human control of system, controls and data entry devices, hand tools and devices.

**WORK PLACE DESIGN** **9**

Applied anthropometry, workspace design and seating, arrangement of components within a physical space, interpersonal aspects of work place design, design of repetitive task, design of manual handling task, work capacity, stress, fatigue.

**ENVIRONMENTAL CONDITIONS AND BIOMECHANICS** **9**

Illumination, climate, noise, motion, sound, vibration, Biostatic mechanics, statics of rigid bodies, upper extremity of hand, lower extremity and foot, bending, lifting and carrying, biodynamic mechanics, human body kinematics, kinetics, impact and collision.

**HUMAN FACTORS APPLICATIONS** **9**

Human error, accidents, human factors and the automobile, organizational and social aspects, steps according to ISO/DIS6385, OSHA's approach, virtual environments.

**TOTAL HOURS :45**

**TEXT BOOKS**


1. Chandler Allen Phillips, "Human Factors Engineering", John Wiley and sons, New York,2000.
2. Mark S Sanders, "Human Factors in Engineering and Design", McGraw Hill, New York, 1993.


**REFERENCES**


1. Bridger R S, "Introduction to Ergonomics", Taylor and Francis, London, 2003.

## 11UAE704 PRODUCTION PLANNING AND COST ESTIMATION

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Objectives**

- To understand the productivity enhancement techniques and the basics of production planning and shop floor control methodologies.
- To estimate the costs and machining times for various manufacturing processes.

**Course Outcome**

- Understand the productivity enhancement techniques
- Describe production planning and shop floor control methodologies.
- Interpret costing and estimating techniques
- Analyse machining time and cost for various manufacturing processes

**BASICS OF WORK STUDY** **9**

Method study, basic procedure - Selection and Recording of process - Critical analysis, Development - Implementation - Micro motion and memo motion study - work measurement - Techniques of work measurement - Time study - Production study - Work sampling - Synthesis from standard data - Predetermined motion time standards.

**PRODUCTION PLANNING AND CONTROL** **9**

Demand forecasting –forecasting methods, aggregate production planning, master scheduling, bill of materials and material requirement planning; order control and flow control, routing, scheduling and priority dispatching; JIT; Kanban and pull systems.

**ELEMENT OF COST** **9**

Importance and aims of cost estimation - difference between costing and estimation - estimation procedure – cost ladder diagram - determination of material cost, labour cost and overhead expenses. Depreciation – causes of depreciation – methods of depreciation.

**PRODUCT COST ESTIMATION** **9**

Estimation in forging shop – losses in forging – forging cost – illustrative examples, estimation in welding shop – gas cutting – electric welding – illustrative examples. Estimation in foundry shop, estimation of pattern cost and casting cost – illustrative examples.

**ESTIMATION OF MACHINING TIME** **9**

Estimation of machining time for lathe operations – Estimation of machining time for drilling, boring, shaping, planning, milling and grinding operations – illustrative examples.

**TOTAL HOUR: 45**

**TEXT BOOKS**


1. M. Adithan and B.S. Pabla, “Estimating and Costing”, Konark Publishers Pvt. Ltd. 1989.
2. Martand Telsang, “Industrial Engineering and Production Management”, S. Chand, 2011.


**REFERENCES**


1. S.N. Chary, “Production and Operations Management,” Tata McGraw Hill, 1994.
2. T.R. Banga, and S.C. Sharma, “Mechanical Estimation and Costing”, Khanna Publishers, 1993.

## 11UAE705 MEMS AND NANO TECHNOLOGY

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Objectives**

- To study the underlying physical principles, methods of fabrication and applications of a broad range of micro- and nano-scale devices and systems.

**Course Outcome**

- Understand the physical principles and applications of a broad range of micro- and nano-scale devices and systems.
- Identify and understand various fabrication techniques, considerations used for micro and nano manufacturing
- Select the suitable MEMS sensor and actuator for the micro and nano level applications
- Understand and study the various nano structure and devices used

**LEARNING OUTCOMES**

After attending the course students should (a) have detailed knowledge of the operation of micro- and nano-scale devices, their applications and the technologies used to fabricate them, and (b) be able to analyse & design a range of devices using relevant mechanical/electrical engineering principles.

**INTRODUCTION** **9**

micro- and nano-scale size domains; scaling of physical laws; MEMS materials and processes; MEMS devices and applications; nanostructures in semiconductors and metals; introduction to quantum effects in nanostructures; nano structure applications.

**FABRICATION TECHNOLOGIES** **9**

semiconductor materials; photolithography; doping; thin film growth and deposition; metallisation; wet and dry etching; silicon micromachining; metal MEMS processes; nanofabrication methods submicron optical lithography; electron beam lithography.

**MEMS SENSORS AND ACTUATORS** **9**

Mechanics including elasticity, beam bending theory, membranes/plates; microactuators based on various principles e.g. electrothermal, electrostatic, electromagnetic, piezoelectric and SMA; actuator applications e.g. inkjet, electrical and optical switching; physical sensors e.g. Acceleration, strain, flow; chemical sensors, **Microfluidics:** Scaling laws for microfluidics; transport in micro-channels; microfluidic components e.g. filters, mixers/reactors, valves/controllers, pumps.

**GROWN NANOSTRUCTURES** **9**

Si nanowires and nanocrystals; carbon nanotubes; nanostructures in III-V materials; metal nanostructures; devices using grown nanostructures.
**Nanoelectronic Semiconductor Devices:** the nano-scale MOSFET; short channel effects in a nano-MOSFET; scaling of MOSFETs; scaling of semiconductor memory (FLASH and Random Access memory); bio-sensors.

**QUANTUM DEVICES IN NANOSTRUCTURES** **9**

electron tunnelling; quantum confinement effects; single-electron effects; ballistic transport; optical properties of nanostructures; quantum dots; quantum point contacts; single-electron transistor; single-electron memory and logic.

**TOTAL HOURS: 45**

**TEXT BOOKS**

1. Tai-Ran Hsu,"MEMS and Microsystems Design and Manufacture", Tata McGraw Hill Publishing Co. Ltd., New Delhi, 2002.
2. Guozhong Coa, "Nanostructures and Nanomaterials", Imperial College Press, 2006.

**REFERENCES**

1. Mark Madou "Fundamentals od Microfabrications", CRC Press, New York,1997.
2. Rogers, Pennathur and Adams, "Nanotechnology: Understandinh Small system", CRC Press, 2008.
3. Julian W Gardner, "Microsensors: Principles and Applications", John Wiley and Sons, New York, 2001.

## 11UAE706 FOUNDRY AND WELDING TECHNOLOGY

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Objectives**

- To study the different types of casting processes and equipment used
- To study the different types of special welding processes
- To study the different methods of inspection and testing of welded joints

**Course Outcome**

- List the different manufacturing processes available.
- Understand the different casting methods.
- Understand the different metal joining processes.
- Understand the different methods of inspection and testing of welded joints.

**INTRODUCTION** **9**

Scope and development of Foundry. Types of foundries. PATTERNS: Materials for patterns, types of patterns; functions and pattern allowance. Moulding materials: Moulding sands, properties and selection of materials and additives used.

**CASTING PROCESSES AND EQUIPMENT** **9**

Green and dry sand moulding, shell moulding, CO2 moulding. Core moulds and cores. Plaster mould casting, composite mould casting, Investment casting. Permanent mould casting, pressure die-casting, Gravity die-casting and centrifugal casting, Types of moulding equipment.

**MELTING OF FERROUS ALLOYS** **9**

Melting of Gray iron and cupola. Cupola operation and control. Effect on chemical composition, carbon equivalent and effect of alloying elements on foundry characteristics. Melting of non-ferrous alloys: Melting of Aluminium and copper alloys production processes: Production of Gray Iron, ductile iron. Malleable iron castings.

**SPECIAL WELDING PROCESSES** **9**

Soldering, brazing and braze welding and their application., welding of special materials – Stainless steel, Aluminium etc. weldability of cast iron, steel, stainless steel, aluminium alloys. Introduction to Electron beam and Laser welding.

**WELDMENTS TESTING AND METALLURGY** **9**

Inspection of welds – destructive and non-destructive testing methods, Defects in welding-causes and remedies, -effect of gases in welding-fatigue failure in Weldments.

**TOTAL HOURS: 45**

**TEXT BOOKS**


1. Heine, Loper and Rosenthal, “Principles of Metal casting”, Tata McGraw-Hill, 2001.
2. P.N.Rao, “Manufacturing Technology”, TMH Ltd 1998 (Revised edition).


**REFERENCES**


1. Metals Handbook Vol. 5 published by ASM, Ohio.
2. Lindberg,“Processes and Materials of Manufacture”, Prentice hall India (p) Ltd.

## 11UAE707 NUCLEAR ENGINEERING

| L | T | P | C |
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**Course Objectives**

- To gain some fundamental knowledge about nuclear physics, nuclear reactor, nuclear fuels, reactors and safe disposal of nuclear wastes.

**Course Outcome**

- Recall the theory of nuclear reactions and radio-active materials.
- Explain the working of various nuclear reactors and the processes used for reprocessing fuels
- Interpret the safety systems and its significance in nuclear power plants
- Elaborate on the threats posed by radioactive wastes and the means to dispose them safely

**NUCLEAR PHYSICS** **9**

Nuclear model of an atom-Equivalence of mass and energy-binding- radio activity-half life-neutron interactions-cross sections.

**NUCLEAR REACTIONS AND REACTION MATERIALS** **9**

Mechanism of nuclear fission and fusion- radio activity- chain reactions-critical mass and composition-nuclear fuel cycles and its characteristics-uranium production and purification-Zirconium, thorium, beryllium.

**REPROCESSING** **9**

Reprocessing: nuclear fuel cycles-spent fuel characteristics-role of solvent extraction in reprocessing-solvent extraction equipment.

**NUCLEAR REACTOR** **9**

Nuclear reactors: types of fast breeding reactors-design and construction of fast breeding reactors-heat transfer techniques in nuclear reactors- reactor shielding. Fusion reactors.

**SAFETY AND DISPOSAL** **9** Safety and disposal: Nuclear plant safety-safety systems-changes and consequences of accident-criteria for safety-nuclear waste-types of waste and its disposal-radiation hazards and their prevention-weapons proliferation.

**TOTAL HOURS: 45**

**TEXT BOOKS**


1. Thomas J.Cannoly, “Fundamentals of nuclear Engineering” John Wiley 1978.
2. Wakil M.M.El., “Power Plant Technology” – McGraw-Hill International, 1984.


**REFERENCE**


1. Collier J.G., and Hewitt G.F, “Introduction to Nuclear power”, Hemisphere publishing, New York. 1987

## 11UAE708 REFRIGERATION AND AIR CONDITIONING

| L | T | P | C |
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**Course Objectives**

- To understand the underlying principles of operation in different Refrigeration & Air conditioning systems and components.
- Familiarize students with the terminologies associated with refrigeration & air conditioning.
- To cover the basic principles of psychrometry and applied psychometric.
- To provide knowledge on design aspects of Refrigeration & Air conditioning Systems.

**Course Outcome**

- Illustrate the fundamental principles and applications of refrigeration and air conditioning system
- Obtain cooling capacity and coefficient of performance by conducting test on vapor compression refrigeration systems
- Present the properties, applications and environmental issues of different refrigerants
- Calculate cooling load for air conditioning systems used for various applications

**REFRIGERATION** **9**

Recapitulation of Thermodynamics, Thermodynamics process pertaining to refrigeration and air conditioning. First and Second law applied to refrigerating machines, Carnot principles, Unit of refrigeration, COP. Concept of Air refrigeration system. Vapour compression refrigeration cycle - use of p-h charts - multistage and multiple evaporator systems - cascade system - COP comparison.

**REFRIGERANTS, SYSTEM COMPONENTS AND BALANCING** **9**

Compressors - reciprocating & rotary (elementary treatment) - condensers – evaporators - cooling towers. Refrigerants - properties - selection of refrigerants, Eco friendly Refrigerants- Refrigeration plant controls.

**PSYCHROMETRY AND HEAT LOAD ESTIMATION** **9**

Psychrometric processes use of psychrometric charts - Thermal analysis of human body, Effective temperature and comfort chart, Cooling and heating load calculations, Selection of inside & outside design conditions, Heat transfer through walls & roofs, Infiltration & ventilation, Internal heat gain, Sensible heat factor (SHF), By pass factor, Grand Sensible heat factor (GSHF), Apparatus dew point (ADP).Requirements of comfort air conditioning, summer and Winter Air conditioning.

**AIR CONDITIONING SYSTEMS** **9**

Cooling load calculation working principles of - Centralized Air conditioning systems, Split, Ductable split, Packaged Air conditioning, VAV & VRV Systems. Duct Design by equal friction method, Indoor Air quality concepts.

**UNCONVENTIONAL REFRIGERATION CYCLES** **9**

Vapor Absorption system –Ejector jet, Steam jet refrigeration, and Thermo electric refrigeration. APPLICATIONS - ice plant - food storage plants - milk - chilling plants.

**TOTAL HOURS: 45**

**TEXT BOOKS**


1. Manohar Prasad, "Refrigeration and Air Conditioning", Wiley Eastern Ltd., 1983
2. Arora C.P., "Refrigeration and Air Conditioning", Tata McGraw Hill, New Delhi, 1988.


**REFERENCES**


1. Roy. J. Dossat, " Principles of Refrigeration", Pearson Education 1997
2. Jordon and Priester, "Refrigeration and Air Conditioning", Prentice Hall of India PVT Ltd., New Delhi, 1985.
3. Stoecker N.F and Jones, "Refrigeration and Air Conditioning", TMH, New Delhi, 1981.

**11UAE709 PRODUCTION PLANNING & CONTROL**

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**Course Objectives**

- To understand the various components and functions of production planning and control such as work study, product planning, process planning, production scheduling, Inventory Control

**Course Outcome**

- Understand the fundamentals of production planning and control
- Analyze the inventory level and control the inventory
- Apply the concepts of ergonomics in anatomy, posture and body mechanics
- Create sheets and charts for routing, scheduling and dispatching

**INTRODUCTION** **9**

Introduction: Types and characteristics of production systems Objective and functions of Production, Planning & Control, Place of production, planning in Engineering, manufactures organization. Preplanning: Forecasting & Market Analysis. Factory Location & Layout, Equipment policy and replacement. Preplanning production, capacity planning.

**PRODUCTION PLANNING** **9**

Aggregate Planning, MPS, Material Resource Planning, Selection of material methods, machines & manpower. Routing, Scheduling and Dispatching and its sheets & charts, Production Line Balancing.

**PRODUCTION AND INVENTORY CONTROL**: **9**

Progress control through records and charts. Types of inventories, Inventory Classification. Inventory Control under constraints Economic lot (batch) size. Trends in purchasing and store keeping, JIT production MRP II, comparison of Push & Pull systems, ERP, CAPPC.

**PRODUCTIVITY** **9**

Importance, Productivity patterns, productivity measurements & ratios, improvement-maintenance process. Human Factors & Ergonomics: Human abilities, Training & motivation safety programs, workplace design & working conditions.

**DISPATCHING** **9**

Activities of dispatcher – Dispatching procedure – follow up – definition – Reason for existence of functions – types of follow up, applications of computer in production planning and control.

**TOTAL HOURS: 45**

**TEXT BOOKS**


1. Samson Eilon, "Elements of production planning and control", Universal Book Corpn.1984
2. Elwood S.Buffa, and Rakesh K.Sarin, "Modern Production / Operations Management", 8th Ed. John Wiley and Sons, 2000.


**REFERENCES**


1. S.K. Hajra Choudhury, Nirjhar Roy and A.K. Hajra Choudhury, "Production Management", Media Promoters and Publishers Pvt. Ltd., 1998
2. Elwood S.Buffa, and Rakesh K.Sarin, "Modern Production / Operation Management", 8th Ed. John Wiley and Sons, 2000.
3. K.C.Jain & L.N. Aggarwal, "Production Planning Control and Industrial Management", Khanna Publishers, 1990.

## 11UAE710 AUTOMOTIVE DESIGN

| L | T | P | C |
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**Course Objectives**

- To impart knowledge at an advanced level in automobile engineering field.

**Course Outcome**

- Describe the basic lay-out of an automobile.
- Understand the design principles involved in transmission, suspension, steering and braking systems.
- Explore the latest developments in performance of vehicles.
- Design and fabricate the automotive systems.

**DESIGN OF ENGINE PARTS**

Auto design, aspect of auto design, basic requirement for design, design procedure- Design of piston for I.C Engine, design of piston rings, piston pin - Fuel system- carburetor performance - review questions.

**DESIGN OF CLUTCH PLATES, GEAR BOX AND PROPELLERSHAFT**

Function of clutch- requirement of clutch- types of clutch- clutch system derivation - problems for single plate clutch, multi plate clutch, centrifugal clutch- state the factors to be considered for designing a gear drive, design of constant mesh gear box, problems - design of propeller shaft – derivation – problems.

**DESIGN OF SUSPENSION SPRINGS AND STEERING MECHANISM**

Types of suspension springs, design of coil spring, problems - types of steering mechanism, types of steering gears turning circle radius problems.

**DESIGN OF BRAKING SYSTEM**

Classification of brake, braking of vehicle, Band and block brake, internal expanding brake, braking of vehicle, problems.

**PERFORMANCE OF VEHICLE**

Power of propulsion, air resistance, rolling resistance, grade resistance, traction and tractive effort, acceleration, gradiability, draw bar pull, calculation of equivalent weight, problems.

**FIELD STUDY**

Design and evaluation of any one sub system of a 4 Wheel automobile.

**Self Study: Rule book of BAJA event conducted by SAE INDIA**

**Total Hours: 60**

**TEXT BOOKS**


1. M.N.Srinivas Reddy, Automotive Mechanics, Eastern book promoters belgaum-Gagag.
2. Shigley J.E and Mischke C. R., “Mechanical Engineering Design”, Sixth Edition, Tata McGraw-Hill , 2003.


**REFERENCES**


1. Bhandari, V.B., “Design of Machine Elements”, Tata McGraw-Hill Publishing Company Ltd., 1994.
2. Anil Chhikare, Automobile Engineering Volume 1 &2, Satya Prakashan, New Delhi.
3. Spotts M.F., Shoup T.E “Design and Machine Elements” Pearson Education, 2004.

## 11UAE711 BUSINESS CONCEPTS

| L | T | P | C |
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**Course Objectives**

- To impart knowledge on business.
- To create an awareness about Organisation Structure, Human Resource Management, Foreign Trade and Banking.

**Course Outcome**

- Understand the fundamentals, scope and importance of business.
- Learn the different business Structure and organization
- Understand the functions of marketing, finance and purchase department.
- Learn the concept of human resource management, foreign trade and banking.

**BUSINESS ENVIRONMENT** **9**

Nature and purpose of business, classification of business activities: industry, commerce and trade, objective of business and essential of successful business, economic environment –basic problems of scarcity and choice, allocation of resources, opportunity cost, Business growth, International Environment-balance of trade ,the trade gap ,and balance of payments, role and methods of trade protectionism, Business Ethics.

**BUSINESS STRUCTURE AND ORGANIZATION** **9**

Historical view of business development forms of business organization: sole proprietorship, partnership, join stock companies, co-operative societies, public enterprise-Definition, Meaning, characteristics, Advantages and Disadvantages, organization charts.

**ELEMENTS OF BUSINESS ACTIVITY** **9**

Purchasing-choosing suppliers, overview of stock control, production-scale of production, main features of job, mass, and batch production systems, Marketing-concept and role of marketing, marketing mix, channels of distribution, Finance-sources of finance, assessing business performance.

**HUMAN RESOURCES** **9**

Demographic trends and their impact on business concerns, unemployment-effects and types of unemployment, local trends in employment in various sectors, selection, recruitment, training of workers, motivation, basic knowledge of working age, contract of work, minimum wage, statutory hours of work, statutory benefits.

**FOREIGN TRADE AND BANKING** **9**

Foreign trade-meaning, nature, importance, procedure of export and import, globalization, MNC, MNE, Introductory idea about commercial banks-functions and services, Insurance-meaning, types, principles, benefits.

**TOTAL HOURS: 45**

**TEXT BOOKS**


1. Martand Telsang, “Industrial and Business Management”, S.Chand Publications.
2. Joel Dean - Managerial Economics, Prentice Hall/Pearson Edition, 2009.


**REFERENCES**


1. Rangarajan - Principles of Macro Economics, Tata McGraw-Hill Publishing Company Limited, 1997.
2. Marketing Management - Philip Kotler - Pearson Education- Millennium Edition, 2001.
3. Gary Dessler, "Human Resource Management", Seventh edition, Prentice-Hall of India P.Ltd, 2002.

## 11UAE712 DESIGN FOR MANUFACTURING AND ASSEMBLY

| L | T | P | C |
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**Course Objectives**

- To understand the concept of tolerance analysis.
- To enable the students to understand and appreciate better design and manufacturing methodologies that facilitates easier assembly of complex equipment.

**Course Outcome**

- Understand the design fundamentals for manufacturing oriented design.
- Understand the strength and mechanical factors involved in manufacturing.
- Apply the concept of geometrical tolerances in manufacturing
- Understand the design principles and process parameters involved in assembly and machining.
- Know the machining and casting considerations for manufacturing oriented design Get the exposure about the impact of design on environment to achieve eco-friendly component design

**SELECTION OF MATERIALS AND PROCESSES** **9**

Phases of design – General requirements for material and process selection, effect of material properties and manufacturing process on design – DFM approach - DFM Guidelines – Product design for manual assembly, automatic assembly – Computer aided DFMA.

**GEOMETRIC TOLERANCE** **9**

Geometric Tolerances; Feature control frame, tolerance zones, Symbols, Flatness, Straightness, Circularity, Concentricity, Roundness, Position Control, Profile Tolerancing, Run-out Control, Datums and datum features – Examples; Comparison between co-ordinate and convention method of feature location, tolerancing and true position tolerancing, virtual size concept, floating and fixed fasteners, projected tolerance zone

**TOLERANCE ANALYSIS** **9**

Process capability – metrics – costs aspects – Feature tolerance – geometric tolerance – surface finish, review of relationship between attainable tolerance grades and difference machining process – Cumulative effect of tolerances; sure fit law , normal law and truncated normal law.

**SELECTIVE ASSEMBLY AND DATUM SYSTEMS** **9**

Interchangeable selective assembly – Control and axial play; introducing secondary machining operations, laminated shims, examples. Datum systems : Degrees of freedom, grouped datum systems different types, two and three mutually perpendicular grouped datum planes and applications.

**DESIGN FOR MACHINING** **9**

Design features to facilitate machining – Functional and manufacturing datum features, component design, machining considerations, redesign for manufacture, examples. Form design**:** Form design of castings and weldments

**Total Hours: 45**

**TEXT BOOKS**

1. Boothroyd, G, Marcel Dekker. "Design for Assembly Automation and Product Design. New York, 1980.
2. Bralla, "Design for Manufacture handbook", McGraw hill, 1999

**REFERENCES**

1. Boothroyd, G, Heartz and Nike, "Product Design for Manufacture", Marcel Dekker, 1994.
2. Dickson, John. R, and Corroda Poly, "Engineering Design and Design for Manufacture and Structural Approach", Field Stone Publisher
3. Whitney, Daniel E., "Mechanical Assemblies - Their Design, Manufacture, and Role in Product Development " Oxford University Press, 2004.

## 11UAE801 ERGONOMICS

| L | T | P | C |
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**Course Objectives**

- To understand the concept of industrial design, visual effects and aesthetic concepts.

**Course Outcome**

- Describe the concept of Industrial Design
- Gain knowledge in anthropomorphic mechanism and mechanics of seeing
- Apply the concept of visual effects and aesthetic concepts
- Use color related concepts in design
- Relate the psychological requirement of an industry based upon ergonomic factors

**ERGONOMICS AND INDUSTRIAL DESIGN** **9**

Introduction - general approach to the man - machine relationship - work station design - working position. Control and displays - Shapes and sizes of various controls and displays – multiple display and control situations - design of major controls in automobiles, machine tools etc., and - design of office furniture - redesign of instruments.

**ERGONOMICS AND PRODUCTION** **9**

Ergonomics and product design - ergonomics in automated systems - expert systems for ergonomic design. Anthropomorphic data and its applications in ergonomic design - limitations of anthropomorphic data - use of computerized data base.

**VISUAL EFFECTS OF LINE AND FORM** **9**

The mechanics of seeing - psychology of seeing - general influences of line and form.

**COLOUR** **9**

Colour and light - colour and objects - colour and the eye - colour consistency - colour terms - reactions to colour and colour continuation - colour on engineering equipments.

**AESTHETIC CONCEPTS** **9**

Concept of unity - concept of order with variety - concept of purpose - style and environment - Aesthetic expressions. Style - components of style - house style, observing style in capital goods.

**TOTAL HOURS: 45**

**TEXT BOOKS**


1. Mayall W. H., "Industrial design for Engineers", London Iliffee Books Ltd, 1988.
2. Brian Shackel (Edited), “Applied Ergonomics Hand Book", Butterworth Scientific, London, 1989.


**REFERENCES**


1. Dale Huchinson R., "New Horizons for Human Factors in Design", Mc Graw Hill book company, 1990.

2. Robert W. Bailey, "Human Performance Engineering", Prentice Hall Inc., New Jercey, 1991.

## 11UAE802 PRODUCT DEVELOPMENT

| L | T | P | C |
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**Course Objectives**

- To understand the concept of product development, customer need and generating concepts.

**Course Outcome**

- Understand the basic product development process
- Apply the design process for developing a product
- Get exposed to understand the need of customer
- Demonstrate the knowledge on concept generation and product manufacturing

**INTRODUCTION** **9**

Quality function deployment- quality project approach and the problem solving process. Design creativity- innovations in design alternatives. Concurrent engineering, industrial design principles.

**JOURNEY IN PRODUCT DEVELOPMENT** **9**

Product development Vs design, types of design and redesign, modern production development process, reverse engineering and redesign product development process, examples of product development process, scoping product development- S curve, new product development.

**UNDERSTANDING CUSTOMER NEEDS** **9**

Gathering customer needs, organizing and prioritizing customer needs, establishing product function, FAST method, establishing system functionality.

**PRODUCT TEAR DOWN AND EXPERIMENTATION** **9**

Tear down method, post teardown report, benchmarking and establishing engineering specifications, product portfolios.

**GENERATING CONCEPTS** **9**

Information gathering, brain ball, C-sketch/6-3-5 methods, morphological analysis, concept selection, technical feasibility, ranking, measurement theory, DFMA, Design for robustness, types of prototypes, uses of prototypes, rapid prototyping technique scale, design of experiments, statistical analysis of experiments.

**TOTAL HOURS: 45**

**TEXT BOOKS**

1. John W Gosnay and Christine M Mears, “Business Intelligence with cold Fusion”, Prentice Hall india, New Delhi,2000
2. David S Linthicum, “B2B Application Integration”, Addison Wesley, Boston,2001.

**REFERENCES**

1. Alexis Leon, “Enterprise Resource Planning” Tata McGraw Hill, New Delhi, 2002.
2. Karl T Ulrich and Stephen D Eppinger, “Product Design and Development”, McGraw Hill, New York, 1994.

## 11UAE803 MODERN MANUFACTURING METHODS

| L | T | P | C |
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**Course Objectives**

- This course will give a good perspective with adequate depth to understand the unconventional manufacturing processes; its relative advantages were conventional techniques.

**Course Outcome**

- Describe the importance of unconventional machining processes and its techniques.
- Classify and understand the principle and applications of Mechanical and Electrical energy based processes.
- Identify the etchants, maskant, techniques of applying maskants for chemical and electro chemical machining processes.
- Understand the working principle and applications of thermal energy based processes.
- Classify forming process and its applications

**INTRODUCTION** **5**

Unconventional machining Process – Need – classification – Brief overview of all techniques.

**MECHANICAL ENERGY AND ELECTRICAL ENERGY BASED PROCESSES** **10**

Abrasive Jet Machining – Water Jet Machining – Ultrasonic Machining. (AJM, WJM and USM). Working Principles – equipment used -Variation in techniques used – Applications.

Electric Discharge Machining (EDM) - working Principles-equipments-Process Parameters- Tool Wear –Wire cut EDM – Applications.

**CHEMICAL AND ELECTRO-CHEMICAL ENERGY BASED PROCESSE** **10**

Chemical machining and Electro-Chemical machining (CHM and ECM)-Etchants-maskant-techniques of applying maskants-Process Parameters – MRR-Applications. Principles of ECM-equipments-MRR-Electrical circuit-Process Parameters-ECG and ECH Applications.

**THERMAL ENERGY BASED PROCESSES** **10**

Laser Beam machining (LBM), plasma Arc machining (PAM) and Electron Beam Machining (EBM). Principles-Equipment-Types-Beam control techniques – Applications.

Unconventional welding processes: Explosive welding, Cladding etc. Under water welding, Metallising, Plasma are welding/cutting etc.

**UNCONVENTIONAL FORMING PROCESSES** **10**

Principle, working and applications of High energy forming processes such as Explosive Forming, Electromagnetic forming, Electro-Discharge forming, water hammer forming, explosive compaction etc.

**TOTAL HOURS : 45**

**TEXT BOOK**


1. Vijay.K. Jain “Advanced Machining Processes” Allied Publishers Pvt. Ltd., New Delhi (2002) ISBN 81-7764-294-4.
2. Benedict. G.F. “Nontraditional Manufacturing Processes” Marcel Dekker Inc., New York (1987).


**REFERENCES**


1. Pandey P.C. and Shan H.S. “Modern Machining Processes” Tata McGraw-Hill, New Delhi (1980).
2. Mc Geough, “Advanced Methods of Machining” Chapman and Hall, London (1998).
3. Paul De Garmo, J.T.Black, and Ronald.A.Kohser, “Material and Processes in Manufacturing” Prentice Hall of India Pvt. Ltd., New Delhi (8th Edition) (2001) ISBN – 81-203-1243-0.

## 11UAE804 PLANT LAYOUT AND MATERIAL HANDLING SYSTEMS

| L | T | P | C |
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**Course Objectives**

- To understand the tools and techniques for planning a plant lay-out
- To apply the principles of material handling in choosing the appropriate system
- To analyze and design an efficient and effective material handling system

**Course Outcome**

- Identify the tools and techniques for planning a new plant lay-out
- Understand the maintenance system and select the type of material handling system for the plant
- Apply the concept of palletization for handling the materials
- Analyze the cost and safety for effective material handling system

**PLANT LOCATION AND PHYSICAL FACILITIES** **9**

Factors to be considered – Influence of location on plant layout, selection of plant site, consideration in facilities planning and layout – equipment required for plant operation, capacity, serviceability and flexibility and analysis in selection of equipments, space and man power requirements.

**PLANT LAYOUT** **9**

Need for layout, types of layout, factors influencing product, process, fixed and combination layout, tool and techniques for developing layout, process chart, flow diagram, string diagram, template and scale models – machine data; layout planning procedure – visualization of layout, revision and improving existing layout, balancing of fabrication and assembly lines.

**INDUSTRIAL BUILDINGS AND UTILITIES** **9**

Centralized electrical, pneumatic, water line systems; types of buildings, lighting, heating, air-conditioning and ventilation utilities – planning and maintenance, waste handling, statutory requirements, packing and storage of materials: importance of packaging, layout for packaging – packaging machinery – wrapping and packing of materials, cushion materials.

**MATERIAL HANDLING** **9**

Importance and scopes – principles of material handling – engineering and economic factors - planning, relationship to plant layout – types and selection of material handling systems, factors influencing their choice – concept of containerization and palletization.

**ANALYSIS OF MATERIAL HANDLING** **9**

Factors involved – motion analysis, flow analysis, graphical analysis, safety analysis, equipment cost analysis, palletization analysis, analysis of operation, material handling surveys – designing of material handling systems – system equation - planning chart, unit load design – principle - efficiency of containers, pallet sizes.

**TOTAL HOURS: 45**

**TEXT BOOKS**


1. Govindan, K. R., "Plant Layout and Material Handling", Anuradha Publications, Kumbakonam, 2001.
2. Khanna, O. P., "Industrial Engineering and Management", Dhanpatrai and Sons, 2003.


**REFERENCES**


1. Fred E Meyers, "Plant Layout and Material Handling", 2nd edition, Prentice Hall, 1999.
2. James A. Tompkins, John A. White, Yavuz A. Bozer and J. M. A. Tanchoco, "Facilities Planning", 3rd edition, John Wiley & Sons, 2003.

## 11UAE805 RAPID PROTOTYPING AND RAPID TOOLING

| L | T | P | C |
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**Course Objectives**

- Generating a good understanding of RP history, its development and applications.
- Expose the students to different types of Rapid prototyping processes, materials used in RP systems and reverse engineering.

**Course Outcome**

- Understand and apply the concepts of rapid prototyping parameters in manufacturing systems.
- Demonstrate the ability to conceptualize manufacturing processes and systems through direct and indirect tooling systems
- Demonstrate the ability to explain rapid tooling and software used in RPT

**INTRODUCTION** **5**

Need - Development of RP systems – RP process chain - Impact of Rapid Prototyping on Product Development –Digital prototyping - Virtual prototyping- Rapid Tooling - Benefits- Applications.

**REVERSE ENGINEERING AND CAD MODELING** **8**

Basic concept- Digitization techniques – Model Reconstruction – Data Processing for Rapid Prototyping: CAD model preparation, Data Requirements – geometric modeling techniques: Wire frame, surface and solid modeling – data formats - Data interfacing, Part orientation and support generation, Support structure design, Model Slicing and contour data organization, direct and adaptive slicing, Tool path generation.

**LIQUID BASED AND SOLID BASED RAPID PROTOTYPING SYSTEMS** **8**

Stereolithography (SLA): Apparatus: Principle, per-build process, part-building, post-build processes, photo polymerization of SL resins, part quality and process planning, recoating issues, materials, advantages, limitations and applications.

Solid Ground Curing (SGC): working principle, process, strengths, weaknesses and applications.Fused deposition Modeling (FDM): Principle, details of processes, process variables, types, products, materials and applications. laminated object manufacturing(LOM): Working Principles, details of processes, products, materials, advantages, limitations and applications - Case studies.

**POWDER BASED RAPID PROTOTYPING SYSTEMS** **8**

Selective Laser Sintering(SLS): Principle, process, Indirect and direct SLS- powder structures, modeling of SLS, materials, post processing, post curing, surface deviation and accuracy, Applications. Laser Engineered Net Shaping (LENS): Processes, materials, products, advantages, limitations and applications– Case Studies.

**OTHER RAPID PROTOTYPING TECHNOLOGIES** **8**

Three dimensional Printing (3DP):Principle, basic process, Physics of 3DP, types of printing, process capabilities, material system. Solid based, Liquid based and powder based 3DP systems, strength and weakness, Applications and case studies. Shape Deposition Manufacturing (SDM): Introduction, basic process, shape decomposition, mold SDM and applications. Selective Laser Melting, Electron Beam Melting – Rapid manufacturing.

**RAPID TOOLING** **8**

Indirect Rapid Tooling - Silicone rubber tooling, Aluminum filled epoxy tooling, Spray metal tooling, etc. Direct Rapid Tooling - Direct AIM, Quick cast process, Copper polyamide, Rapid Tool, Sand casting tooling, Laminate tooling, soft tooling vs hard tooling.

**TOTAL HOURS: 45**

**TEXT BOOKS**


1. Pham. D. T. and Dimov. S. S., "Rapid Manufacturing", Verlag, London, 2001.
2. Chee Kai Chua, Kah Fai Leong, Chu Sing Lim**, "**Rapid prototyping: principles and applications"


**REFERENCES**


1. Rapid Prototyping and Engineering applications : A tool box for prototype development, Liou W.Liou, Frank W.Liou, CRC Press, 2007.
2. Terry Wohlers, "Wohlers Report 2001", Wohlers Associates, 2001
3. Ali K. Kamrani, Emad Abouel Nasr, "Rapid Prototyping: Theory and practice", Springer, 2006.

## 11UAE806 RENEWABLE ENERGY SOURCES

| L | T | P | C |
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**Course Objectives**

- At the end of the course, the student expected to do Understand and analyze the pattern of renewable energy resources Suggest methodologies / technologies for its utilization Economics of the utilization and environmental merits.

**Course Outcome**

- List the various sources of energy
- Explain the various means to utilize the Renewable Energy resources
- Identify the impact of renewable energy resources on the environment
- Examine the scope of newer sources of energy and their application

**SOLAR ENERGY** **9**

Solar Radiation – Measurements of solar Radiation and sunshine – Solar Thermal Collectors – Flat Plate and Concentrating Collectors – Solar Applications – fundamentals of photo Voltaic Conversion – solar Cells – PV Systems – PV Applications.

**WIND ENERGY** **9**

Wind Data and Energy Estimation – wind Energy Conversion Systems – Wind Energy generators and its performance – Wind Energy Storage – Applications – Hybrid systems.

**BIO - ENERGY** **9**

Biomass, Biogas, Source, Composition, Technology for utilization – Biomass direct combustion – Biomass gasifier – Biogas plant – Digesters – Ethanol production – Bio diesel production and economics. Photosynthesis, Bio gas production Aerobic and anaerobic bio-conversion process, Raw materials, Properties of bio gas, Producer gas, Transportation of bio gas, bio gas plant technology & status, Community biogas plants, Problems involved in bio gas production .

**OTEC, TIDAL, GEOTHERMAL AND HYDEL ENERGY** **9**

Principle of ocean thermal energy conversion, Wave energy conversion machines, Power plants based on ocean energy, Problems associated with ocean thermal energy conversion systems Tidal energy – Data, Technology options – Open and closed OTEC Cycles – Small hydro, turbines – Geothermal energy sources, power plant and environmental issues.

**NEW ENERGY SOURCES** **9**

Hydrogen, generation, storage, transport and utilisation, Applications : power generation, transport – Fuel cells – technologies, types – economics and the power generation

**TOTAL HOURS: 45**

**TEXT BOOKS**


1. G.D. Rai, Non Conventional Energy Sources, Khanna Publishers, New Delhi, 1999.
2. S.P. Sukhatme, Solar Energy, Tata McGraw Hill Publishing Company Ltd., New Delhi, 1997.


**REFERENCES**


1. Godfrey Boyle, Renewable Energy, Power for a Sustainable Future, Oxford University Press, U.K., 1996.
2. Twidell, J.W. & Weir, A., Renewable Energy Sources, EFN Spon Ltd., UK, 1986.
3. G.N. Tiwari, solar Energy – Fundamentals Design, Modelling & applications, Narosa Publishing House, New Delhi, 2002.

## 11UAE807 ENERGY ENGINEERING

| L | T | P | C |
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**Course Objectives**

- To understand the different types of fuels available
- To understand the energy audit and conservation methods
- To understand the principles of power plants and waste heat recovery systems

**Course Outcome**

- List the various sources of energy
- Explain the various classes of fuel, and the steps necessary to refine them.
- Interpret the safety systems and its significance in a nuclear power plant
- Analyze and compare the various alternatives for generating power
- Calculate the calorific value of various fuels and the cost of energy

**INTRODUCTION** **9**

Sources of energy, types of fuels- energy and relative forms. Calorific value- gross and net value, calculation of calorific value from fuel analysis, experimental determination energy resources present and future energy demands with reference to India.

**SOLID AND LIQUID FUELS** **9**

Coal: origin, occurrence, reserves, petrography, classification, ranking, analysis, testing, storage, coal carbonization and byproduct recovery, liquefaction of coal, gasification of coal, burning of coal and firing mechanism, burning of pulverized coal. Liquid fuels: petroleum: origin, occurrence, reserves, composition, classification, characteristics, fractionation, reforming, cracking, petroleum products, specification of petroleum products, burning of liquid fuels.

**GASEOUS FUELS** **9**

Natural gas, coke oven gas, producer gas, water gas, LPG, burning of gaseous fuels, hydrogen (from water) as future fuel, fuel cells, flue gas, analysis: orsat apparatus.

**ENERGY AUDIT AND CONSERVATION** **9**

Energy auditing: short term, medium term, long term schemes, energy conversion, energy index, energy cost, representation of energy consumption, Sankey diagram, energy auditing.

Energy conservation: conservation methods in process industries, theoretical analysis, practical limitations.

**POWER PLANTS** **9**

Steam Plant: Run time cycle, boiler plant, steam cost, steam distribution and utilization, combined heat and power systems, energy from biomass and biogas plants, gas purification, solar energy, wind energy, energy storage.Waste heat recovery, sources of waste heat and potential application, various types of heat recovery systems, regenerators, recuperators, waste heat boilers

**TOTAL HOURS: 45**

**TEXT BOOKS**


1. O.P.Gupta, “Elements of Fuels , furnaces and refractories” Khanna Publishers, New Delhi, India, 1996
2. Sami Sarkar, “Fuels and combustion”, 2nd edition orient Longman (1998).


**REFERENCES**


1. G.D.Rai, “Non-conventional energy resources”, Khanna Publishers, New Delhi, India.
2. S.P.Sukhathame, “Solar energy”, Academic press London, 1981

## 11UAE808 COMPUTATIONAL FLUID DYNAMICS

| L | T | P | C |
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**Course Objectives**

- To introduce Governing Equations of viscous fluid flows.
- To introduce numerical modeling and its role in the field of fluid flow and heat transfer.
- To enable the students to understand the various discretization methods, solution procedures and turbulence modeling.
- To create confidence to solve complex problems in the field of fluid flow and heat transfer by using high speed computers.

**Course Outcome**

- Understand and solve the governing equations for viscous fluid flow.
- Describe and solve finite difference, finite volume and finite element methods related to fluid flow problems
- Acquire necessary skills required to model and solve simple multi-dimensional fluid flow and heat transfer problems.
- Gain exposure to CFD analysis

**GOVERNING EQUATIONS AND BOUNDARY CONDITIONS** **9**

Basics of computational fluid dynamics – Governing equations of fluid dynamics – Continuity, Momentum and Energy equations – Chemical species transport – Physical boundary conditions – Time-averaged equations for Turbulent Flow – Turbulent–Kinetic Energy Equations – Mathematical behavior of PDEs on CFD - Elliptic, Parabolic and Hyperbolic equations.

**FINITE DIFFERENCE METHOD** **9**

Derivation of finite difference equations – Simple Methods – General Methods for first and second order accuracy – solution methods for finite difference equations – Elliptic equations – Iterative solution Methods – Parabolic equations – Explicit and Implicit schemes – Example problems on elliptic and parabolic equations.

**FINITE VOLUME METHOD (FVM) FOR DIFFUSION** **9**

Finite volume formulation for steady state One, Two and Three - dimensional diffusion problems. One dimensional unsteady heat conduction through Explicit, Crank – Nicolson and fully implicit schemes.

**FINITE VOLUME METHOD FOR CONVECTION DIFFUSION** **9**

Steady one-dimensional convection and diffusion – Central, upwind differencing schemes-properties of discretization schemes – Conservativeness, Boundedness, Trasnportiveness, Hybrid, Power-law, QUICK Schemes.

**CALCULATION FLOW FIELD BY FVM** **9**

Representation of the pressure gradient term and continuity equation – Staggered grid – Momentum equations – Pressure and Velocity corrections – Pressure Correction equation, SIMPLE algorithm and its variants. Turbulence models, mixing length model, two equation (k-Є) models – High and low Reynolds number models.

**TOTAL HOURS: 45**

**TEXT BOOKS**


1. T.J. Chung, Computational Fluid Dynamics, Cambridge University, Press, 2002.
2. Versteeg, H.K., and Malalasekera, W., An Introduction to Computational Fluid Dynamics: The finite volume Method, Longman, 1998.


**REFERENCES**


1. Patankar, S.V. Numerical Heat Transfer and Fluid Flow, Hemisphere Publishing Corporation, 2004.
2. Muralidhar, K., and Sundararajan, T., computationsl Fluid Flow and Heat Transfer, Narosa Publishing House, NewDelhi, 1995.
3. Ghoshdastidar P.S., Heat Transfer, Oxford Unversity Press, 2005.

## 11UAE809 MARKETING MANAGEMENT

| L | T | P | C |
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**Course Objectives**

- To understand the various processes involved in Marketing and its Philosophy, Psychology of consumers and strategies for advertising, pricing and selling.

**Course Outcome**

- Manage people, processes and resources within a diverse organization.
- Apply knowledge of leadership concepts in an integrated manner.
- Analyze an organization's activities to develop/implement a marketing strategy.

**MARKETING PROCESS** **9**

Definition, Marketing process, dynamics, needs, wants and demands, marketing concepts, environment, mix, types. Philosophies, selling versus marketing, organizations, industrial versus consumer marketing, consumer goods, industrial goods, product hierarchy.

**BUYING BEHAVIOUR AND MARKET SEGMENTATION** **9**

Cultural, demographic factors, motives, types, buying decisions, segmentation factors - demographic –Psycho graphic and geographic segmentation, process, patterns.

**PRODUCT PRICING AND MARKETING RESEARCH** **9**

Objectives, pricing, decisions and pricing methods, pricing management. Introduction, uses, process of marketing research.

**MARKETING PLANNING AND STRATEGY FORMULATION** **9**

Components of marketing plan-strategy formulations and the marketing process, implementations, portfolio analysis, BCG, GEC grids.

**ADVERTISING SALES PROMOTION AND DISTRIBUTION** **9**

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

**TOTAL HOURS: 45**

**TEXT BOOKS**


1. Ramasamy and Nama kumari, —Marketing Environment: Planning, implementation
2. and control the Indian context, 1990.
3. Steven J.Skinner, —Marketing, All India Publishers and Distributes Ltd. 1998.


**REFERENCES**


1. Govindarajan.M. —Industrial marketing management, Vikas Publishing Pvt Ltd, 2003.
2. Philip Kolter, —Marketing Management, Pearson Education 2001.
3. Green Paul.E.and Donald Tull, —Research for marketing decisions, Prentice Hall of India, 1975.

## 11UAE810 FIRE AND INDUSTRIAL SAFETY

| L | T | P | C |
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**Course Objectives**

- To understand the basic concepts of safety engineering.
- To understand the principles of fire and explosive control.
- To understand the methods of safety training.

**Course Outcome**

- Discuss the basic concepts of safety Engineering and Acts, and the importance of safety in industries
- Administer the concepts of audits in industries with respect to industrial hygiene and health.
- Classify various classes of Fire and its controlling methodology using different forms of extinguishers
- Apply the concept of ergonomics in anatomy, posture and body mechanics.
- Explain the importance of safety education and training methods.

**BASICS OF SAFETY ENGINEERING & ACTS** **9**

Evolution of modern safety concept – safety audit – concept of an accident investigation and reporting – safety performance monitoring; Acts – factories act – 1948 – statutory authorities – inspecting staff – Tamilnadu factories Rules 1950 under safety and health – environment act – 1986 – air act 1981, water act 1974 – other acts; safety in industries – general safety concepts, machine guarding, hazards in metal removing process, welding process, cold and hot working process.

**OCCUPATIONAL HEALTH AND INDUSTRIAL HYGIENE** **9**

Physical hazards – noise, heat, recognition of chemical hazards-dust, fumes, mist, vapour, fog, gases; biological and ergonomical hazards-basic concepts; occupational health-concept and spectrum of health – functional units and activities of occupational health services, pre-employment and post-employment medical examinations – occupational related diseases, levels of prevention of diseases, notifiable occupational diseases; hazard assessment, procedure, methodology; safety audit, checklist analysis, what-if analysis, safety review, preliminary hazard analysis (PHA), human error analysis, hazard operability studies (HAZOP), safety warning systems.

**FIRE ENGINEERING AND EXPLOSIVE CONTROL** **9**

Fire properties of solid, liquid and gases – fire triangle – principles of fire extinguishing – active and passive fie protection systems – various classes of fires – A, B, C, D, E – types of fire extinguishers – principles of explosion – explosion protection – electrical safety; electrical hazards – primary and secondary hazards – concept of earthing – protection systems – fuses, circuit breakers and over load relays – first aid.

**ERGONOMICS** **9**

Introduction to ergonomics: The focus of ergonomics, ergonomics and its areas of application in the work system, a brief history of ergonomics, attempts to humanize work, modern ergonomics, future directions for ergonomics; anatomy, posture and body mechanics: some basic body mechanics, anatomy of the spine and pelvis related to posture, posture stability and posture adaptation, low back pain, risk factors for musculoskeletal disorders in the workplace, behavioural aspects of posture, effectiveness and cost effectiveness; anthropometry and its uses in ergonomics, principles of applied anthropometry in ergonomics; applications of human

factors engineering, man as a sensor, man as information processor, man as controller – man vs machine – concepts of bio-mechanics.

**SAFETY EDUCATION AND TRAINING** **9**

Importance of training – identification of training needs – training methods – programmes, conferences, competitions – method of promoting safe practice – motivation – communication – role of government agencies and private consulting agencies in safety training – creating awareness, awards, celebrations, safety posters, safety displays, safety pledge, safety incentive scheme, safety campaign – domestic safety and training.

**TOTAL HOURS: 45**

**TEXT BOOKS**


1. Krishnan N.V., "Safety Management in Industry", Jaico Publishing House, Bombay, 1997.
2. "Hand book of Occupational Safety and Health", National Safety Council, Chicago, 1982.


**REFERENCES**


1. "The Factories Act 1948", Madras Book Agency, Chennai, 2000.
2. "Water (Prevention and control of pollution) Act 1974", Commercial Law publishers (India) Pvt. Ltd., New Delhi.
3. Air (Prevention and control of pollution) act 1981, Commercial Law Publishers (India) Pvt. Ltd., New Delhi

## 11UAE811 TOTAL QUALITY MANAGEMENT

| L | T | P | C |
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**Course Objectives**

- To understand the Total Quality Management concept and principles and the various tools available to achieve Total Quality Management.
- To understand the statistical approach for quality control.
- To create an awareness about the ISO and QS certification process and its need for the industries.

**Course Outcome**

- Associate the core concepts and principles of TQM stated by different Quality Guru's with the industry
- Identify the importance of a customer and various methods to obtain best customer satisfaction
- Apply the concepts of Statistical process control and the seven Quality tools in the industry.
- Analyze the failures using various tools of Quality.
- Advertise to create an awareness about the ISO and QS certification process and its need for the industries

**INTRODUCTION** **9**

Core concepts, Definition, Frame work, Learning's from Quality Gurus – Shewhart, Deming, Juran, Feigenbaum, Ishikawa, Crosby, Genichi Taguchi. Basic concepts of Total Quality Management, Historical Review, Principles of TQM. Quality-definitions, dimensions, planning and costs. Quality Council, Quality Statements, Strategic Planning, Deming Philosophy, Barriers to TQM Implementation.

**TQM PRINCIPLES** **9**

Customer satisfaction – Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Employee Involvement – Motivation, Empowerment, Teams, Recognition and Reward, Performance Appraisal, Benefits, Continuous Process Improvement – Juran Trilogy, PDSA Cycle, 5S, Kaizen, Supplier Partnership and Relationship Development.

**STATISTICAL PROCESS CONTROL (SPC)** **9**

The seven tools of quality, Statistical Fundamentals – Measures of central Tendency and Dispersion, Population and Sample, Normal Curve, Control Charts for variables and attributes, Process capability, Concept of six sigma, New seven Management tools.

**TQM TOOLS** **9**

Benchmarking – Reasons to Benchmark, Benchmarking Process, Quality Function Deployment (QFD) – House of Quality, QFD Process, Benefits, Taguchi Quality Loss Function, Total Productive Maintenance (TPM) – Concept, Improvement Needs, FMEA – Stages of FMEA.

**QUALITY SYSTEMS** **9**

Need for ISO 9000 and Other Quality Systems, ISO 9000:2000 Quality System – Elements, Implementation of Quality System, Documentation, Quality Auditing, TS 16949, ISO 14000 – Concept, Requirements and Benefits.

**TOTAL HOURS: 45**

**TEXT BOOKS**

1. Dale H.Besterfiled, et al., "Total Quality Management", Pearson Education, Inc. 2003. (Indian reprint 2004). ISBN 81-297-0260-6.
2. Sunil Sharma: Total Engineering Quality Management, Macmillan India Ltd. 2003.

**REFERENCES**

1. James R.Evans & William M.Lidsay, "The Management and Control of Quality", (5th Edition), South-Western (Thomson Learning), 2002 (ISBN 0-324-06680-5).
2. Feigenbaum.A.V. "Total Quality Management", McGraw-Hill, 1991.
3. Oakland.J.S. "Total Quality Management", Butterworth Hcinemann Ltd., Oxford, 1989.

## 11UAE812 TURBO MACHINERY

| L | T | P | C |
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**Course Objectives**

- To understand the principles of turbo machines.
- To understand the design and construction of centrifugal fans, blowers, compressor and turbines.

**Course Outcome**

- Ability to design and calculate different parameters for turbo machines
- Prerequisite to CFD and Industrial fluid power courses
- Ability to formulate design criteria
- Ability to understand thermodynamics and kinematics behind turbo machines

**PRINCIPLES** **9**

Energy transfer between fluid and rotor-classification of fluid machinery - Euler's equation - dimensionless parameters - specific speed – applications - velocity triangles - work and efficiency.

**CENTRIFUGAL FANS AND BLOWERS** **9**

Types - stage and design parameters - flow analysis in impeller blades - volute and diffusers, losses, characteristic curves and selection, fan drives and fan noise.

**CENTRIFUGAL COMPRESSOR** **9**

Construction details, impeller flow losses, slip factor, diffuser analysis, stall and chocking, losses and performance curves.

**AXIAL FLOW COMPRESSOR** **9**

Stage velocity diagrams, enthalpy - entropy diagrams, stage losses and efficiency, work done in single stage design - problems and performance characteristics

**AXIAL AND RADIAL FLOW TURBINES** **9**

Stage velocity diagrams, reaction stages, losses and coefficients, blade design principles, testing and performance characteristics.

Self Study Topic: Cross flow fan, Banki turbine, Turbulators.

**TOTAL HOURS: 45**

**TEXT BOOKS**


1. Yahya, S.M., "Turbines, Compressor and Fans", Tata McGraw Hill Publishing Company, 1996.
2. Venkanna B.K., "Fundamentals of Turbo-machinery", PHI Learning Private Limited, 2009.


**REFERENCES**


1. Earl Logan, Jr., "Hand book of Turbomachinery", Marcel Dekker Inc., 1992.
2. Dixon, S.I., "Fluid Mechanics and Thermodynamics of Turbomachinery", Pergamon Press, 1990.
3. Ganesan, V., "Gas Turbines", Tata McGraw Hill Pub. Co., 1999.

## 11UAE813 RELIABILITY ENGINEERING

| L | T | P | C |
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**Course objectives:**

- To understand the types of failure models and reliability of systems.
- To understand the concepts of design for reliability.
- To understand the concepts of maintainability and availability.

**Course Outcome**

- Describe the concepts of reliability, availability and maintainability
- Classify the types of failure models and reliability of systems and to Develop hazard rate models to know the behavior of components
- Use the concept of various configurations and different types of models
- Analyze the failures and downtime and to Implement strategies for improving reliability of repairable and non-repairable systems
- Assess reliability of components and systems using field and test data.

**RANDOM VARAIBLES AND PROBABILITY DISTRIBUTIONS** **9**

Sample spaces- events, probability axiom, conditional probability-independent events, Bayes' formula, probability distributions – binomial, Poisson, geometric, uniform, normal, gamma and beta distributions, mean and variance-simple problems.

**INTRODUCTION TO RELIABILITY** **9**

Definition of reliability – reliability vs. quality- reliability function-MTTF-hazard rate function-bathtub curve-derivation of reliability function-constant failure rate model-time dependent failure models- exponential, Weibull distribution.

**RELIABILITY OF SYSTEM AND MODELS** **9**

Serial configuration – parallel configuration –Combined serial parallel systems–system structure function - minimal path and cut sets – load sharing systems, standby system - degraded systems, three state devices – covariate models, static models, dynamic models, physics of failure models.

**DESIGN FOR RELIABILITY, MAINTAINABILITY AND AVAILABILITY** **9**

Reliability specification and system measurements – reliability allocation- design methods-failure analysis- system safety and fault tree analysis- analysis of downtime – repair time distribution – reliability under preventive maintenance - maintenance requirements – design methods – availability concepts and definitions .

**RELIABILITY IMPROVEMENT** **9**

Data collection- empirical methods – ungrouped and grouped – complete , censored data- static life estimation – test time calculation – burn in testing – acceptance, sequential, binomial testing- accelerated life testing –other acceleration models- experimental design – reliability growth process- idealized growth curve- various growth models- identifying failure and repair distributions

**Total Hours: 45**

**TEXT BOOKS:**


1. Charles E. Ebeling, “An introduction to Reliability and Maintainability Engineering”, Tata Mc Graw Hill publications, 2000.
2. S. S. Rao, “Reliability Based Design”, Mc-Graw Hill Publications, 1992.


**REFERENCES:**


1. Patrick D T O’Connor, “Practical Reliability Engineering”, John Wiley and sons Inc., 2002.
2. L.S. Srinath, “Reliability Engineering”, Affiliated East-West Press, New Delhi.
3. K.C. Kapur and L.R. Lamberson, “Reliability in Engineering Design”, Wiley Publications.