VINAYAKA MISSION'S RESEARCH FOUNDATION

(Deemed to be University under section 3 of the UGC Act 1956)

# Faculty of Engineering and Technology

## Programme : B.E – Mechanical Engineering – Part Time

## Choice Based Credit System (CBCS)

## Curriculum & Syllabus (Semester I to VII)

## Regulations 2021

# VINAYAKA MISSION'S RESEARCH FOUNDATION, DEEMED TO BE UNIVERSITY, SALEM

# Board of Mechanical Engineering

## PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

| | |
|---|---|
| **PEO.1** | Design, analyze & fabricate, maintain and improve mechanical engineering systems that are technically sound, economically feasible and socially acceptable to enhance quality of life. |
| **PEO.2** | Apply modern computational, analytical, simulation tools and techniques to address the challenges faced in mechanical and allied engineering streams. |
| **PEO.3** | Communicate effectively using innovative tools and demonstrate leadership & entrepreneurial skills. |
| **PEO.4** | Exhibit professionalism, ethical attitude, team spirit and pursue lifelong learning to achieve career and organizational goals. |

## PROGRAM SPECIFIC OUTCOMES (PSOs)

To achieve the mission of the program, Mechanical Engineering graduates will be able:

| | |
|---|---|
| **PSO.1** | To work independently as well as in team to formulate, design, execute solutions for engineering problems and also analyze, synthesize technical data for application to product, process, system design & development |
| **PSO.2** | To understand & contribute towards social, environmental issues, following professional ethics and codes of conduct and embrace lifelong learning for continuous improvement |
| **PSO.3** | To develop expertise towards use of modern engineering tools, careers in industries and research and demonstrate entrepreneurial skill |

# PROGRAMME OUTCOMES

Engineering Graduates will be able to:

| | |
|---|---|
| **PO1** | **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems |
| **PO2** | **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences. |
| **PO3** | **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations. |
| **PO4** | **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions. |
| **PO5** | **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations. |
| **PO6** | **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice. |
| **PO7** | **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development. |
| **PO8** | **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice. |
| **PO9** | **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings. |
| **PO10** | **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions. |
| **PO11** | **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments. |
| **PO12** | **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change. |

**VINAYAKA MISSION'S RESEARCH FOUNDATION**
**DEEMED TO BE UNIVERSITY, SALEM**
**CURRICULUM FOR REGULATION-2021**

# Credit Requirement for the Course Categories

**DEPARTMENT OF MECHANICAL ENGINEERING- (PART TIME)**

| Sl. No. | Category of Courses | Types of Courses | Suggested Breakup of Credits (min – max) |
|---|---|---|---|
| 1. | **A.Foundation Courses** | | **18-24** |
| | Humanities and Social Sciences including Management courses | | 9-12 |
| | Basic Science Courses (Maths, Physics and Chemistry) | | 9-12 |
| 2. | **B. Professional Core Courses** | | **61** |
| 3. | **C. Elective Courses** | | **18-27** |
| | Professional Electives | | 12-15 |
| | | Innovation, Entrepreneurship, Skill Development etc. | 3-6 |
| | Open Electives | Emerging Areas like 3D Printing, Artificial Intelligence, Internet of Things etc. | 3-6 |
| 4. | **D. Project work** | | 8 |
| 5. | **E. Mandatory/Audit Courses** Yoga and Meditation, Indian Constitution, Essence of Indian Traditional Knowledge, NCC/NSS/RRC/YRC/Student Clubs/Unnat Bharat Abhiyan/Swachh Bharat, Sports and Games, Gender Equity and Law | | Zero Credit Course (Minimum 2 courses to be completed other than Yoga and Meditation) |
| | **Minimum Credits to be earned** | | **105** |

## B.E./B.TECH. – MECHANICAL ENGINEERING - SEMESTER I TO VII

### A.Foundation Courses (18-24)

### Humanities and Social Sciences including Management Courses Credits (9-12)

| SL. NO | COURSE CODE | COURSE | OFFERING DEPT. | CATEGORY | L | T | P | C | PREREQUISITE |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 34121H02 | TOTAL QUALITY MANAGEMENT | MANAG | FC-HS | 3 | 0 | 0 | 3 | NIL |
| 2 | 34121H05 | ENGINEERING MANAGEMENT AND ETHICS | MANAG | FC-HS | 3 | 0 | 0 | 3 | NIL |
| 3 | 34121H83 | UNIVERSAL HUMAN VALUES – UNDERSTANDING HARMONY | ENG | FC-HS | 3 | 0 | 0 | 3 | NIL |
| 4 | 34121H08 | OPERATIONS MANAGEMENT | MANAG | FC-HS | 3 | 0 | 0 | 3 | NIL |
| 5 | 34121H11 | SOFT SKILLS FOR ENGINEERS | ENG | FC-HS | 3 | 0 | 0 | 3 | NIL |

### Basic Science Courses Credits (9-12)

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 34121B01 | ENGINEERING MATHEMATICS | MATH | FC-BS | 2 | 1 | 0 | 3 | NIL |
| 2 | 34121B12 | SMART MATERIALS | PHY | FC-BS | 3 | 0 | 0 | 3 | NIL |
| 3 | 34121B24 | INDUSTRIAL MATERIALS | CHEM | FC-BS | 3 | 0 | 0 | 3 | NIL |
| 4 | 34121B11 | MATHEMATICS FOR MECHANICAL SCIENCES | MATH | FC-BS | 2 | 1 | 0 | 3 | ENGINEERING MATHEMATICS |
| 5 | 34121B15 | NUMERICAL METHODS FOR MECHANICAL SCIENCES | MATH | FC-BS | 2 | 1 | 0 | 3 | 1.ENGINEERING MATHEMATICS 2.MATHEMATICS FOR MECHANICAL SCIENCES |
| 6 | 34121B35 | RESOURCE MANAGEMENT TECHNIQUES | MATH | FC-BS | 2 | 1 | 0 | 3 | NIL |
| 7 | 34121B18 | PROBABILITY AND STATISTICS | MATH | FC-BS | 2 | 1 | 0 | 3 | NIL |
| 8 | 34121B19 | ENVIRONMENTAL SCIENCES | CHEM | FC-BS | 3 | 0 | 0 | 3 | NIL |

## B.E./B.TECH. – MECHANICAL ENGINEERING - SEMESTER I TO VII

## B. Professional Core Courses Credits-(61)

| SL. NO | COURSE CODE | COURSE | OFFERING DEPT. | CATEGORY | L | T | P | C | PREREQUISITE |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 34421C02 | MANUFACTURING PROCESSES (THEORY AND PRACTICALS) | MECH | CC | 3 | 0 | 2 | 4 | NIL |
| 2 | 34421C05 | FLUID MECHANICS AND MACHINERY (THEORY AND PRACTICALS) | MECH | CC | 2 | 1 | 2 | 4 | NIL |
| 3 | 34421C08 | MECHANICS OF MACHINES (THEORYAND PRACTICALS) | MECH | CC | 2 | 1 | 2 | 4 | NIL |
| 4 | 34421C03 | MECHANICAL BEHAVIOUR OF MATERIALS AND METALLURGY (THEORY AND PRACTICALS) | MECH | CC | 3 | 0 | 2 | 4 | NIL |
| 5 | 34421C06 | STRENGTH OF MATERIALS (THEORY AND PRACTICALS) | MECH | CC | 2 | 1 | 2 | 4 | NIL |
| 6 | 34421C04 | ENGINEERING THERMODYNAMICS (THEORY AND PRACTICALS) | MECH | CC | 2 | 1 | 2 | 4 | NIL |
| 7 | 34421C09 | THERMAL ENGINEERING (THEORY AND PRACTICALS) | MECH | CC | 2 | 1 | 2 | 4 | ENGINEERING THERMODYNAMICS |
| 8 | 34421C11 | DESIGN OF MACHINE ELEMENTS | MECH | CC | 2 | 1 | 0 | 3 | NIL |
| 9 | 34421C13 | ENGINEERING METROLOGY AND MEASUREMENTS (THEORY AND PRACTICALS) | MECH | CC | 3 | 0 | 2 | 4 | NIL |
| 10 | 34421C10 | AUTOMOBILE ENGINEERING (THEORY AND PRACTICALS) | MECH | CC | 3 | 0 | 2 | 4 | NIL |
| 11 | 34421C07 | COMPUTER INTEGRATED MANUFACTURING (THEORY AND PRACTICALS) | MECH | CC | 3 | 0 | 2 | 4 | NIL |
| 12 | 34421C12 | DESIGN OF TRANSMISSION SYSTEMS | MECH | CC | 2 | 1 | 0 | 3 | DESIGN OF MACHINE ELEMENTS |
| 13 | 34421C16 | HEAT AND MASS TRANSFER (THEORYAND PRACTICALS) | MECH | CC | 2 | 1 | 2 | 4 | ENGINEERING THERMODYNAMICS |
| 14 | 34421C14 | FINITE ELEMENT ANALYSIS (THEORY AND PRACTICALS) | MECH | CC | 2 | 1 | 2 | 4 | NIL |
| 15 | 34421C15 | GAS DYNAMICS AND JET PROPULSION | MECH | CC | 3 | 1 | 0 | 4 | ENGINEERING THERMODYNAMICS |
| 16 | 34421C01 | ENGINEERING MECHANICS (STATICS AND DYNAMICS) | MECH | CC | 2 | 1 | 0 | 3 | NIL |

## B.E./B.TECH. –MECHANICAL ENGINEERING - SEMESTER I TO VII

## C. Elective Courses (18-27)

## Professional Elective Courses Credits-(12-15)

| SL. NO | COURSE CODE | COURSE | OFFERING DEPT. | CATEGORY | L | T | P | C | PREREQUISITE |
|---|---|---|---|---|---|---|---|---|---|

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 34421P01 | RENEWABLE SOURCES OF ENERGY | MECH | EC-PS | 3 | 0 | 0 | 3 | NIL |
| 2 | 34421P03 | ADVANCED IC ENGINES | MECH | EC-PS | 3 | 0 | 0 | 3 | NIL |
| 3 | 34421P15 | INDUSTRIAL TRIBOLOGY | MECH | EC-PS | 3 | 0 | 0 | 3 | NIL |
| 4 | 34421P16 | LEAN MANUFACTURING SYSTEMS | MECH | EC-PS | 3 | 0 | 0 | 3 | NIL |
| 5 | 34421P13 | INDUSTRIAL ENGINEERING | MECH | EC-PS | 3 | 0 | 0 | 3 | NIL |
| 6 | 34421P12 | HYDRAULICS AND PNEUMATICS SYSTEMS | MECH | EC-PS | 3 | 0 | 0 | 3 | NIL |
| 7 | 34421P09 | FAILURE ANALAYSIS OF MATERIALS | MECH | EC-PS | 3 | 0 | 0 | 3 | NIL |
| 8 | 34421P11 | FUNDAMENTALS OF PIPING ENGINEERING | MECH | EC-PS | 3 | 0 | 0 | 3 | NIL |
| 9 | 34421P04 | CONCURRENT ENGINEERING | MECH | EC-PS | 3 | 0 | 0 | 3 | NIL |
| 10 | 34421P08 | ENGINEERING PRODUCT DESIGN | MECH | EC-PS | 3 | 0 | 0 | 3 | NIL |
| 11 | 34421P07 | DESIGN OF EXPERIMENTS | MECH | EC-PS | 3 | 0 | 0 | 3 | NIL |
| 12 | 34421P10 | FLUID POWER SYSTEMS | MECH | EC-PS | 3 | 0 | 0 | 3 | NIL |
| 13 | 34421P17 | MEMS AND NEMS | MECH | EC-PS | 3 | 0 | 0 | 3 | NIL |
| 14 | 34421P19 | PETROLEUM PRODUCTION ENGINEERING | MECH | EC-PS | 3 | 0 | 0 | 3 | NIL |

## Open Electives

## Electives from Innovation, Entrepreneurship, Skill Development etc Credits (3-6)

| SL. NO | COURSE CODE | COURSE | OFFERING DEPT. | CATEGORY | L | T | P | C | PREREQUISITE |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 34121O01 | ENGINEERING STARTUPS AND ENTREPRENEURIAL MANAGEMENT | MANAG | OE-IE | 3 | 0 | 0 | 3 | NIL |
| 2 | 34121O02 | INTELLECTUAL PROPERTY RIGHTS | MANAG | OE-IE | 3 | 0 | 0 | 3 | NIL |
| 3 | 34121O04 | INNOVATION, PRODUCT DEVELOPMENT AND COMMERCIALIZATION | MANAG | OE-IE | 3 | 0 | 0 | 3 | NIL |
| 4 | 34121O07 | SOCIAL ENTREPRENEURSHIP | MANAG | OE-IE | 3 | 0 | 0 | 3 | NIL |
| 5 | 34121O06 | NEW VENTURE PLANNING AND MANAGEMENT | MANAG | OE-IE | 3 | 0 | 0 | 3 | NIL |
| 6 | 34121O03 | FINANCE AND ACCOUNTING FOR ENGINEERS | MANAG | OE-IE | 3 | 0 | 0 | 3 | NIL |

## Emerging Areas like 3D Printing, Artificial Intelligence, Internet of Things etc Credits (3-6)

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 35321O01 | BIOSENSORS AND TRANSDUCERS | BME | OE-EA | 3 | 0 | 0 | 3 | NIL |
| 2 | 35321O03 | PRINCIPLES OF BIOMEDICAL INSTRUMENTATION | BME | OE-EA | 3 | 0 | 0 | 3 | NIL |
| 3 | 38121O02 | INTRODUCTION TO BIOFUELS | BTE | OE-EA | 3 | 0 | 0 | 3 | NIL |
| 4 | 38121O01 | FOOD AND NUTRITION TECHNOLOGY | BTE | OE-EA | 3 | 0 | 0 | 3 | NIL |
| 5 | 34221O01 | DISASTER RISK MANAGEMENT | CIVIL | OE-EA | 3 | 0 | 0 | 3 | NIL |
| 6 | 34221O02 | MUNICIPAL SOLID WASTE MANAGEMENT | CIVIL | OE-EA | 3 | 0 | 0 | 3 | NIL |
| 7 | 35021O02 | FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE | CSE | OE-EA | 3 | 0 | 0 | 3 | NIL |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 8 | 35021O03 | INTRODUCTION TO INTERNET OF THINGS | CSE | OE-EA | 3 | 0 | 0 | 3 | NIL |
| 9 | 35021O01 | CYBER SECURITY | CSE | OE-EA | 3 | 0 | 0 | 3 | NIL |
| 10 | 34721O01 | DESIGN OF ELECTRONIC EQUIPMENT | ECE | OE-EA | 3 | 0 | 0 | 3 | NIL |
| 11 | 34721O02 | INTRODUCTION TO INDUSTRY 4.0 AND INDUSTRIAL INTERNET OF THINGS | ECE | OE-EA | 3 | 0 | 0 | 3 | NIL |
| 12 | 34621O01 | GREEN POWER GENERATION SYSTEMS | EEE | OE-EA | 3 | 0 | 0 | 3 | NIL |
| 13 | 34621O02 | INDUSTRIAL DRIVES AND AUTOMATION | EEE | OE-EA | 3 | 0 | 0 | 3 | NIL |
| 14 | 36921O01 | BIOMOLECULES-STRUCTURE AND FUNCTION | PE | OE-EA | 3 | 0 | 0 | 3 | NIL |
| 15 | 36921O02 | PHARMACOGENOMICS | PE | OE-EA | 3 | 0 | 0 | 3 | NIL |

## B.E./B.TECH. – MECHANICAL ENGINEERING - SEMESTER I TO VII

## D. Project Work Credits-(8)

| SL. NO | COURSE CODE | COURSE | OFFERING DEPT. | CATEGORY | L | T | P | C | PREREQUISITE |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 34421R01 | PROJECT WORK | MECH | PI-P | 0 | 0 | 16 | 8 | NIL |

## B.E./B.TECH. –MECHANICAL ENGINEERING – SEMESTER I TO VII

## E. Mandatory/Audit Courses

**MANDATORY COURSES (ZERO CREDITS)**
**( NOT INCLUDED FOR CGPA CALCULATIONS)**

| SL. NO | COURSE CODE | COURSE | OFFERING DEPT. | CATEGORY | L | T | P | C | PREREQUISITE |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 34121Z81 | YOGA AND MEDITATION | PHED | AC | 0 | 0 | 2 | 0 | NIL |

**ANY TWO COURSES**

| SL. NO | COURSE CODE | COURSE | OFFERING DEPT. | CATEGORY | L | T | P | C | PREREQUISITE |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 34121Z84 | INDIAN CONSTITUTION | LAW | AC | 0 | 0 | 2 | 0 | NIL |
| 2 | 34121Z83 | ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE | GEN | AC | 0 | 0 | 2 | 0 | NIL |
| 3 | 34121Z85 | NCC/NSS/RRC/YRC/STUDENT CLUBS/UNNAT BHARAT ABHIYAN/ SWACTH BHARAT/ROTARACT CLUB | GEN | AC | 0 | 0 | 2 | 0 | NIL |
| 4 | 34121Z86 | SPORTS AND GAMES | PHED | AC | 0 | 0 | 2 | 0 | |
| 5 | 34121Z82 | GENDER EQUITY AND LAW | LAW | AC | 0 | 0 | 2 | 0 | NIL |

# HUMANITIES AND SOCIAL SCIENCES COURSES

| | TOTAL QUALITY | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| 34121H02 | MANAGEMENT | FC-HS | 3 | 0 | 0 | 3 |

**PREAMBLE:**

Quality is the mantra for success or even for the survival of any organization in this competitive global market. Total Quality Management (TQM) is an enhancement to the traditional way of doing business. TQM integrates fundamental management techniques, existing improvement efforts, and technical tools under a disciplined approach for providing quality of products and processes. It becomes essential to survive and grow in global markets, organizations will be required to develop customer focus and involve employees to continually improve Quality and keep sustainable growth.

**PREREQUISITE:** Not Required

**COURSE OBJECTIVES:**

1. To understand the Total Quality Management concepts.
2. To practice the TQM principles.
3. To apply the statistical process control.
4. To analyze the various TQM tools.
5. To adopt the quality systems.

**COURSE OUTCOMES:**

After successful completion of the course, students will be able to

| | |
|---|---|
| CO1: Understand the importance of quality and TQM at managerial level. | Understand |
| CO2: Practice the relevant quality improvement tools to implement TQM. | Apply |
| CO3: Analyze various TQM parameters with help of statistical tools. | Analyze |
| CO4: Assess various TQM Techniques. | Evaluate |
| CO5: Practice the Quality Management Systems in a different organization Environment. | Apply |

**MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | M | - | - | - | - | - | L | L | L | M | L | M | - | - | - |
| CO2 | M | - | - | - | L | L | - | L | M | M | - | L | - | - | M |
| CO3 | S | S | M | S | S | - | - | L | - | L | - | L | L | M | L |
| CO4 | L | M | S | L | M | - | L | - | L | M | L | M | - | - | - |
| CO5 | L | L | M | - | L | M | S | S | M | L | L | M | - | - | M |

**S- Strong; M-Medium; L-Low**

## SYLLABUS:

**INTRODUCTION**

Concept of Quality and Quality Management - Determinants of quality of product & service - Quality costs – Analysis Techniques for Quality Costs – TQM Principles and Barriers & Implementation –Leadership – Concepts- Role of Top Management- Quality Council – Quality statements: vision, mission, Policy - SMART Goal setting - Strategic Planning.

**TQM PRINCIPLES AND PHILOSOPHIES**

Customer satisfaction – Perception of Quality- Customer Complaints - Service Quality- Customer Retention- Employee Involvement – Motivation- Empowerment – Teams - Recognition and Reward- Performance Appraisal - Continuous Process Improvement: Deming's Philosophy - Juran's Trilogy - PDSA Cycle- Taguchi Quality Loss Function - 5S principles and 8D methodology - Kaizen - Basic Concepts.

**STATISTICAL PROCESS CONTROL (SPC) & PROCESS CAPABILITY**

Statistical Fundamentals – Measures of central Tendency & Dispersion - Population and Sample- Normal Curve- Control Charts for variables and attributes - OC curve - Process capability- Concept of six sigma- The Seven tools of Quality - New seven Management tools.

**TOOLS AND TECHNIQUES FOR QUALITY MANAGEMENT**

Benchmarking – Reasons - Process- Quality Function Deployment (QFD) – House of Quality- QFD Process- Benefits- Total Productive Maintenance (TPM) – Concept- Improvement Needs- FMEA – Stages of FMEA - Business process re-engineering (BPR) – principles, applications, reengineering process, benefits and limitations.

**QUALITY SYSTEMS**

Introduction to IS/ISO 9004:2000 – quality management systems – Elements- Implementation of Quality System - Documentation- Quality Auditing- ISO 14000 – Concept- Requirements and Benefits.

## TEXT BOOKS:


1. Dale H.Besterfiled- et at. - Total Quality Management- PHI-1999. (Indian reprint 2002).
2. Feigenbaum.A.V. "Total Quality Management- McGraw-Hill- 1991.


## 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. Oakland.J.S. "Total Quality Management Butterworth – Hcinemann Ltd - Oxford. 1989.
3. Narayana V and Sreenivasan - N.S. Quality Management – Concepts and Tasks- New Age International 1996.


**COURSE DESIGNERS:**


| S.No | Name of the Faculty | Designation | Department | Mail ID |
|---|---|---|---|---|
| **1** | A. Mani | Associate Professor | Management Studies | mani@vmkvec.edu.in |
| **2** | Dr. V. Sheela Mary | Associate Professor | Management Studies | sheelamary@avit.ac.in |

| 34121H05 | ENGINEERING MANAGEMENT AND ETHICS | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | FC-HS | 3 | 0 | 0 | 3 |

**PREAMBLE:**

Engineering management provides technological problem-solving ability of engineering and the organizational to oversee the operational performance of complex engineering enterprises to Engineers. Engineers require honesty, impartiality, fairness, and equity, and dedication to the protection of the public health, safety, and welfare. Ethics emphasises the importance of moral issues, rights and duties of the employees through basic ethics confronting individuals and organizations engaged. It also emphasise values that are morally desirable in engineering practice and research. It allows them to understand various occupational crimes and learn the moral leadership.

**PREREQUISITE:** Not Required

**COURSE OBJECTIVES:**

1. To Understand the principles of planning at various levels of the organisation.
2. To analyse and practice the concepts of organizing, staffing to higher productivity.
3. To apply the concepts related to directing and controlling.
4. To understand and apply the case studies to practice code of ethics in organisation.
5. To apply the ethical principles in working environment.

**COURSE OUTCOMES:**

After successful completion of the course, students will be able to

| | |
|---|---|
| CO1: Understand the importance of planning principles in organization | Understand |
| CO2: Apply the various strategies of organising and staffing process. | Apply |
| CO3: Analyze various leadership skills and control techniques for shaping the organization. | Analyze |
| CO4: Understand and apply best ethical practices in organisation | Analyze |
| CO5: Analyse and Apply relevant ethical practices in engineering. | Apply |

**MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | M | M | M | L | S | M | M | L | S | S | S | S | - | - | - |
| CO2 | M | L | L | - | M | M | M | L | M | S | M | M | - | - | - |
| CO3 | M | M | L | - | M | M | M | L | L | S | S | M | - | - | - |
| CO4 | L | M | - | M | - | M | S | S | S | S | - | M | - | - | - |
| CO5 | M | M | - | L | - | M | S | S | S | S | - | M | - | - | - |

**S- Strong; M-Medium; L-Low**

**SYLLABUS:**

**PLANNING**

Nature and purpose of planning – planning process – types of planning – objectives – setting -Objectives – policies – Planning premises – Strategic Management – Planning Tools and Techniques – Decision making steps and process.

**ORGANISING**

Nature and purpose – Formal and informal organization – organization chart – organization structure– types – Line and staff authority – departmentalization – delegation of authority – centralization and decentralization – Job Design - Human Resource Management – HR Planning, Recruitment, selection, Training and Development, Performance Management, Career planning and management.

**DIRECTING**

Foundations of individual and group behavior – motivation – motivation theories – motivational - Techniques – job satisfaction – job enrichment – leadership – types and theories of leadership – Communication – process of communication – barrier in communication – effective communication – communication and IT.

**CONTROLLING**

System and process of controlling – budgetary and non-budgetary control techniques – use of Computers and IT in Management control – Productivity problems and management – control and performance – direct and preventive control – reporting.

**ETHICS IN ENGINEERING**

Moral dilemmas -Uses of Ethical Theories- Engineering as Social Experimentation- Engineer's Responsibility For Safety-Codes of Ethics-Challenger - Employed Engineers Rights and Duties- Collective Bargaining - Occupational Crime - Global Issues- Multinational Corporation- Technology transfer - Engineers as managers - Consulting Engineers - Expert Witness-Moral Leadership.

**TEXT BOOKS:**

1. Stephen P. Robbins and Mary Coulter, 'Management', Prentice Hall of India, 8th edition.
2. Charles W L Hill, Steven L McShane, 'Principles of Management', Mcgraw Hill Education, Special Indian Edition, 2007.
3. Mike Martin and Roland Schinzinger, "Ethics in Engineering", McGraw Hill, New York (2005).

**REFERENCES:**

1. Charles D Fleddermann, "Engineering Ethics", Prentice Hall, New Mexico, (1999).
2. Harold Koontz, Heinz Weihrich and Mark V Cannice, 'Management - A global & Entrepreneurial Perspective', Tata Mcgraw Hill, 12th edition, 2007.
3. Andrew J. Dubrin, 'Essentials of Management', Thomson South-western, 7th edition, 2007.
4. Prof. (Col) P S Bajaj and Dr. Raj Agrawal, "Business Ethics – An Indian Perspective", Biztantra, New Delhi, (2004)
5. David Ermann and Michele S Shauf, "Computers, Ethics and Society", Oxford University Press, (2003).

**COURSE DESIGNERS:**



| S.No | Name of the Faculty | Designation | Department | mail id |
|---|---|---|---|---|
| **1** | M. Manickam | Associate Professor | Management Studies | manickam@vmkvec.edu.in |
| **2** | Mr. T. Thangaraja | Assistant Professor | Management Studies | thangaraja@avit.ac.in |

| | | Category | L | T | P | C |
|---|---|---|---|---|---|---|
| 34121H83 | UNIVERSAL HUMAN VALUES – UNDERSTANDING HARMONY | FC-HS | 3 | 0 | 0 | 3 |

**Course Objectives:**

1. Development of a holistic perspective based on self- exploration.

2. Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence.

3. Strengthening of self-reflection.

4. Development of commitment and courage to act.

**UNIT I Introduction**

Value Education, Definition, Concept and Need for Value Education-Content and Process of -basic guidelines for Value Education -Self exploration - Happiness and Prosperity as parts of Value Education.

**UNIT II Understanding Harmony in the Human Being**

Harmony in Myself-Understanding human being as a co-existence of the sentient 'I' and the material 'Body'-Understanding the needs of Self ('I') and 'Body' - happiness and physical facility. -Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)-Understanding the characteristics and activities of 'I' and harmony in 'I'-Understanding the harmony of I with the Body-Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail

**UNIT III Understanding Harmony in the Family and Society**

Harmony in Human-Human Relationship -meaning of Justice - Trust and Respect -Difference between intention and competence- respect and differentiation; the other salient values in relationship Understanding the harmony in the society - Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals –Gratitude

**UNIT IV Understanding Harmony in the Nature and Existence**

Whole existence as Coexistence -Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self-regulation in nature-Holistic perception of harmony at all levels of existence.

**UNIT V Holistic Understanding of Harmony on Professional Ethics**

Natural acceptance of human values -Definitiveness of Ethical Human Conduct - Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order- Competence in professional ethics

**Total Hours: 45 Hours**

**Text Book**

1.Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010

**Reference Books**

1. Jeevan Vidya: EkParichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2.Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi.

| COURSE DESIGNERS | | | | |
|---|---|---|---|---|
| **S.NO** | **COURSE INSTRUCTOR** | **DESIGNATION** | **NAME OF THE INSTITUTION** | **MAIL ID** |
| **1** | Dr.S.P.Sangeetha | Vice Principal(Academics) | AVIT | sangeetha@avit.ac.in |
| **2** | Dr.Jennifer G Joseph | HoD-H&S | AVIT | Jennifer@avit.ac.in |

| | | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| **34121H08** | **OPERATIONS MANAGEMENT** | **FC-HS** | **3** | **0** | **0** | **3** |

**PREAMBLE:**

The contemporary uncertain business environment is forcing the organizations to adopt the latest tools, techniques and strategies for managing their resources in the most effective and efficient fashion. The topics of the course deals with the management of resources and activities that lead to production of goods of right quality, in right quantity, at right time and place in the most cost- impressive manner. The course focuses on the basic concepts, issues, and techniques adopted worldwide for efficient and effective operations. The topics include operations strategy, product design and development, forecasting, facility planning and layout, aggregate production planning, capacity planning, project management, production control, materials management, inventory and quality management, JIT and Kanban System.

**PREREQUISITE:** Not Required

**COURSE OBJECTIVES:**

1. To understand the Fundamentals of Operations.
2. To Understand the importance of Job Design and their relationship towards Efficiency.
3. To understand the importance of Production, Planning and Control.
4. To evaluate the material requirement with the techniques.
5. To impart the Operation management Techniques to get rid of the Competitive advantage.

| **COURSE OUTCOMES:** | |
|---|---|
| CO1. Understand the importance of Operations Management. | Understand |
| CO2. Evaluating the various organisation and staffing functions | Evaluate |
| CO3. Understand the Importance of Production Planning and Control. | Understand |
| CO4. Evaluate the Various Operation Management Techniques | Evaluate |
| CO5. Analyze and Evaluating the various Inventory Management Techniques to take Competitive advantage. | Analyze |

**MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | S | L | L | S | L | S | L | L | L | L | L | - | - | - |
| CO2 | S | S | M | M | - | L | L | M | M | L | L | M | - | - | - |
| CO3 | S | S | S | S | S | M | L | S | M | L | L | L | - | - | - |
| CO4 | M | M | S | S | M | L | L | M | M | L | L | L | - | - | - |
| CO5 | S | S | S | S | M | M | S | L | M | M | S | L | - | - | - |

**S- Strong; M-Medium; L-Low**

**SYLLABUS:**

**UNIT- I INTRODUCTION TO OPERATIONS MANAGEMENT** **9 Hours**

Operations Management- Nature & Scope – Evolution of Operations Management – Types of Production System, Operations Strategy – Product Life Cycle- Value Engineering concepts - Make or Buy Decision- Recent Trends in Operations Management- Plant Capacity - Plant Location & Factors.

**UNIT-II JOB DESIGN & MATERIAL HANDLING** **9 Hours**

Layout- Principles of Layout- Factory-Basic types of layout product layout, group technology layout, fixed position layout, Retail service layout. Principles of material handling-Material handling equipment. Job-design: Effective job design- Combining engineering and behavioral approaches, Work measurement- method analysis- Ergonomics-Case studies.

**UNIT- III PRODUCTION, PLANNING & CONTROL**

**Hours**

Basic types of production- Interminent, Batch, continuous-Routing, Scheduling, Activating and Monitoring-Production Planning and Control, Process Planning, Aggregate Production Planning, Capacity Planning: Introduction, Capacity Planning

**UNIT IV OPERATION TECHNIQUES**

**9 Hours**

Project Scheduling, Network Diagrams, Critical Path Method (CPM), Critical Path Method: Problems, Critical Path Method. Program Evaluation and Review Technique (PERT), PERT Problems, PERT Problems, Time Cost Trade Off Production Control, Sequencing, Sequencing Problems-I, Sequencing Problems- II, Master Production Scheduling- Concept of Quality, Total Quality Management (TQM), Total Productive Maintenance (TPM), Statistical Quality Control (SQC), Six Sigma.

**UNIT- V INVENTROY MANAGEMENT**

**9 Hours**

Materials Management, Inventory Control, Economic Order Quantity (EOQ) Models, Economic Order Quantity (EOQ): Problems, Production Quantity- Just in Time (JIT), Kanban System, Materials Requirement Planning (MRP)-I, Materials Requirement Planning (MRP)-II, Enterprise Resource Planning (ERP).

## TEXT BOOKS:

1.Operation Management: K. N. Dervitsiotis, McGraw-Hill International Company.
2.Operations Management: R.S. Russell, and B.W. Taylor, Pearson Education
3.Industrial Engineering and Production Management: M. Telsang, S. Chand & Company Ltd.

## REFERENCES:

1. The Encyclopedia of Operations Management: A Field Manual and Glossary of Operations Management ARTHUR V HILL 1st Edition.
2. Handbook of Industrial Engineering: Technology and Operations Management, Gavriel Salvendy 3rd Edition.
3. Quality and Operations Management: Revised Edition.
4. Operations Management: Theory and Practice by Mahadevan
5. Production and Operations Management by PANNEERSELVAM. R.

**COURSE DESIGNERS:**


| S.No | Name of the Faculty | Designation | Department | mail id |
|---|---|---|---|---|
| 1 | Dr. B. Rajnarayanan | Associate Professor | Management Studies | rajnarayanan@vmkvec.edu.in |
| 2 | Mr. T. Thangaraja | Associate Professor | Management Studies | thangaraja@avit.ac.in |

| 34121H11 | SOFT SKILLS FOR ENGINEERS | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | FC-HS | 3 | 0 | 0 | 3 |

**PREAMBLE**

Technical English is a life skill course necessary for all students of Engineering and Technology. It aims at developing communication skills in English, essential for understanding and expressing the ideas of different professional context. The outcome of the course is to help the students acquire the language skills of Listening, Speaking, Reading and Writing competency in English language and thereby making the students competent and employable in the globalised scenario.

**PREREQUISITE: NIL**

**COURSE OBJECTIVES**

| | |
|---|---|
| 1 | To enable students to develop LSRW skills in English. (Listening, Speaking, Reading, and Writing.) |
| 2 | To make them become effective communicators. |
| 3 | To ensure that learners use Electronic media materials for developing language. |
| 4 | To aid the students with employability skills. |
| 5 | To develop the students communication skills in formal and informal situations. |

**COURSE OUTCOMES**

On the successful completion of the course, students will be able to

| | |
|---|---|
| CO1. Listen, remember and respond to others in different scenario | Remember |
| CO2. Understand and speak fluently and correctly with correct pronunciation in different situation. | Understand |
| CO3. To make the students experts in professional writing | Apply |
| CO4. To make the students in proficient technical communicator | Apply |
| CO5 To make the students recognize the role of technical writing in their careers in business, technical and scientific field | Analyze |

**MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES**

| COS | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | - | - | - | - | - | M | M | M | - | S | - | S | S | - | S |
| CO2 | - | - | - | - | - | - | L | - | - | S | - | S | - | - | S |
| CO3 | - | - | - | L | - | - | - | - | - | - | - | L | - | M | - |
| CO4 | - | - | - | - | - | M | - | L | M | S | L | S | S | M | S |
| CO5 | M | - | L | S | - | - | - | - | - | - | - | S | M | - | S |

**S- Strong; M-Medium; L-Low**

**SYLLABUS**

**INTRODUCTION TO SOFT SKILLS**

Aspects of Soft Skills, Effective Communication Skills, Classification of Communication, Telephonic Communication Skills, Communicating without Words, Paralanguage.

**INTERPERSONAL SKILLS**

Group Communication Skills, Leadership Skills, Group Discussion, Meeting Management, Adaptability & Work Ethics, Personality development Positive Thinking, Proxemics, Haptics: The Language of Touch, Meta-communication, Applied Grammar.

**LIFE SKILLS**

Emotional Intelligence, Critical Thinking, Decision making, Problem solving, Listening Skills, Types of Listening, Negotiation Skills, Culture as Communication, Communication Breakdown, Organizational Communication.

**PROFESSIONAL WRITING SKILLS**

Advanced Writing Skills, Principles of Business Writing, Business Letters: Format and Style, Types of Business Letter writing, Reports, Types of Report, Strategies for Report Writing, Evaluation and Organization of Data Structure and Style of Report.

**CAREER SKILLS**

Advanced Speaking Skills, Speeches & Debates, Combating Nervousness, Patterns & Methods of Presentation, Oral Presentation: Planning & Preparation, Making Effective Presentations, Speeches for Various Occasions, Interviews, Planning & Preparing: Effective Résumé, Facing Job Interviews.

**TEXTBOOK**

1. English for Engineers- Faculty of English – VMKV Engineering College, Salem and AVIT, Chennai

**REFERENCE BOOKS**

1. English for Effective Communication, Department of English, VMKV & AVIT, SCM Publishers, 2009.
2. Practical English Usage- Michael Swan (III edition), Oxford University Press
3. Grammar Builder- I, II, III, and Cambridge University Press.

4 Pickett and Laster. Technical English: Writing, Reading and Speaking, New York: Harper and Row Publications, 2002.

**Course Designers:**



| S.No. | Name of the Faculty | Mail ID |
|---|---|---|
| 1 | Dr.P.Saradha / Associate Professor - English | saradhap@vmkvec.edu.in |
| 2 | Dr Bhuvaneswari R/ Assistant Professor - English | bhuvaneswarir@vmkvec.edu.in |

# BASIC SCIENCE COURSES

| | | | | | | |
|---|---|---|---|---|---|---|
| | **ENGINEERING** | **Category** | **L** | **T** | **P** | **Credit** |
| **34121B01** | **MATHEMATICS** | **FC-BS** | **2** | **1** | **0** | **3** |

**Preamble**

The driving force in Engineering Mathematics is the rapid growth of technology and the sciences. Matrices had been found to be of great utility in many branches of engineering applications such as theory of electric circuits, aerodynamics, and mechanics and so on. Many physical laws and relation can be expressed mathematically in the form of differential equations. Based on this we provide a course in matrices, calculus and differential equations. Vector calculus is a form of mathematics that is focused on the integration of vector fields. An Engineer should know the Transformations of the Integrals, as Transformation of Line Integral to surface and then to volume integrals.

**Prerequisite : NIL**

**Course Objectives**

| | |
|---|---|
| 1 | To recall the advanced matrix knowledge to Engineering problems. |
| 2 | To equip themselves familiar with the functions of several variables. |
| 3 | To improve their ability in solving geometrical applications of differential calculus problems. |
| 4 | To examine knowledge in multiple integrals. |
| 5 | To improve their ability in Vector calculus. |

**Course Outcomes: On the successful completion of the course, students will be able to**

| | | |
|---|---|---|
| CO1. | Apply the concept of orthogonal reduction to diagonalise the given matrix. | Apply |
| CO2. | Find the radius of curvature, circle of curvature and centre of curvature for a given curve. | Apply |
| CO3. | Classify the maxima and minima for a given function with several variables, through by finding stationary points | Apply |
| CO4. | Find double integral over general areas and triple integral over general volumes | Apply |
| CO5. | Apply Gauss Divergence theorem for evaluating the surface integral. | Apply |

**Mapping with Programme Outcomes and Programme Specific Outcomes**

| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | **S** | **S** | **M** | **-** | **-** | **-** | **-** | **L** | **-** | **-** | **-** | **M** | **-** | **-** | **-** |
| **CO2** | **S** | **S** | **M** | **-** | **-** | **-** | **-** | **L** | **-** | **-** | **-** | **M** | **-** | **-** | **-** |
| **CO3** | **S** | **S** | **M** | **-** | **-** | **-** | **-** | **L** | **-** | **-** | **-** | **M** | **-** | **-** | **-** |
| **CO4** | **S** | **S** | **M** | **-** | **-** | **-** | **-** | **L** | **-** | **-** | **-** | **M** | **-** | **-** | **-** |
| **CO5** | **S** | **S** | **M** | **-** | **-** | **-** | **-** | **L** | **-** | **-** | **-** | **M** | **-** | **-** | **-** |

**S- Strong; M-Medium; L-Low**

**SYLLABUS**

**MATRICES**

Characteristic equation – Eigen values and eigenvectors of a real matrix – Properties of eigenvalues and eigenvectors (Without proof) – Cayley-Hamilton theorem (excluding proof).

**DIFFERENTIAL CALCULUS&PARTIAL DERIVATIVES**

Curvature – Cartesian and Parametric Co-ordinates – Centre and radius of curvature – Circle of curvature. Partial Derivatives – Total Differentiation – Maxima and Minima -Constrained Maxima and Minima by Lagrangian Multiplier Method.

**ORDINARY DIFFERENTIAL EQUATIONS**

Solutions of second and third order linear ordinary differential equation with constant coefficients – Method of variation of parameters -Simultaneous first order linear equations with constant coefficients.

**MULTIPLE INTEGRALS**

Introduction of multiple integration by examples of Double and Triple integral-Evaluation of double and Triple Integration (in both Cartesian and polar coordinates)-Change of order of integration**.**

**VECTOR CALCULUS**

Scalar and vector point functions, Gradient, divergence, curl, Solenoidal and irrotational vectors, Vector identities (without proof), Normal and Directional derivatives, Solenoidal and irrotational field, Integration of vectors: Definition of Line, surface and volume integrals, Green's, Gauss divergence and Stoke's theorems (Statements only)

**Text Books**

1. Veerarajan T., "Engineering Mathematics", Tata McGraw Hill Education Pvt, New Delhi (2019).
2. Grewal B.S., "Higher Engineering Mathematics", 44th Edition, Khanna Publishers, Delh (2020).
3. Kreyszig E., "Advanced Engineering Mathematics", 8th Edition, John Wiley and Sons (Asia) Pvt. Ltd., Singapore (2012).

**Reference Books**

1. Engineering Mathematics", Department of Mathematics, VMKVEC (Salem) & AVIT (Chennai), (2017).
2. Dr.A.Singaravelu, "Engineering Mathematics I & II", 23rd Edition, Meenakshi Agency, Chennai (2016).

**Alternative NPTEL/SWAYAM Course**

| S.No | NPTEL /SWAYAM Course Name | Instructor | Host Institution | Duration |
|---|---|---|---|---|
| | Nil | | | |

**Course Designers**

| S.No | Faculty Name | Designation | Department/Name of the College | Email id |
|---|---|---|---|---|
| **1** | Dr. A.K.Bhuvaneswari | Assistant Professor | Mathematics/AVIT | bhuvaneswari@avit.ac.in |
| **2** | Dr.G.Selvam | Associate Professor | Mathematics/VMKVEC | selvam@vmkvec.edu.in |

| | | CATEGORY | L | T | P | C |
|---|---|---|---|---|---|---|
| **34121B12** | **SMART MATERIALS** | **FC-BS** | **3** | **0** | **0** | **3** |

**PREAMBLE**

Smart Materials gives an outlook about various types of materials having potential application in Engineering and Technology. In particular, Students learn about Properties of Crystalline Materials, Smart Materials and Nanomaterials, and their industrial applications, characteristics and industrial applications of Magnetic and Superconducting materials.

**PREREQUISITE:**

Nil

**COURSE OBJECTIVES:**

| | |
|---|---|
| 1 | To impart the basic properties of different materials. |
| 2 | To understand the structure of crystalline materials. |
| 3 | To understand the properties of smart materials and realize its industrial applications. |
| 4 | To learn the synthesis of Nano materials and carbon nanotubes. |
| 5 | To learn the properties, classification and relevant applications of magnetic materials. |
| 6 | To understand the concept of superconductivity, properties of super conductor and their industrial applications. |

**COURSE OUTCOMES:**

After successful completion of the course, learner will be able to

| | |
|---|---|
| CO1. Understand the basic properties of various materials. | Understand |
| CO2. Learn the structure of Crystalline Materials | Apply |
| CO3. Gain the basic knowledge and recognize the applications of Smart Materials | Apply |
| CO4. Get an exposure about the properties of Nano materials | Apply |
| CO5. Gain the knowledge about the properties of magnetic materials and familiarize their applications. | Apply |
| CO6. Gain the knowledge about Superconducting materials | Apply |

**MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES**

| COS | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO10 | PO11 | PO12 | POS 1 | POS 2 | POS3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CO2 | S | S | S | S | M | - | - | - | - | - | - | S | - | - | - |
| CO3 | S | M | S | S | - | - | - | - | - | - | - | S | - | - | - |
| CO4 | S | S | S | S | M | - | - | - | - | - | - | S | - | - | - |
| CO5 | S | S | S | S | - | - | - | - | - | - | - | S | - | - | - |
| CO6 | S | M | M | S | M | - | - | - | - | - | - | S | - | - | - |

S – strong, M- Medium, L – Low

**SYLLABUS**

**CRYSTALLINE MATERIALS:** Unit cell – Bravais lattice – Miller indices – Calculation of number of atoms per unit cell – atomic radius – coordination number – packing factor for SC, BCC, FCC, HCP structures – determination of interplanar distance (d).

**SMART MATERIALS:** Shape Memory Alloys (SMA) – Characteristics and properties of SMA, Application – SMA in Actuators and Blood clot filters, advantages and disadvantages of SMA. Metallic glasses – Preparation, properties and industrial applications (Core of the Transformer).

**NANO MATERIALS:** Nanophase materials – Top-down approach - Mechanical Grinding - Lithography - Bottom-up approach – Sol-gel method – Carbon nanotubes – Fabrication – applications; Chemical Sensors.

**MAGNETIC MATERIALS:** Basic concepts – Classification of magnetic materials – Domain theory – Hysteresis – Soft and Hard magnetic materials – Applications of Magnetic materials (Magnets in Generators and MRI scan).

**SUPER CONDUCTING MATERIALS:** Superconducting phenomena – properties of superconductors – Meissner effect – isotope effect – Type I and Type II superconductors – High Tc Superconductors – Industrial Applications of superconductors (SQUID, Cryotrons and Maglev Trains).

**TEXT BOOKS**


1. Palanisamy P.K. Materials Science. SCITECH Publishers, 2015.
2. A.K. Katiyar and C.K. Pandey, Engineering Physics Theory and Practical, Wiley Publisher, 2015.


**REFERENCES**


1. Pillai S.O., Solid State Physics, 9th Edition, New Age International (P) Ltd., Publishers, 2020.
2. William D. Callister Jr., David G. Rethwisch., Materials Science and Engineering: An Introduction, 10th Edition, Wiley Publisher, 2018.


**COURSE DESIGNERS**


| S. No. | Name of the Faculty | Designation | Department | Mail ID |
|---|---|---|---|---|
| 1 | Dr. G. Suresh | Associate Professor | Physics | suresh.physics@avit.ac.in |
| 2 | Dr. R. N. Viswanath | Professor | Physics | rnvishwanath@avit.ac.in |
| 3 | Dr. B. Dhanalakshmi | Associate Professor | Physics | dhanalakshmi.phy@avit.ac.in |

| | | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| **34121B24** | **INDUSTRIAL MATERIALS** | **FC-BS** | **3** | **0** | **0** | **3** |

**Preamble:**

Industrial Material is a part of the long chain in the design and manufacturing process. It deals with the ideas, the design, the testing, and prototyping of new industrial products. To solve the major problems of the world and their essential skills are, in-depth knowledge and application of chemistry and creativity with chemicals.

**Prerequisite : NIL**

**Course Objectives**

| | |
|---|---|
| 1 | To Describe the various metallic materials. |
| 2 | To Apply the various smart materials for industries. |
| 3 | To Distinguish the lubricants in the industries. |
| 4 | To Categorize various types of paints using in the industries. |
| 5 | To Distinguish the various petroleum products. |

**Course Outcomes: On the successful completion of the course, students will be able to**

| | | |
|---|---|---|
| CO1. | Discuss the various metallic materials using in industries. | Understand |
| CO2. | Interpret the various smart materials and its applications. | Apply |
| CO3. | Compare the different lubricants with their properties. | Analyze |
| CO4. | Relate the various surface coatings. | Apply |
| CO5. | Categorize the different petroleum products. | Analyze |

**Mapping with Programme Outcomes and Programme Specific Outcomes**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | S | M | - | - | - | M | S | - | - | - | - | - | M | M | M |
| **CO2** | S | M | - | - | - | S | S | - | - | - | - | - | M | M | M |
| **CO3** | S | M | - | - | - | S | M | - | - | - | - | - | M | M | M |
| **CO4** | S | S | - | - | - | M | S | - | - | - | - | - | M | M | M |
| **CO5** | S | S | - | - | - | S | M | - | - | - | - | - | M | M | M |

**S- Strong; M-Medium; L-Low**

**SYLLABUS**

**METALS AND ALLOYS**

Engineering materials: Ferrous materials, Aluminium, Copper, Nickel, Magnesium, Titanium alloys for engineering applications. Phase diagrams, properties and typical alloys with reference to their applications.

**SMART MATERIALS**

Shape Memory Alloys, Varistors and Intelligent materials for bio-medical applications, Polymers and Plastics from industry. Development, important properties and smart applications of polymeric materials.

**LUBRICANTS**

Lubricants: Classification of lubricants, lubricating oils (conducting and non-conducting) Solid and semisolid lubricants, synthetic lubricants. Properties of lubricants (viscosity index, cloud point, pour point) and their determination.

**PAINTS**

surface Coatings: Objectives of coatings surfaces, preliminary treatment of surface, classification of surface coatings- Paints, pigments, Oil paint, Vehicle, modified oils, Pigments, toners and lakes pigments, Fillers, Thinners, Enamels, emulsifying agents.

Special paints (Heat retardant, Fire retardant, Eco-friendly paint, Plastic paint), Dyes, Wax polishing, Water and Oil paints, Metallic coatings (electrolytic and electroless), metal spraying and anodizing.

**PETROLEUM AND PETROCHEMICAL INDUSTRY**

Composition of crude petroleum- Refining and different types of petroleum products and their applications - Reforming Petroleum and non-petroleum fuels (LPG, CNG, LNG, bio-gas, fuels derived from biomass) - synthetic fuels (gases and liquids).

Petrochemicals: Vinyl acetate, Propylene oxide, Isoprene, Butadiene, Toluene and its derivatives Xylene.

**Text Books**

1. Industrial chemistry by B.K.Sharma. Goel publishing home.
2. Engineering Material Technology, 5th edition, by James A.Jacobs & Thomas F. Kilduff.

**Reference Books**

1. An Introduction to Industrial chemistry by C,A.Heaton. Springer publications.
2. Engineering materials1: An introduction to properties, applications and design by Michael F Ashby and David R H Jones, Elsevier Butterworth Heinmann Publishers, 2007

**Course Designers**

| S.No | Faculty Name | Designation | Department/Name of the College | Email id |
|---|---|---|---|---|
| **1** | Mr.A.Gilbert sunderraj | Associate Professor | Chemistry/VMKVEC | gilbertsunderraj@vmkvec.edu.in |
| **2** | Dr.R.Nagalakshmi | Professor | Chemistry/AVIT | nagalakshmi.chemistry@avit.ac.in |

| | MATHEMATICS FOR MECHANICAL SCIENCES | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| 34121B11 | | FC-BS | 2 | 1 | 0 | 3 |

**Preamble**

This course provides a solid undergraduate foundation in partial differential equations, probability theory and mathematical statistics and at the same time provides an indication of the relevance and importance of the theory in solving practical problems in the real world. Partial differential equations are derived from physics and instruct the methods for solving boundary value problems, that is, methods of obtaining solutions which satisfy the conditions required by the physical situations such as Heat flow equations of one dimension and two dimensions. Fourier analysis is to represent complicated functions in terms of simple periodic functions, namely cosines and sines. Statistics is permeated by probability. Statistics has been responsible for accelerating progress in all applied sciences by defining the correct methods of planning, collecting, analyzing and interpreting data for establishing cause and effect relationship.

**Prerequisite :** Engineering Mathematics

**Course Objectives**

| | |
|---|---|
| 1 | To formulate and solve partial differential equations. |
| 2 | To represent a periodic function as a Fourier series. |
| 3 | To be familiar with applications of partial differential equations. |
| 4 | To provide an understanding for the graduate on statistical concepts to include measures of central tendency, curve fitting, correlation and regression. |
| 5 | To be familiar with discrete and continuous random variables. |

**Course Outcomes: On the successful completion of the course, students will be able to**

| | | |
|---|---|---|
| CO1. | Explain the methodology of forming and solving partial differential equations. | Apply |
| CO2. | Demonstrate periodic functions arising in the study of engineering problems as Fourier series of sine and cosines and compute the Fourier coefficients numerically. | Apply |
| CO3. | Solve partial differential equations arising in engineering problems like wave equations and heat flow equation by Fourier series | Apply |
| CO4. | Apply least square method to fit a curve for the given data and evaluate the correlation coefficient and regression lines for the data | Apply |
| CO5. | Apply concepts of probability, discrete and continuous random variables. | Apply |

**Mapping with Programme Outcomes and Programme Specific Outcomes**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | M | M | L | -- | -- | -- | -- | M | -- | -- | -- | M | -- | -- | -- |
| CO2 | S | M | M | L | -- | -- | -- | M | -- | -- | -- | M | -- | -- | -- |
| CO3 | S | M | M | L | -- | -- | -- | M | -- | -- | -- | M | -- | -- | -- |
| CO4 | S | M | L | -- | -- | -- | -- | M | -- | -- | -- | M | -- | -- | -- |
| CO5 | S | S | M | L | -- | -- | -- | M | -- | -- | -- | M | -- | -- | -- |

**S- Strong; M-Medium; L-Low**

**SYLLABUS**

**PARTIAL DIFFERENTIAL EQUATIONS**

Formation - Solutions of standard types f(p,q)=0, clairauts form, f(z,p,q)=0,f(p,x)=g(q,y) of first order equations - Lagrange's Linear equation - Linear partial differential equations of second and higher order with constant coefficients.

**FOURIER SERIES**

Dirichlet's conditions – General Fourier series – Half -range Sine and Cosine series – Parseval's identity – Harmonic Analysis.

**BOUNDARY VALUE PROBLEMS**

Classification of second order linear partial differential equations – Solutions of one – dimensional wave equation, one – dimensional heat equation – Steady state solution of two – dimensional heat equation – Fourier series solutions in Cartesian coordinates.

**STATISTICS**

Measures of central tendency, Curve fitting – Straight line and Parabola by least square method, Correlation, Rank correlation and Regression**.**

**VECTOR CALCULUS**

Probability Concepts – Random Variables - Discrete and Continuous Random Variables- Probability mass function – Probability density functions - Moment Generating Functions and their properties.

**Text Books**

1. S.C. Gupta, V.K. Kapoor, "Fundamentals of mathematical statistics", Sultan Chand & Sons (2017).
2. Grewal, B.S., "Higher Engineering Mathematics", 42nd Edition, Khanna Publishers, Delhi (2012).
3. T. Veerarajan, "Probability, Statistics and Random processes" 2nd Edition, Tata McGraw-Hill Publishing Company Ltd., New Delhi (2006).

**Reference Books**

1. Dr.A. Singaravelu, "Transforms and Partial differential Equations", 18th Edition, Meenakshi Agency, Chennai (2013).
2. Dr.A. Singaravelu, "Probability and Statistics", Meenakshi Agencies, Chennai (2016).

**Alternative NPTEL/SWAYAM Course**

| S.No | NPTEL /SWAYAM Course Name | Instructor | Host Institution | Duration |
|---|---|---|---|---|
| | Nil | | | |

**Course Designers**

| S.No | Faculty Name | Designation | Department/Name of the College | Email id |
|---|---|---|---|---|
| **1** | Dr. S. Punitha | Associate Professor | Mathematics/VMKVEC | punitha@vmkvec.edu.in |
| **2** | Ms. S. Sarala | Associate Professor | Mathematics/AVIT | sarala@avit.ac.in |

| | | | | | | |
|---|---|---|---|---|---|---|
| | **NUMERICAL METHODS FOR MECHANICAL** | **Category** | **L** | **T** | **P** | **Credit** |
| **34121B15** | **SCIENCES** | **FC-BS** | **2** | **1** | **0** | **3** |

**Preamble**

This course provides an introduction to the basic concepts and techniques of numerical solution of algebraic equation, system of algebraic equation, numerical solution of differentiation, integration, interpolations and applications to computer science and engineering, and science areas and develops problem solving skills with both theoretical and computational oriented problems.

**Prerequisite:** 1. Engineering Mathematics
2. Mathematics for Mechanical Sciences

**Course Objectives**

| | |
|---|---|
| 1 | To familiar with numerical solution of linear equations |
| 2 | To familiar with numerical solution of Non-linear equations |
| 3 | To be get exposed to finite differences and interpolation and the numerical Differentiation and integration |
| 4 | To find numerical solutions of ordinary differential equations |
| 5 | To find numerical solutions of partial differential equations |

**Course Outcomes: On the successful completion of the course, students will be able to**

| | | |
|---|---|---|
| CO1. | Solve the system of linear algebraic equations and single non linear equations arising in the field of Mechanical Engineering. | Apply |
| CO2. | Apply methods to find intermediate numerical value & polynomial of numerical data. | Apply |
| CO3. | Apply methods to find integration, derivatives of one and two variable functions. | Apply |
| CO4. | Solve the initial value problems using single step and multistep methods. | Apply |
| CO5. | Solve the boundary value problems using finite difference methods. | Apply |

**Mapping with Programme Outcomes and Programme Specific Outcomes**

| **COs** | **PO1** | **PO2** | **PO 3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO 8** | **PO 9** | **PO1 0** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | **S** | **M** | **L** | **--** | **--** | **--** | **--** | **L** | **--** | **--** | **--** | **M** | **--** | **--** | **--** |
| **CO2** | **S** | **M** | **L** | **--** | **--** | **--** | **--** | **L** | **--** | **--** | **--** | **M** | **--** | **--** | **--** |
| **CO3** | **S** | **S** | **L** | **--** | **--** | **--** | **--** | **L** | **--** | **--** | **--** | **M** | **--** | **--** | **--** |
| **CO4** | **S** | **S** | **L** | **L** | **--** | **--** | **--** | **L** | **--** | **--** | **--** | **M** | **--** | **--** | **--** |
| **CO5** | **S** | **S** | **L** | **M** | **--** | **--** | **--** | **L** | **--** | **--** | **--** | **M** | **--** | **--** | **--** |

**S- Strong; M-Medium; L-Low**

**SYLLABUS**

**SOLUTION OF LINEAR EQUATIONS**

Solution of linear system – Gaussian elimination and Gauss-Jordan methods – LU-decomposition methods – Jacobi and Gauss-Seidel iterative methods – sufficient conditions for convergence – Power method to find the dominant eigenvalue and eigenvector.

**SOLUTION OF NONLINEAR EQUATIONS**

Solution of nonlinear System – Bisection method – Secant method – Regula falsi method – Newton-Raphson method for $f(x) = 0$ – Order of convergence – Horner's method.

**METHODS OF INTERPOLATION, NUMERICAL DIFFERENTIATION AND**

**INTEGRATION**

Newton's forward, backward and divided difference interpolation –Lagrange's interpolation – Numerical Differentiation and Integration –Trapezoidal rule –Simpson's 1/3 and 3/8 rules -Curve fitting -Method of least squares and group averages.

**INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS**

Euler's method – Euler's modified method – Taylor's method and Runge-Kutta method for simultaneous equations and 2nd order equations -Multistep methods – Milne's and Adams' methods.

**BOUNDARY VALUE PROBLEMS FOR ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS**

Numerical solution of Laplace equation and Poisson equation by Liebmann's method – s lution of one dimensional heat flow equation – Bender-Schmidt recurrence relation – Crank -Nicolson method – Solution of one dimensional wave equation.

**Text Books**


1. S.K Gupta, "Numerical Methods for Engineers", New Age International Pvt. Ltd. Publishers (2015).
2. S.R.K. Iyengar, R.K. Jain, Mahinder Kumar Jain, "Numerical methods for Scientific and Engineering Computations", New Age International publishers, 6th Edition (2012).
3. T. Veerarajan, T.Ramachandran, "Numerical Methods with Programs in C and C++", Tata McGraw-Hill (2008).


**Reference Books**


1. Joe D. Hoffman , Steven Frankel, "Numerical Methods for Engineers and Scientists", 3rd Edition, Tata Mc-Graw Hill.(New York) (2015).
2. Steven C. Chapra, Raymond P. Canale, "Numerical Methods for Engineers", MC Graw Hill Higher Education (2010).


**Alternative NPTEL/SWAYAM Course**

| S.No | NPTEL /SWAYAM Course Name | Instructor | Host Institution | Duration |
|---|---|---|---|---|
| | Nil | | | |

**Course Designers**

| S.No | Faculty Name | Designation | Department / Name of the College | Email id |
|---|---|---|---|---|
| **1** | Dr. M.Vijayarakavan | Associate Professor | Mathematics/ VMKVEC | vijayarakavan@vmkvec.edu.in |
| **2** | Dr. S. Gayathri | Assistant Professor | Mathematics/AVIT | gayathri@avit.ac.in |

| 34121B35 | RESOURCE MANAGEMENT TECHNIQUES | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | FC-BS | 2 | 1 | 0 | 3 |

**PREAMBLE**

Operations Research is the study of optimization techniques and its helps in solving problems in different environments that need decisions like, Inventory control problems, Maintenance and Replacement problems, Sequencing and Scheduling problems, Assignment of Jobs to applicants, Transportation problems, Network problems and Decision models. Entire subject is useful for all resource managers of various fields.

**Prerequisite : NIL**

**Course Objectives**

| | |
|---|---|
| 1 | To be thorough with linear programming problem and formulate a real world problem as a mathematical programming model. |
| 2 | To Study and acquire knowledge on engineering and Managerial solutions in Assignment and scheduling problems. |
| 3 | To acquire skills in handling techniques of PERT, CPM and sequencing model to perform operation among various alternatives. |
| 4 | To be get exposed to the concepts of Inventory control. |
| 5 | To study decision theory and game theory techniques to analyze the real world systems. |

**Course Outcomes: On the successful completion of the course, students will be able to**

| | | |
|---|---|---|
| CO1. | Formulate the Linear programming problem. Conceptualize the feasible region. Solve the LPP with two variables using graphical method and by simplex method. | Apply |
| CO2. | Solve specialized linear programming problems like the Transportation and Assignment problems. | Apply |
| CO3. | Solve network problems using CPM, PERT techniques and sequencing model. | Apply |
| CO4. | Design a continuous or periodic review inventory control system | Apply |
| CO5. | Work in a team, specifically to solve larger problem, communicate technical knowledge. Partition a problem into smaller tasks and complete tasks on time. | Apply |

**Mapping with Programme Outcomes and Programme Specific Outcomes**

| COs | PO1 | PO2 | PO 3 | PO4 | PO5 | PO6 | PO7 | PO 8 | PO 9 | PO1 0 | PO1 1 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | S | S | M | M | L | -- | -- | S | -- | -- | -- | S | -- | -- | -- |
| **CO2** | S | S | M | L | L | -- | -- | S | -- | -- | -- | S | -- | -- | -- |
| **CO3** | S | S | M | L | S | -- | -- | S | -- | -- | -- | S | -- | -- | -- |
| **CO4** | S | S | S | M | -- | -- | -- | S | -- | -- | -- | S | -- | -- | -- |
| **CO5** | S | S | S | M | M | -- | -- | S | -- | -- | -- | S | -- | -- | -- |

**S- Strong; M-Medium; L-Low**

**SYLLABUS**

**LINEAR MODELS:** Linear Programming Techniques: Formulation of linear programming problem, applications and limitations, Graphical method, Simplex Method – The Big –M

method –Duality principle

**TRANSPORTATION AND ASSIGNMENT MODELS:** Transportations problem: North West Corner Method, Least Cost Method, Vogel's Approximation Method, Modified Distribution Method, Unbalance and Degeneracy in Transportation Model, Assignment problem: Hungarian algorithm, Unbalanced Assignment problems - Maximization case in Assignment problems, traveling salesman problem.

**NETWORK MODELS:** Basic terminologies, constructing a project network, network computations in CPM and PERT, Sequencing Models: Scheduling – processing n jobs through two machines, processing n jobs through three machines, processing n jobs through m machines.

**INVENTORY MODELS:** Variables in inventory problems – Economic Order Quantity Model – Purchasing Model (with and without shortages) – Manufacturing Model (with and without shortages) - Stochastic Inventory Model (Stock in discrete and continuous units). Inventory models with quantity discount, safety stock, multi-item deterministic model.

**DECISION MODELS:** Decision Model – Game theory – Two Person Zero sum game – Algebraic solutions Graphical solutions, Matrix Oddment method for nxn games (Arithmetic Method) – Replacement Models: Replacement of Items due to deterioration with and without time value of Money, Group replacement policy.

**TEXTBOOKS:**


1. H.A.Taha, "Operations Research: An Introduction", 10th Edition, Prentice Hall of India (2019).
2. F.S Hillier and G.J. Lieberman, "Introduction to Operations Research: Concept and Cases", McGraw-Hill International (2012).


**REFERENCES:**


1. Kanti Swarup, P.K.Gupta, Man Mohan, "Operations Research", S.Chand & Sons, New Delhi (2014).
2. Sundarasen.V, Ganapathy Subramaniyam, K.S, Ganesan.K. "Resource Management Techniques", A.R. Publications, Chennai (2013).
3. Premkumar Gupta, D.S. Hira, "Operations Research", S.Chand & company New Delhi (2014).


**Alternative NPTEL/SWAYAM Course**

| S.No | NPTEL /SWAYAM Course Name | Instructor | Host Institution | Duration |
|---|---|---|---|---|
| | Nil | | | |

**Course Designers**


| S.No | Faculty Name | Designation | Department/Name of the College | Email id |
|---|---|---|---|---|
| 1 | Dr.S.Punitha | Associate Professor | Mathematics | punitha@vmkvec.edu.in |
| 2 | Dr.M.Thamizhsudar | Associate Professor | Mathematics | thamizhsudar@avit.ac.in |

| | | | | | | |
|---|---|---|---|---|---|---|
| **34121B18** | **PROBABILITY AND STATISTICS** | **Category** | **L** | **T** | **P** | **Credit** |
| | | **FC-BS** | **2** | **1** | **0** | **3** |

**Preamble**

Probabilistic and statistical analysis is mostly used in varied applications in Engineering and Science. Statistical method introduces students to cognitive learning in statistics and develops skills on analyzing the data by using different tests and designing the experiments with several factors. Statistical Quality control is a method of quality control which employs statistical methods to monitor and control a process and ensure the process operates efficiently, producing more specification-conforming product. Based on this, the course aims at giving adequate exposure in random variables, probability distributions, regression and correlation, test of hypothesis and statistical quality control.

**Prerequisite : Nil**

**Course Objectives**

| | |
|---|---|
| 1 | To get the knowledge on concepts of random variables and distributions with respect to how they are applied to statistical data. |
| 2 | To acquire skills in handling situations involving more than one random variable and functions of random variables |
| 3 | To acquire knowledge of Testing of Hypothesis useful in making decision and test them by means of the measurements made on the sample. |
| 4 | To be exposed to statistical methods designed to contribute to the process of making scientific judgments in the face of uncertainty and variation |
| 5 | To understand the concept of Quality control and the use of operating characteristic (OC) curves in Acceptance sampling. |

**Course Outcomes: On the successful completion of the course, students will be able to**

| | | |
|---|---|---|
| CO1. | Select an appropriate probability distribution to determine probability function for solving engineering problem. | Apply |
| CO2. | Derive the marginal and conditional distributions of bivariate random variables. | Apply |
| CO3. | Apply the concepts of large/small sample tests into real life problems. | Apply |
| CO4. | Interpret results from Analysis of Variance (ANOVA), a technique used to compare means amongst more than two independent populations. | Apply |
| CO5. | Prepare Control charts and decide on the in-control status of the process. Estimate whether a lot is acceptable or unacceptable based on acceptance sampling plans. | Apply |

**Mapping with Programme Outcomes and Programme Specific Outcomes**

| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO 9** | **PO1 0** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | **S** | **S** | **M** | **L** | **--** | **--** | **--** | **L** | **--** | **--** | **--** | **M** | **--** | **--** | **--** |
| **CO2** | **S** | **S** | **M** | **L** | **--** | **--** | **--** | **L** | **--** | **--** | **--** | **M** | **--** | **--** | **--** |
| **CO3** | **S** | **S** | **M** | **L** | **--** | **--** | **--** | **L** | **--** | **--** | **--** | **M** | **--** | **--** | **--** |
| **CO4** | **S** | **S** | **M** | **L** | **--** | **--** | **--** | **L** | **--** | **--** | **--** | **M** | **--** | **--** | **--** |
| **CO5** | **S** | **S** | **M** | **M** | **--** | **--** | **--** | **L** | **--** | **--** | **--** | **M** | **--** | **--** | **--** |

**S- Strong; M-Medium; L-Low**

**SYLLABUS**

**STANDARD DISTRIBUTION**

Standard Distributions - Binomial, Poisson, Geometric, Uniform, Exponential, Normal distributions.

**TWO DIMENSIONAL RANDOM VARIABLES**

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and Regression Analysis

**TESTING OF HYPOTHESIS**

Sampling distributions – Statistical hypothesis – Testing of hypothesis for mean, variance, and proportions for large and Small Samples (Z, t and F test) - Chi-square Tests for Goodness of fit - independence of attributes.

**DESIGN OF EXPERIMENTS**

Analysis of Variance – One Way Classification – Two Way Classification – Completely Randomized Design – Randomized Block Design – Latin Square Design.

**STATISTICAL QUALITY CONTROL**

Introduction – Process control – Control charts for measurements (X and R charts) – Control charts for attributes (p, c and np charts) – Tolerance limits – Acceptance sampling – single sampling, double sampling, multiple sampling and sequential sampling.

**Text Books**

1. S.P. Gupta, "Statistical Methods", 45th Edition, Sultan Chand & Sons Publishers (2017).
2. Douglas C. Montgomery and George C.Runger, "Applied Statistics and Probability for Engineers", 6th Edition, Wiley (2013).

**Reference Books**

1. S.C.Gupta and V.K.Kapoor, "Fundamentals of Mathematical Statistics", 12th Edition, Sultan Chand & Sons, New Delhi (2020).
2. Miller, "Probability and Statistics for Engineers", 9th Edition, Freund-Hall, Prentice India Ltd. (2017).

**Alternative NPTEL/SWAYAM Course**

| S.No | NPTEL /SWAYAM Course Name | Instructor | Host Institution | Duration |
|---|---|---|---|---|
| | Nil | | | |

**Course Designers**

| S.No | Faculty Name | Designation | Department / Name of the College | Email id |
|---|---|---|---|---|
| 1 | Dr.M.Vijayarakavan | Associate Professor | Mathematics/VMKVEC | vijayarakavan@vmkvec.edu.in |
| 2 | Dr. A.K.Bhuvaneswari | Associate Professor | Mathematics/AVIT | bhuvaneswari@avit.ac.in |

| 34121B19 | ENVIRONMENTAL SCIENCES (Common to All Branches) | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | FC-BS | 3 | 0 | 0 | 3 |

**Environmental science** is an interdisciplinary field that integrates physical, chemical, biological, and atmospheric sciences. Environmental studies deals with the human relations to the environment and societal problems and conserving the environment for the future. Environmental engineering focuses on the various issues of environment and its management for sustainable development by improving the environmental quality in every aspect.

**PREREQUISITE**
**NIL**

**COURSE OBJECTIVES**

| | |
|---|---|
| 1 | To inculcate the knowledge of significance of environmental studies and conservation of the natural resources. |
| 2 | To acquire knowledge of ecosystem, biodiversity, it's threats and the need for conservation |
| 3 | To gain knowledge about environmental pollution, it's sources, effects and control measures |
| 4 | To familiarize the legal provisions and the national and international concern for the protection of environment |
| 5 | To be aware of the population on human health and environment, role of technology in monitoring human health and environment. |

**COURSE OUTCOMES**

On the successful completion of the course, students will be able to

| | |
|---|---|
| CO1. Understand the importance of environment and alternate energy resources | Understand |
| CO2. Initiate the awareness and recognize the social responsibility in ecosystem and biodiversity conservation | Apply |
| CO3. To develop technologies to analyse the air, water and soil pollution and solve the problems | Apply |
| CO4. To evaluate the social issues and apply suitable environmental regulations for a sustainable development | Evaluate |
| CO5. To identify and analyse the urban problems, population on human health and environment | Analyse |

**MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES**

| COS | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | M | L | - | - | S | S | S | - | - | - | S | - | - | - |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO2 | S | M | M | - | - | S | S | S | - | - | - | S | - | - | - |
| CO3 | S | L | M | - | - | S | S | S | - | - | - | S | - | - | - |
| CO4 | S | S | S | L | - | S | S | S | - | - | - | S | - | - | - |
| CO5 | S | S | S | M | - | S | S | S | - | - | - | S | - | - | - |

S- Strong; M-Medium; L-Low

**SYLLABUS**

**ENVIRONMENT AND NATURAL RESOURCES** **9 hrs**

Environment - Definition, scope & importance - Public awareness- Forest resources- Use and over-exploitation, deforestation, case studies- Water resources: Use and over-utilization of surface and ground water, dams-benefits and problems –Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, Agriculture- effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Renewable and non renewable energy sources, use of alternate energy sources, Scope & role of engineers in conservation of natural resources.

**ECOSYSTEMS AND BIO – DIVERSITY** **9 hrs**

Ecosystem - Definition, structure and function - Food chain, food web, ecological pyramids- Introduction, types, characteristics, structure and function of forest and Aquatic ecosystems – pond and sea, Introduction to biodiversity, Levels of biodiversity: genetic, species and ecosystem diversity – Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values –India as a mega-diversity nation – hot-spots of biodiversity –Threats to biodiversity: Habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – Conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.

**ENVIRONMENTAL POLLUTION** **9 hrs**

Pollution - Definition, causes, effects and control measures of Air, Water and Land pollution, Solid waste- solid waste Management–Disaster management: Floods, earthquake, cyclone, landslides and tsunamis - Clean technology options, Low Carbon Life Style

**SOCIAL ISSUES AND ENVIRONMENT** **9 hrs**

Sustainable Development- Water conservation – rain water harvesting, watershed management -Resettlement and rehabilitation of people, case studies –Climate change - Global warming - Acid rain - Ozone depletion- Environment Protection Act – Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act- Pollution Control Board-central and state pollution control boards.

**HUMAN POPULATION AND ENVIRONMENT** **9 hrs**

Population – Population growth & Population Explosion –Family welfare programme - Environment & human health - Human rights – Value education –AIDS/HIV, Role of information technology in environment and human health.

**TEXT BOOK**


1. Environmental Science and Engineering by Dr.A. Ravikrishnan, Sri Krishna Publications, Chennai.
2. Erach Bharucha "The Biodiversity of India" Mapin Publishing Pvt Ltd, Ahmedabad, India
3. Benny Joseph “Environmental Science and Engineering”, Tata Mc Graw- Hill, New Delhi


**REFERENCES:**


1.Wager K.D. "Environmental Management", W.B. Saunders Co. Philadelphia, USA, 1998.
2. Anubha Kaushik and C.P Kaushik “Perspectives of Environmental Studies”, New age international publishers.
3. Trivedi R.K. “Handbook of Environmental Laws", Rules, Guidelines,Compliances and Standards Vol I & II,

Enviromedia.
4. Environmental Science and Engineering by Dr. J. Meenambal, MJP Publication, Chennai Gilbert M. Masters: Introduction to Environmental Engineering and Science, Pearson EducationPvtLtd., II Edition, ISBN 81-297-0277-0,2004.
5. Miller T.G.Jr. Environmental Science Wads worth Publishing. Co.
6. Townsend C. Harper J. and Michael Begon, Essentials of Ecology, Blackwell Science.

**COURSE DESIGNERS**


| S.No. | Name of the Faculty | Mail ID |
|---|---|---|
| 1 | Dr. R.Nagalakshmi | nagalakshmi.chemistry@avit.ac.in |
| 2 | A. Gilbert Sunderraj | gilbertsunderraj@vmkvec.edu.in |

# PROGRAM CORE COURSES

| | | | | | | |
|---|---|---|---|---|---|---|
| | **MANUFACTURING PROCESSES** | **Category** | **L** | **T** | **P** | **Credit** |
| **34421C02** | **(Theory and Practicals)** | **CC** | **3** | **0** | **2** | **4** |

**Preamble**

This course provides an introduction to Basic Manufacturing Process with a focus casting, welding, forming process, Sheet metal working and plastic Engineering and also provides knowledge on the working, advantages, limitations and applications of various machining processes. Machine tools are power driven machine for making products of a given shape, size and accuracy by removing metal from the metal block

**Prerequisite : NIL**

**Course Objectives**

| | |
|---|---|
| 1 | To identify and explain manufacturing concepts. |
| 2 | To understand the manufacturing process of conventional and special casting process of foundry technology. |
| 3 | To impart the knowledge of various types welding process in metal joining processes. |
| 4 | To apply fundamentals of metal cutting processes and cutting tools. |
| 5 | To apply the knowledge of different operations on special machines and various types of work holding devices. |
| 6 | To impart the knowledge of various metal forming processes. |
| 7 | To know the working principles of the various unconventional, conventional machining operations and also metal forming processes. |

**Course Outcomes: On the successful completion of the course, students will be able to**

| | | |
|---|---|---|
| CO1. | Explain the working principles of various metal casting processes and to identify the defects and interpret causes in the product of metal casting processes. | Understand |
| CO2. | Discuss the working principles of various metal joining processes and machines/equipments used and Select the suitable joining methods for fabrication/ assembly of products. | Understand |
| CO3. | Understand the chip formation for different cutting forces and cutting tool life. | Understand |
| CO4. | Understand the working principle and operations of Shaper, Milling, Drilling and boring Machines | Understand |
| CO5. | Understand the working principle of various metal forming processes and basics of additive manufacturing technology | Understand |

**Mapping with Programme Outcomes and Programme Specific Outcomes**

| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | **S** | **M** | **S** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **M** | **-** | **-** |
| **CO2** | **S** | **M** | **S** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **M** | **-** | **-** |
| **CO3** | **S** | **M** | **S** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **M** | **-** | **-** |
| **CO4** | **S** | **L** | **S** | **L** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **M** | **M** | **-** | **-** |
| **CO5** | **S** | **L** | **S** | **L** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **M** | **M** | **-** | **-** |

**S- Strong; M-Medium; L-Low**

**SYLLABUS**

**INTRODUCTION TO MANUFACTURING & CASTING**

Introduction-Role of Manufacturing in the development of a country - classification of manufacturing processes-Fundamentals of metal casting – Types of patterns – sand mold making –different casting techniques – types of furnaces – Defects in castings – Testing and inspection of castings.

**JOINING PROCESSES**

Classification of welding processes - Principles of Oxy-acetylene gas welding-A.C metal arc welding- Resistance welding- Submerged arc welding- tungsten inert gas welding- metal inert gas welding- plasma arc welding- thermit welding- electron beam welding- laser beam welding, and identify defects in welding process - Soldering and brazing.

**FUNDAMENTALS OF METAL CUTTING & CUTTING TOOLS**

Basics of metal cutting: Mechanism of chip formation (orthogonal and oblique cutting)-Chip thickness ratio-Velocity ratio-Merchant circle diagram- Types of chips- Basics of cutting tools: Characteristics, Cutting tool materials, properties and applications -Tool life: Taylor's equation-Variables affecting tool life and Tool wear. Tool wear and Causes.

**MACHINING PROCESSES**

Introduction, Classification, working principle, operations performed: Lathe, Shaper, Planner, Horizontal milling machine, Universal drilling machine, Cylindrical grinding machine, Capstan and Turret lathe. Basics of CNC machines. Super finishing processes: Lapping, Honing, Super finishing, Polishing & Buffing.

**METAL FORMING PROCESSES & ADVANCED MANUFACTURING TECHNOLOGY**

Cold and hot working of metals – Bulk metal forming- Sheet metal forming- High Energy Rate Forming processes: Explosive forming- Electro hydraulic forming – Electromagnetic forming. Need and Classification of Additive Manufacturing Technology - Product development and Materials for Additive Manufacturing Technology – Tooling - Applications.

**LIST OF EXPERIMENTS**

1. Greens and moulding process using split pattern.
2. Joining of two metal pieces by electric arc welding.
3. Make an external thread cutting operation by using centre lathe.
4. Make a square end from a given round bar by using shaping machine.
5. Make a hexagonal block from a given round stock by using plain milling machine.
6. Make a spur gear from the given blank by using universal milling machine.
7. Make an external keyway on a given round rod by using vertical milling machine.
8. Make an internal keyway on a given hallow specimen by using slotting machine.
9. Make a grinding process on a machined surface as given surface finish by using cylindrical grinding machine.
10. Make an internal thread cutting on a given specimen as per given dimensions by the sequence drilling, boring, reaming and tapping by using respective tools and machines.

**Text Books**


1. Fundamental of Modern Manufacturing : Mikell P.Groover
2. A Text Book of Production Technology (Manufacturing Processes) : S. Chand.


**Reference Books**


1. SeropeKalpajian, Steven R.Schmid, “Manufacturing Processes for Engineering Materials”, 4/e, Pearson Education, Inc. 2007.
2. Jain. R.K.,and S.C. Gupta, “Production Technology”, 16th Edition, Khanna Publishers, 2001
3. E.PaulDegarmo, J.T.Black, and Ronald A. Konser, „Materials and Processes in Manufacturing“, 5th Edition, Prentice Hall India Ltd., 1997.
4. P. N. Rao, Manufacturing Technology (Volume 1) – Foundry, Forging and Welding, 4th Edition, Tata McGraw Hill Education, New Delhi, 2013.
5. Mikell P. Groover, Fundamentals of Modern Manufacturing Materials, Processes and Systems, Publishers: Wiley India, 2012.


**Alternative NPTEL/SWAYAM Course**

| S.No | NPTEL /SWAYAM Course Name | Instructor | Host Institution | Duration |
|---|---|---|---|---|
| 1 | Manufacturing Process Technology I & II | Prof. Shantanu Bhattacharya | IIT Kanpur | 12 weeks |

**Course Designers**


| S.No | Faculty Name | Designation | Department/Name of the College | Email id |
|---|---|---|---|---|
| 1 | R.Jayaraman | Associate Professor | MECH/VMKVEC | jayaramanr@vmkvec.edu.in |

| | | | | |
|---|---|---|---|---|
| **2** | C.Thangavel | Associate Professor | MECH/VMKVEC | thangavel@vmkvec.edu.in |
| **3** | P.Kumaran | Assistant Professor-II | MECH/AVIT | kumaranp@avit.ac.in |

| | | | | | | |
|---|---|---|---|---|---|---|
| | **FLUID MECHANICS AND MACHINERY** | **Category** | **L** | **T** | **P** | **Credit** |
| **34421C05** | **(Theory andPracticals)** | **CC** | **2** | **1** | **2** | **4** |

**Preamble**

The aim of the subject is to provide a fundamental knowledge in fluid mechanics and machinery.

**Prerequisite**

**NIL**

**Course Objectives**

| | |
|---|---|
| 1 | To introduce the students about properties of the fluids, behaviour of fluids under static conditions. |
| 2 | To impart basic knowledge of the kinematics of fluids and boundary layer concept. |
| 3 | To understand the importance of dimensional analysis. |
| 4 | To understand the importance of various types of flow in pumps. |
| 5 | To understand the importance of various types of flow in turbines. |

**Course Outcomes: On the successful completion of the course, students will be able to**

| | | |
|---|---|---|
| CO1. | Apply mathematical knowledge to predict the properties and characteristics of a fluid. | Apply |
| CO2. | To understand the conservation laws applicable to fluids and its application through fluid kinematics and also to understand the concept of boundary layer and its thickness on the flat solid surface. | Understand |
| CO3. | Formulate the relationship among the parameters involved in the given fluid phenomenon and to predict the performances of prototype by model studies. | Apply |
| CO4. | Explain the working principles of centrifugal pumps and reciprocating pumps. | Understand |
| CO5. | Explain the working principles of various turbines and design the various types of turbines. | Understand |

**Mapping with Programme Outcomes and Programme Specific Outcomes**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | M | L | - | - | - | - | - | - | - | - | - | M | M | L |
| CO2 | S | S | M | L | - | - | - | - | - | - | - | - | M | M | L |
| CO3 | S | S | M | L | - | - | - | - | - | - | - | - | M | M | L |
| CO4 | S | S | S | S | - | - | - | - | - | - | - | - | M | M | L |
| CO5 | S | S | S | S | - | - | - | - | - | - | - | - | M | M | L |

**S- Strong; M-Medium; L-Low**

## SYLLABUS

**BASIC CONCEPTS AND PROPERTIES**

Definition of fluid-mechanics-Properties of fluids-mass density, specific weight, specific volume, specific gravity-Viscosity-Newton's law of viscosity-Compressibility and Buk modulus, Surface tension and Capillarity-Vapor pressure-Continuity equation (one and three dimensional differential forms)-Bernoulli'sequation and its assumptions.

**KINEMATICS AND BOUNDARY LAYER OF FLUID FLOW**

Types of fluid flow - Velocity and acceleration – Velocity Potential Function -Stream Function-Types of motion –Vortex flow-Euler's equation of motion-Flow of viscous fluid through circular pipe-Major and Minor losses-Darcy Weisbach's equation-Boundary layer concepts-Types of boundary layer thickness-Separation of Boundary Layer.

**DIMENSIONAL ANALYSIS**

Fundamental dimensions -Dimensional homogeneity-Methods of dimensional analysis-Model analysis -Similitude –Types of similitude-Dimensionless Numbers-Types of dimensionless numbers-Model laws–Classification of models.

**HYDRAULIC PUMPS**

Classification of pumps-Centrifugal pumps-Working principles-Work done by the impeller-Velocity Triangles-Heads and efficiencies of centrifugal pumps-Characteristic curves of centrifugal pumps-Cavitations in centrifugal pumps-Net Positive Suction Head (NPSH)- Reciprocating pumps-

Working principles-Slip and negative slip of reciprocating pump-Classification of reciprocating pumps-Indicator diagram and it's variations - Work saved by fitting air vessels.

**HYDRAULIC TURBINES**

Classification of turbines-Heads and efficiencies- Pelton wheel -Velocity triangles- Radial flow reaction turbines- -Francis turbine-Axial flow reaction turbines-Working principles – Draft-Tube-Specific speed-Unit quantities-Performance curves for turbines –Governing of turbines.

**LIST OF EXPERIMENTS**

1. Determination of the Coefficient of discharge given Orifice Meter
2. Determination of the Coefficient of discharge given Venturi Meter
3. Determination of friction factor for a given set of pipes.
4. Conducting experiments and drawing the characteristic curves of Centrifugal Pump/Submersible Pump
5. Conducting experiments and drawing the characteristic curves of Reciprocating Pump
6. Conducting experiments and drawing the characteristic curves of Gear Pump
7. Conducting experiments and drawing the characteristic curves of Jet Pump
8. Conducting experiments and drawing the characteristic curves of Kaplan Turbine
9. Study about the performance characteristics curves of Pelton wheel & Francis Turbine

**Text Books**


1. Modi P.N. and Seth, S.M. Hydraulics and Fluid Mechanics, Standard Book House, New Delhi, 22nd edition 2019.
2. Jain A. K. Fluid Mechanics including Hydraulic Machines, Khanna Publishers, New Delhi, 2014.
3. Bansal- R.K. - "Fluid Mechanics and Hydraulics Machines"- (9th edition)–Laxmi Publications (P) Ltd- New Delhi 2010.


**Reference Books**


1. Pani B S, Fluid Mechanics: A Concise Introduction, Prentice Hall of India Private Ltd, 2016.
2. Cengel Y A and Cimbala J M, Fluid Mechanics, McGraw Hill Education Pvt. Ltd., 2014.
3. S K Som; Gautam Biswas and S Chakraborty, Introduction to Fluid Mechanics and Fluid Machines, Tata McGraw Hill Education Pvt. Ltd., 2012.
4. Streeter, V. L. and Wylie E. B., Fluid Mechanics, McGraw Hill Publishing Co., 2010.


**Alternative NPTEL/SWAYAM Course**

| S.No | NPTEL /SWAYAM Course Name | Instructor | Host Institution | Duration |
|---|---|---|---|---|
| | | | | |

**Course Designers**

| S.No | Faculty Name | Designation | Department/Name of the College | Email id |
|---|---|---|---|---|
| 1 | Dr.S.Arunkumar | Associate Professor | MECH / VMKVEC | arunkumar@vmkvec.edu.in |
| 2 | B.Selva Babu | Assistant Professor | MECH/ AVIT | selvababu@avit.ac.in |

| 34421C08 | MECHANICS OF MACHINES (Theory and Practicals) | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | CC | 3 | 0 | 2 | 4 |

**Preamble**

The students completing this course are expected to understand the role of mechanisms and its applications.

**Prerequisite**

**NIL**

**Course Objectives**

| | |
|---|---|
| 1 | To demonstrate the various types of kinematics of mechanisms. |
| 2 | To study the gear nomenclature and illustrate the various types of gears and gear trains. |
| 3 | To study and construct the cam profile. |
| 4 | To categorize the knowledge of static force analysis. |
| 5 | To analyze the balancing of masses and vibrations. |

**Course Outcomes: On the successful completion of the course, students will be able to**

| | | |
|---|---|---|
| CO1. | Explain the principles involved in mechanics of machines. | Understand |
| CO2. | Solve problems related to gear tooth for various applications | Apply |
| CO3. | Construct cams and followers for specified motion profiles. | Apply |
| CO4. | Analyze about the various static and dynamic forces. | Analyze |
| CO5. | Analyze balancing problems in rotating and reciprocating parts of machinery. | Analyze |

**Mapping with Programme Outcomes and Programme Specific Outcomes**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | M | L | - | - | - | - | - | - | - | - | - | M | M | L |
| CO2 | S | S | M | L | - | - | - | - | - | - | - | - | M | M | L |
| CO3 | S | S | M | L | - | - | - | - | - | - | - | - | M | M | L |
| CO4 | S | S | S | S | - | - | - | - | - | - | - | - | M | M | L |
| CO5 | S | S | S | S | - | - | - | - | - | - | - | - | M | M | L |

**S- Strong; M-Medium; L-Low**

## SYLLABUS

**KINEMATIC OF MECHANICS**

Mechanisms – Terminology and definitions – kinematics inversions of 4 bar and slide crank chain – kinematics analysis in simple mechanisms – velocity and acceleration polygons – Analytical methods.

**GEARS AND GEAR TRAINS**

Spur gear – law of toothed gearing – involute gearing – Interchangeable gears – Gear tooth action interference and undercutting – nonstandard teeth – gear trains – parallel axis gears trains – epicyclic gear trains – automotive transmission gear trains

**KINEMATICS OF CAM**

Classifications - Displacement diagrams-parabolic- Simple, harmonic and Cycloidal motions - Layout of plate cam profiles - Derivatives of Follower motion - High speed cams - circular arc and tangent cams - Standard cam motion

**FORCE ANALYSIS**

Applied and Constrained Forces – Free body diagrams – static Equilibrium conditions – Two, Three and four members – Static Force analysis in simple machine members – Dynamic Force Analysis – Inertia Forces and Inertia Torque – D‘Alembert‘s principle – superposition principle – dynamic Force Analysis in simple machine members.

**BALANCING AND VIBRATION**

Static and Dynamic balancing – Balancing of revolving and reciprocating masses – Balancing machines-Direct and reverse crank method

Free vibrations – Equations of motion – natural Frequency – Damped Vibration –critical speed of simple shaft – Torsional vibration – Forced vibration

**LIST OF EXPERIMENTS**

1. To perform an experiment on Watt and Porter Governor to prepare performance characteristic curves and to find stability and sensitivity
2. To determine the position of sleeve against controlling force and speed of a Hartnell governor and to plot the characteristic curve of radius of rotation
3. To analyse the motion of a motorized gyroscope when the couple is applied along its spin axis and determine gyroscopic couple
4. Determine the Moment of Inertia by compound pendulum and tri-filar suspension.
5. To determine the frequency of undamped free vibration and damped forced vibration of an equivalent spring mass system.
6. To determine whirling speed of shaft theoretically and experimentally.

**Text Books**


1. Ambekar A.G., ―Mechanism and Machine Theory‖ Prentice Hall of India, New Delhi, 2007
2. Shigley J.E., Pennock G.R and Uicker J.J., ―Theory of Machines and Mechanisms‖, Oxford University Press, 2003
3. Khurmi.R.S. and Gupta, Theory of Machines, S.Chand @ Co., 2005.


**Reference Books**


1. Thomas Bevan, ―Theory of Machines‖, CBS Publishers and Distributors, 1984.
2. Ghosh.A, and A.K.Mallick, ―Theory and Machine‖, Affiliated East-West Pvt. Ltd., New Delhi,
3. Rao.J.S. and Dukkipatti R.V. ―Mechanisms and Machines‖, Wiley-Eastern Ltd., New Delhi, 1992.
4. Ramamurthi. V., "Mechanisms of Machine", Narosa Publishing House, 2002
5. Robert L.Norton, "Design of Machinery", McGraw-Hill, 2004.


**Alternative NPTEL/SWAYAM Course**

| S.No | NPTEL /SWAYAM Course Name | Instructor | Host Institution | Duration |
|---|---|---|---|---|
| 1 | Kinematics of Mechanisms and Machines | Prof. A. Dasgupta | IIT Kharagpur | 12 Weeks |

**Course Designers**

| S.No | Faculty Name | Designation | Department/Name of the College | Email id |
|---|---|---|---|---|
| 1 | Dr.S.Venkatesan | Professor | MECH/ VMKVEC | venkatesan@vmkvec.edu.in |
| 2 | Mr.S.Sathiyaraj | Assistant Professor-II | MECH/AVIT | Sathiyaraj@avit.ac.in |

| | | | | | | |
|---|---|---|---|---|---|---|
| | **MECHANICAL BEHAVIOUR OF MATERIALS AND METALLURGY** | **Category** | **L** | **T** | **P** | **Credit** |
| **34421C03** | **(Theory and Practicals)** | **CC** | **3** | **0** | **2** | **4** |

**Preamble**

This course to imparts through knowledge on the metallic and nonmetallic materials, mechanical testing methods and deformation mechanisms in crystalline solid materials, also the mechanical treatment process, corrosion and advanced materials pertaining to Mechanical Engineers.

**Prerequisite**

**NIL**

**Course Objectives**

| | |
|---|---|
| 1 | To develop the broad knowledge of the classification, properties and application of various Engineering Materials. |
| 2 | To provide an understanding to students on the mechanical properties and performance of materials. |
| 3 | Identify the suitable mechanical treatment methods for selecting ferrous and non ferrous materials. |
| 4 | Develop the knowledge of the various forms of corrosion and powder metallurgy fabrication methods. |
| 5 | To give insight to advanced materials such as polymers, ceramics and composite and their applications. |

**Course Outcomes: On the successful completion of the course, students will be able to**

| | | |
|---|---|---|
| CO1. | Understand the concepts of structure properties, performance and processing related to metallurgy and materials. | Understand |
| CO2. | Evaulate the mechanical behaviour of materials and the effect of mechanical properties. | Apply |
| CO3. | Correlate the structure-property relationship in metal/alloys in as-received and heat-treated conditions. | Apply |
| CO4. | Predict the formation of corrosion, mechanism and to prevent corrosion and powder metallurgy fabrication methods. | Apply |
| CO5. | Apply advanced materials such as polymers, ceramics and composites in product design. | Apply |

**Mapping with Programme Outcomes and Programme Specific Outcomes**

| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | **S** | **M** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **M** | **M** | **-** | **-** |
| **CO2** | **S** | **M** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **M** | **S** | **M** | **-** | **M** |
| **CO3** | **S** | **S** | **M** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **S** | **M** | **-** | **M** |
| **CO4** | **S** | **S** | **-** | **-** | **-** | **S** | **-** | **S** | **-** | **-** | **-** | **S** | **M** | **-** | **M** |
| **CO5** | **S** | **S** | **-** | **-** | **S** | **-** | **-** | **-** | **-** | **-** | **-** | **S** | **M** | **-** | **M** |

**S- Strong; M-Medium; L-Low**

**SYLLABUS**

**FERROUS & NON-FERROUS MATERIALS**

Classification of cast iron and steels – properties, microstructures and uses of cast irons, plain carbon, alloy steels, HSLA, stainless, tool and die steels & maraging steels. Properties, microstructures and uses of non – ferrous alloys – copper, aluminium and nickel alloys. Phase diagrams - Iron – Iron carbide equilibrium diagram.

**MECHANICAL BEHAVIOR OF MATERIALS**

Introduction to plastic deformation - Slip and twinning – Types of fracture – ductile fracture, brittle fracture, - Fatigue – Fatigue test, S-N curves, Creep and stress rupture fatigue – mechanism of creep. Testing of materials under tension, compression and shear loads – Hardness tests (Brinell, Vickers & Rockwell), Impact test Izod and charpy.

**MATERIAL TREATMENT**

Heat treatment - Overview- objectives – Annealing and types, Normalizing - Hardening and

Tempering, Austempering and martempering. Case hardening process- Carburizing- nitriding - cyniding and carbonitriding, flame and induction hardening. Hardenability - Jominy end quench test.Time Temperature Transformation (TTT) and Cooling Curve Transformation (CCT) curve.

**POWDER METALLURGY AND CORROSION**

Powder metallurgy–powder production, blending, compaction, sintering-applications, Introduction- forms of corrosion-pitting, intergranular, stress corrosion, corrosion fatigue, dezincification, erosion-corrosion, Crevice Corrosion, Fretting-Protection methods - PVD, CVD.

**INTRODUCTION TO ADVANCED MATERIALS**

Polymers – types of polymer, Properties and applications of various Engineering polymers (PP,PS, PVC, PMMA, PET,PC, PA, ABS, PI,PAI,PPO,PPS,PEEK, PTEF, Urea and phenol formaldhydes. Composites - Types- Metal Matrix Composites (MMC), Polymer Matrix Composites (PMC), Ceramic Matrix Composites (CMC) – properties,processing and applications. Ceramics – properties and applications of SiC, Al2O3, Si3N4, PSZ and SIALON

**LIST OF EXPERIMENTS**

1. Introduction to Metallographic
2. Preparation metallographic specimen
3. Identification of Ferrous specimens (Minimum 5)
4. Identification of Non-Ferrous specimen (Minimum 2)
5. Heat treatment – Annealing – comparation between annealed and unheat treated specimen.
6. Heat treatment – Normalizing – comparation between annealed and unheat treated specimen.

**Text Books**


1. William D Callister "Material Science and Engineering", John Wiley and Sons 2010–8thEdition.
2. Sydney H.Avner "Introduction to Physical Metallurgy" McGraw Hill Book Company – Prentice Hall 2014- 8th Edition.
3. V. Raghavan , " Materials Science and Engineering", PHI, Sixth Edition


**Reference Books**


1. George E. Dieter, "Mechanical Metallurgy" – TATA McGraw Hill – 2013 – 3rd Edition
2. Kenneth G.Budinski and Michael K. Budinski, "Engineering Materials", Prentice Hall of India
3. Upadhyay. G.S. and AnishUpadhyay, "Materials Science and Engineering", Viva Books Pvt. Ltd., New Delhi, 2006.


**Alternative NPTEL/SWAYAM Course**

| S.No | NPTEL /SWAYAM Course Name | Instructor | Host Institution | Duration |
|---|---|---|---|---|
| 1 | Mechanical Behaviour of Materials | Prof. S. Shankar | IIT Madras | 12 Weeks |
| 2 | Materials Science and Engineering | Dr. Vivek Pancholi | IIT Roorkee | 12 Weeks |

**Course Designers**

| S.No | Faculty Name | Designation | Department/Name of the College | Email id |
|---|---|---|---|---|
| 1 | Dr.S.Arunkumar | Assoc. Professor | MECH/VMKVEC | arunkumar@vmkvec.edu.in |
| 2 | Dr.M.Thiruchirambalam | Professor | MECH/AVIT | thiru.mech@avit.ac.in |

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|---|---|---|---|---|---|---|
| | **STRENGTH OF MATERIALS** | **Category** | **L** | **T** | **P** | **Credit** |
| **34421C06** | **(Theory and Practicals)** | **CC** | **2** | **1** | **2** | **4** |

**Preamble**

The students completing this course are expected to understand the role of mechanisms and its applications.

**Prerequisite**

**NIL**

**Course Objectives**

| | |
|---|---|
| 1 | To know the behavior of material at various loading conditions in compression and tension. |
| 2 | Understand and analyze shear force and bending moment in various loading conditions. |
| 3 | To know the phenomenon of bending of different sections and its analysis and recognize principle stresses. |
| 4 | To understands various columns sections and geometrical analysis. |
| 5 | Concepts of strain energy, torsion and numerical analysis. |

**Course Outcomes: On the successful completion of the course, students will be able to**

| | | |
|---|---|---|
| CO1. | Explain the behavior of material at various loading conditions in compression and tension. | Understand |
| CO2. | Analyze shear force and bending moment in various loading conditions. | Apply |
| CO3. | Analyze the phenomenon of bending of different sections and recognize principle stresses. | Analyze |
| CO4. | Analyze about the various columns sections and geometrical. | Analyze |
| CO5. | Analyze of strain energy, torsion and numerical analysis. | Analyze |

**Mapping with Programme Outcomes and Programme Specific Outcomes**

| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | **S** | **M** | **L** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **M** | **M** | **L** |
| **CO2** | **S** | **S** | **M** | **L** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **M** | **M** | **L** |
| **CO3** | **S** | **S** | **S** | **S** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **M** | **M** | **L** |
| **CO4** | **S** | **S** | **S** | **S** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **M** | **M** | **L** |
| **CO5** | **S** | **S** | **S** | **S** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **M** | **M** | **L** |

**S- Strong; M-Medium; L-Low**

**SYLLABUS**

**STRESSES AND STRAINS**

Stress and strain due to axial force – Strain energy due to axial force –sudden load and impact load. Poisson's ratio– volumetric strain– shear stress–shear strain. Thin cylindrical and spherical shells under internal pressure. Thermal stresses. Principal stresses and planes – Mohr's circle for plane stress and plane strain. Strain gauges and rosettes.

**BENDING MOMENT AND SHEAR FORCE IN BEAMS**

Shear force and bending moment diagrams for cantilever, simply supported and overhanging beams under concentrated loads, uniformly distributed loads, uniformly varying loads, concentrated moments – maximum bending moment and point of contra flexure.

**FLEXURE & TORSION IN BEAMS**

Theory of simple bending and assumptions – flexure equation. Theory of torsion and assumptions – torsion equation – power transmitted by a shaft.

**DEFLECTION OF DETERMINATE BEAMS**

Governing differential equation – Macaulay's method – moment area method – application to simple problems (cantilever beams and simply supported beams only).

**COLUMNS AND STRUTS**

Columns – behaviour of axially loaded short and long column members – buckling load – Euler's theory – different end conditions – Rankine's formula.

**LIST OF EXPERIMENTS**

1. Direct Shear Test on Mild Steel Rod and Mild Steel Plate
2. Brinell Hardness Test
3. Izod Impact Test
4. Bending Test on Mild Steel
5. Rockwell Hardness Test
6. Tensile Test on Mild Steel
7. Compression test& Torsion test on Mild Steel

**Text Books**


1. Bedi D.S., "Strength of Materials", Khanna Publishing House, 2017.
2. Jindal U C, "Strength of Materials", Asian Books Pvt Ltd, New Delhi, 2007.
3. Rajput.R K, "Strength of Materials", S.Chand& Co Ltd, New Delhi, 1996.


**Reference Books**


1. Egor P Popov, "Engineering Mechanics of Solids", Prentice Hall of India, New Delhi, 1997.
2. Subramanian R, "Strength of Materials", Oxford University Press, Oxford Higher Education Series, Oxford, 2007.
3. Hibbeler R.C, "Mechanics of Materials", Pearson Education, New Jersey, 2007.
4. Bansal R.K, "Strength of Materials", Lakshmi Publications(P)Ltd, New Delhi,2010.
5. Ferdinand P Been, Russell Johnson,J.R. and John J Dewole, "Mechanics of Materials", Tata Mcgraw Hill Publishing Co Ltd, New Delhi, 2006.


**Alternative NPTEL/SWAYAM Course**

| S.No | NPTEL /SWAYAM Course Name | Instructor | Host Institution | Duration |
|---|---|---|---|---|
| 1 | STRENGTH OF MATERIALS | PROF. SRIMAN KUMAR BHATTACHARYYA | IIT KGP | 12 Weeks |

**Course Designers**

| S.No | Faculty Name | Designation | Department/Name of the College | Email id |
|---|---|---|---|---|
| 1 | Dr.S.Sangeetha | Associate Professor | MECH/AVIT | sangeethas@avit.ac.in |
| 2 | R.Chandrasekar | Assistant Professor | MECH / VMKVEC | chandrasekar@vmkvec.edu.in |

| | | | | | | |
|---|---|---|---|---|---|---|
| | **ENGINEERING THERMODYNAMICS** | **Category** | **L** | **T** | **P** | **Credit** |
| **34421C04** | **(Theory and Practicals)** | **CC** | **2** | **1** | **2** | **4** |

**Preamble**

This course provides an introduction to the basic concepts in thermodynamics, first law of thermodynamics and energy, second law, entropy, enthalpy and internal energy, ideal and real gases and non-reactive ideal gas mixtures and general thermodynamic property relations. It develops the problem solving skills in engineering problems in basic thermodynamics.

**Prerequisite**

**Nil**

**Course Objectives**

| | |
|---|---|
| 1 | To learn about work and heat interactions, and balance of energy between system and its surroundings. |
| 2 | To learn about application of I law to various energy conversion devices. |
| 3 | To evaluate the changes in properties of substances in various processes. |
| 4 | To understand the difference between high grade and low grade energies. |
| 5 | To understand the II law limitations on energy conversion. |

**Course Outcomes: On the successful completion of the course, students will be able to**

| | | |
|---|---|---|
| CO1. | To assess the basic elements & various modes of heat transfer Used in Engineering applications. | Understand |
| CO2. | To solve the engineering problems using various methods of Transient heat conduction technologies | Apply |
| CO3. | To apply the concepts of convection systems in an engineering problem using standard values | Apply |
| CO4. | To choose the various concepts of radiation based on the requirements for the given problems | Apply |
| CO5. | To solve the engineering problems using Boiling, Condensation and heat transfer rate of heat exchangers using LMTD and NTU method | Apply |

**Mapping with Programme Outcomes and Programme Specific Outcomes**

| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | **S** | **M** | **L** | **L** | **-** | **-** | **-** | **S** | **S** | **S** | **-** | **-** | **S** | **M** | **-** |
| **CO2** | **S** | **M** | **L** | **L** | **-** | **-** | **-** | **S** | **S** | **S** | **-** | **-** | **S** | **M** | **-** |
| **CO3** | **S** | **M** | **L** | **L** | **-** | **-** | **-** | **S** | **S** | **S** | **-** | **-** | **S** | **M** | **-** |
| **CO4** | **S** | **M** | **L** | **L** | **-** | **-** | **-** | **S** | **S** | **S** | **-** | **-** | **S** | **M** | **-** |
| **CO5** | **S** | **M** | **L** | **L** | **-** | **-** | **-** | **S** | **S** | **S** | **-** | **-** | **S** | **M** | **-** |

**S- Strong; M-Medium; L-Low**

**SYLLABUS**

**FUNDAMENTALS OF THERMODYNAMIC**

Fundamentals - System & Control volume; Property, State & Process; Exact & Inexact differentials; Work - Thermodynamic definition of work; examples; Displacement work; Path dependence of displacement work and illustrations for simple processes; electrical, magnetic, gravitational, spring and shaft work. Temperature, Definition of thermal equilibrium and Zeroth law; Temperature scales; Various Thermometers- Definition of heat; examples of heat/work interaction in systems- First Law for Cyclic & Non-cyclic processes; Concept of total energy E ; Demonstration that E is a property; Various modes of energy, Internal energy and Enthalpy.

**FIRST AND SECOND LAW OF THERMODYNAMICS**

First Law for Flow Processes - Derivation of general energy equation for a control volume; Steady state steady flow processes including throttling; Examples of steady flow devices; Unsteady processes; examples of steady and unsteady I law applications for system and control volume. Second law - Definitions of direct and reverse heat engines; Definitions of thermal efficiency and COP; Kelvin-Planck and Clausius statements; Definition of reversible process; Internal and external irreversibility; Carnot cycle; Absolute temperature scale

**CLAUSIUS INEQUALITY, IRREVERSIBILITY AND AVAILABILITY**

Clausius inequality; Definition of entropy S ; Demonstration that entropy S is a property; Evaluation of S for solids, liquids, ideal gases and ideal gas mixtures undergoing various processes; Determination of s from steam tables- Principle of increase of entropy; Illustration of processes in T-s coordinates; Definition of Isentropic efficiency for compressors, turbines and nozzles- Irreversibility and Availability, Availability function for systems and Control volumes undergoing different processes, Lost work. Second law analysis for a control volume. Energy balance equation and Exergy analysis.

**PURE SUBSTANCE AND GAS MIXTURES**

Definition of Pure substance, Ideal Gases and ideal gas mixtures, Real gases and real gas mixtures, Compressibility charts- Properties of two phase systems - Const. temperature and Const. pressure heating of water; Definitions of saturated states; P-v-T surface; Use of steam tables and R134a tables; Saturation tables; Superheated tables; Identification of states & determination of properties, Mollier's chart

**THERMODYNAMIC CYCLES AND RELATIONS**

Thermodynamic cycles - Basic Rankine cycle; Basic Brayton cycle; Basic vapor compression cycle and comparison with Carnot cycle. Thermodynamic relations : Thermodynamic potentials, thermodynamic gradients, general thermodynamics relations, entropy (Tds) equations, equations for internal energy and enthalpy, equation of state, coefficient of expansion and compressibility, specific heats, Joule Thomson coefficient, Clausius –Claperyon equation, Maxwell's relations.

**LIST OF EXPERIMENTS**

IC Engine Valve Timing diagrams.
IC Engine Port Timing diagrams.
Determination of Flash Point and Fire Point of Various fuels / Lubricant
Determination of Viscosity of Various fuels / Lubricant
Actual P-V diagrams of IC engines.
Determination of Calorific value of liquid fuel

**Text Books**

1. Jones, J. B. and Duggan, R. E., 1996, Engineering Thermodynamics, Prentice-Hall of India
2. Nag, P.K, 1995, Engineering Thermodynamics, Tata McGraw-Hill Publishing Co. Ltd.

**Reference Books**

1. Sonntag, R. E, Borgnakke, C. and Van Wylen, G. J., 2003, 6th Edition, Fundamentals of Thermodynamics, John Wiley and Sons.
2. Moran, M. J. and Shapiro, H. N., 1999, Fundamentals of Engineering Thermodynamics, John Wiley and Sons.

**Alternative NPTEL/SWAYAM Course**

| S.No | NPTEL /SWAYAM Course Name | Instructor | Host Institution | Duration |
|---|---|---|---|---|
| 1 | Basic Thermodynamics | Prof. Suman Chakraborty | IIT Kharagpur | 12 weeks |

**Course Designers**

| S.No | Faculty Name | Designation | Department/ Nameof the College | Email id |
|---|---|---|---|---|
| **1** | R.Anandan | Associate Professor | MECH/VMKVEC | anandan@vmkvec.edu.in |
| **2** | Dr.P. Sellamuthu | Associate Professor | MECH/VMKVEC | sellamuthu@vmkvec.edu.in |
| **3** | C.Thiagarajan | Associate Professor | MECH/AVIT | cthiagarajan@avit.ac.in |

| | | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| 34421C09 | THERMAL ENGINEERING ((Theory and Practicals) | CC | 2 | 1 | 2 | 4 |

**Preamble**

This course imparts understanding about the power generation using heat energy conversion and makes an attempt to be conversant with the equipment's used in the process. It helps in understanding the thermodynamic concepts, the construction and the working principles of various engineering devices

**Prerequisite**

**Engineering Thermodynamics**

**Course Objectives**

| | |
|---|---|
| 1 | To learn about of reacting systems and heating value of fuels. |
| 2 | To learn about gas and vapor cycles and their first law and second law efficiencies. |
| 3 | To understand about the properties of dry and wet air and the principles of psychrometry |
| 4 | To learn about gas dynamics of air flow and steam through nozzles. |
| 5 | To learn the about reciprocating compressors with and without intercooling and performance of steam turbines. |

**Course Outcomes: On the successful completion of the course, students will be able to**

| | | |
|---|---|---|
| CO1. | To assess the basic of reacting systems and heating value of fuels | Understand |
| CO2. | Apply the gas and vapor cycles and their first law and second law efficiencies | Apply |
| CO3. | Apply the properties of dry and wet air and the principles of psychrometry | Apply |
| CO4. | Apply the concept of gas dynamics of air flow and steam through nozzles | Apply |
| CO5. | Analyze the reciprocating compressors with and without intercooling and performance of steam turbines | Analyze |

**Mapping with Programme Outcomes and Programme Specific Outcomes**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | M | L | L | - | - | - | S | S | S | - | - | S | M | - |
| CO2 | S | M | L | L | - | - | - | S | S | S | - | - | S | M | - |
| CO3 | S | M | L | L | - | - | - | S | S | S | - | - | S | M | - |
| CO4 | S | M | L | L | - | - | - | S | S | S | - | - | S | M | - |
| CO5 | S | M | L | L | - | - | - | S | S | S | - | - | S | M | - |

**S- Strong; M-Medium; L-Low**

**SYLLABUS**

**INTRODUCTION TO SOLID, LIQUID AND GASEOUS FUELS**

Introduction to solid, liquid and gaseous fuels– Stoichiometry, exhaust gas analysis- First law analysis of combustion reactions- Heat calculations using enthalpy tables- Adiabatic flame temperature- Chemical equilibrium and equilibrium composition calculations using free energy.

**GAS AND VAPOR CYCLES**

Vapor power cycles Rankine cycle with superheat, reheat and regeneration, exergy analysis. Super-critical and ultra super-critical Rankine cycle- Gas power cycles, Air standard Otto, Diesel and Dual cycles-Air standard Brayton cycle, effect of reheat, regeneration and intercooling- Combined gas and vapor power cycles- Vapor compression refrigeration cycles, refrigerants and their properties.

**PROPERTIES OF DRY AND WET AIR**

Properties of dry and wet air,use of pschyrometric chart, processes involving heating/cooling and humidification/dehumidification, dew point.

**COMPRESSIBLE FLOW**

Basics of compressible flow. Stagnation properties, Isentropic flow of a perfect gas through a nozzle, choked flow, subsonic and supersonic flows- normal shocks- use of ideal gas tables for isentropic flow and normal shock flow- Flow of steam and refrigerant through nozzle, supersaturation- compressible flow in diffusers, efficiency of nozzle and diffuser.

**RECIPROCATING COMPRESSORS AND STEAM TURBINE**

Reciprocating compressors, staging of reciprocating compressors, optimal stage pressure ratio, effect of intercooling, minimum work for multistage reciprocating compressors.
Analysis of steam turbines, velocity and pressure compounding of steam turbines

**LIST OF EXPERIMENTS**

1. Load Test on a four stroke Single cylinder diesel engine.
2. Load Test on a four stroke twin cylinder diesel engine.
3. Performance and Emission test of a four stroke multi-cylinder Petrol engine.
4. Performance and Emission test of a four stroke multi-cylinder Diesel engine.
5. Morse Test on a multi-cylinder petrol engine.
6. Performance test of a bio-fuel on a variable compression ratio engine.

**Text Books**

1. Jones, J. B. and Duggan, R. E., 1996, Engineering Thermodynamics, Prentice-Hall of India
2. Nag, P.K, 1995, Engineering Thermodynamics, Tata McGraw-Hill Publishing Co. Ltd.

**Reference Books**

1. Sonntag, R. E, Borgnakke, C. and Van Wylen, G. J., 2003, 6th Edition, Fundamentals of Thermodynamics, John Wiley and Sons.
2. Moran, M. J. and Shapiro, H. N., 1999, Fundamentals of Engineering Thermodynamics, John Wiley and Sons.

**Alternative NPTEL/SWAYAM Course - Nil**

| S.No | NPTEL /SWAYAM Course Name | Instructor | Host Institution | Duration |
|---|---|---|---|---|
| | | | | |

**Course Designers**

| S.No | Faculty Name | Designation | Department/Name of the College | Email id |
|---|---|---|---|---|
| **1** | R.Anandan | Associate Professor | MECH/VMKVEC | anandan@vmkvec.edu.in |
| **2** | Dr.P. Sellamuthu | Associate Professor | MECH/VMKVEC | sellamuthu@vmkvec.edu.in |
| **3** | C.Thiagarajan | Associate Professor | MECH/AVIT | cthiagarajan@avit.ac.in |

| | | | | | | |
|---|---|---|---|---|---|---|
| | **DESIGN OF MACHINE** | **Category** | **L** | **T** | **P** | **Credit** |
| **34421C11** | **ELEMENTS** | **CC** | **2** | **1** | **0** | **3** |

**Preamble**

Students will be able to demonstrate the fundamentals of stress analysis, theories of failure and material science in the design of machine components. Students will be able to make proper assumptions with respect to material, factor of safety, static and dynamic loads for various machine components. Enable the students to have high ethical standards in terms of team work to be a good design engineer

**Prerequisite**

**NIL**

**Course Objectives**

| | |
|---|---|
| 1 | Develop an ability to apply knowledge of mechanics and materials. |
| 2 | Develop an ability to design various machine elements with practical constraints by applying standard design procedures. |
| 3 | Utilize the codes and standard design principles. |
| 4 | Apply Design principles and validation for critical safety analysis. |
| 5 | Understand the background in material failure through the study of theories of failure. |

**Course Outcomes: On the successful completion of the course, students will be able to**

| | | |
|---|---|---|
| CO1. | Explain the influence of steady and variable stresses in machine component design. | Understand |
| CO2. | Apply the design principles in shafts and couplings for defined constraints. | Apply |
| CO3. | Apply the design principles in bolted and welded joints for defined constraints. | Apply |
| CO4. | Apply the design principles in mechanical springs for steady and varying load conditions | Apply |
| CO5. | Apply the design principles in bearing and flywheel for defined constraints | Apply |

**Mapping with Programme Outcomes and Programme Specific Outcomes**

| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | **S** | **S** | **S** | **L** | **-** | **-** | **-** | **M** | **L** | **L** | **-** | **-** | **S** | **-** | **-** |
| **CO2** | **S** | **S** | **S** | **M** | **-** | **-** | **-** | **M** | **L** | **L** | **-** | **-** | **S** | **-** | **-** |
| **CO3** | **S** | **S** | **S** | **M** | **-** | **-** | **-** | **M** | **L** | **L** | **-** | **-** | **S** | **-** | **-** |
| **CO4** | **S** | **S** | **S** | **M** | **-** | **-** | **-** | **M** | **L** | **L** | **-** | **-** | **S** | **-** | **-** |
| **CO5** | **S** | **S** | **S** | **M** | **-** | **-** | **-** | **M** | **L** | **L** | **-** | **-** | **S** | **-** | **-** |

**S- Strong; M-Medium; L-Low**

**SYLLABUS**

**INTRODUCTION TO DESIGN PROCESS WITH VARIOUS STRESS COMBINATIONS**

Introduction to the design process - factor influencing machine design – Direct – Bending and torsional stress equations –Impact and shock loading-Calculation of principal stresses for various load combinations – Factor of safety-theories of failure–stress concentration –design for variable loading – Soderberg – Goodman and Gerber relations

**DESIGN OF SHAFTS AND COUPLINGS**

Design of solid and hollow shafts based on strength – rigidity and critical speed – Design of rigid and flexible couplings.

**DESIGN OF BOLTED AND WELDED JOINTS**

Threaded fasteners – Design of bolted joints – Design of welded Joints for pressure vessels and structures- Theory of Bolted joints

**DESIGN OF SPRINGS**

Design of helical, leaf and torsional springs under constant loads and varying loads.

**DESIGN OF BEARINGS AND FLYWHEELS**

Design of bearings – sliding contact and rolling contact types – Design of journal bearings calculation ofbearing dimensions- Design of flywheels involving stresses in rim and arm.

**Text Books**

1. Design of Machine Elements-V.B.Bhandari
2. Mechanical Engineering Design: Joseph E Shigley and Charles R. Mischke

**Reference Books**

1. Machine Design: Robert L. Norton, Pearson Education,2001
2. Design of Machine Elements-M.F. Spotts, T.E. Shoup, pearson Edn,2006.
3. Fundamentals of Machine component Design–Robert C. Juvinall, Wiley India Pvt.Ltd,3rdEdn,2007.
4. Design Data – PSG College of Technology, DPV Printers, Coimbatore, 2012.
5. P.C. Sharma &D.K. Aggarwal, A Text Book of Machine Design, S.K. Kataria & Sons, New Delhi,12thedition, 2012.

**Alternative NPTEL/SWAYAM Course – Nil**

| S.No | NPTEL /SWAYAM Course Name | Instructor | Host Institution | Duration |
|---|---|---|---|---|
| | - | - | - | - |

**Course Designers**

| S.No | Faculty Name | Designation | Department/Name of the College | Email id |
|---|---|---|---|---|
| **1** | R.Venkatesh | Assistant Professor | MECH/VMKVEC | venkatesh@vmkvec.edu.in |
| **2** | J. Senthil | Associate Professor | MECH/AVIT | jsenthil@avit.ac.in |

| | | | | | | |
|---|---|---|---|---|---|---|
| | **ENGINEERING METROLOGY AND MEASUREMENTS (Theory and Practicals)** | **Category** | **L** | **T** | **P** | **Credit** |
| **34421C13** | | **CC** | **3** | **0** | **2** | **4** |

**Preamble**

The aim of the subject is to provide basic knowledge in instrumentation and measurements. Familiarization with basic concepts and different instrumentation and measurement strategies being used in practice.

**Prerequisite**

**NIL**

**Course Objectives**

| | |
|---|---|
| 1 | To apply the fundamentals of basic engineering measurement system. |
| 2 | To understand the various instruments used for linear, angular measurement, form measurement and surface finish. |
| 3 | To apply the knowledge of different measuring instruments like linear, angular measurement, form measurement and surface finish. |
| 4 | To understand the principle, concepts, applications and advancements of temperature, pressure and flow measurements. |
| 5 | To use information to classifications, working and processes of optical measuring instruments, also to acquire the data and store in computer. |

**Course Outcomes: On the successful completion of the course, students will be able to**

| | | |
|---|---|---|
| CO1. | Explain the sensitivity of the instruments by evaluating the error in measurements | Understand |
| CO2. | Discuss the working principle and usage of various instruments used for linear, angular measurement, form measurement and surface finish | Understand |
| CO3. | Demonstrate the various setups used for measuring linear, angular measurement, form measurement and surface finish | Apply |
| CO4. | Determine the appropriate instruments for temperature, pressure and flow measurements | Apply |
| CO5. | Explain the application oriented knowledge in the use of optical measuring instruments | Understand |

**Mapping with Programme Outcomes and Programme Specific Outcomes**

| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | **S** | **M** | **M** | **L** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **L** | **-** | **-** |
| **CO2** | **S** | **S** | **M** | **L** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **L** | **-** | **-** |
| **CO3** | **S** | **L** | **M** | **L** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **L** | **-** | **-** |
| **CO4** | **S** | **S** | **M** | **L** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **L** | **-** | **-** |
| **CO5** | **S** | **M** | **S** | **L** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **L** | **-** | **-** |

**S- Strong; M-Medium; L-Low**

**SYLLABUS**

**BASIC PRINCIPLES & LINEAR / ANGULAR MEASUREMENT**

Basic principles of measurement - Generalized measuring system - Characteristics of measuring instruments, Static and Dynamic characteristics - Precision, Accuracy, Sensitivity, Repeatability, Reproducibility, Linearity, Errors –sources of error, classification and elimination of error- Calibration. Linear and angular Measurements: Vernier – Micrometer - Slip gauges and classification - Optical flats - Limit gauges - Comparators: Mechanical - Pneumatic and Electrical types – applications. -Sine bar - optical bevel protractor - Autocollimator- Angle Decker – Taper measurements.

**DISPLACEMENT, SPEED & ACCELERATION / VIBRATIONMEASUREMENT**

Measurement of displacement: Theory and construction of various transducers to measure displacement - LVDT, piezo electric, inductive, capacitance, resistance, ionization and photo electric transducers, calibration procedures.
Measurement of speed: Mechanical tachometers, electrical tachometers, strobe Objective, noncontact type of tachometer.
Measurement of acceleration and vibration: Piezoelectric Accelerometer, Seismic Accelerometer, Vibrometer.

**TEMPERATURE, PRESSURE AND FLOW MEASUREMENT**

**Measurement of Temperature:** Classification, ranges, various principles of measurement, expansion, electrical resitance, Thermistor, Thermo couples, Pyrometers, temperature Indicators.
Measurement of pressure: Units, classification, different principles used, piston Digital pressure gauges, Manometers, bourdon, pressure gauges, bellows diaphragm gauges. Low pressure measurement, thermal conductivity gauges – ionization pressure gauges, Mcleod pressure gauge, Knudsen gauge. Calibration of pressure gauges. Measurement of level: Direct method – indirect methods– capacitative, ultrasonic, magnetic, cryogenic fuel level indicators – bubler level indicators
Measurement of flow: Orifice meter, Venturi meter, Rotameter, magnetic, ultrasonic, turbine flow meter, Anemometers - hotwire anemometer, Laser Doppler anemometer (LDA).

**FORCE, TORQUE, & STRAIN MEASUREMENTS**

Measurement of force& torque: Load cells, Dynamometers: Eddy current dynamometer, Cantilever beams, proving rings, differential transformers.
Measurement of torque: Torsion bar dynamometer, servo controlled dynamometer, absorption dynamometers. Power Measurements.
Strain Measurements: types of stress and strain measurements – electrical strain gauge – gauge factor – method of usage of resistance strain gauge for bending compressive and tensile strains – usage for measuring torque, Strain gauge calibration.

**FORM MEASUREMENTS AND OPTICAL MEASUREMENTS**

Form measurements: Measurement of screw threads - thread gauges - Floating carriage micrometer-measurement of gears-tooth thickness-constant chord and base tangent method- Gleason gear testing machine – radius measurements-surface finish - Straightness - Flatness and roundness measurements.
Optical measurements: Optical Micro Objective, interference micro Objective, tool makers micro Objective, profile projector, vision Systems, laser interferometer – linear and angular measurements.

**LIST OF EXPERIMENTS**

1. Angular Measurements using Bevel Protector and Sine Bar
2. Measurement of linear parameters using precision measuring instruments like micrometer, Vernier caliper and Vernier height gauge.
3. Flow Measurement using a Rotameter.
4. Fundamental dimension measurement of a gear using a contour projector.
5. Measurement of Displacement using Linear Variable Differential Transducer
6. Measurement of speed of Motor using Stroboscope
7. Measurement of cutting forces using Lathe Tool Dynamometer

**Text Books**


1. Kumar D.S., Mechanical Measurements and Control, Tata McGraw Hill.
2. Jain R.K., Engineering Metrology, Khanna Publishers, 1994.
3. GuptaS.C.- “Engineering Metrology”- Dhanpatrai Publications- 2018.
4. Metrology and Measurements lab Manual


**Reference Books**


1. Alan S. Morris- “The Essence of Measurement”- Prentice Hall of India- 1997
2. Jayal A.K- “Instrumentation and Mechanical Measurements”- Galgotia Publications 2000
3. Beckwith T.G- and N. Lewis Buck- “Mechanical Measurements”- Addison Wesley- 1999.
4. Donald D Eckman- “Industrial Instrumentation”- Wiley Eastern-1985.

| Alternative NPTEL/SWAYAM Course | | | | |
|---|---|---|---|---|
| **S.No** | **NPTEL /SWAYAM Course Name** | **Instructor** | **Host Institution** | **Duration** |
| **1** | Engineering Metrology | Prof. J. Ramkumar, Prof. Amandeep Singh | IIT Kanpur | 12 Weeks |

| Course Designers | | | | |
|---|---|---|---|---|
| **S.No** | **Faculty Name** | **Designation** | **Department/Name of the College** | **Email id** |
| **1** | S.Duraithilagar | Associate Professor | MECH/VMKVEC | duraithilagar@vmkvec.edu.in |
| **2** | R.Mahesh | Assistant Professor | MECH/AVIT | mahesh@avit.ac.in |

| | | | | | | |
|---|---|---|---|---|---|---|
| | **AUTOMOBILE ENGINEERING (Theory and** | **Category** | **L** | **T** | **P** | **Credit** |
| **34421C10** | **Practicals)** | **CC** | **3** | **0** | **2** | **4** |

**Preamble**

Automobile Engineering is a blend of both practical and theories, course the students will be able to learn the layout and arrangement of principal parts of an automobile, Engine Management and Emission Control System, working of Transmission, Suspension, Steering and brake systems along with the Advance in Automobile Engineering.

**Prerequisite**

**NIL**

**Course Objectives**

| | |
|---|---|
| 1 | To impart knowledge on the constructional details and principle of operation of various Automobile components. |
| 2 | To analyzing the various types Engine Auxiliary and Engine management systems. |
| 3 | To analyzing the various types of transmission systems for a vehicle. |
| 4 | To analyzing the working parameters of various braking and suspension system in a Vehicle. |
| 5 | To Analyzing the Various advance in automotive Engineering. |

**Course Outcomes: On the successful completion of the course, students will be able to**

| | | |
|---|---|---|
| CO1. | Recognize the various parts of the automobile and their functions and materials. | Apply |
| CO2. | Analyzing the various types Engine Auxiliary and Engine managementsystems. | Analyze |
| CO3. | Analyzing the various types of transmission systems for a vehicle | Analyze |
| CO4. | Analyzing the working parameters of various braking and suspension system in a vehicle | Analyze |
| CO5. | Analyzing the Various advance in automotive Engineering. | Analyze |

**Mapping with Programme Outcomes and Programme Specific Outcomes**

| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | **S** | **L** | **L** | **L** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **S** | **-** | **-** |
| **CO2** | **S** | **L** | **L** | **L** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **S** | **-** | **-** |
| **CO3** | **S** | **M** | **M** | **M** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **S** | **-** | **-** |
| **CO4** | **S** | **M** | **M** | **M** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **S** | **-** | **-** |
| **CO5** | **S** | **M** | **M** | **M** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **S** | **-** | **-** |

**S- Strong; M-Medium; L-Low**

**SYLLABUS**

**VEHICLE STRUCTURE AND ENGINES**

Types of automobiles vehicle construction and different layouts, chassis, frame and body, Vehicle aerodynamics, IC engines –components-functions and materials, variable valve timing (VVT).

**ENGINE MANAGEMENT & EMISSION CONTROL SYSTEMS**

Engine auxiliary systems, electronic injection for SI and CI engines, unit injector system, rotary distributor type and common rail direct injection system, transistor based coil ignition & capacitive discharge ignition systems, turbo chargers (WGT, VGT), Engine emission control by 3-way catalytic converter system, Emission norms (Euro & BS).

**TRANSMISSION SYSTEMS**

Clutch-types and construction, gear boxes- manual and automatic, gear shift mechanisms, overdrive, transfer box, fluid flywheel – propeller shaft, slip joints, universal joints, Differential and rear axle, Hotchkiss Drive and Torque Tube Drive

**STEERING, BRAKING AND SUSPENSION SYSTEMS**

Steering Geometry,Types of steering Gearbox – Power Steering, Front Axle, Stub Axle, Types of Suspension Systems, Pneumatic and Hydraulic Braking Systems, ABS and Traction Control.

**ADVANCES IN AUTOMOBILE ENGINEERING**

Passenger comfort - Safety and security - HVAC - Seat belts - Air bags - Automotive Electronics - Electronic Control Unit (ECU). Active Suspension System (ASS) - Electronic Brake Distribution (EBD) – Electronic Stability Program (ESP) Traction Control System (TCS) - Global Positioning System (GPS) - Electric - Hybrid vehicle.

**LIST OF EXPERIMENTS**

1. Construction Mechanism of Petrol and Diesel engine (Four stroke and Two Stoke)
2. Construction Mechanism of Clutch Assembly
3. Construction Mechanism of Sliding mesh, Constant mesh and Synchromesh gear boxes
4. Construction Mechanism of Differential and Rear axles assembly
5. Construction Mechanism of Hydraulic brake, Disc brake and Air brake systems
6. Construction Mechanism of Suspension and Steering systems
7. Construction Mechanism of Hybrid and Electric vehicles

**Text Books**

1. Kirpal Singh, "Automobile Engineering Vol 1 & 2 ", Standard Publishers, Seventh Edition, New Delhi R.B. Gupta- "Automobile Engineering "- Satya Prakashan.
2. Jain K.K. and Asthana R.B., Automobile Engineering, Tata McGraw Hill, New Delhi.
3. Gill P.S., "A Textbook of Automobile Engineering – Vol. I , II and III", S.K.Kataria and Sons, 2ndEdition.

**Reference Books**

1. William Crouse- "Automobile Engineering Series "- McGraw-Hill
2. Newton and Steeds- "Motor Vehicles "- ELBS
3. Duffy Smith- "Auto Fuel Systems "- The Good Heat Willcox Company Inc.
4. "Hybrid and Electric Vehicles"-CRC Press – Taylor and Francis Group.

**Alternative NPTEL/SWAYAM Course**

| S.No | NPTEL /SWAYAM Course Name | Instructor | Host Institution | Duration |
|---|---|---|---|---|
| 1 | Fundamentals of Automotive Systems | Prof C.S. Shankar Ram | IIT Madras | 12 Weeks |

**Course Designers**

| S.No | Faculty Name | Designation | Department/Name of the College | Email id |
|---|---|---|---|---|
| 1 | T. Raja | Associate Professor | MECH/VMKVEC | rajat@vmkvec.edu.in |
| 2 | N. Shivakumar | Assistant Professor | MECH/AVIT | shivakumar@avit.ac.in |

| | | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| 34421C07 | COMPUTER INTEGRATED MANUFACTURING (Theory and Practicals) | CC | 3 | 0 | 2 | 4 |

**Preamble**

The students completing this course are expected to understand the nature and role of computers in manufacturing. The course includes computer aided design, fundamentals of CNC machines, programming of CNC machines, group technology, computer aided process planning techniques, shop floor control and flexible manufacturing systems. It exposes the students to various current trends followed in the industries

**Prerequisite**

**NIL**

**Course Objectives**

| | |
|---|---|
| 1 | Demonstrate basics of CAD/CAM/CIM concepts. |
| 2 | To apply geometric modelling techniques and various graphics standards in CAD. |
| 3 | Illustrate with tooling and fixtures in CNC programming and machining. |
| 4 | Demonstrate part programs and group technology techniques. |
| 5 | Discuss latest advances in the manufacturing perspectives. |

**Course Outcomes: On the successful completion of the course, students will be able to**

| | | |
|---|---|---|
| CO1 | Understand basic concept of CAD/CAM/CIM | Understand |
| CO2 | Utilize CAD standards for geometrical modelling. Demonstrate Solid modelling techniques. | Apply |
| CO3 | Interpret and demonstrate complex programs for CNC machining centers | Apply |
| CO4 | Apply group technology concept in manufacturing product. Make use of FEA concept for analysis. | Apply |
| CO5 | Explain FMS and CIM wheel for manufacturing industry, discuss the latest advances in the manufacturing perspectives. | Apply |

**Mapping with Programme Outcomes and Programme Specific Outcomes**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | M | M | M | - | - | - | - | - | - | - | L | M | - | - |
| CO2 | S | M | M | M | - | - | - | - | - | - | - | L | M | - | - |
| CO3 | S | M | M | M | - | - | - | - | - | - | - | L | M | - | - |
| CO4 | S | M | M | M | - | - | - | - | - | - | - | L | M | - | - |
| CO5 | S | M | M | M | - | - | - | - | - | - | - | L | M | - | - |

**S- Strong; M-Medium; L-Low**

**SYLLABUS**

**INTRODUCTION**

Definition and scope of CAD/CAM- Computers in industrial manufacturing, design process- Computer Aided Design (CAD)-Computer Aided Manufacturing (CAM)-Computer Integrated Manufacturing (CIM) - Introduction to Computer graphics -Raster scan graphics-Co-ordinate systems.

**GRAPHICS AND COMPUTING STANDARDS**

Data base for graphic modeling-transformation geometry-3D transformations –Clipping-hidden line removal-Colour-shading-Standardization in graphics- Open GL Data Exchange standards – IGES, STEP - Graphic Kernal system (GKS). Geometric construction methods-Constraint based modeling- Wireframe, Surface and Solid – Parametric representation of curves, solids & surfaces.

**CNC MACHINE TOOLS**

Introduction to NC, CNC, DNC - Manual part Programming – Computer Assisted Part Programming – Examples using NC codes- Adaptive Control – Canned cycles and subroutines – CAD/ CAM approach to NC part programming – APT language, machining from 3D models.

**GROUP TECHNOLOGY & FEA CONCEPTS**

Group technology-coding-Production flow analysis-computer part- programming-CAPP implementation techniques. Nodes -Meshing – Pre and Post processing – Modal analysis – Stress analysis – Steady state and Transient analysis.

**AUTOMATED MANUFACTURING SYSTEMS**

Flexible Manufacturing systems (FMS) – the FMS concepts – transfer systems – head changing FMS – Introduction to Rapid prototyping, Knowledge Based Engineering, Virtual Reality, Augmented Reality –automated guided vehicle-Robots-automated storage and retrieval systems - computer aided quality control-CMM-Non contact inspection methods.

**LIST OF EXPERIMENTS**

1. 2D Geometry –Splines
2. Surface Modelling –NURBS
3. Solid Modelling-CSG, Brep.
4. Preparing solid models for analysis-Neutral files
5. Real time component analysis-STRESS, STRAIN Analysis.
6. Model analysis of different structures.
7. Tolerance analysis of any mechanical component.
8. CNC Milling program involving linear motion and circular interpolation
9. CNC Milling program involving contour motion and canned cycles
10. CNC Milling program involving Pocket milling.
11. CNC Turning program involving turning and facing
12. CNC Turning program involving Step turning, Taper turning and Grooving
13. CNC Turning program involving Fixed/Canned cycles& Thread cutting cycles
14. Diagnosis and trouble shooting in CNC machine
15. Route sheet generation using CAM software.
16. Generation of CNC programming and machining using Master Cam/Edge Cam.

**Text Books**


1. Mikell.P.Groover “Automation, Production Systems and Computer Integrated
2. Radhakrishnan P, Subramanyan.S. andRaju V., “CAD/CAM/CIM”, New Age International (P) Ltd., New Delhi.
3. P.N.Rao, CAD/CAM: Principles and Applications-3rd Edition, Tata McGraw Hill, India, 2010.


**Reference Books**


1. Yoremkoren, “Computer Integrated Manufacturing System”, McGraw-Hill.
2. Ranky, Paul G., “Computer Integrated Manufacturing”, Prentice Hall International
3. David D.Bedworth, Mark R.Hendersan, Phillip M.Wolfe “Computer Integrated Design and Manufacturing”, McGraw-Hill Inc.
4. Roger Hanman “Computer Integrated Manufacturing”, Addison – Wesley
5. Viswanathan.N, Narahari.Y “Performance Modeling& Automated Manufacturing systems” Prentice hall of indiapvt. Ltd.


**Alternative NPTEL/SWAYAM Course**

| S.No | NPTEL /SWAYAM Course Name | Instructor | Host Institution | Duration |
|---|---|---|---|---|
| **1** | Computer Integrated Manufacturing | Prof. J. Ramkumar, Prof. Amandeep Singh | IIT Kanpur | 12 weeks |

| Course Designers | | | | |
|---|---|---|---|---|
| **S.No** | **Faculty Name** | **Designation** | **Department/Name of the College** | **Email id** |
| **1** | Dr.L.Prabhu | Associate Professor | MECH/ AVIT | prabhu@avit.ac.in |
| **2** | S.Prakash | Assistant Professor-II | MECH/ AVIT | prakash@avit.ac.in |
| **3** | M.Saravanan | Associate Professor | MECH/VMKVEC | saravanan@vmkvec.edu.in |

| | | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| 34421C12 | DESIGN OF TRANSMISSION SYSTEMS | CC | 2 | 1 | 0 | 3 |

**Preamble**

Design of Transmission System course is concerned with design of mechanical transmission elements for engineering applications. In industries motors and turbines use energy to produce rotational mechanical motion. In order to harness this motion to perform useful work, there must be a way to transmit it to other components and machines. Three common methods of accomplishing this include gears, chain drives, and belt drives. The Mechanical Transmission Systems subject area covers these types of transmission systems, including specific applications, how each works.

**Prerequisite**

**DESIGN OF MACHINE ELEMENTS**

**Course Objectives**

| | |
|---|---|
| 1 | To interpret the procedure for power transmission by belt, ropes and chain drives. |
| 2 | To design the spur and helical gears. |
| 3 | To design the bevel and worm gears. |
| 4 | To explore the importance of gear box and design of gear box. |
| 5 | To assess the design procedure for clutches and brakes. |

**Course Outcomes: On the successful completion of the course, students will be able to**

| | | |
|---|---|---|
| CO1. | Design a suitable flat belt, V-belt, ropes and chain drive for specified loading condition by using pre-defined set of values and procedures. | Apply |
| CO2. | Determine the number of teeth, bending strength and wear strength for given spur gear, helical, bevel gear and worm gear pair by using pre-defined set of values and procedures. | Apply |
| CO3. | Determine the number of teeth, bending strength and wear strength for given bevel gear and worm gear pair by using pre-defined set of values and procedures. | Analyze |
| CO4. | Design the gearbox and gear shaft dimensions for given speed conditions byusing pre-defined set of values and procedures. | Apply |
| CO5. | Design of brakes by using pre-defined set of values and procedures and single plate clutch and multiple plate clutch for given specified loading conditions. | Apply |

**Mapping with Programme Outcomes and Programme Specific Outcomes**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | M | S | M | - | - | - | - | - | - | - | - | S | - | - |
| CO2 | S | M | S | M | - | - | - | - | - | - | - | - | S | - | - |
| CO3 | M | S | S | M | - | - | - | - | - | - | - | - | S | - | - |
| CO4 | S | M | S | M | - | - | - | - | - | - | - | - | S | - | - |
| CO5 | S | M | S | M | - | - | - | - | - | - | - | - | S | - | - |

**S- Strong; M-Medium; L-Low**

**SYLLABUS**

**DESIGN OF FLEXIBLE DRIVES**

Types and configuration of belt drive-slip-initial tension-centrifugal tension-selection of flat belt drive, Selection of V-belt drives- problems-based on basic equations. Types of chain-factor of safety-selection of chain drives. Design of Sprockets

**DESIGN OF SPUR GEAR AND HELICAL GEARS**

Gear nomenclature - Spur gears - Stresses induced in gears - gear tooth failure - Lewis bending equations, Calculation of appropriate safety factors and power rating - force analysis, Design of spur gears -helical

**DESIGN OF BEVEL AND WORM GEARS**

Gear nomenclature - Stresses induced in gears - gear tooth failure - Lewis bending equations - Calculation of appropriate safety factors and power rating - force analysis - Design of bevel and worm gears

**DESIGN OF GEAR BOXES**

Geometric progression - Standard step ratio - Ray diagram, kinematics layout -Design of sliding mesh gear box - Design of multi speed gear box for machine tool applications - Constant mesh gear box - peed reducer unit

**DESIGN OF CLUTCHES AND BRAKES**

Design of plate clutches –axial clutches-cone clutches-internal expanding rim clutches-Electromagnetic clutches. Band and Block brakes – external shoe brakes – Internal expanding shoe brake.

**Text Books**

1. Joseoh Edward Shigley, Charles R Misucke, Mechanical Engineering Design, Tata Mc Graw Hill.
2. Prabhu. T.J. - –Design of Transmission Elements- Mani Offset- Chennai.
3. V.B. Bhandari, –Design of Machine Elements, Tata McGraw Hill.

**Reference Books**

1. Md.Jalaludeen- Machine Design- Anuradha Publicatiions,Chennai
2. Maitra G.M. - Prasad L.V. - –Hand book of Mechanical Design- II Edition- Tata McGraw
3. Sundarajamoorthy T.V. and Shanmugam. N, –Machine Design, Anuradha Publications
4. Design Data, PSG College of Technology, Coimbatore.

**Alternative NPTEL/SWAYAM Course**

| S.No | NPTEL /SWAYAM Course Name | Instructor | Host Institution | Duration |
|---|---|---|---|---|
| | | | | |

**Course Designers**

| S.No | Faculty Name | Designation | Department/Name of the College | Email id |
|---|---|---|---|---|
| **1** | S.Kalyanakumar | Assistant Professor | MECH/AVIT | kalyanakumar @avit.ac.in |
| **2** | J Satheesbabu | Associate Professor | MECH/VMKVEC | satheesbabu@vmkvec.edu.in |

| | | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| 34421C16 | **HEAT AND MASS TRANSFER (Theory and Practicals)** | **CC** | **2** | **1** | **2** | **4** |

**Preamble**

The purpose of this subject is to been able students understood different principles of heat transfer and its Extensive Engineering applications**.**

**Prerequisite**

**ENGINEERING THERMODYNAMICS**

**Course Objectives**

| | |
|---|---|
| 1 | To enable students understand their conduction mechanism in steady state emphasizing on application in engineering. |
| 2 | To enable students understand their conduction mechanism in unsteady state emphasizing on application in engineering. |
| 3 | To categorize various types of convection and its application. |
| 4 | To assess various concepts of radiation and its applications. |
| 5 | To enable students to understand Boiling, Condensation and Various types of Heat Exchangers. |

**Course Outcomes: On the successful completion of the course, students will be able to**

| | | |
|---|---|---|
| CO1. | To assess the basic elements & various modes of heat transfer Used in Engineering applications. | Understand |
| CO2. | To solve the engineering problems using various methods of Transient heat conduction technologies | Apply |
| CO3. | To apply the concepts of convection systems in an engineering problem using standard values | Apply |
| CO4. | To choose the various concepts of radiation based on the requirements for the given problems | Apply |
| CO5. | To solve the engineering problems using Boiling, Condensation and heat transfer rate of heat exchangers using LMTD and NTU method | Apply |

**Mapping with Programme Outcomes and Programme Specific Outcomes**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | **S** | **M** | **L** | **L** | **-** | **-** | **-** | **S** | **S** | **S** | **-** | **-** | **S** | **M** | **-** |
| **CO2** | **S** | **M** | **L** | **L** | **-** | **-** | **-** | **S** | **S** | **S** | **-** | **-** | **S** | **M** | **-** |
| **CO3** | **S** | **M** | **L** | **L** | **-** | **-** | **-** | **S** | **S** | **S** | **-** | **-** | **S** | **M** | **-** |
| **CO4** | **S** | **M** | **L** | **L** | **-** | **-** | **-** | **S** | **S** | **S** | **-** | **-** | **S** | **M** | **-** |
| **CO5** | **S** | **M** | **L** | **L** | **-** | **-** | **-** | **S** | **S** | **S** | **-** | **-** | **S** | **M** | **-** |

**S- Strong; M-Medium; L-Low**

**SYLLABUS**

**INTRODUCTION TO HEAT TRANSFER AND STEADY STATE CONDUCTION**

Heat transfer fundamentals; Basic heat transfer mechanisms (conduction, convection and radiation), Conduction -Introduction -Fourier law of conduction- General equation in Cartesian coordinates - One dimensional steady state conduction across Large plane wall, Long cylinder and Sphere- Composite wall – Composite cylinder – Composite sphere, Overall heat transfer coefficients, Critical Radius of insulation, Variable thermal conductivity, conduction with Heat generation, - Fins or extended

surfaces- Pin fins, annular fins, longitudinal fins, fins efficiency and fins effectiveness- Problems.

**TRANSIENT HEAT CONDUCTION**

Introduction – Lumped system analysis, semi – infinite solids. Transient Heat Conduction in Large Plane Walls, Long cylinders and Spheres. Significance of Biot and Fourier numbers, Transient heat transfer analysis of an infinite slab with specified temperature and connective boundary conditions. - Refrigeration and Freezing of Foods- Problems.
Use of Grover & Heisler charts for solving problems of infinite slabs, cylinders, spheres.

**CONVECTION**

Introduction – Physical Mechanism on Convection, Classification of Fluid Flows, Significance of non-dimensional numbers, Velocity Boundary Layer, Thermal Boundary Layer, Laminar and Turbulent Flows. External Forced convection – Flow over a Flat plate, cylinder, sphere and Tube Banks. Internal Forced Convection - Flow through pipes – annular spaces and noncircular conducts. Natural convection from vertical, inclined and horizontal surfaces.

**RADIATION**

Introduction – Thermal Radiation – Black body Radiation – Radiation Intensity- Radioactive Properties – Atmospheric and Solar Radiation – View Factor- Simple Problems- Black surfaces and Grey Surfaces – Net Radiation – Heat Transfer in Two and Three Surface Enclosures- Radiation Shield – Problems – Radiation Exchange with Emitting and Absorbing Gases.

**BOILING, CONDENSATION AND HEAT EXCHANGERS**

Boiling – Types of Boiling- Problems. Condensation – Types of Condensation- Problems. Heat Exchangers- Types- Overall heat transfer co-efficient- Analysis of Heat Exchangers – LMTD method – Effectiveness - NTU Method – Selection of Heat Exchangers – Problems.

**LIST OF EXPERIMENTS**

1. Determination of Thermal conductivity (Insulating Powder)
2. Determination of Emissivity
3. Determination of Heat transfer co-efficient through Forced Convection
4. Determination of Heat transfer co-efficient through Natural Convection
5. Determination of Heat transfer co-efficient of Pin-Fin Apparatus.
6. Determination of Stefan Boltzmann' s Constant
7. Determination of Thermal conductivity (Two Slabs Guarded Hot Plate Method)
8. Determination of Effectiveness of a Heat Exchanger by Parallel & Counter Flow
9. Determination of Thermal conductivity of the Composite wall.

**Text Books**


1. YUNUS A CENGEL "Heat Transfer"-Tata Mc Graw Hill–New Delhi.
2. KOTHANDARAMAN C.P "Fundamentals of Heat and Mass Transfer" New Age International.
3. SACHDEV R C -"Fundamentals of Engineering Heat and Mass Transfer" New Age International.


**Reference Books**


1. OZISIKM.N- "Heat Transfer"-Tata Mc Graw-Hill Book Co.
2. NAGP.K-"Heat Transfer"-Tata Mc Graw-Hill-New Delhi.
3. HOLMAN J.P "Heat and Mass Transfer" Tata Mc Graw-Hill.
4. INCROPRA and DEWITE, Heat Transfer–John Wiley.


**Alternative NPTEL/SWAYAM Course**

| S.No | NPTEL /SWAYAM Course Name | Instructor | Host Institution | Duration |
|---|---|---|---|---|

| | | | | |
|---|---|---|---|---|
| **1** | Heat Transfer | Prof. Sunando DasGupta | IIT Kharagpur | 12 weeks |

**Course Designers**

| S.No | Faculty Name | Designation | Department/Name of the College | Email id |
|---|---|---|---|---|
| **1** | R.Anandan | Associate Professor | MECH/VMKVEC | anandan@vmkvec.edu.in |
| **2** | C.Thiagarajan | Associate Professor | MECH/AVIT | cthiagarajan@avit.ac.in |

| 34421C14 | FINITE ELEMENT ANALYSIS (Theory and Practicals) | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | CC | 2 | 1 | 2 | 4 |

**Preamble**

This course provides to learn the basic concepts of finite element analysis (FEA) of solids, structures, fluids and its application in engineering.

**Prerequisite**

**NIL**

**Course Objectives**

| | |
|---|---|
| 1 | Understand finite element analysis fundamentals and formulations. |
| 2 | Study the basics of element properties natural, Triangular & rectangular. |
| 3 | Formulation of finite element methods for Two and three-dimensional solids. |
| 4 | Formulate the truss, beam and frame problems. |
| 5 | Formulation of finite element methods for the analysis of heat transfer in solids. |

**Course Outcomes: On the successful completion of the course, students will be able to**

| | | |
|---|---|---|
| CO1. | To understand the basic concepts of finite element analysis, node and node numbering methods. | Understand |
| CO2. | Derive the finite element equations for different mechanical elements. Natural, Triangular & rectangular elements | Apply |
| CO3. | Formulate and solve problems in 2-D& 3-D structural systemsof solids and their structures. | Apply |
| CO4. | Identify the application and characteristics of FEA elements such as bars, beams, plane and isoparametric elements | Apply |
| CO5. | To be able to conduct engineering analysis of basic heat conduction, structural mechanics problems use finite element methods. | Apply |

**Mapping with Programme Outcomes and Programme Specific Outcomes**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | M | M | M | - | - | - | - | - | - | - | L | M | - | - |
| CO2 | S | M | M | M | - | - | - | - | - | - | - | L | M | - | - |
| CO3 | S | M | M | M | - | - | - | - | - | - | - | L | M | - | - |
| CO4 | S | M | M | M | - | - | - | - | - | - | - | L | M | - | - |
| CO5 | S | M | M | M | - | - | - | - | - | - | - | L | M | - | - |

**S- Strong; M-Medium; L-Low**

**SYLLABUS**

**INTRODUCTION TO FINITE ELEMENT ANALYSIS**

Introduction, Basic Concepts of Finite Element Analysis, Introduction to Elasticity, Steps in Finite Element Analysis. Finite Element Formulation Techniques, Virtual Work and Variational Principle, Galerkin Method, Finite Element Method: Displacement Approach, Stiffness Matrix and Boundary Conditions.

**ELEMENT PROPERTIES**

Natural Coordinates, Triangular Elements, Rectangular Elements, Lagrange and Serendipity Elements. Solid Elements, Isoparametric Formulation, Stiffness Matrix of Isoparametric Elements, Numerical Integration – one dimensional, Numerical Integration: Two and Three Dimensional, Worked out Examples

**FEM FOR TWO- AND THREE-DIMENSIONAL SOLIDS**

Constant Strain Triangle, Linear Strain Triangle, Rectangular Elements, Numerical Evaluation of Element Stiffness, Computation of Stresses, Geometric Nonlinearity and Static Condensation, Axisymmetric Element, Finite Element Formulation of Axisymmetric Element, Finite Element Formulation for 3 Dimensional Elements, Worked out Examples

**ANALYSIS OF FRAME STRUCTURES**

Stiffness of Truss Members, Analysis of Truss, Stiffness of Beam Members, Finite Element Analysis of Continuous Beam, Plane Frame Analysis, Analysis of Grid and Space Frame.

**STEADY STATE HEAT TRANSFER ANALYSIS**

Basic equations of heat transfer, Axially loaded bar- Heat flow in a bar, Structure of FEA software package.Rate equation: conduction, convection, radiation, energy generated in solid

**LIST OF EXPERIMENTS**

1. Study of analysis and its benefits
2. Stress analysis of cantilever and simply supported beam
3. Application of distributed loads
4. Nonlinear analysis of cantilever beam
5. Buckling analysis
6. Stress analysis of axis-symmetry vessels
7. Static analysis of two-dimensional truss
8. Transient thermal conduction
9. Conductive heat transfer analysis
10. Plane stress bracket
11. Modal analysis of simply supported beam
12. Harmonic analysis of a cantilever beam

**Text Books**


1. Hutton, D.V., "Fundamentals of Finite Element Analysis", McGraw Hill, International Edition, 2004.
2. Segerlind, L.J., "Applied Finite Element Analysis", John Wiley & Sons, 1984.


**Reference Books**


1. Chandrupatla, T.R., Belegundu, A.D., "Introduction to Finite Elements in Engineering", Prentice HallofIndia, 2002.
2. Zienkiewicz, O.C., "Finite Elements and Approximation", Dover International, 2006.
3. Cook R.D., Malkus, D.S., Plesha, M.E., Witt, R.J., "Concepts and Applications of Finite Element Analysis", 4$^{th}$Edition, John Wiley & Sons, 2001.
4. H. C. Martin and G. F. Carey, Introduction to Finite Element Analysis - Theory and Application New York, McGraw-Hill


**Alternative NPTEL/SWAYAM Course**

| S.No | NPTEL /SWAYAM Course Name | Instructor | Host Institution | Duration |
|---|---|---|---|---|
| 1 | Introduction to Finite Element Analysis | Prof.Nachiketa Tiwari, | IIT Karagpur | 12 weeks |

**Course Designers**

| S.No | Faculty Name | Designation | Department/Name of the College | Email id |
|---|---|---|---|---|
| 1 | Dr.S.Prakash | Assistant Professor Gr II | MECH/ AVIT | prakash@avit.ac.in |
| 2 | J.Santhos | Assistant Professor | MECH/VMKVEC | santhos@vmkvec.edu.in |

| | | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| 34421C15 | GAS DYNAMICS AND JET PROPULSION | CC | 3 | 1 | 0 | 4 |

**Preamble**

This subject is providing knowledge of insight into the applications of compressible flows and the fundamentals of jet propulsion system. Formulate and solve problems in one -dimensional steady compressible flow including isentropic nozzle flow, constant area flow with friction (Fanno flow) and constant area flow with heat transfer (Rayliegh flow). To enhance the knowledge of determining the change in flow conditions through Prandtl-Meyer expansion wave and characteristic methods to solve problems in two-dimensional compressible flows.

**Prerequisite**

**ENGINEERING THERMODYNAMICS**

**Course Objectives**

| | |
|---|---|
| 1 | To understand the compressible flow fundamentals. |
| 2 | To analyze the flow through variable area ducts. |
| 3 | To study the compressible flow with friction and heat transfer. |
| 4 | To know the application of normal shock in compressible flow. |
| 5 | To study the aircraft propulsion systems and rocket propulsion and its applications. |

**Course Outcomes: On the successful completion of the course, students will be able to**

| | | |
|---|---|---|
| CO1. | Understand the basic of compressible flow. | Understand |
| CO2. | Know to solve flow through variable area ducts. | Analyze |
| CO3. | Know the differences between compressible and incompressible flows. | Analyze |
| CO4. | Solve problems in Rayleigh and Fanno flow. | Analyze |
| CO5. | Understand the knowledge about the rocket propulsion and various propellants. | Understand |

**Mapping with Programme Outcomes and Programme Specific Outcomes**

| COs | PO1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO1 0 | PO1 1 | PO1 2 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | M | L | M | M | M | L | - | - | - | - | - | - | L | - | - |
| CO2 | M | M | L | M | L | L | - | - | - | - | - | - | L | - | - |
| CO3 | S | M | L | M | M | L | - | - | - | - | - | - | L | - | - |
| CO4 | S | S | M | S | M | L | - | - | - | - | - | - | L | - | - |
| CO5 | S | S | S | S | M | L | - | - | - | - | - | - | L | - | - |

**S- Strong; M-Medium; L-Low**

**SYLLABUS**

**COMPRESSIBLE FLOW –FUNDAMENTALS**

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 ofwaves, Mach cone, Mach angle, effect of Mach number on compressibility.

**FLOW THROUGH VARIABLE AREA DUCTS**

Isentropic flow through variable area ducts, T-s and 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.

**FLOW THROUGH CONSTANT AREA DUCTS**

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

**NORMAL AND OBLIQUE SHOCK**

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. Flow with Oblique Shock Fundamental relations, Prandtl"s equation, Variation of flow parameters

**PROPULSION**

Aircraft propulsion –types of 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 engine, ram jet and pulse jet engines. Rocket propulsion –rocket engines thrust equation –effective jet velocity specific impulse–rocket engine performance, solid and liquid propellants.

**Text Books**


| | |
|---|---|
| **1** | Yahya. S.M., Fundamental of compressible flow with Aircraft and Rocket propulsion", New Age International (p) Ltd., New Delhi, 2005. |
| **2** | Ganesan. V., "Gas Turbines", Tata McGraw-Hill, New Delhi, 1999. |


**Reference Books**


| | |
|---|---|
| **1** | Rathakrishnan. E., "Gas Dynamics", Prentice Hall of India, New Delhi, 2001. |
| **2** | Patrich.H. Oosthvizen, William E. Carscallen, "Compressible fluid flow", McGraw-Hill, 1997. |


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| | | | | | | |
|---|---|---|---|---|---|---|
| | **ENGINEERING MECHANICS** | **Category** | **L** | **T** | **P** | **Credit** |
| **34421C01** | **(Statics andDynamics)** | **CC** | **2** | **1** | **0** | **3** |

**Preamble**

This course provides the basic knowledge about the behavior of the bodies which are under static and dynamic conditions.

**Prerequisite**

**NIL**

**Course Objectives**

| | |
|---|---|
| 1 | To explain the basic laws of mechanics and forces. |
| 2 | To relate the basic concepts and application of rigid bodies under equilibrium in two dimension. |
| 3 | To employ the concepts of properties of surfaces and to find the Centroid and moment of Inertia using various methods in solid sections. |
| 4 | To practice problems in the areas of Friction and Rigid body dynamics by understanding the basic concepts of Friction and Rigid body dynamics. |
| 5 | To calculate and categorize of problems in the area of dynamics of particles. |

**Course Outcomes: On the successful completion of the course, students will be able to**

| | | |
|---|---|---|
| CO1. | Identify the engineering problems using the concept of static equilibrium | Understand |
| CO2. | Solve problems of rigid bodies under equilibrium in two dimension and apply various conditions | Apply |
| CO3. | Determine the Centroid of a line, areas, and volumes, center of mass of body and moment of inertia of composite areas, mass moment of inertia | Apply |
| CO4. | Solve problems involving frictional phenomena. | Apply |
| CO5. | Solve problems in engineering systems using the concept of dynamic equilibrium and analyze the numerical results | Analyze |

**Mapping with Programme Outcomes and Programme Specific Outcomes**

| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | M | L | L | L | - | L | - | - | - | - | - | - | L | - | - |
| CO2 | S | L | L | M | - | L | - | - | - | - | - | - | L | - | - |
| CO3 | S | M | M | M | - | L | - | - | - | - | - | - | M | - | - |
| CO4 | S | M | M | M | - | L | - | - | - | - | - | - | M | - | - |
| CO5 | S | S | S | S | - | L | - | - | - | - | - | - | S | - | - |

**S- Strong; M-Medium; L-Low**

**SYLLABUS**

**BASICS & STATICS OF PARTICLES**

Introduction - Units and Dimensions - Laws of Mechanics - Lame's theorem. Parallelogram and triangular law of forces - Coplanar Forces - Resolution and Composition of forces - Equilibrium ofa particle - Forces in space - Equilibrium of a particle in space - Equivalent systems of forces - Principle of transmissibility - Single equivalent force.

**EQUILIBRIUM OF RIGID BODIES**

Free body diagram - Types of supports and their reactions - requirements of stable equilibrium - Moments and Couples - Moment of a force about a point and about an axis - Vectorial representation of moments and couples - Scalar components of a moment - Varignon's theorem - Equilibrium of Rigid bodies in two dimension.

**PROPERTIES OF SURFACES AND SOLIDS**

Determination of Areas and Volumes - First moment of area the Centroid of sections - Rectangle, circle, triangle from integration - T section, I section, Angle section, Hollow section by using standard formula - second and product moments of plane area - Rectangle, triangle, circle from integration - T section, I section, Angle section, Hollow section by using standard formula - Parallel axis theorem and perpendicular axis theorem - Polar moment of inertia - Principle moments of inertia of plane areas - Mass moment of inertia.

**FRICTION AND ELEMENTS OF RIGID BODY DYNAMICS**

Frictional force - Laws of Coloumb friction - simple contact friction - Rolling resistance - Belt friction. Translation and Rotation of Rigid Bodies - Velocity and acceleration - General Plane motion.

**DYNAMICS OF PARTICLES**

Displacement, Velocity and acceleration, their relationship - Relative motion - Curvilinear motion - Newton's law - Work Energy equation of particles - Impulse and Momentum - Impact of elastic bodies.

**Text Books**


| | |
|---|---|
| **1** | Beer & Johnson, Vector Mechanics for Engineers. Vol. I Statics and Vol. II Dynamics, McGraw Hill International Edition, 1995. |
| **2** | Kottiswaran N,Engineering Mechanics-Statics & Dynamics,Sri Balaji Publications,2014. |
| **3** | Meriam, Engineering Mechanics, Vol. I Statics & Vol. II Dynamics 2/e, Wiley Intl., 1998. |


**Reference Books**


| | |
|---|---|
| **1** | Rajasekaran.S, and Sankara Subramanian G, “Engineering Mechanics”, Vikas Publishing Co. New Delhi. |
| **2** | Irving H. Sharma, Engineering Mechanics - Statics & Dynamics, III Edition, Prentice Hall of India Pvt. Ltd., 1993. |
| **3** | K.L.Kumar, Engineering Mechanics III Edition, Tata McGraw Hill Publishing Co. Ltd., 1998 |

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# PROGRAM ELECTIVE COURSES

| | | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| **34421P01** | **RENEWABLE SOURCES OF ENERGY** | **EC-PS** | **3** | **0** | **0** | **3** |

**Preamble**

Renewable source of energy are developing fast throughout the world, and their combination is increasingly able to meet the needs for available, agreeable, and affordable energy, also for the people that lack access to energy today. In addition, local energy resources are not hit by the high energy price increases that are threatening to reverse the progress in providing energy to the poor people that lack appropriate energy today. This is why sustainable energy, the combination of renewable energy and energy efficiency, is increasingly become a part of the efforts to reduce poverty.

**Prerequisite**

**NIL**

**Course Objectives**

| | |
|---|---|
| 1 | To understand the importance of solar energy. |
| 2 | To learn the importance of wind energy. |
| 3 | To know the importance of bio energy. |
| 4 | To know various renewable energy power plants. |
| 5 | To learn the necessity of latest and modern energy sources. |

**Course Outcomes: On the successful completion of the course, students will be able to**

| | | |
|---|---|---|
| CO1. | To apply the solar radiation, measurements of solar radiation and solar thermal collectors | Apply |
| CO2. | To apply wind data, energy estimation and wind energy conversion systems | Apply |
| CO3. | To apply the Biomass directs Combustion, Biomass gasifier and Biogas plant. | Apply |
| CO4. | To apply the Wave energy, Open and closed OTEC Cycles and Small hydro plant turbines | Apply |
| CO5. | To apply the power generation, transport, Fuel cells and its technologies | Apply |

**Mapping with Programme Outcomes and Programme Specific Outcomes**

| **COs** | **PO1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO1 0** | **PO1 1** | **PO1 2** | **PSO 1** | **PSO 2** | **PS O3** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | M | M | M | - | - | - | - | - | - | - | - | - | M | - | - |
| CO2 | S | M | M | - | - | - | - | - | - | - | - | - | M | - | - |
| CO3 | S | M | M | - | - | - | - | - | - | - | - | - | M | - | - |
| CO4 | S | M | M | M | - | - | - | - | - | - | - | - | M | - | - |
| CO5 | S | M | M | M | - | - | - | - | - | - | - | - | M | - | - |

**S- Strong; M-Medium; L-Low**

**SYLLABUS**

**SOLAR ENERGY**

Solar Radiation – Measurements of solar Radiation – Solar Thermal Collectors – Flat Plate and Concentrating Collectors – Solar Applications – fundamentals of photo Voltaic Conversion – solar Cells – PV Systems – PV applications.

**WIND ENERGY**

Wind Data and Energy Estimation – wind Energy Conversion Systems – Wind Energy-Generators and its performance – Wind Energy Storage – Applications – Hybrid systems.

**BIO – ENERGY**

Biomass, Biogas, Source, Composition, Technology for utilization – Biomass direct Combustion – Biomass gasifier – Biogas plant – Digesters – Ethanol production – BioDiesel production and economics.

**OTEC, TIDAL, GEOTHERMAL AND HYDEL ENERGY**

Tidal energy – Wave energy –Open and closed OTEC Cycles – Small hydro plant turbines – Geothermal energy sources- environmental issues.

**NEW ENERGY SOURCES**

Hydrogen generation, storage, transport and utilization, Applications - power generation- transport – Fuel cells – technologies, types – economics and the power generation.

**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. |


**Reference Books**


| | |
|---|---|
| **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 and applications", Narosa Publishing House, New Delhi, 2002 |
| **4** | L.L. Freris, "Wind Energy Conversion systems", Prentice Hall, UK, 1990. |


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| | | | | | | |
|---|---|---|---|---|---|---|
| | **ADVANCED IC** | **Category** | **L** | **T** | **P** | **Credit** |
| **34421P03** | **ENGINES** | **EC-PS** | **3** | **0** | **0** | **3** |

**Preamble**

On completion of this course, the students would be able to understand the operation, combustion, performance and emissions of internal combustion engines.

**Prerequisite**

**NIL**

**Course Objectives**

| | |
|---|---|
| 1 | To study the construction and working of Spark Ignition Engines. |
| 2 | To study about the Compression Ignition Engines and Turbocharger. |
| 3 | To understand the different pollutants and its control techniques. |
| 4 | To study the different Alternative fuels available. |
| 5 | To study the various recent trends adopted in the field of automobiles. |

**Course Outcomes: On the successful completion of the course, students will be able to**

| | | |
|---|---|---|
| CO1. | Understand the combustion aspects of SI Engines | Understand |
| CO2. | Understand the combustion aspects of CI Engines | Understand |
| CO3. | Distinguish the causes, effects and control of pollutants from an IC engine. | Understand |
| CO4. | Know the various alternate fuels, engine emissions, Measuring and Control techniques | Apply |
| CO5. | Illustrate the recent developments in Internal Combustion engines Include this | Understand |

**Mapping with Programme Outcomes and Programme Specific Outcomes**

| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | L | L | L | - | - | - | - | - | - | - | - | L | - | - |
| CO2 | S | S | M | S | - | - | - | - | - | S | - | - | L | - | - |
| CO3 | S | L | M | | - | - | - | - | - | - | - | - | L | - | - |
| CO4 | S | M | L | | - | - | - | - | - | - | - | - | L | - | - |
| CO5 | S | S | M | L | - | - | - | - | - | - | - | L | L | - | - |

**S- Strong; M-Medium; L-Low**

**SYLLABUS**

**SPARK IGNITION ENGINES**

Mixture requirements – Fuel injection systems – Monopoint, Multipoint & Direct injection – Stages of combustion – Normal and Abnormal combustion – Knock – Factors affecting knock – Combustion chambers.

**COMPRESSION IGNITION ENGINES**

Diesel Fuel Injection Systems – Stages of combustion – Knocking – Factors affecting knock – Direct and Indirect injection systems – Combustion chambers – Fuel Spray behaviour – Spray structure and spray penetration – Air motion – Introduction to Turbocharging.

**POLLUTANT FORMATION AND CONTROL**

Pollutant – Sources – Formation of Carbon Monoxide, Unburnt hydrocarbon, Oxides of Nitrogen, Smoke and Particulate matter – Methods of controlling Emissions – Catalytic converters, Selective Catalytic Reduction and Particulate Traps – Methods of measurement – Emission normsand Driving cycles.

**ALTERNATIVE FUELS**

Alcohol, Hydrogen, Compressed Natural Gas, Liquefied Petroleum Gas and Bio Diesel – Properties, Suitability, Merits and Demerits – Engine Modifications.

**RECENT TRENDS**

Air assisted Combustion, Homogeneous charge compression ignition engines – Variable Geometry turbochargers – Common Rail Direct Injection Systems – Hybrid Electric Vehicles – NOx Adsorbers – Onboard Diagnostics.

**Text Books**


| | |
|---|---|
| **1** | Ramalingam. K.K., "Internal Combustion Engine Fundamentals", Scitech Publications, 2002. |
| **2** | Ganesan, "Internal Combustion Engines", II Edition, TMH, 2002. |


**Reference Books**


| | |
|---|---|
| **1** | Mathur. R.B. and R.P. Sharma, "Internal Combustion Engines"., Dhanpat Rai & Sons 2007. |
| **2** | Duffy Smith, "Auto Fuel Systems", The Good Heart Willcox Company, Inc., 1987. 3. Eric Chowenitz, "Automobile Electronics", SAE Publications, 1995 |


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| | | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| **34421P15** | **INDUSTRIAL TRIBOLOGY** | **EC-PS** | **3** | **0** | **0** | **3** |

**Preamble**

To present the engineering concepts of friction, its effects and different lubrication theories and types used in industries.

**Prerequisite**

**NIL**

**Course Objectives**

| | |
|---|---|
| 1 | To understand the concept of tribology. |
| 2 | To examine the concepts of various types of wear. |
| 3 | To understand and apply the film lubrication theory. |
| 4 | To illustrate the various types of lubricants for different applications. |
| 5 | To demonstrate the various surface engineering concepts and bearing materials. |

**Course Outcomes: On the successful completion of the course, students will be able to**

| | | |
|---|---|---|
| CO1. | Explain the concepts of friction, wear and lubrication. | Understand |
| CO2. | Illustrate about the various types of wear, wear mechanism and its measurements. | Apply |
| CO3. | Examine the various film lubrication theory. | Apply |
| CO4. | Illustrate about the various types of lubricants. | Apply |
| CO5. | Examine various surface modifications and bearing materials. | Apply |

**Mapping with Programme Outcomes and Programme Specific Outcomes**

| CO | PO1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | M | L | - | - | - | - | - | - | - | - | - | M | - | L |
| CO2 | S | M | L | - | - | L | - | - | - | - | - | - | M | - | L |
| CO3 | S | M | L | - | - | L | - | - | - | - | - | - | M | - | L |
| CO4 | S | S | M | M | - | L | - | - | - | - | - | - | M | - | L |
| CO5 | S | S | S | M | - | L | - | - | - | - | - | - | M | - | L |

**S- Strong; M-Medium; L-Low**

**SYLLABUS**

**SURFACES AND FRICTION**

Introduction to the concept of tribology, Tribological problems- Nature of engineering surfaces, Surface topography- Surface profilometer, measurement of surface topography-Contact between surfaces, Sources of sliding Friction- Friction due to ploughing, Friction due to adhesion- Friction characteristics of metals and non-metals -Sources of rolling friction, Stick slip motion -Friction of ceramic materials and polymers- Measurement of friction.

**WEAR**

Wear and Types of Wear-Simple theory of sliding wear mechanism-Abrasive wear-Adhesive wear-Corrosive wear-Surface fatigue wear situations-Wear of ceramics-Wear of polymers-Wear measurements.

**FILM LUBRICATION THEORY**

Coefficient of viscosity, Fluid film in simple shear-Viscous flow between very close parallel plates:Tutorials-Lubricant supply, Lubricant flow rate-Cold jacking,Couette flow-Cavitations, Film rupture, oil whirl-Shear stress variation within the film-Lubrication theory by Osborne Reynolds: Tutorials-Pressure fields for full sommerfeld, Half sommerfeld-Reynolds boundary conditions.

**LUBRICANTS AND LUBRICATION TYPES**

Types of Lubricants-Properties of Lubricants-Testing methods-Hydrodynamic Lubrication-Elasto-hydrodynamic Lubrication-Hydrostatic lubrication

**SURFACE ENGINEERING AND MATERIALS FOR BEARINGS**

Classification of Surface modifications and Surface coatings-Surface modifications, Transformation hardening-Surface modifications, surface fusion-Thermo chemical Processes-Surface coatings -Materials for rolling element bearings- Materials for fluid film bearings-Materials for marginally lubricated and dry bearings.

**Text Books**

| | |
|---|---|
| **1** | Bearing Tribology: priniciples and applications. |
| **2** | Williams.J.A, “Engineering Tribology”, Oxford University Press. |
| **3** | GwidonStachowiak, Andrew W Batchelor., “Engineering tribology”, Elsevier Butterworth –Heinemann, USA. |

**Reference Books**

| | |
|---|---|
| **1** | Industrial Tribology: Tribosystems, Friction, Wear and Surface Engineering, Lubrication Hardcover , by Theo Mang, Kirsten Bobzin, Thorsten Bartels |
| **2** | Cameron.A, “Basic Lubrication Theory”, Longman, U.K. |
| **3** | Neale.M.J. (Editor), “Tribology Handbook”, Newnes Butter worth, Heinemann, U.K. |

**Course Designers**

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| | | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| **34421P16** | **LEAN MANUFACTURING SYSTEMS** | **EC-PS** | **3** | **0** | **0** | **3** |

**Preamble**

This course provides basic knowledge in various tools and techniques in lean manufacturing systems.

**Prerequisite**

**NIL**

**Course Objectives**

| | |
|---|---|
| 1 | To gain the knowledge and understanding the basic concepts of lean manufacturing process. |
| 2 | To understand the various quality improvement methods in lean manufacturing. |
| 3 | To learn the basic concepts of JIT and VSM. |
| 4 | To analyse the importance of JIDOKA and its role. |
| 5 | To understand the importance of employee involvement and systematic planning. |

**Course Outcomes: On the successful completion of the course, students will be able to**

| | | |
|---|---|---|
| CO1. | Remember and understand the Principles, basic concepts in lean manufacturing. | Understand |
| CO2. | Understand, analyze and design a suitable method for quality improvement | Analyze |
| CO3. | Understand the JIT methodology, Kanban rules and the importance of defining value. | Apply |
| CO4. | Understand and Analyze the importance of Jidoka and the implementation | Analyze |
| CO5. | Learn the requirement of employee involvement in the implementation of lean culture. | Apply |

**Mapping with Programme Outcomes and Programme Specific Outcomes**

| **COs** | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO 10** | **PO 11** | **PO 12** | **PSO 1** | **PSO 2** | **PSO 3** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | M | L | S | L | S | L | - | - | - | - | - | - | M | - | - |
| CO2 | M | L | S | L | S | L | - | - | - | - | - | - | M | - | - |
| CO3 | M | L | S | L | S | L | - | - | S | - | - | - | S | - | - |
| CO4 | M | L | S | L | S | L | - | - | S | - | - | - | S | - | - |
| CO5 | M | L | S | L | S | L | - | L | S | - | - | - | S | - | - |

**S- Strong; M-Medium; L-Low**

**SYLLABUS**

**INTRODUCTION**

Objectives of lean manufacturing-key principles -- traditional Vs lean manufacturing-Origin of lean production system – Necessity – Lean revolution in Toyota – Systems and systems thinking – Basic image of lean production – Customer focus – Muda (waste).

**STABILITY OF LEAN SYSTEM**

Standards in the lean system–5S system–Total Productive Maintenance–standardized work–Elements of standardized work–Charts to define standardized work–Man power reduction–Overall efficiency–standardized work and Kaizen–Common layouts.

**JUST IN TIME**

Introduction - JIT system-Principles and elements of JIT – Kanban rules – Expanded role of conveyance

– Production leveling – Pull and Push systems – Process Mapping and Value stream mapping

**JIDOKA (AUTOMATION WITH A HUMAN TOUCH)**

Jidoka concept – Poka-Yoke (mistake proofing) systems – Inspection systems and zone control – Types and use of Poka-Yoke systems – Implementation of Jidoka.

**WORKER INVOLVEMENT AND SYSTEMATIC PLANNING METHODOLOGY**

Involvement – Activities to support involvement – Quality circle activity – Kaizen training - Suggestion Programmes – Hoshin Planning System (systematic planning methodology) – Phases of Hoshin Planning – Lean culture

**Text Books**

| | |
|---|---|
| **1** | Pascal Dennis, Lean Production Simplified: A Plain-Language Guide to the World's Most Powerful Production System, (Second edition), Productivity Press,New York. |
| **2** | Mike Rother and John Shook, Learning to See: Value Stream Mapping to Add Value and Eliminate MUDA, Lean Enterprise Institute. |

**Reference Books**

| | |
|---|---|
| **1** | Jeffrey Liker, the Toyota Way: Fourteen Management Principles from the World's Greatest Manufacturer, McGraw Hill. |
| **2** | Michael L. George, Lean Six SIGMA: Combining Six SIGMA Qualities with Lean Production Speed, McGraw Hill. |

**Course Designers**

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| | | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| **34421P13** | **INDUSTRIAL ENGINEERING** | **EC-PS** | **3** | **0** | **0** | **3** |

**Preamble**

This course deals with productivity measurements, method study techniques, work measurement, production planning and control and industrial Legislation.

**Prerequisite**

**NIL**

**Course Objectives**

| | |
|---|---|
| 1 | To understand the importance of work study methods and its importance in various fields. |
| 2 | To develop the skills of selection of a plant and also material handling equipment required. |
| 3 | To learn PPC and its functions. |
| 4 | To learn the skills of purchasing materials and their management. |
| 5 | To learn the awareness on various labour acts and management principles. |

**Course Outcomes: On the successful completion of the course, students will be able to**

| | | |
|---|---|---|
| CO1. | Evaluate the work methods through work measurement | Understand |
| CO2. | Establish the efficient work system | Apply |
| CO3. | Identify the suitable forecasting techniques for given applications | Apply |
| CO4. | Prepare the charts, diagrams and production plan. | Apply |
| CO5. | Describe the theory in industrial engineering and their applications. | Apply |

**Mapping with Programme Outcomes and Programme Specific Outcomes**

| COs | PO1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO1 0 | PO1 1 | PO1 2 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CO2 | S | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CO3 | S | M | M | L | S | - | - | - | - | - | - | - | M | - | S |
| CO4 | S | M | M | L | - | - | - | - | - | - | - | - | M | - | M |
| CO5 | S | S | S | S | S | - | - | - | S | M | - | - | S | - | S |

**S- Strong; M-Medium; L-Low**

**SYLLABUS**

**WORK MEASUREMENT AND WORK STUDY**

Evolution and importance of industrial engineering–Production-Classification-Productivity-Factors influencing productivity-quality route to productivity- Introduction to Work measurement and its Techniques-Work study-Definition-Procedure and benefits of work study-Charting techniques-Time study-Stop watch time study-Motion study-Work sampling procedure-collection of data-Method study.

**PLANT LAYOUT AND MATERIAL HANDLING**

Plant location and site location-factors influencing the location-Plant layout-Types, needs, factors influencing the plant layout-Plant layout procedure-Material handling-scope and principles of material handling-Types of Material Handling equipment-Factors influencing material handling-Methods of material handling.

**PRODUCTION PLANNING AND CONTROL**

Introduction-Objectives and Functions of PPC-Forecasting-Sales Forecasting Techniques-Types of Forecasting-Routing-Objectives and procedure of routing-Scheduling-Master Production Schedule- purpose and preparation of schedules-Scheduling techniques like CPM and PERT-Dispatching-Dispatch Procedure-Centralized and Decentralized dispatching-Tool dispatching

**MATERIAL MANAGEMENT**

Procurement of materials-codification of materials-Inventory control-Objectives of inventory control-EBQ & EOQ values-Inventory models-ABC analysis-Material requirements planning(MRP)-Enterprise resource planning(ERP)-supply chain management(SCM)-Inspection and quality control-SQC-control charts-Sampling procedures-Benchmarking

**INDUSTRIAL LEGISLATION AND MANAGEMENT CONCEPTS9 Hours**

Importance and necessity of labour acts-principles of labour legislation-various acts-Industrial Ownership and various types-Functions of management-Manpower Planning-Recruitment and Selection-Break EvenAnalysis-Managerial applications of breakeven point-Decision making - Techniques of decision making.

**Text Books:**


| | |
|---|---|
| **1** | Khan, M.I, "**Industrial Engineering**", New Age International, 2nd Edition, 2009. |
| **2** | Kapoor N.D, "**Handbook of Industrial Law**", sultan Chand & sons, 14th revised edition 2013. |


**Reference Books:**


| | |
|---|---|
| **1** | Khanna, O.P, "**Industrial Engineering and Management**", Dhanpat Rai and Sons, 2008. |
| **2** | Samuel Eilon, "**Elements of Production Planning and Control**", Universal Publishing Corporation, Bombay, 1994. |
| **3** | Panneerselvam R, "**Production and Operations Management**", PHI, New Delhi, 2006. |


**Course Designers**


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| | | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| **34421P12** | **HYDRAULICS AND PNEUMATIC SYSTEMS** | **EC-PS** | **3** | **0** | **0** | **3** |

**PREAMBLE**

Today, Industries are increasingly demanding process automation in all sectors. Automation results into better quality, increased production and reduced costs. The controlling parameters like motion, Speed, Position and torque are paramount in raising productivity and quality and reducing energy and equipment costs in all industries. Electric drives share most of industrial machine control applications. The variable speed drives which controls speed of a.c/d.c motors are indispensable controlling elements in automation systems. Such drives contains various high performance motors, power electronic converters and digital control systems. With wide options which are open to engineers for selecting proper drive system, one can look forward for a highly efficient and reliable drive for every application in industry.

**PREREQUISITE**

**NIL**

**COURSE OBJECTIVES**

| | |
|---|---|
| 1 | To understand about basics of fluid power systems fundamentals |
| 2 | To acquire knowledge about components used in hydraulic and pneumatic systems |
| 3 | To familiarize about the various types of valves and actuators |
| 4 | To design hydraulic circuits for different applications |
| 5 | To design pneumatic circuits for different applications |

**Course Outcomes On the successful completion of the course, students will be able to**

| | |
|---|---|
| **CO1.** Understand the different drive systems and identify which is suitable for specific application. | Understand |
| **CO2.** Understand the working of different components in fluid power system. | Understand |
| **CO3.** Understand about the utilization of cylinders, accumulators, valves and various control components. | Understand |
| **CO4**. Design a feasible hydraulic circuit for a given application. | Apply |
| **CO5**. Design a feasible pneumatic circuit for a given application. | Apply |

**MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES**

| COS | PO1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO1 | PSO2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | M | M | L | M | - | - | - | - | - | - | - | L | - | - |
| CO2 | S | M | M | L | M | - | - | - | - | - | - | - | L | - | - |
| CO3 | S | M | M | L | M | - | - | - | - | - | - | - | L | - | - |
| CO4 | S | S | S | M | L | M | - | - | - | - | - | - | L | - | - |
| CO5 | S | S | S | M | L | M | - | - | - | - | - | - | L | - | - |

**S- Strong; M-Medium; L-Low**

**SYLLABUS**

**FLUID POWER SYSTEMS AND FUNDAMENTALS**

Introduction to fluid power, Advantages and Applications of fluid power system. Basic Laws in Fluid power system, Types of fluid power systems, Properties of fluids – General types of fluids – Fluid power symbols. Basic Laws in Fluid power system. Low cost automation.

**HYDRAULIC SYSTEM & PNEUMATIC SYSTEMS COMPONENTS**

Pump classification – Gear pump, Vane Pump, Piston pump, construction and working of pumps– Variable displacement pumps. Pneumatic Components: Compressors-types. Filter, Regulator, Lubricator Unit, Muffler

**VALVES AND ACTUATORS**

Construction of Control Components: Director control valve – 3/2 way valve ,4/2 way valve, Shuttle valve ,check valve – pressure control valve –pressure reducing valve, sequence valve-Flow control valve.. Fluid Power Actuators: Linear hydraulic actuators – Types of hydraulic cylinders – Single acting, Double acting special cylinders like Telescopic, Cushioning mechanism, Construction of single acting and double acting cylinder.

**DESIGN OF HYDRAULIC CIRCUITS**

Accumulators and Intensifiers: Types of accumulators – Accumulators circuits, intensifier – Intensifier circuit. Circuits: Reciprocating- Regenerative - Quick return – Sequencing – Synchronizing - Safety circuits -Press – Planer.

**DESIGN OF PNEUMATIC CIRCUITS**

Fluid Power Circuit Design: Speed control circuits, synchronizing circuit, Sequential circuit design for two and three cylinder using cascade method. Pneumo-hydraulic circuit. Electro pneumatic circuit, Fluid power circuits- failure and troubleshooting.

**Text Books:**


1. Anthony Esposito - “Fluid Power with Applications”- Pearson Education - 2013
2. Srinivasan - “Hydraulic and Pneumatic Controls”- TMH - 2011.
3. Andrew Parr - “Hydraulics and Pneumatics "- Jaico Publishing House


**Reference Books:**


1. Thomson, “Introduction to Fluid power”- Prentice Hall - 2004.
2. Majumdar S.R. - “Oil Hydraulics – Principles and maintenance”- Tata McGraw-Hill.
3. Majumdar S.R. - “Pneumatic systems – Principles and maintenance”- Tata McGraw Hill.


**Course Designers**


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| | | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| **34421P09** | **FAILURE ANALYSIS OF MATERIALS** | **EC-PS** | **3** | **0** | **0** | **3** |

**Preamble**

This course covers failures of materials and causes of failure, topics include types of failure in components and equipments for failure analysis.

**Prerequisite**

**NIL**

**Course Objectives**

| | |
|---|---|
| 1 | To study the fundamentals of failure analysis. |
| 2 | To study introduction to failure analysis. |
| 3 | To study the causes of failure in components. |
| 4 | To study the types of failure in components. |
| 5 | To study the methods and equipments for failure analysis. |

**Course Outcomes: On the successful completion of the course, students will be able to**

| | | |
|---|---|---|
| CO1. | Apply the importance of failure analysis for automotive components and Determination of failure mode. | Apply |
| CO2. | Identify the failure mode identification methods and Corrosion failures. | Apply |
| CO3. | Explain the causes of failure in components. | Understand |
| CO4. | Summarize the types of failures in components. | Understand |
| CO5. | Identify the methods and equipments for failure analysis. | Apply |

**Mapping with Programme Outcomes and Programme Specific Outcomes**

| **COs** | **PO 1** | **PO2** | **PO3** | **PO4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO1 0** | **PO1 1** | **PO12** | **PSO 1** | **PSO 2** | **PSO 3** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | M | M | - | - | M | - | - | - | - | - | - | L | - | - |
| CO2 | S | M | M | - | - | L | - | - | - | - | - | - | L | - | - |
| CO3 | S | M | M | - | - | M | - | - | - | - | - | - | L | - | - |
| CO4 | S | L | L | - | - | L | - | - | - | - | - | - | L | - | - |
| CO5 | S | M | M | - | - | L | - | - | - | - | - | - | L | - | - |

**S- Strong; M-Medium; L-Low**

**SYLLABUS**

**FUNDAMENTALS OF FAILURE ANALYSIS**

Importance of failure analysis for automotive components, Steps in typical failure analysis: Collection of background data (review documentation and speak with appropriate individuals), Selection of failed and un failed samples for examination, Preliminary examination of the failed part, Non-destructive evaluation, Mechanical testing, Macroscopic examination and analysis, Microscopic examination and analysis, Determination of failure mode, Chemical analysis, Fracture mechanics considerations, Full scale testing under service conditions, Analysis of the evidence, Formulation of conclusions, Recommendations to prevent reoccurrence, Sample preparation methods for failure analysis, Selection of locations/samples
For failure analysis.

**INTRODUCTION TO FAILURE ANALYSIS**

Failure mode identification methods, Failure mechanisms: Fatigue failures, fractography, effect of variables: part shape, type of loading, stress concentration, metallurgical factors, etc. Wear failures, adhesive, abrasive, erosive, corrosive wear. Corrosion failures, types of corrosion: uniform, pitting, selective leaching,
intergranular, crevice, etc. Elevated temperature failures, creep, thermal fatigue, micro structural instability, and oxidation.

**CAUSES OF FAILURE IN COMPONENTS**

Misuse or Abuse, Assembly errors, Manufacturing defects, Improper maintenance, Fastener failure, Design errors, Improper material, Improper heat treatments, Unforeseen operating conditions, Inadequate quality assurance, Inadequate environmental protection/control, Casting discontinuities. Data compilation and identification of root cause.

**TYPES OF FAILURES IN COMPONENTS**

Fatigue failures, Corrosion failures, Stress corrosion cracking, Ductile and brittle fractures, Hydrogen embrittlement, Liquid metal embrittlement, Creep and stress rupture.

**METHODS AND EQUIPMENTS FOR FAILURE ANALYSIS**

Selection of suitable testing methods for failure analysis, Selection of metallurgical equipments for Failure Analysis, SEM-EDAX.

**Text Books**

| | |
|---|---|
| **1** | "Understanding How Components Fail" by Donald J. Wulpi; ASM International Publication. |
| **2** | "Analysis of Metallurgical Failures: by Vito J. Colangelo; Francis A. Heiser Wiley Publication |
| **3** | ASM Handbook Vol.11 - Failure Analysis and Prevention, ASM International Publication, 1995. |

**Reference Books**

| | |
|---|---|
| **1** | "Metallurgy of Failure Analysis" by A K. Das; by McGraw-Hill Professional Publication. |
| **2** | Metallurgical Failure Analysis by Charlie R. Brooks; Ashok Choudury; McGraw-Hill Publication. |

**Course Designers**

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| 34421P11 | FUNDAMENTALS OF PIPING ENGINEERING | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | EC-PS | 3 | 0 | 0 | 3 |

**Preamble:**
The students completing this course are expected to gain knowledge on fundamentals of piping engineering, pipe hydraulics, piping supports and design.

**Prerequisite**

**NIL**

**Course Objectives**

| | |
|---|---|
| 1 | To understand the importance of piping engineering. |
| 2 | To enable student to learn the application of flanges and valves. |
| 3 | To understand about process mechanical equipments. |
| 4 | To gain knowledge about various pipe supports. |
| 5 | To enable students to learn about various types of stress analysis. |

**Course Outcomes: On the successful completion of the course, students will be able to**

| | | |
|---|---|---|
| CO1. | Discuss the basic concepts of piping engineering. | Understand |
| CO2. | Discuss the application of flanges and valves. | Understand |
| CO3. | Apply the concept of various process mechanical equipments. | Apply |
| CO4. | To gain knowledge about various pipe supports. | Apply |
| CO5. | Analyze the different types of stress. | Analyze |

**Mapping with Programme Outcomes and Programme Specific Outcomes**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | M | L | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CO2 | S | M | L | - | - | - | - | - | - | - | - | - | L | - | - |
| CO3 | S | M | L | - | - | - | - | - | - | - | - | - | M | - | - |
| CO4 | S | S | M | L | - | - | - | - | - | M | - | - | M | - | - |
| CO5 | S | S | S | M | S | - | - | - | - | S | - | - | L | - | - |

**S- Strong; M-Medium; L-Low**

**SYLLABUS**

**INTRODUCTION**

Introduction to Piping Responsibilities of Piping Engineer and Designer - Scope of PipingInput and Outputs - General: Process Diagrams (PFD, UFD, P&ID, Line List etc) -
Piping Fundamentals Definition, Application Codes and Standards.

**FLANGES AND VALVES**

Introduction to Flanges and Valves – Application and advantages of Flanges - Pipe Fittings - Pipe Flanges – Valves -Piping Special Items

**PROCESS MECHANICAL EQUIPMENTS**

Process Mechanical Equipments – Static equipments & Rotary equipments
Layouts - Preparation of Plot Plan - Preparation of Equipment Layouts - Preparation of Piping General Arrangement Drawings - Preparation of Cross Sectional Drawings - Piping Isometric Drawings & Material Take off

**PIPE SUPPORTS**

Pipe Supports: Support Types - Support Selection, Support Location, Support Span Calculation - Typical Unit Conversion - Materials: Preparation of Piping Material Specification - Valve Material Specification - Familiarity with ASME B31.3 Pipe Wall thickness Calculations.

**STRESS ANALYSIS**

Preparation of Special Items Datasheets: Pressure Design of Miter Bends – Single & Multiple Miters - Pressure Design of Blanks - Branch reinforcement calculations - Overview of Technical Queries and Technical Bid Evaluations
Stress Analysis: Types of stresses, Significance of forces and moments - Introduction to Stress Analysis - Expansion Loop types, Bellows Types

**Text Books**

| | |
|---|---|
| **1** | G.K.Sahu, Fundamentals of piping design, New Age International Publishers |

**Reference Books**

| | |
|---|---|
| **1** | Peter Smith, R.W.Zappe, Valve Selection Hand Book, Elsevier Science |
| **2** | Peter Smith, The fundamentals of piping design, Elsevier Science |

**Course Designers**

| S.No | Faculty Name | Designation | Department/ College | Email id |
|---|---|---|---|---|
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| | | | | | | |
|---|---|---|---|---|---|---|
| | **CONCURRENT** | **Category** | **L** | **T** | **P** | **Credit** |
| **34421P04** | **ENGINEERING** | **EC-PS** | **3** | **0** | **0** | **3** |

**Preamble**

This course reviews the benefits of Concurrent engineering, life cycle product design, designas per customer requirements, different manufacturing methods with computer based approach, importance of quality during product design, reliability, maintainability and economics of product design.

**Prerequisite**

**NIL**

**Course Objectives**

| | |
|---|---|
| 1 | Study the benefits of concurrent engineering, life-cycle design of the products, structure and organization and implementation process of the CE. |
| 2 | Learn about the design of the product as per the customer requirements and also understand the co-operation/ coordination required between the different departments like marketing, design and the latest softwares available so far. |
| 3 | Study the role of design for manufacturing in concurrent engineering, different DFM methods, creative design methods and computer based approach to DFM. |
| 4 | Learn about the importance of quality during the product design and methods used to evaluate the quality. |
| 5 | Learn about the design of the product for reliability, maintainability and economics. |

**Course Outcomes: On the successful completion of the course, students will be able to**

| | | |
|---|---|---|
| CO1. | Know the meaning, objectives and benefits of the concurrent engineering, life-cycle design of the products, structure and organization and implementation process of the CE. | Understand |
| CO2. | Understand the design of the product as per the customer requirements and also understand the co-operation/ coordination required between the different departments like marketing, design and the latest softwares available so far. | Understand |
| CO3. | Understand the role of design for manufacturing in concurrent engineering, different DFM methods, creative design methods and computer based approach to DFM. | Understand |
| CO4. | Know the importance of quality during the product design and methods used to evaluate the quality. | Understand |
| CO5. | Understand the design of the product for reliability, maintainability and economics. | Understand |

**Mapping with Programme Outcomes and Programme Specific Outcomes**

| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | M | S | L | L | -- | - | - | - | - | - | - | L | - | - |
| CO2 | S | M | S | S | S | M | - | - | - | - | - | - | S | - | - |
| CO3 | S | M | S | L | M | M | - | - | - | - | - | - | M | - | - |
| CO4 | S | M | S | S | M | M | - | - | - | - | - | - | M | - | - |
| CO5 | S | L | S | M | L | -- | - | - | - | - | - | - | M | - | - |

**S- Strong; M-Medium; L-Low**

**SYLLABUS**

**INTRODUCTION:**

Sequential engineering process, Concurrent engineering definition and requirement, meaning of concurrent objectives of CE, benefits of CE, Life cycle design of products, life cycle costs. SUPPORT FOR CE: Classes of support for CE activity, CE organizational, structure CE, team composition and duties, Computer based Support, CE Implementation Process.

**DESIGN PRODUCT FOR CUSTOMER**

Industrial Design, Quality Function Deployment, house of quality, Translation process of quality function deployment (QFD). Modeling of Concurrent engineering design- Compatibility approach, Compatibility index, implementation of the Compatibility model, integrating the compatibility Concerns.

**DESIGN FOR MANUFACTURE (DFM)**

Introduction, role of DFM in CE, DFM methods, e.g. value engineering, DFM guidelines, design for assembly, creative design methods, product family themes, design axioms, Taguchi design methods, Computer based approach to DFM. Evaluation of manufacturability and assembliability.

**QUALITY BY DESIGN**

Quality engineering & methodology for robust product design, parameter and Tolerance design, Quality loss function and signal to noise ratio for designing the quality, experimental approach.

**DESIGN FOR X-ABILITY**

Design for reliability, life cycle serviceability design, design for maintainability, design for economics, decomposition in concurrent design, concurrent design case studies.

**Text Books**

| | |
|---|---|
| **1** | Concurrent Engineering- Kusiak - John Wiley & Sons |
| **2** | Concurrent Engineering- Menon - Chapman & Hall |

**Reference Books**

| | |
|---|---|
| **1** | Integrated Product Development/Anderson MM and Hein, L.Berlin, Springer Verlog,1987. |
| **2** | Design for Concurrent Engineering/ Cleetus, J. Concurrent Engg. Research Centre, Morgantown, WV, 1992. |

**Course Designers**

| **S.No** | **Faculty Name** | **Designation** | **Department/Name of the College** | **Email id** |
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| 34421P08 | ENGINEERING PRODUCT DESIGN | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | EC-PS | 3 | 0 | 0 | 3 |

**Preamble**

Engineering Product Design is a challenging, rewarding activity that requires multifunctional cooperation and inter-disciplinary skills.

**Prerequisite**

**NIL**

**Course Objectives**

| | |
|---|---|
| 1 | To understand the models in developing new engineering products. |
| 2 | To learn how to identify the customer needs and integrate the end-consumer into process. |
| 3 | To learn and apply the concepts and tools necessary for concept generation and evaluation. |
| 4 | To apply embodiment design concept in the process of new product development. |
| 5 | To Understand the concept of manufacturing process and design the product accordingly. |

**Course Outcomes: On the successful completion of the course, students will be able to**

| | | |
|---|---|---|
| CO1. | Understand the conceptual development techniques to find solution for a critical design issue. | Understand |
| CO2. | Apply embodiment principles to translate the conceptual ideas to engineering design. | Understand |
| CO3. | Apply environmental, ethical and social issues during innovative design process. | Apply |
| CO4. | Design and develop innovative engineering products for industrial needs using robust design philosophy. | Apply |
| CO5. | Apply the concept of Design for Manufacture and to understand the different modes of Failure of the product. | Analyze |

**Mapping with Programme Outcomes and Programme Specific Outcomes**

| COs | PO1 | PO2 | PO3 | PO 4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | M | L | L | L | L | - | - | - | - | - | - | - | M | - | - |
| CO2 | M | L | L | L | L | - | - | - | - | - | - | - | M | - | - |
| CO3 | S | S | S | S | S | - | - | - | - | - | - | - | S | - | - |
| CO4 | S | M | M | M | M | - | - | - | - | - | - | - | M | - | - |
| CO5 | S | S | S | S | S | - | - | - | - | - | - | - | M | - | - |

**S- Strong; M-Medium; L-Low**

**SYLLABUS**

**INTRODUCTION**

Innovations in Design, Engineering Design Process, Prescriptive and integrative models of design,Design Review and societal considerations.

**IDENTIFICATION OF CUSTOMER NEED**

Evaluating Customer requirements and survey on customer needs, Conversion of customer needsinto technical Specifications, Information sources.

**CONCEPT GENERATION AND EVALUATION**

Creativity and Problem solving, Brainstorming, Theory of Inventive Problem solving (TRIZ), Functional Decomposition of the problem for innovative concept development, Morphological design, Introduction to Axiomatic Design, Concept evaluation and decision making.

**EMBODIMENT DESIGN**

Introduction, Product Architecture, Configuration and Parametric design Concepts, Industrial Design.

**DESIGN FOR MANUFACTURING**

Design for Manufacturing, Design for Assembly, Design for Environment, Design for Reliabilityand Robustness, Introduction to FMEA.

**Text Books**


| | |
|---|---|
| **1** | Nigel Cross, Engineering Design Methods, John Wiley, 2009. |


**Reference Books**


| | |
|---|---|
| **1** | George E. Dieter, Engineering Design, McGraw-Hill, 2009. |
| **2** | Genrich Altshuller, The Innovation Algorithm, Technical Innovation Centre, 20LL. |


**Course Designers**


| S.No | Faculty Name | Designation | Department/Name of the College | Email id |
|---|---|---|---|---|
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| | | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| **34421P07** | **DESIGN OF EXPERIMENTS** | **EC-PS** | **3** | **0** | **0** | **3** |

**Preamble**

This course that deals with two of the most important approaches to collecting research data experiments. To enable the students to understand the various statistical tools & Problem solving techniques.

**Prerequisite**

Nil

**Course Objectives**

| | |
|---|---|
| 1 | Know about Design of Experiment. |
| 2 | Understand the methodology for Design of Experiment. |
| 3 | Familiarize about concepts of confounding and ANOVA. |
| 4 | Expose the concepts of response surface design. |
| 5 | To apply Taguchi method. |

**Course Outcomes: On the successful completion of the course, students will be able to**

| | | |
|---|---|---|
| CO1. | Understand the principles and theory of designing experiments. | Understand |
| CO2. | Apply basic principles in the design of simple experiments. | Apply |
| CO3. | Understand and use the terminology of experimental designs. | Understand |
| CO4. | Select and design an appropriate method of data collection for a research project. | Analyze |
| CO5. | Apply the concept toproduct design and development for obtain optimum results. | Apply |

**Mapping with Programme Outcomes and Programme Specific Outcomes**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | S | M | S | - | - | - | - | - | - | - | - | - | - | - |
| CO2 | S | M | L | S | - | - | - | - | - | - | - | - | S | - | - |
| CO3 | S | S | S | M | S | - | - | - | - | - | - | - | M | - | - |
| CO4 | M | S | M | M | M | L | - | - | - | - | - | - | M | - | - |
| CO5 | M | M | L | M | L | M | - | - | - | - | - | - | L | - | - |

**S- Strong; M-Medium; L-Low**

**SYLLABUS**

**BASICS OF DESIGN OF EXPERIMENTS**

Introduction in Design of experiments (DOE) - Fundamental and practical issue in industrial experimentation - Statistical thinking and its role within DOE - Basic principles of DOE and Degrees of freedom - Selection of quality characteristics for industrial experiments - Understanding key interaction in processes - Alternative method for calculating two-order interaction effect - Synergistic interaction versus Antagonistic interaction

**METHODOLOGY FOR DESIGN OF EXPERIMENTS**

DOE methodology - Barriers in the successful application of DOE - Practical methodology of DOE and Analytical tools for DOE - Confidence interval for the mean response - Introduction of Screening design - Geometric and non-geometric P-B design - Introduction of full factorial design - $2^2$ , $2^3$ ,$2^4$ full factorial design

**CONFOUNDING**

Introduction and uses of confounding - $2^3$ factorial experiment with complete confounding -$2^3$ factorial experiment with partial confounding - Confounding in the $2^n$ series and examples - Confounding of $3^2$ factorial - Confounding of $3^3$ factorial and examples - Mixed series and examples - Introduction on ANOVA Analysis

**RESPONSE SURFACE DESIGN**

Background of response surface design - Creation of response surface design - Central composite design - Box Behnken design - Contour profile of response surface plot - Design table - Analyze the data - Case studies on response surface design - Experiment with random factor

**TAGUCHI METHOD**

Taguchi design approach - Orthogonal array, S/N ratio - Smaller is better, Nominal is better and larger is better with simple case studies - Analyze the data, factor effect diagram - Levels of parameters - Confirmation test - Augmented design with simple case studies

**Text Books**


| | |
|---|---|
| **1** | Jijuantony, "Design of Experiments for Engineers and Scientists", Elsevier. |
| **2** | Douglas C Montgomery, " Design and Analysis of Experiments" , John Wiley & Sons Ltd. |


**Reference Books**


| | |
|---|---|
| **1** | 1. M N Das, N C Giri, “Design and Analysis of Experiments", New Age International (P) Limited, Publishers, 1997. |
| **2** | Larry B. Barrentine, “An introduction to Design of Experiments A simplified approach”, New Age International Publishers, 2010. |
| **3** | William G. Cochran, Gertrude M. Cox, “Experimental Design", John Wiley and sons, Inc. |
| **4** | Cox C.R, “The theory of Design of Experiments", Chapman and Hall, CRC Press. |


**Course Designers**


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| | | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| 34421P10 | FLUID POWER SYSTEMS | EC-PS | 3 | 0 | 0 | 3 |

**Preamble**

Fluid Power is the technology that deals with the generation, control, and transmission of power, using pressurized fluids. Fluid power is called hydraulics when the fluid is a liquid and is called pneumatics when the fluid is a gas. Hydraulic systems use liquids such as petroleum oils, synthetic oils, and water. Pneumatic systems use air as the gas medium because air is very abundant and can be readily exhausted into the atmosphere after completing its assigned task.

**Prerequisite**

NIL

**Course Objectives**

| | |
|---|---|
| 1 | To study about the principles of main hydraulic and pneumatic components. |
| 2 | To design and study about the principles of main pneumatic components. |
| 3 | To learn the methodology of circuit diagram. |
| 4 | To design and study about the principles of electro-pneumatic and hydraulic circuits. |
| 5 | To study and analyze various circuits application ,maintenance and safety aspects. |

**Course Outcomes: On the successful completion of the course, students will be able to**

| | | |
|---|---|---|
| CO1. | Explain the principles of main hydraulic and pneumatic components. static and dynamic performance characteristics design of component | Understand |
| CO2. | Explain the principles of main pneumatic components. static and dynamic performance characteristics design of component | Apply |
| CO3. | Students are able to read the circuit diagrams methodology and to understand the principles of circuit operation, in relation to the performance of the individual components themselves. | Apply |
| CO4. | Explain the design of electro-pneumatic and hydraulic circuits. | Apply |
| CO5. | Students are able to design of hydraulic and pneumatic circuits applied to machine tools. Maintenance and safety aspects . | Apply |

**Mapping with Programme Outcomes and Programme Specific Outcomes**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | M | M | S | S | - | - | - | - | - | - | - | M | - | - |
| CO2 | M | S | M | M | S | - | - | - | - | - | - | - | L | - | - |
| CO3 | S | M | M | M | L | - | - | - | - | - | - | - | M | - | - |
| CO4 | M | L | S | L | S | - | - | - | - | - | - | - | M | - | - |
| CO5 | S | M | L | M | M | - | - | - | - | - | - | - | L | - | - |

**S- Strong; M-Medium; L-Low**

**SYLLABUS**

**HYDRAULIC COMPONENTS**

Introduction to fluid power system-Pascal's Law-Hydraulic fluids-Hydraulic pumps-Gear, Vane and Piston pumps-Pump Performance-Characteristics and Selection-actuators-valves-pressure control-flow control and direction control valves-Hydraulic accessories-Hydraulic Accumulator.

**PNEUMATIC COMPONENTS**

Introduction to Pneumatics-Compressors-types-Air treatment-FRL unit-Air dryer-Control valves-Logic valves-Time delay valve and quick exhaust valve-Pneumatic Sensors–types-characteristics and applications.

**FLUID POWER CIRCUITS**

Circuit Design Methodology-Sequencing circuits-Overlapping signals-Cascade method-KV Map method-Industrial Hydraulic circuits-Double pump circuits-Speed control Circuits-Regenerative circuits-Safety circuits-Synchronizing circuits-Accumulator circuits.

**ELECTRO - PNUEMATICS AND HYDRAULICS**

Relay, Switches-Solenoid-Solenoid operated valves-Timer-Counter-Servo and proportional control-Microcontroller and PLC based control-Design of electro-pneumatic and hydraulic circuits.

**APPLICATION, MAINTENANCE AND TROUBLE SHOOTING**

Development of hydraulic / pneumatic circuits applied to machine tools-Presses-Material handling systems-Automotive systems-Packaging industries-Manufacturing automation- Maintenance and trouble shooting of Fluid Power circuits-Safety aspects involved.

**Text Books**


| | |
|---|---|
| **1** | Anthony "Esposito, Fluid Power with applications", Prentice Hall international–1997. |
| **2** | Majumdar.S.R, "Oil Hydraulics", Tata McGraw Hill, 2002. |
| **3** | Majumdar S.R, "Pneumatic systems-principles and maintenance", Tata McGraw Hill 1995. |


**Reference Books**


| | |
|---|---|
| **1** | John Pippenger, Tyler "Hicks, Industrial Hydraulics", McGraw Hill International Edition, 1980. |
| **2** | Andrew Parr, "Hydraulics and pneumatics", Jaico Publishing House, 2003. |
| **3** | FESTO, "Fundamentals of Pneumatics", Vol I, II, III. |


**Course Designers**


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| | | Category | L | T | P | C |
|---|---|---|---|---|---|---|
| **34421P17** | **MEMS AND NEMS** | **EC-PS** | **3** | **0** | **0** | **3** |

**PREAMBLE**

The course reviews the various applications of MEMS AND NEMS and its applications in sensors and actuators.

**PREREQUISITE**: NIL

**COURSE OBJECTIVES**

| | |
|---|---|
| 1 | To study the fundamentals of MEMS and NEMS. |
| 2 | To gain knowledge on fabrication of MEMS. |
| 3 | To study on Micro Sensors. |
| 4 | To study on Micro actuators. |
| 5 | To study on Nano systems and Quantum Mechanics. |

**Course Outcomes, On the successful completion of the course, students will be able to**

| | |
|---|---|
| CO1.The student will understand the various applications of NEMS and MEMS | Understand |
| CO2. The student will understand the Various fabrication of MEMS | Understand |
| CO3. The student will learn the working of various micro sensors | Analyze |
| CO4. The student will know how to design the working of micro actuators | Apply |
| CO5. The student will understand the nanosystems and quantum mechanics | Understand |

**Mapping with Programme Outcomes and Programme Specific Outcomes**

| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO 7** | **PO 8** | **PO 9** | **PO1 0** | **PO1 1** | **PO1 2** | **PSO 1** | **PSO 2** | **PSO 3** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | - | - | - | - | - | - | - | - | - | - | - | M | - | - |
| CO2 | S | - | - | - | - | - | - | - | - | - | - | - | M | - | - |
| CO3 | S | S | S | L | L | - | - | - | - | - | - | - | S | - | - |
| CO4 | S | S | S | L | L | - | - | - | - | - | - | - | M | - | - |
| CO5 | S | M | M | M | S | - | - | - | - | - | - | - | M | - | - |

**S- Strong M-Medium L- Low**

**SYLLABUS**

**OVERVIEW AND INTRODUCTION**

New trends in Engineering and Science: Micro and Nano scale systems Introduction to Design of MEMS and NEMS, Overview of Nano and Micro electromechanical Systems, Applications of

| |
|---|
| Micro and Nano electro mechanical systems, Micro electromechanical systems, devices and structures Definitions, Materials for MEMS: Silicon, silicon compounds, polymers, metals |
| **MEMS FABRICATION TECHNOLOGIES** |
| Microsystem fabrication processes: Photolithography, Ion Implantation, Diffusion, Oxidation. Thin film depositions: LPCVD, Sputtering, Evaporation, Electroplating; Etching techniques: Dry and wet etching, electrochemical etching; Micromachining: Bulk Micromachining, Surface Micromachining, High Aspect-Ratio (LIGA and LIGA-like) Technology; Packaging: Microsystems packaging, Essential packaging technologies, Selection of packaging materials |
| **MICRO SENSORS** |
| MEMS Sensors: Design of Acoustic wave sensors, resonant sensor, Vibratory gyroscope,Capacitive and Piezo Resistive Pressure sensors- engineering mechanics behind these<br>Micro sensors. Case study: Piezo-resistive pressure sensor |
| **MICRO ACTUATORS** |
| Design of Actuators: Actuation using thermal forces, Actuation using shape memory Alloys, Actuation using piezoelectric crystals, Actuation using Electrostatic forces (Parallel plate, Torsion bar, Comb drive actuators), Micromechanical Motors and pumps. Case study: Comb drive actuators |
| **NANOSYSTEMS AND QUANTUM MECHANICS** |
| Atomic Structures and Quantum Mechanics, Molecular and Nanostructure Dynamics: Shrodinger Equation and Wave function Theory, Density Functional Theory, Nanostructures and Molecular Dynamics, Electromagnetic Fields and their quantization, Molecular Wires and Molecular Circuits. |
| **Text Books:** |
| 1. Marc Madou, “Fundamentals of Micro fabrication”, CRC press.<br>2. Stephen D. Senturia,” Micro system Design”, Kluwer Academic Publishers. |
| **Reference:** |
| 1. Tai Ran Hsu , “MEMS and Microsystems Design and Manufacture” ,Tata McGraw Hill.<br>2. Chang Liu, “Foundations of MEMS”, Pearson education India limited. |

**Course Designers**

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| | | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| **34421P19** | **PETROLEUM PRODUCTION ENGINEERING** | **EC-PS** | **3** | **0** | **0** | **3** |

**Preamble**:
The students completing this course are expected to gain knowledge on oil well drilling engineering and operations and fundamentals equations and calculations used in drilling engineering.

**Prerequisite: Nil**

**Course Objectives**

| | |
|---|---|
| 1 | To understand oil well drilling engineering and operations. |
| 2 | To get familiarized with field equipment practices, difficulties and actions to be taken. |
| 3 | To learn fundamental equations and calculations used in drilling engineering. |
| 4 | To gain knowledge about casing and cementation. |
| 5 | To enable students to analysis various drilling fluids. |

**Course Outcomes: On the successful completion of the course, students will be able to**

| | | |
|---|---|---|
| CO1. | Discuss the basic concepts of well drilling engineering | Understand |
| CO2. | Apply the concept of fundamental equations and calculations used in drilling engineering. | Apply |
| CO3. | To gain knowledge about Casing and cementation | Apply |
| CO4. | Apply the concept of using of drilling fluids | Apply |
| CO6 | Analyze the different drilling fluids | Analyze |

**Mapping with Programme Outcomes and Programme Specific Outcomes**

| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | M | L | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CO2 | S | M | L | - | - | - | - | - | - | - | - | - | M | - | M |
| CO3 | S | S | M | L | - | - | - | - | - | M | - | - | M | - | M |
| CO4 | S | S | S | M | - | - | - | - | - | M | - | - | L | - | L |
| CO5 | S | S | S | M | S | - | - | - | - | S | - | - | L | - | L |

**S- Strong; M-Medium; L-Low**

**SYLLABUS**

**DRILLING RIG**

Rotary / top drive drilling for oil and natural gas, introduction to hardware system, power generation system, Hoisting, Rotary and drilling fluid circulation system, Rig selection, onshore offshore rigs, onshore and offshore drilling operations, Horse power calculations for draw-works and rotary advantages and disadvantages of top drive system.

**DRILLING OPERATIONS AND DIFFICULTIES**

Down hole drilling problems and solutions, factors affecting rate of penetration, drill off test, bit section, IADC classification of bit, dull bit gradation, circulation system, mud pumps, numerical related to mud pumps of circulation system, problems concerned with drilling fluid and drill pipe stuck up, geometry of a stuck pipe. Hole problems (lost circulation, kick etc) well control equipment BOP.

**DRILLING TECHNIQUES AND FISHING**

Introduction to directional, horizontal multilateral drilling techniques. Types of well, coring operations, Fishing tools and operations. Terminology used in directional wells and basic mathematics used in directional wells (DMS to Dec. Deg, co-ordinate system).

**CASING AND CEMENTATION**

Casing and Cementation, Functions, types, API grades properties of casing, Threads and couplings, Functions, classification of cement, Strength retrogenion, Cement additives, Methods of cementation, Equipment accessories, Field problems pertaining to cementation job, Cement slurry calculations.

**DRILLING FLUIDS**

Drilling fluid, Functions, Types, compositions, Properties of mud, Field test, Rheology, Additives and contamination, Selection of drilling fluids and mud, Conditioning equipments, Mud calculations, Hydrostatic pressure, Volume, Weight related calculations during drilling.

**Text Books**

| | |
|---|---|
| **1** | Gatlin C.; Petroleum Engineering, Drilling and Well Completions, Prentice Hall. |

**Reference Books**

| | |
|---|---|
| **1** | Rabia H.; Oil Well Drilling Engineering, Graham Trotman Ltd., London. |
| **2** | Azar, J. J., G. Robello Samuel; Drilling Engineering, Penn Well. |

**Course Designers**

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# OPEN ELECTIVE-INNOVATION, ENTREPRENEURSHIP, SKILL DEVELOPMENT COURSES

| | | | | | | |
|---|---|---|---|---|---|---|
| | **ENGINEERING STARTUPS AND ENTREPRENEURIAL** | **Category** | **L** | **T** | **P** | **Credit** |
| **34121O01** | **MANAGEMENT** | **OE-IE** | **3** | **0** | **0** | **3** |

**PREAMBLE:**

A startup means company initiated by individual innovator or entrepreneurs to search for a repeatable and scalable business model. More specifically, a startup is a newly emerged business venture that aims to developa viable business model to meet a marketplace needs or wants in an optimum manner.

**PREREQUISITE:** Not Required

**COURSE OBJECTIVES:**

1. To understand the basics of Startups Management and components.
2. To analyze the startups fund management practices
3. To practice the various kinds of stocks and employment considerations in startups.
4. To apply the importance of intellectual property rights and its procedures.
5. To explore the entrepreneurial mindset and culture.

**COURSE OUTCOMES:**

**After successful completion of the course, students will be able to**

| | |
|---|---|
| CO1: Explain the concept of engineering startups, objectives and functions and its components. | Understand |
| CO2: Analyze the startups funding issues and remuneration practices in startups business. | Analyze |
| CO3: Analyze the various kinds of stocks and employment opportunities and consideration in startups business. | Analyze |
| CO4: Compare and contrast the various forms of intellectual property protection and practice. | Analyze |
| CO5: Explore the entrepreneurial mindset and culture that has been developing in companies of all sizes and industries. | Evaluate |

**MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | M | - | - | - | - | M | M | S | - | M | - | M | - | L | L |
| CO2 | S | S | M | M | M | L | - | - | - | - | - | M | L | L | - |
| CO3 | S | S | S | M | M | M | - | - | - | - | - | M | L | - | M |
| CO4 | S | S | S | M | M | M | - | - | - | - | - | M | - | M | L |
| CO5 | S | S | - | M | M | M | - | - | - | - | - | M | M | M | M |

**S- Strong; M-Medium; L-Low**

**SYLLABUS:**

**Elements of a successful Startup:** Startup Process – Create Management Team and Board of Directors – Evaluate market and Target Customers – Define your product or service – preparation of business plan -

specific problems and challenge in startup.

**Funding Issues and Remuneration Practices:** Funding Issues: Investment Criteria – Looking for seed cash – Seed, Startup, and subsequent Funding Rounds – Milestone Funding - Remuneration Practices for your Start –up: Salaries – Equity Ownership – Other compensation – Employment Contracts

**Stock Ownership & startup Employment Considerations:** Stock ownership: Risk- Reward Scale – Ownership Interest over time – Common and preferred stock – Authorized and outstanding shares – Acquiring stock – Restricted Stock Grants – Future Tax Liability on Restricted Shares - Compensation and startup Employment Considerations: Entrepreneurs Need Insurance – Do Fringe benefits – outsourcing your benefits work – Life Insurance – Health Insurance – Disability Insurance

**Protecting Intellectual Property:** Protecting your intellectual property: Copyrights - patents–Trade secrets – Trademarks - The Legal Form of your Startup: Corporation – Partnership – Limited Liability Company – Sole Proprietorship - – Making the startup decision: commitment – Leaving a current employer - stay fit.

**Startup Capital Requirements and Legal Environment**:

Identifying Startup capital Resource requirements - estimating Startup cash requirements - Develop financial assumptions- Constructing a Process Map - Positioning the venture in the value chain - Launch strategy to reduce risks- Startup financing metrics - The Legal Environment- Approval for New Ventures- Taxes or duties payable for new ventures.

**Text Book:**


1. James A. Swanson & Michael L. Baird, "Engineering your start-up: A Guide for the High-Tech Entrepreneur" 2nd ed, Professional Publications.inc
2. Donald F Kuratko, "Entrepreneurship – Theory, Process and Practice", 9th Edition, Cengage Learning 2014.


**Reference Books:**


1. Hisrich R D, Peters M P, "Entrepreneurship" 8th Edition, Tata McGraw-Hill, 2013.
2. Mathew J Manimala, "Enterprenuership theory at cross roads: paradigms and praxis" 2nd Edition Dream tech, 2005.
3. Rajeev Roy, „Entrepreneurship" 2nd Edition, Oxford University Press, 2011.
4. EDII "Faulty and External Experts – A Hand Book for New Entrepreneurs Publishers: Entrepreneurship Development", Institute of India, Ahmadabad, 1986.


**COURSE DESIGNERS:**


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| 34121O02 | INTELLECTUAL PROPERTY RIGHTS | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | OE-IE | 3 | 0 | 0 | 3 |

**PREAMBLE:**

The course is designed to introduce fundamental aspects of Intellectual property Rights to students who are going to play a major role in development and management of innovative projects in industries.

**PREREQUISITE:** Not Required

**COURSE OBJECTIVES:**

1. To introduce fundamental aspects of Intellectual property Rights.
2. To disseminate knowledge on patents and copyrights.
3. To disseminate knowledge on trademarks, Design and Geographical Indication (GI).
4. To disseminate knowledge on Plant Varieties, Layout Design Protection and create awareness about current trends in IPR.
5. To disseminate knowledge on Legislation of IPRs and Alternate Dispute Resolution.

**COURSE OUTCOMES:**

**After successful completion of the course, students will be able to**

| | |
|---|---|
| CO1: Understand the important of intellectual property rights | Understand |
| CO2: Apply for the patents | Apply |
| CO3: Understand and apply for the copyrights | Understand |
| CO4: Understand the important of trademarks | Apply |
| CO5: Appreciate the importance of IPR and its related issues | Understand |

**MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L | - | - | - | - | L | S | L | - | L | - | L | L | M | - |
| CO2 | L | S | S | M | M | L | - | - | - | - | - | L | M | L | - |
| CO3 | L | S | L | M | M | L | - | - | - | - | - | L | M | L | - |
| CO4 | L | S | S | S | M | L | - | - | - | - | - | L | L | L | - |
| CO5 | L | S | S | M | - | L | - | - | - | - | - | L | M | L | - |

**S- Strong; M-Medium; L-Low**

**SYLLABUS:**

**Unit 1 - Overview of Intellectual Property**

Introduction and the need for intellectual property right (IPR) - Kinds of Intellectual Property Rights: Patent, Copyright, Trade Mark, Design, Geographical Indication, Plant Varieties and Layout Design – Genetic Resources and Traditional Knowledge – Trade Secret - IPR in India : Genesis and development – IPR in abroad - Major International Instruments concerning Intellectual Property Rights: Paris Convention, 1883, the Berne Convention, 1886, the Universal Copyright Convention, 1952, the WIPO Convention,

1967,the Patent Co-operation Treaty, 1970, the TRIPS Agreement, 1994.

**Unit 2 - Patents & Copyright**

**Patents** - Elements of Patentability: Novelty, Non Obviousness (Inventive Steps), Industrial Application - Non - Patentable Subject Matter - Registration Procedure, Rights and Duties of Patentee, Assignment and license , Restoration of lapsed Patents, Surrender and Revocation of Patents, Infringement, Remedies & Penalties - Patent office and Appellate Board

**Copyright** - Nature of Copyright - Subject matter of copyright: original literary, dramatic, musical, artistic works; cinematograph films and sound recordings - Registration Procedure, Term of protection, Ownership of copyright, Assignment and license of copyright - Infringement, Remedies & Penalties – Related Rights - Distinction between related rights and copyrights

**Unit 3 – Trademarks, Design and Geographical Indication (GI)**

**Trademarks:** Concept of Trademarks - Different kinds of marks (brand names, logos, signatures, symbols, well known marks, certification marks and service marks) - Non Registrable Trademarks - Registration of Trademarks - Rights of holder and assignment and licensing of marks - Infringement, Remedies & Penalties - Trademarks registry and appellate board

**Design:** Meaning and concept of novel and original - Procedure for registration, effect of registration and term of protection

**Geographical Indication (GI):** Meaning, and difference between GI and trademarks - Procedure for registration, effect of registration and term of protection

**Unit 4 - Plant Varieties, Layout Design and Indian National Intellectual Property Policy**

**Plant Variety Protection:** Plant variety protection: meaning and benefit sharing and farmers' rights – Procedure for registration, effect of registration and term of protection.

**Layout Design Protection:** Layout Design protection: meaning – Procedure for registration, effect of registration and term of protection.

**Indian National Intellectual Property Policy:** India`s New National IP Policy, 2016 – Govt. of India step towards promoting IPR – Govt. Schemes in IPR – Career Opportunities in IP - IPR in current scenario with case studies

**UNIT – V: Legislation of IPRs and Alternate Dispute Resolution**

**Legislation of IPRs:** The Patent Act of India, Patent Amendment Act (2005), Design Act, Trademark Act, Geographical Indication Act, Bayh- Dole Act - Patent Ownership and Transfer, Patent Infringement, International Patent Law

**Alternate Dispute Resolution:** Alternate Dispute Resolution and Arbitration – ADR Initiatives –Reason for Choosing ADR – Advantages and Disadvantages of ADR – Assessment of ADR's – Litigation – Arbitration - Effective Mechanism for Business Issues.

**Text Books:**

1. Nithyananda, K V. (2019). Intellectual Property Rights: Protection and Management. India, IN: Cengage Learning India Private Limited.
2. Neeraj, P., & Khusdeep, D. (2014). Intellectual Property Rights. India, IN: PHI learning Private Limited.

**Reference Book**:

1. Ahuja, V K. (2017). Law relating to Intellectual Property Rights. India, IN: Lexis Nexis.

**COURSE DESIGNERS:**



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| **2** | A. Mani | Associate Professor | Management | mani@vmkvec.edu.in |

| | | | | | | |
|---|---|---|---|---|---|---|
| | **INNOVATION, PRODUCT DEVELOPMENT AND** | **Category** | **L** | **T** | **P** | **Credit** |
| **34121O04** | **COMMERCIALIZATION** | **OE-IE** | **3** | **0** | **0** | **3** |

**PREAMBLE**

commercialization of innovation and new products in fast-paced, high-tech markets and matchingtechnological innovation to market opportunities.

**PREREQUISITE -** Not Required

**COURSE OBJECTIVES**

| | |
|---|---|
| 1 | To make students understand multiple-perspective approach in organization to capture knowledge and creativity to develop successful products and services for Volatile, Uncertain, Complex and Ambiguous (VUCA) world. |
| 2 | Inculcate a disruptive thought process to generate ideas for concurrent and futuristic problems of society in general and markets in particular which focus on commercialization. |
| 3 | Improved understanding of organizational best practices to transform exciting technology into successful products and services. |
| 4 | Critically assess and evaluate innovation policies and practices in organizations especially from a cultural and leadership point of view. |
| 5 | Explain why innovation is essential to organizational strategy – especially in a global environment. |

**COURSE OUTCOMES**

On the successful completion of the course, students will be able to

| | |
|---|---|
| CO1: Understand the role of innovation in gaining and maintaining competitive advantage | Understand |
| CO2: Integrate the innovation basis and its role in decision making especially under uncertainty | Apply |
| CO3: Analyze business challenges involving innovation management | Apply |
| CO4: Having problem solving ability – solving social issues and business problems | Apply |
| CO5: Comprehend the different sources of innovation | Apply |

**MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES**

| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **P012** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | M | - | - | - | - | M | S | S | - | M | - | - |
| **CO2** | S | S | S | M | M | M | - | - | - | - | - | - |
| **CO3** | S | S | S | M | M | M | - | - | - | - | - | - |
| **CO4** | S | S | S | M | M | M | - | - | - | - | - | - |
| **CO5** | S | S | S | M | M | M | - | - | - | - | - | - |

S- Strong; M-Medium; L-Low

Pre-launch, during launch and Post launch preparations;

**SYLLABUS:**

**Introduction to Innovation Management** - Innovation – What it is? Why it Matters? - Innovation as a Core Business Process – system thinking for innovation – Framework for System Thinking - system thinking tools

**Creating New Products and Services** - Product and Service Innovation – Exploiting Open Innovation and Collaboration –The Concept of Design Thinking and Its Role within NPD and Innovation – framework for design thinking

**Capturing Innovation Outcome** - New Venture – Benefits of Innovation, and Learning from Innovation – Building Innovative Organization and Developing Innovation Strategy - Globalization for Innovations, Innovating for Emerging Economies and Role of National Governments in Innovation

**New Product Brand Development and Pricing Strategies** - Importance of Brand decisions and Brand identity development; Pricing of a new product, Pre-test Marketing

**The Product offer** Selecting Market opportunity and Designing new market offers-Concept Generation and Evaluation, Developing and Testing Physical offers - Pre-launch, during launch and Post launch preparations;

**Text Book:**

1. Joe Tidd, John Bessant (2013), Managing Innovation: Integrating Technological, Market and Organizational Change, 5th edition, Wiley.

**Reference Books:**

1. Schilling, M (2013), Strategic management of technological innovation, 4th edition, McGraw Hill Irwin.
2. Allan Afuah (2003), Innovation Management: Strategies, Implementation and Profits, 2nd edition, Oxford University Press.
3. Michael G. Luchs, Scott Swan, Abbie Griffin (2015), Design Thinking: New Product Development Essentials from the PDMA, Wiley-Blackwell.
4. John Boardman, Brian Sauser (2013), Systemic Thinking: Building Maps for Worlds of Systems, 1st edition, Wiley.
5. Rich Jolly (2015), Systems Thinking for Business: Capitalize on Structures Hidden in Plain Sight, Systems Solutions Press

**COURSE DESIGNERS:**

| S.No | Name of the faculty | Designation | Department | E-Mail Id |
|---|---|---|---|---|
| 1 | | | Management Studies | |
| 2 | | | Management Studies | |

| | | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| **34121O07** | **SOCIAL ENTREPRENEURSHIP** | **OE-IE** | **3** | **0** | **0** | **3** |

**PREAMBLE**

Social entrepreneurship involves the creativity, imagination and innovation often associated with entrepreneurship.

**PREREQUISITE -** Not Required

**COURSE OBJECTIVES**

| | |
|---|---|
| 1 | To provide students with a working knowledge of the concepts, opportunities and challenges of social entrepreneurship. |
| 2 | To demonstrate the role of social entrepreneurship in creating innovative responses to critical social needs (e.g., hunger, poverty, inner city education, global warming, etc). |
| 3 | To engage in a collaborative learning process to develop a better understanding of the context and domain of social entrepreneurship. |
| 4 | To help prepare you personally and professionally for meaningful employment by reflecting on the issues of social entrepreneurship. |
| 5 | Engage with a diverse group of social entrepreneurs. |

**COURSE OUTCOMES**

On the successful completion of the course, students will be able to

| | |
|---|---|
| CO1: Explain the concept social entrepreneurship and distinguish its elements from across a continuum of organizational structures from traditional nonprofits to social enterprises to traditional for profits | Understand |
| CO2: Analyze the operations of a human service organization using social entrepreneurial orientation and industry assessment and diagnostic tools. | Apply |
| CO3: Apply the Social Business Model Canvas and lean startup methods for planning, developing, testing, launching and evaluating social change ventures. | Apply |
| CO4: Compare funding options for social change ventures. | Apply |
| CO5: The outcomes of social entrepreneurship are focused on addressing persistent social problems particularly to those who are marginalized or poor. | Apply |

**MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES**

| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO 8** | **PO9** | **PO10** | **PO11** | **P012** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | M | - | - | - | - | M | S | S | - | M | - | - |
| **CO2** | S | S | S | M | M | M | - | - | - | - | - | - |
| **CO3** | S | S | S | M | M | M | - | - | - | - | - | - |
| **CO4** | S | S | S | M | M | M | - | - | - | - | - | - |
| **CO5** | S | S | S | M | M | M | - | - | - | - | - | - |

**S- Strong; M-Medium; L-Low**

**SYLLABUS:**

**Social entrepreneurship** – dimensions of social entrepreneurship – social change theories – equilibrium and

complexity – theory of social emergence

**Social entrepreneurs** – mindset, characteristics and competencies – developing a social venture sustainability model – feasibility study – planning – marketing challenges for social ventures

**Microfinance**– MFI (Micro Finance Institutions) in India – regulatory framework of MFI – Banks and MFIs – sustainability of MFI – Self Help Groups– successful MFI models

**Angel Investors & Venture Capitalists** – difference – valuation of firm – negotiating the funding agreement – pitching idea to the investor

**Corporate entrepreneurship** – behavioral aspects – identifying, evaluating and selecting the opportunity – venture– location – organization – control – developing business plan – funding the venture – implementing corporate venturing in organization.

**Text Book:**

1. Constant Beugré, Social Entrepreneurship: Managing the Creation of Social Value, Routledge, 2016.

2. Björn Bjerke, Mathias Karlsson, Social Entrepreneurship: To Act as If and Make a Difference, Edward Elgar Publishing, 2013.

**Reference Books:**

1. Wei-Skillern, J., Austin, J., Leonard, H., & Stevenson, H. (2007). Entrepreneurship in the Social Sector (ESS). Sage Publications.
2. Janus, K. K. (2017). Social startup success. New York, NY: Lifelong Books.
3. Dancin, T. M., Dancin, P. A., & Tracey, P. (2011). Social entrepreneurship: A critique and future directions.
4. Alex Nicholls, Social Entrepreneurship: New Models of Sustainable Social Change, OUP Oxford, 2008.
5. David Bornstein, Susan Davis, Social Entrepreneurship: What Everyone Needs to Know, Oxford University Press, 2010.

**COURSE DESIGNERS:**

| S.No | Name of the faculty | Designation | Department | E-Mail Id |
|---|---|---|---|---|
| 1 | | | Management Studies | |
| 2 | | | Management Studies | |

| | | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| 34121O06 | NEW VENTURE PLANNING AND MANAGEMENT | OE-IE | 3 | 0 | 0 | 3 |

**PREAMBLE**

Contemporary methods and best practices for the entrepreneur to plan, launch, and operate a newventure and creation of a business plan

**PREREQUISITE -** Not Required

**COURSE OBJECTIVES**

| | |
|---|---|
| 1 | An opportunity for self-analysis, and how this relates to success in an entrepreneurial environment. |
| 2 | Information and understanding necessary to launch and grow an entrepreneurial venture. |
| 3 | A realistic preview of owning and operating an entrepreneurial venture. |
| 4 | An entrepreneur must understand the diversity, emotional involvement, and workload necessary to succeed. |
| 5 | The opportunity to develop a business plan. |

**COURSE OUTCOMES**

On the successful completion of the course, students will be able to

| | |
|---|---|
| CO1: Explain the concept of new venture planning, objectives and functions and its components. | Understand |
| CO2: Analyze the business plan issues and remuneration practices in startups business. | Apply |
| CO3: Explore an entrepreneurial idea to the point where you can intelligently and decide whether to "go for it" or not. | Apply |
| CO4: Compare and contrast the different forms entrepreneurial environment in terms of their key differences and similarities. | Apply |
| CO5: Explore the business plan and business model canvas for your idea. | Apply |

**MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | P012 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | M | - | - | - | - | M | S | S | - | M | - | - |
| **CO2** | S | S | S | M | M | M | - | - | - | - | - | - |
| **CO3** | S | S | S | M | M | M | - | - | - | - | - | - |
| **CO4** | S | S | S | M | M | M | - | - | - | - | - | - |
| **CO5** | S | S | S | M | M | M | - | - | - | - | - | - |

**S- Strong; M-Medium; L-Low**

**SYLLABUS:**

**STARTING NEW VENTURE:** Opportunity identification - Search for new ideas - Sources of innovative ideas - Techniques for generating ideas - Entrepreneurial imagination &creativity - The role of creative thinking - Developing your creativity - Impediments to creativity.

**METHODS TO INITIATE VENTURES:** Pathways to new venture - Creating new ventures - Acquiring an existing venture - Advantages of acquiring an established venture - Examination of key issues – Franchising -

How a franchise works and franchise law - Evaluating franchising opportunity.

**THE SEARCH FOR ENTREPRENEURIAL CAPITAL:** The venture capital market - Criteria for evaluating new venture proposals - Evaluating venture capitalists - stage of venture capital financing - Alternate sources of financing for Indian entrepreneurs - Bank funding - State financial corporations - Business incubators and facilitators - Informal risk capital - Angel investors.

**THE MARKETING ASPECTS OF NEW VENTURE:** Developing a marketing plan - Customer analysis - Sales analysis - Competition analysis - Market research - Sales forecasting - Sales Evaluation - Pricing decisions.

**BUSINESS PLAN PREPARATION FOR NEW VENTURE:** Business plan concept - Pitfalls to avoid in business plan - Developing a well conceived business plan - Elements of a business plan - Harvest strategy - Form of business organization - Legal acts governing businesses in India .

**Text Book:**

1. The Successful Business Plan, Secrets & Strategies, Rhonda Abrams, Published by The Planning Shop Titan, Ron Chernow, Random House
2. Osterwalder, A. and Pigneur, Y. (2010). Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers, Hoboken, NJ: John Wiley & Sons

**Reference Books:**

1. Blackwell, E. (2011). How to Prepare a Business Plan: Create Your Strategy; Forecast Your Finances; Produce That Persuasive Plan. Kogan Page Publishers.
2. Levi, D. (2014). Group Dynamics for Teams. Sage Publications, Inc. Thousand Oaks.
3. Rajeev Roy, „Entrepreneurship" 2nd Edition, Oxford University Press, 2011.
4. Business Model Generation by Osterwalder and Pigneur.

**COURSE DESIGNERS:**

| S.No | Name of the faculty | Designation | Department | E-Mail Id |
|---|---|---|---|---|
| 1 | | | Management Studies | |
| 2 | | | Management Studies | |

| | FINANCE AND ACCOUNTING | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| 34121O03 | FOR ENGINEERS | OE-IE | 3 | 0 | 0 | 3 |

**PREAMBLE:**

Engineers are in a position to do Decision Making during every activity in the industry. The activities ranging from Operation to Non-Operation during the routine functions of the organization. Especially, Finance and Accounting also becomes the part of responsibility of every engineer to do data analysis activities. His interpretation through data analysis and reporting in every transaction helps the organization to do decision making to run the organization effectively and efficiently. Finance and Accounting Practices enable the engineers to handle the resources to do cost and Financial decisions with optimum resources for the betterment of the organization.

**PREREQUISITE:** Not Required

**COURSE OBJECTIVES:**

1. To understand the concepts and conventions to prepare Income Statement, and Balance Sheet.
2. To apply the various methods to claim depreciation.
3. To practice fundamental investment decision through capital budgeting techniques.
4. To analyze cost-volume profit analysis for decision making and analyze standard costing techniques.
5. To estimate the working capital requirements for day-to-day activities and handling inventories with economic ordering quantities.

**COURSE OUTCOMES:**

After successful completion of the course, students will be able to

| | |
|---|---|
| CO1: Understand the importance of recording, book keeping and reporting of the business transaction. | Understand |
| CO2: Identify and Apply suitable method for charging depreciation on fixed assets. | Apply |
| CO3: Analyze the various methods of capital budgeting techniques for investment decision. | Analyze |
| CO4: Justify the scope of cost-volume-profit analysis, standard costing, and marginal costing techniques for decision making. | Analyze |
| CO5: Estimation of working capital requirements of the organization. | Evaluate |

**MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES**

| Cos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | - | - | M | L | S | M | - | S | - | M | M | L | M | L | M |
| CO2 | L | - | - | L | M | - | L | L | - | - | L | M | L | L | - |
| CO3 | - | M | - | M | L | - | - | L | S | M | - | L | - | L | M |
| CO4 | L | L | - | S | - | - | L | - | - | L | M | L | M | L | M |
| CO5 | L | - | L | S | L | - | - | M | M | L | - | L | M | M | - |

**S- Strong; M-Medium; L-Low**

**SYLLABUS:**

**Introduction:** Business Environment – Book Keeping and Accounting – Accounting Concepts and Conventions – Double entry system - Preparation of journal, ledger and Trial balance – Final Accounts.

**Deprecation:** Meaning – Causes - Methods of Calculating Depreciation: Straight Line Method, Diminishing Balance Method and Annuity Method.

**Capital Budgeting Decisions:** Meaning – Nature & Importance of Investment Decisions – Types - Financial statement analysis and interpretation - Types of Analysis - Objectives - Tools of Analysis - Ratio Analysis: Objectives, Uses and Limitations - Classification of Ratios: Liquidity, Profitability, Financial and Turnover Ratios - Funds Flow Analysis and Cash Flow Analysis: Sources and Uses of Funds, Preparation of Funds Flow statement, Uses and Limitations: Pay Back Period – Accounting Rate of Return – NPV – IRR - Profitability Index.

**Marginal Costing:** Marginal Cost - Breakeven Analysis - Cost Volume Profit Relationship - Applications of Standard and marginal Costing Techniques.

**Working Capital Management:** – Types of Working Capital – Operating Cycle – Determinants of Working Capital - Receivables Management – Inventory Management – Need for holding inventories – Objectives – Inventory Management Techniques: EOQ & Reorder point – ABC Analysis - Cash Management – Motives for holding cash.

**Text Book**


1. Kesavan, C. Elenchezhian, and T. Sunder Selwyan, "Engineering Economics and Financial Accounting", Firewall Media, 2005.
2. Kasi Reddy .M and Saraswathi .S, "Managerial Economics and Financial Accounting", PHI Learning Pvt., Ltd. 2007.


**Reference Book**


1. Periyasamy .P, "A Textbook of Financial, Cost and Management Accounting", Himalaya Publishing House, 2010.
2. Palanivelu V.R., "Accounting for Managers", Lakshmi Publications, 2005.
1. Mark S Bettner, Susan Haka, Jan Williams, Joseph V Carcello, "Financial and Management Accounting", Mc-Graw-Hill Education, 2017


**COURSE DESIGNERS:**


| S.No | Name of the Faculty | Designation | Department | Mail ID |
|---|---|---|---|---|
| 1 | M.Manickam | Associate Professor | Management Studies | manickam@vmkec.edu.in |
| 2 | Dr. Rajeshkumar | Assistant Professor | Management Studies | rajesh.mba@avit.ac.in |

# OPEN ELECTIVE-
# EMERGING AREA
# COURSES

| | | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| **35321O01** | **BIOSENSORS AND TRANSDUCERS** | **OE-EA** | **3** | **0** | **0** | **3** |

**PREAMBLE**

The course is designed to make the student acquire conceptual knowledge of the transducers and biological components used for the detection of an analyte. The relation between sensor concepts and biological concepts is highlighted. The principles of biosensors that are currently deployed in the clinical side are introduced.

**PREREQUISITE –** Nil

**COURSE OBJECTIVES**

| | |
|---|---|
| 1 | To use the basic concepts of transducers, electrodes and its classification. |
| 2 | To discuss the various types of electrodes. |
| 3 | To determine the recording of biological components. |
| 4 | To employ the knowledge in electrochemical and optical biosensors. |
| 5 | To outline the various biological components using biosensors. |

**COURSE OUTCOMES**

On the successful completion of the course, students will be able to

| | |
|---|---|
| **CO1.** Describe the working principles of transducers. | Understand |
| **CO2.** Explain the various types of electrodes. | Understand |
| **CO3.** Utilize various FET sensors for recording of biological components. | Apply |
| **CO4.** Distinguish various biosensors like electrochemical and optical biosensors. | Analyze |
| **CO5.** Analyze the biological components using biosensors in various applications. | Analyze |

**MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES**

| COS | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | M | L | -- | M | -- | M | -- | -- | L | -- | -- | M | -- | M | -- |
| CO2 | M | L | -- | M | -- | M | -- | -- | L | -- | -- | M | -- | M | -- |
| CO3 | S | M | L | S | -- | S | M | M | M | -- | -- | M | M | M | M |
| CO4 | S | S | L | S | -- | S | M | M | S | -- | -- | M | M | M | S |
| CO5 | S | S | L | S | -- | S | M | M | S | -- | -- | S | M | M | S |

**S- Strong; M-Medium; L-Low**

**SYLLABUS**

**INTRODUCTION:** General measurement system, Transducers and its classification, Resistance transducers, capacitive transducer, Inductive transducer.

**TRANSDUCERS:**

Temperature transducers, piezoelectric transducers, Piezo resistive transducers, photoelectric transducers.

**BIO POTENTIAL ELECTRODES:**
Half cell potential, Types of Electrodes –Micro electrodes, Depth and needle electrodes, Surface electrodes, Chemical electrodes, Catheter type electrodes, stimulation electrodes, electrode paste, electrode material.

**BIOSENSORS:**
Biological elements, Immobilization of biological components, Chemical Biosensor-ISFET, IMFET, electrochemical sensor, chemical fibro sensors.

**APPLICATIONS OF BIOSENSORS:**
Bananatrode, blood glucose sensors, non invasive blood gas monitoring, UREASE biosensor, Fermentation process control, Environmental monitoring, Medical applications.

**TEXT BOOKS:**


1. H.S. Kalsi, **"Electronic Instrumentation & Measurement"**, Tata McGraw HILL, 1995.
2. Brain R Eggins, **"Biosensors: An Introduction",** John Wiley Publication, 1997.
3. Shakthi chatterjee, **"Biomedical Instrumentation"**, Cengage Learning, 2013.
4. John G Webster, **"Medical Instrumentation: Application and design"**, John Wiley Publications, 2001.


**REFERENCES:**


1. K.Sawhney, **"A course in Electronic Measurements and Instruments"**, Dhapat Rai & sons, 1991.
2. John P Bentley, **"Principles of Measurement Systems"**, 3rd Edition, Pearson Education Asia, (2000 Indian reprint).
3. Geddes and Baker, **"Principles of Applied Biomedical Instrumentation"**, 3rd Edition, John Wiley Publications, 2008.


**COURSE DESIGNERS**


| S.No. | Name of the Faculty | Designation | Department | Mail ID |
|---|---|---|---|---|
| **1** | Dr.L.K.Hema | Professor & Head | BME | hemalk@avit.ac.in |
| **2** | Dr.N.Babu | Professor | BME | babu@vmkvec.edu.in |
| **3** | Mr.V.Prabhakaran | Assistant Professor (Gr-II) | BME | Prabhakaran.bme@avit.ac.in |
| **4** | Mrs.S.Vaishnodevi | Assistant Professor | BME | vaishnodevi@vmkvec.edu.in |

| | | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| 35321O03 | PRINCIPLES OF BIOMEDICAL INSTRUMENTATION | OE-EA | 3 | 0 | 0 | 3 |

**PREAMBLE**

To enable the students to develop knowledge of principles, design and applications of the Biomedical Instruments.

**PREREQUISITE – NIL**

**COURSE OBJECTIVES**

| | |
|---|---|
| 1 | To know about bioelectric signals, electrodes and its types. |
| 2 | To know the various Biopotential recording methods. |
| 3 | To study about patient monitoring concept and various Physiological measurements methods. |
| 4 | To study the principle of operation blood flow meter, blood cells counter. |
| 5 | To study about bio chemical measurements and details the concept of biotelemetry and patient safety. |

**COURSE OUTCOMES**

On the successful completion of the course, students will be able to

| | |
|---|---|
| **CO1.** Explain the different Bio signal or biopotential. | Understand |
| **CO2.** Discuss the working principles of diagnostic and therapeutic equipments. | Understand |
| **CO3.** Examine the various instruments like as ECG, EMG, EEG, X-ray machine. | Apply |
| **CO4.** Illustrate medical instruments based on principles and application used in hospital. | Analyze |
| **CO5.** Analyze and calibrate fundamental biomedical instrumentation used in hospital. | Analyze |

**MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES**

| COS | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | M | -- | -- | - | -- | -- | -- | -- | -- | -- | -- | L | M | -- | -- |
| CO2 | M | -- | -- | -- | -- | -- | -- | -- | L | -- | -- | L | M | -- | -- |
| CO3 | S | S | M | S | M | -- | -- | -- | M | -- | -- | M | M | M | S |
| CO4 | S | M | M | M | L | -- | -- | L | S | L | -- | S | M | S | S |
| CO5 | S | S | M | M | L | M | -- | L | S | L | -- | S | M | S | S |

**S- Strong; M-Medium; L-Low**

**SYLLABUS**

**BIOELECTRIC SIGNALS AND ELECTRODES**

Basic medical instrumentation system, Origin of Bioelectric Potential, Recording electrodes – Electrode Tissue interface, Electrolyte – skin interface, Polarization, Skin contact impedance, motion artifacts. Electrodes – Silver – silver chloride electrodes, electrodes for ECG, electrodes for EEG, electrodes for EMG, Electrical conductivity of electrode jellies and creams, Microelectrodes.

**BIO AMPLIFIER AND BIOMEDICAL RECORDERS**

Bioamplifier, Need for Bioamplifier, Differential amplifier, Instrumentation amplifier, Chopper amplifier, Isolation Amplifier, ECG, EEG, EMG, PCG, EOG, ERG lead system and recording methods, typical waveform.

**PATIENT MONITORING SYSTEM AND NON ELECTRICAL PARAMETERS MEASUREMENTS**

System concepts of patient monitoring system, Bedside patient monitoring system, central monitors, Blood pressure measurement, Measurement of temperature, Respiration rate measurement, cardiac output measurement, Measurement of pulse rate, Plethysmography technique.

**BLOOD FLOW METERS, BLOOD CELL COUNTERS**

Electromagnetic blood flow meter, ultrasonic blood flow meter, Laser Doppler blood flow meter, Types of blood cells, Methods of cell counting, coulter counters, automatic recognition and differential counting.

**BIO- CHEMICAL MEASUREMENTS AND BIOTELEMETRY AND PATIENT SAFETY**

Ph, Pc02, p02, Phco3 and electrophoresis, colorimeter, spectrophotometer, flame photometer, auto-analyser. Biotelemetry-wireless telemetry, single channel telemetry, multichannel telemetry, multi patient telemetry.

**TEXT BOOKS:**


1. Khandpur R.S, **"Hand-book of Biomedical Instrumentation"**, Tata McGraw Hill, 2nd Edition, 2003.
2. Leslie Cromwell, Fred Weibell J, Erich Pfeiffer. A, **"Biomedical Instrumentation and Measurements"**, Prentice-Hall India, 2nd Edition, 1997.


**REFERENCES:**


1. John G. Webster, **"Medical Instrumentation application and design"**, John Wiley, 3rd Edition, 1997.
2. Carr, Joseph J, Brown, John.M, **"Introduction to Biomedical equipment technology"**, John Wiley and sons, New York, 4th Edition, 1997.


**COURSE DESIGNERS**


| S.No. | Name of the Faculty | Designation | Department | Mail ID |
|---|---|---|---|---|
| **1** | Dr. N.Babu | Professor | BME | babu@vmkvec.edu.in |
| **2** | Mr.V.Prabhakaran | Assistant Professor (Gr-II) | BME | prabhakaran.bme@avit.ac.in |
| **3** | Mrs. S.Vaishnodevi | Assistant Professor | BME | vaishnodevi@vmkvec.edu.in |
| **4** | Ms. Lakshmi Shree | Assistant Professor | BME | lakshmishree.bme@avit.ac.in |

| | | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| 38121O02 | INTRODUCTION TO BIOFUELS | OE-EA | 3 | 0 | 0 | 3 |

**PREAMBLE**

This course will provide an overview of existing energy utilization, production and infrastructure. We will also cover the consequences of our energy choices on the environment. The topics covered will include the chemistry of biofuels, the biology of important feedstocks, the biochemical, genetic and molecular approaches being developed to advance the next generation of biofuels and the economical and global impacts of biofuel production.

**PREREQUISITE –** NIL

**COURSE OBJECTIVES**

| | |
|---|---|
| 1 | To understand the different types and differences between existing energy resources. |
| 2 | To understand the improcurement, utilization and their impacts on society and environment. |
| 3 | To gain knowledge about the existing different biofuels and the methods of production from different sources. |
| 4 | To introduce the techonologies involved in the production, characterization of biofuels. |
| 5 | To impacrt the knowledge and applications of biofuel in various sectors and their beneficial aspects to the society. |

**COURSE OUTCOMES**

After the successful completion of the course, learner will be able to

| | |
|---|---|
| CO1. Understand the existing and emerging biomass to energy technologies | Remember |
| CO2. Understand the concept of 1st generation, 2nd generation and advance biofuels | Understand |
| CO3. Appraise the techno-economic analyses of biofuel conversion technologies | Understand |
| CO4. To articulate the concept of a biorefinery system and be able to develop major unit operations of an integrated biorefinery | Apply |
| CO5. Illustrate the environmental implications | Apply |

**MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES**

| COS | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | - | L | - | M | - | S | L | - | - | - | - | S | - | L |
| CO2 | - | S | S | - | M | - | L | - | - | - | - | - | - | S | L |
| CO3 | S | M | - | M | - | M | - | L | L | - | - | - | S | - | L |
| CO4 | - | S | M | - | M | L | L | - | - | - | - | - | - | S | M |
| CO5 | - | - | - | - | - | - | - | S | M | - | - | - | - | - | L |

S- Strong; M-Medium; L-Low

**SYLLABUS**

**OVERVIEW OF BIOFUELS**

Generation of biofuels − Development of biological conversion technologies − Integration of biofuels into biorefineries − Energy security and supply − Environmental sustainability of biofuels − Economic sustainability of biofuels.

**BIODIESEL**

Biodiesel − Microorganisms and raw materials used for microbial Oil production − Treatment of the feedstocks prior to production of the Biodiesel − Current technologies of biodiesel production − Purification of biodiesel; Industrial production of biodiesel − Biodiesel production from single cell oil.

**BIOETHANOL**

Bioethanol – Properties – Feedstocks − Process technology − Pilot plant for ethanol production from lignocellulosic feedstock − Environmental aspects of ethanol as a biofuel.

**BIOMETHANE AND BIOHYDROGEN**

Biomethanol − Principles, materials and feedstocks − Process technologies and techniques − Advantages and limitations − Biological hydrogen production methods − Fermentative hydrogen production − Hydrogen economy − Advantages and limitations.

**OTHER BIOFUELS**

Biobutanol production − Principles, materials and feedstocks − Process technologies – Biopropanol – Bioglycerol − Production of bio-oils via catalytic pyrolysis − Life-Cycle environmental impacts of biofuels and Co-products.

**TEXT BOOKS:**

**1.** Luque, R., Campelo, J.and Clark, J. Handbook of biofuels production, Woodhead Publishing Limited 2011 2. Gupta, V, K. and Tuohy, M, G. Biofuel Technologies, Springer, 2013 3. Moheimani, N. R., Boer, M, P, M, K, Parisa A. and Bahri, Biofuel and Biorefinery Technologies, Volume 2, Springer, 2015

**REFERENCES:**

1. Eckert, C, A. and Trinh, C, T. Biotechnology for Biofuel Production and Optimization, Elsevier, 2016 2. Bernardes, M, A, D, S. Biofuel production – recent developments and prospects, InTech, 2011

**COURSE DESIGNERS**

| S.No | Name of the Faculty | Designation | Department | Mail ID |
|---|---|---|---|---|
| **1** | Dr.A.Balachandar | Assistant Professor – Gr-II | Biotechnology | balachandar.biotech@avit.ac.in |
| **2** | Dr.M.Sridevi | Professor & Head | Biotechnology | sridevi@vmkvec.edu.in |

| | | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| 38121O01 | FOOD AND NUTRITION TECHNOLOGY | OE-EA | 3 | 0 | 0 | 3 |

**PREAMBLE**

The course aims to enable the students to understand the physicochemical, nutritional, microbiological and sensory aspects, To familiarize the students about the processing and preservation techniques. To emphasize the importance of food safety, food quality, food plant sanitation, food laws and regulations, food engineering and packaging in food industry.

**PREREQUISITE** – NIL

**COURSE OBJECTIVES**

| | |
|---|---|
| 1 | Understand the tradition food processing techniques and the basics concept of food biochemistry. |
| 2 | Demonstrate the product development technique, quality and contaminant check. |
| 3 | To articulate their technical knowledge for industrial purpose. |
| 4 | Describe national food laws and standards. |
| 5 | Laws and qualities of standard for food products. |

**COURSE OUTCOMES**

After the successful completion of the course, learner will be able to

| | |
|---|---|
| CO1: Recall the processing techniques practiced in olden days and the biological process | Remember |
| CO2. Illustrate the methods for animal product development, quality control and also screen the contaminant | Understand |
| CO3.Transfer the techniques in scaling up for industrial needs | Apply |
| CO4. Interpret and Troubleshoot instruments to maintain accuracy | Apply |
| CO5. Develop standards for food additives | Apply |

**MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES**

| COS | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CO2 | - | M | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CO3 | L | M | S | M | L | - | - | - | - | - | - | - | M | L | - |
| CO4 | M | S | S | M | L | - | - | - | - | - | - | - | S | S | - |
| CO5 | - | S | S | M | M | - | - | - | - | - | - | M | L | S | - |

S- Strong; M-Medium; L-Low

**SYLLABUS**

**INTRODUCTION TO FOOD BIOTECHNOLOGY**

Introduction, History and scope of food Biotechnology, development and prospects of biotechnology in animal products, ancient and traditional food processing techniques; Biochemical and metabolic pathways of biological systems used in food production.

**METHODS IN FOOD BIOTECHNOLOGY:** Role of biotechnology in productivity of livestock, Modern biotechnological methods and processes in animal product development, chemical and physical factors required for growing microbial cultures in nutritive substrate; Meat species identification, Quality control, Screening products for contaminants

**BIOTECHNOLOGY METHODS IN FOOD PROCESSING:**

Use of biotechnology in the production of food additives, use of biotechnological tools for the processing and preservation and foods of animal origin, use of biotechnology improved enzymes in food processing industry, Basic principles of the industrial use of bio-reactions for production of biomass-upstream and downstream processing application of microorganisms as starter cultures in meat industry, microbial production of food ingredients; Biosensors and novel tools and their application in food science.

**HURDLE TECHNOLOGY:**

Principles and applications, Hurdle effect in fermented foods, shelf stable products, intermediate moisture foods, application of hurdle technology

**FOOD SAFETY & SECURITY**:

Consumer concerns about risks and values, biotechnology & food safety, Ethical issues concerning GM foods; testing for GMOs; current guidelines for the production, release and movement of GMOs; Future and applications of food biotechnology in India.

**TEXT BOOKS:**

1. Potter, Norman. M. Food Science, 5th Ed. Springer US

2. Manay, S.; Shadakshara Swamy, M., (2004). Foods: Facts and Principles, 4 th Ed. New Age Publishers.

3. B. Srilakshmi., (2002) Food Science, New Age Publishers.

**REFERENCES:**

**1.** Meyer, (2004). Food Chemistry. New Age

**2.** Deman JM. (1990) Principles of Food Chemistry. 2 nd Ed. Van Nostrand Reinhold, NY

**3.** Ramaswamy H and Marcott M. Food Processing Principles and Applications. CRC Press

**COURSE DESIGNERS**

| | | | | |
|---|---|---|---|---|
| | | | | |

| S. No. | Name of the Faculty | Designation | Department | Mail ID |
|---|---|---|---|---|
| **1** | Dr.A.Nirmala | Assistant Professor GII | Biotechnology | nirmalabt@avit.ac,in |
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| | | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| 34221O01 | DISASTER RISK MANAGEMENT | OE-EA | 3 | 0 | 0 | 3 |

**Preamble**

This course deals with the various disasters and to expose the students about the measures, its effect against built structures, and Hazard Assessment procedure in India. This course also deals with the methods of mitigating various hazards such that their impact on communities is reduced.

**Prerequisite**

NIL

**Course Objectives**

| | |
|---|---|
| 1 | To Understand basic concepts in Disaster Management. |
| 2 | To Understand Definitions and Terminologies used in Disaster Management. |
| 3 | To Understand the Challenges posed by Disasters. |
| 4 | To understand Impacts of Disasters. |

**COURSE OUTCOMES**

On the successful completion of the course, students will be able to

| | |
|---|---|
| CO1. Understand the various types of disaster viz Hydrological, Coastal and Marine Disasters, Atmospheric Disasters, Geological, Mass Movement and Land Disasters, Wind and Water Driven Disasters. | Understand |
| CO2. Identify the potential deficiencies of existing buildings for Earthquake disaster and suggest suitable remedial measures. | Understand |
| CO3.Derive the guide lines for the precautionary measures and rehabilitation measures for Earthquake disaster. | Apply |
| CO4. Derive the protection measures against floods, cyclone, land slides | Apply |
| CO5. Understand the effects of disasters on built structures in India | Understand |

**MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES**

| COS | PO 1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | M | - | - | L | - | - | - | - | - | - | - | - | L | - | - |
| CO2 | M | M | L | L | - | M | - | - | - | - | - | - | L | - | - |
| CO3 | S | M | S | M | - | L | - | M | - | - | - | - | M | L | - |
| CO4 | S | M | S | - | L | - | - | - | - | - | - | - | M | L | - |
| CO5 | L | L | - | L | - | - | - | - | - | - | - | - | L | - | - |

S- Strong; M-Medium; L-Low

## SYLLABUS

**INTRODUCTION:** Concept of disaster; Different approaches; Concept of Risk; Levels of disasters; Disaster phenomena and events (Global, national and regional); Disasters: Types of disasters – Earthquake, Landslide, Flood, Drought, Fire etcDos and Don'ts during various types of Disasters.

**RISK ASSESSMENT AND VULNERABILITY ANALYSIS:** Response time, frequency and forewarning levels of different hazards; Characteristics and damage potential of natural hazards; hazard assessment ;Dimensions of vulnerability factors; vulnerability assessment; Vulnerability and disaster risk; Vulnerabilities to flood and earthquake hazards

**DISASTER MANAGEMENT MECHANISM:** Concepts of risk management and crisis management ; Disaster management cycle ;Response and Recovery ; Development, Prevention, Mitigation and Preparedness; Planning for relief, Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster

**DISASTER RESPONSE:** Mass media and disaster management; Disaster Response Plan; Communication, Participation, and Activation of Emergency Preparedness Plan; Logistics Management; Psychological Response; Trauma and Stress Management; Rumour and Panic Management ;Minimum Standards of Relief; Managing Relief; Funding.

**DISASTER MANAGEMENT IN INDIA:** Strategies for disaster management planning; Steps for formulating a disaster risk reduction plan; Disaster management Act and Policy in India; Organisational structure for disaster management in India; Preparation of state and district disaster management plans, , Structural- nonstructural measures, Roles and responsibilities of- community, Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stake- holders

**TEXT BOOKS:**


1. Singhal J.P. "Disaster Management", Laxmi Publications, 2010. ISBN-10: 9380386427 ISBN-13: 978-9380386423
2. Tushar Bhattacharya, "Disaster Science and Management", McGraw Hill India Education Pvt. Ltd., 2012. ISBN-10: 1259007367, ISBN-13: 978-1259007361]
3. Gupta Anil K, Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi, 2011
4. Kapur Anu Vulnerable India: A Geographical Study of Disasters, IIAS and Sage Publishers, New Delhi, 2010.


**REFERENCES:**


1. Abarquez I. & Murshed Z. Community Based Disaster Risk Management: Field Practitioner's Handbook, ADPC, Bangkok, 2004.
2. Goudie, A. Geomorphological Techniques, Unwin Hyman, London 1990.
3. Goswami, S. C. Remote Sensing Application in North East India, Purbanchal Prakesh, Guwahati, 1997.
4. Manual on Natural Disaster Management in India, NCDM, New Delhi, 2001.
5. Disaster Management in India, Ministry of Home Affairs, Government of India, New Delhi, 2011.
6. National Policy on Disaster Management, NDMA, New Delhi, 2009.
7. Disaster Management Act. (2005), Ministry of Home Affairs, Government of India, New Delhi, 2005.

**Course Designers**

| S.No | Name of the Faculty | Designation | Department | Mail ID |
|---|---|---|---|---|
| **1** | Ms.S.Ispara Xavier | Assistant Professor | Civil / AVIT | isparaxavier.civil@avit.ac.in |

| | | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| **34221O02** | **MUNICIPAL SOLID WASTE MANAGEMENT** | **OE-EA** | **3** | **0** | **0** | **3** |

**Preamble**

Structure is an arrangement and organization of interrelated elements in a material object or system, or the object or system so organized. Material structures include man-made objects such as buildings and machines and natural objects such as biological organisms, minerals and chemicals.

**Prerequisite**

Nil

**Course Objectives**

| | |
|---|---|
| 1. | The on-site/off-site processing of the same and the disposal methods. |
| 2. | The student is expected to know about the various effects and disposal options for the municipal solid waste. |
| 3. | The collection and supply of water. |
| 4. | The offsite processing involved in site. |

**Course Outcomes**

On the successful completion of the course, students will be able to

| | |
|---|---|
| CO1. To know about the types of waste & Sources | Analyze |
| CO2 . To Study the on site Storage & Processing | Apply |
| CO3. To study about the collection & transfer the waste | Apply |
| CO4. To Study the process of off site processing | Apply |
| CO5. To know about the solid waste disposal | Apply |

**Mapping with Programme Outcomes and Programme Specific Outcomes**

| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | **S** | **M** | **L** | - | - | - | - | - | - | - | - | - | - | - | **S** |
| CO2 | **S** | **M** | **L** | **S** | - | - | - | - | - | - | - | - | - | **M** | **S** |
| CO3 | **S** | **M** | **M** | **S** | - | - | - | - | - | - | - | - | - | **M** | **S** |
| CO4 | **S** | **M** | **M** | **M** | - | - | - | - | - | - | - | - | - | **M** | **S** |
| CO5 | **S** | **M** | **M** | - | - | - | - | - | - | - | - | **L** | - | - | **S** |

**S- Strong; M-Medium; L-Low**

**SYLLABUS**

**SOURCES AND TYPES OF MUNICIPAL SOLID WASTES**

Sources and types of solid wastes-major legislation-monitoring responsibilities-Effects of disposal of solid wastes - Quantity – factors affecting generation of solid wastes; characteristics – methods of sampling and characterization– public health effects. Principle of solid waste management – social & economic aspects; Public awareness; Role of NGOs; Legislation.

**ON-SITE STORAGE & PROCESSING**

On-site storage methods – materials used for containers – on-site segregation of solid wastes – public health & economic aspects of storage – options under Indian conditions – Critical Evaluation of Options.

**COLLECTION AND TRANSFER**

Methods of Collection – types of vehicles – Manpower requirement – collection routes; transfer stations – selection of location, Anaerobic digestion, RDF and Incineration and co-generation of energy using waste, Pyrolysis of solid Waste operation & maintenance; options under Indian conditions.

**OFF-SITE PROCESSING**

Processing techniques and Equipment; Resource recovery from solid wastes – composting, incineration, Pyrolysis - options under Indian conditions- cradle to grave management concept, Prevailing laws of hazardous waste management- Risk assessment.

**DISPOSAL**

Dumping of solid waste; sanitary landfills – site selection, design and operation of sanitary landfills – Leachate collection & treatment.

**Text Books**

1. George Tchobanoglous et.al., “Integrated Solid Waste Management”, McGraw-HillPublishers, 2002.

2. B.Bilitewski, G.HardHe, K.Marek, A.Weissbach, and H.Boeddicker, “Waste Management”,Springer, 1994.

3. Charles A. Wentz; "Hazardous Waste Management", McGraw-Hill Publication, Latest publication, (1992).

**Reference Books**

1. R.E.Landreth and P.A.Rebers, “Municipal Solid Wastes – problems and Solutions”, Lewis Publishers, 1997, Bhide A.D. and Sundaresan, B.B., “Solid Waste Management in Developing Countries”, INSDOC, 1993.

2. Handbook of Solid Waste Management by Frank Kreith, George Tchobanoglous, McGraw Hill Publication, (2002). Bagchi, A., Design, Construction, and Monitoring of Landfills, (2nd Ed). Wiley Interscience, ISBN: 0-471-30681-9. Manual on Municipal Solid Waste Management, CPHEEO, Ministry of Urban Development.

3.Government of India, New Delhi, (2000).

4. NPTEL – Municipal Soild Waste Management by Prof. Ajay Kalamdhad – IIT Guwahati.

**Course Designers**

| S.No | Name of the Faculty | Designation | Department | Mail ID |
|---|---|---|---|---|
| 1 | Mrs.P.Subathra | Assistant Professor | Civil / AVIT | subathra@avit.ac.in |
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| 35021O02 | FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | OE-EA | 3 | 0 | 0 | 3 |

**PREAMBLE**

This syllabus is intended for the Engineering students and enable them to lean about Artificial Intelligence. This syllabus contains intelligent agent, Knowledge Representation and Game playing. Thus, this syllabus focuses on to know about AI and its concepts.

**PREREQUISITE: NIL**

**COURSE OBJECTIVES**

| | |
|---|---|
| 1. | To introduce the basic principles, techniques, and applications of Artificial Intelligence. |
| 2. | To have knowledge of generic problem-solving methods in Artificial Intelligence. |
| 3. | To design software agents to solve a problem. |
| 4. | Apply the knowledge of algorithms to solve arithmetic problems. |
| 5. | Assemble an efficient code for engineering problems. |

**COURSE OUTCOMES**

On the successful completion of the course, students will be able to

| | |
|---|---|
| **CO1:**. Identify the different agent and its types to solve the problems | Understand |
| **CO2:** know about the problem solving technique in Artificial Intelligence. | Apply |
| **CO3:** Construct the normal form and represent the knowledge. | Apply |
| **CO4**: to know about extension of condition probability and how to apply in the real time environment. | Apply |
| **CO5:** To lean about Information Retrieval and Speech Recognition | Understand |

**MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | M | M | M | M | M | - | - | - | - | - | - | M | S | M | - |
| **CO2** | M | M | L | M | L | - | - | - | - | - | M | M | S | M | M |
| **CO3** | M | | S | M | M | - | - | - | - | - | - | M | S | - | M |
| **CO4** | S | M | M | M | M | - | - | - | - | - | - | M | S | M | M |
| **CO5** | S | M | M | M | M | - | - | - | - | - | - | M | S | M | - |

**S- Strong; M-Medium; L-Low**

| **INTRODUCTION** |
|---|
| What is AI? – AI Problems – What is an AI technique – Defining the problem as a state space search – Production system - Production system – Characteristics – Problem Characteristics? |
| **HEURISTIC SEARCH TECHNIQUES** |
| Generate and test – Hill Climbing – Best first Search – Problem Reduction – Constraints satisfaction – Means end analysis. |
| **KNOWLEDGE REPRESENTATION** |
| Propositional Logic-First Order Predicate Logic-Prolog Programming-Unification-Forward Chaining- Backward Chaining-Ontological Engineering-Categories and Objects-Events-Mental Events and Mental Objects. |
| **REPRESENTING KNOWLEDGE USING RULES** |
| Procedural versus – Declarative Knowledge – logic Programming – Forward versus Backward Reasoning – Matching |
| **GAME PLAYING** |
| The Minimax search procedure – Adding Alpha Beta cut offs – Addition Refinements – Waiting for Quiescence – Secondary Searches – Using Book moves. |
| **TEXT BOOKS** |
| 1. S. Russell and P. Norvig, "Artificial Intelligence – A Modern Approach", Second Edition, Pearson Education, 2015 Bratko, I., Prolog Programming For Artificial Intelligence (International Computer Science Series), Addison-Wesley Educational Publishers Inc; 4th Edition, 2011.. |
| **REFERENCES** |
| 1.David Poole, Alan Mackworth, Randy Goebel,"Computational Intelligence: A Logical Approach", Oxford University Press, 2004.<br>2. G. Luger, "Artificial Intelligence: Structures and Strategies For Complex Problem Solving", Fourth Edition, Pearson Education, 2002.<br>3. J. Nilsson, "Artificial Intelligence: A New Synthesis", Elsevier Publishers, 1998. |

**COURSE DESIGNERS**

| S. No. | Name of the Faculty | Designation | Department | Mail ID |
|---|---|---|---|---|
| **1.** | Dr.M.Nitya | Professor | CSE | nithya@vmkvec.edu.in |
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| 35021O03 | INTRODUCTION TO INTERNET OF THINGS | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | OE-EA | 3 | 0 | 0 | 3 |

**PREAMBLE**

Introduction to IoT for statistical data manipulation and analysis. It was inspired by and is most compatible with the statistical language.

**PREREQUISITE**

NIL

**COURSE OBJECTIVES**

| | |
|---|---|
| 1 | To learn Introduction to IoT. |
| 2 | To Study methodology of IoT. |
| 3 | To Develop IoT applications using Arduino and Intel Edition. |

**COURSE OUTCOMES**

On the successful completion of the course, students will be able to

| | |
|---|---|
| **CO1:** To Understand the basics in Introduction to IoT in terms of constructs, control statements, string functions | Understand |
| **CO2:** To Understand the use of Introduction to IoT fundamentals. | Understand & Apply |
| **CO3:** Learn to apply Introduction to IoT for Communicating Sequential Process | Understand & Apply |
| **CO4:** Able to appreciate and apply the Introduction to IoT from a statistical perspective | Understand & Apply |
| **CO5** To learn Introduction to IoT Challenges | Understand & Apply |

**MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | S | S | M | M | L | S | S | M | S | L | S | - | **S** | M | S |
| **CO2** | | | | | | | | | | | | M | M | M | S |
| **CO3** | M | S | M | M | M | S | S | M | S | M | M | - | M | - | S |
| **CO4** | | | | | | | | | | | | M | M | S | M |
| **CO5** | S | S | S | S | M | S | S | S | S | M | S | S | M | M | M |

**S- Strong; M-Medium; L-Low**

**SYLLABUS**

**UNIT I –INTRODUCTION to IoT**

Defining IoT, Characteristics of IoT, Physical design of IoT, Logical design of IoT, Functional blocks of IoT, Communication models & APIs

.

**UNIT II- IoT & M2M**

Machine to Machine, Difference between IoT and M2M, Software define Network

**UNIT III – Network & Communication aspects**

Wireless medium access issues, MAC protocol survey, Survey routing protocols, Sensor deployment & Node discovery, Data aggregation & dissemination

**UNIT IV – Domain specific applications of IoT**

Design challenges, Development challenges, Security challenges, Other challenges

**UNIT V – Reflection, Low-Level Programming**

Introduction to Python, Introduction to different IoT tools, Developing applications through IoT tools, Developing sensor based application through embedded system platform, Implementing IoT concepts with python

**TEXT BOOKS**


1. Vijay Madisetti, Arshdeep Bahga, “Internet of Things: A Hands-On Approach”
2. Waltenegus Dargie,Christian Poellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice"


**REFERENCES**


**1.** Macro Schewartz, “Internet of Things with the Arduino Yun” Packet Publishing, 2014.


**COURSE DESIGNERS**


| S. No. | Name of the Faculty | Designation | Department | Mail ID |
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| 1 | Dr.R.Jaichandran | Professor | CSE | rjaichandran@avit.ac.in |
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| | | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| **35021O01** | **CYBER SECURITY** | **OE-EA** | **3** | **0** | **0** | **3** |

**PREAMBLE**

To understand the need for Cyber Security in real time and to study techniques involved in it.

**PREREQUISITE :** NIL

**COURSE OBJECTIVES**

| | |
|---|---|
| **1.** | To understand the fundamentals of Cyber Security and issues. |
| **2.** | To study various cyber crimes and legal remedies. |
| **3.** | To apply various privacy and security. |
| **4.** | To study E-Commerce and digital payments.. |
| **5.** | To study the basic security aspects related to Computer and Mobiles. |

**COURSE OUTCOMES**

On the successful completion of the course, students will be able to

| | |
|---|---|
| **CO1:** Able to understand the concept of Cyber security and issues and challenges associated with it. | Understand |
| **CO2:** Able to understand the cyber crimes, their nature, legal remedies and as to how report the crimes through available platforms and procedures | Apply |
| **CO3:** Able to appreciate various privacy and security concerns on online Social media and understand the reporting procedure of inappropriate content, underlying legal aspects and best practices for the use of Social media platforms. | Apply |
| **CO4**: Able to understand the basic concepts related to E-Commerce and digital payments. | Apply |
| **CO5**: Able to understand the basic security aspects related to Computer and Mobiles. | Apply |

**MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES**

| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | M | M | M | M | - | - | - | - | - | - | - | - | M | M | M |
| **CO2** | M | M | M | M | M | - | - | - | - | - | - | - | M | M | M |
| **CO3** | M | M | S | M | M | - | - | - | - | - | - | - | M | M | M |
| **CO4** | S | M | M | M | | - | - | - | - | - | - | - | M | M | S |
| **CO5** | S | M | M | M | S | - | - | - | - | - | - | - | M | M | S |

**S- Strong; M-Medium; L-Low**

**SYLLABUS**

| **INTRODUCTION TO CYBER SECURITY** **9 hours** |
|---|
| Defining Cyberspace and Overview of Computer and Web-technology, Architecture of cyberspace, Communication and web technology, Internet, World wide web, Advent of internet, Internet infrastructure for data transfer and governance, Internet society, Regulation of cyberspace, Concept of cyber security, Issues and challenges of cyber security. |
| **CYBER CRIME AND CYBER LAW** **9 hours** |
| Classification of cyber crimes, Common cyber crimes- cyber crime targeting computers and mobiles, cyber crime against women and children, financial frauds, social engineering attacks, malware and ransomware attacks, zero day and zero click attacks, Cybercriminals modus-operandi , Reporting of cyber crimes, Remedial and mitigation measures, Legal perspective of cyber crime, IT Act 2000 and its amendments, Cyber crime and offences, Organisations dealing with Cyber crime and Cyber security in India, Case studies. |
| **SOCIAL MEDIA OVERVIEW AND SECURITY** **9 hours** |
| Introduction to Social networks. Types of Social media, Social media platforms, Social media monitoring, Hashtag, Viral content, Social media marketing, Social media privacy, Challenges, opportunities and pitfalls in online social network, Security issues related to social media, Flagging and reporting of inappropriate content, Laws regarding posting of inappropriate content, Best practices for the use of Social media, Case studies. |
| **E - C O M M E R C E AND DIGITAL PAYMENTS** **9 hours** |
| Definition of E- Commerce, Main components of E-Commerce, Elements of E-Commerce security, E-Commerce threats, E-Commerce security best practices, Introduction to digital payments, Components of digital payment and stake holders, Modes of digital payments- Banking Cards, Unified Payment Interface (UPI), e-Wallets, Unstructured Supplementary Service Data (USSD), Aadhar enabled payments, Digital payments related common frauds and preventive measures. RBI guidelines on digital payments and customer protection in unauthorised banking transactions. Relevant provisions of Payament Settlement Act,2007. |
| **DIGITAL DEVICES S E C U R I T Y , TOOLS AND TECHNOLOGIES FOR CYBER SECURITY 9 hours** |
| End Point device and Mobile phone security, Password policy, Security patch management, Data backup, Downloading and management of third party software, Device security policy, Cyber Security best practices, Significance of host firewall and Ant-virus, Management of host firewall and Anti-virus, Wi-Fi security, Configuration of basic security policy and permissions. |
| **REFERENCES** |
| 1. Cyber Crime Impact in the New Millennium, by R. C Mishra, Auther Press. Edition 2010.<br>2. Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by Sumit Belapure and Nina Godbole, Wiley India Pvt. Ltd. (First Edition, 2011)<br>3. Security in the Digital Age: Social Media Security Threats and Vulnerabilities by Henry A. Oliver, Create Space Independent Publishing Platform. (Pearson, 13th November, 2001)<br>4. Electronic Commerce by Elias M. Awad, Prentice Hall of India Pvt Ltd.<br>5. Cyber Laws: Intellectual Property & E-Commerce Security by Kumar K, Dominant Publishers.<br>6. Network Security Bible, Eric Cole, Ronald Krutz, James W. Conley, 2nd Edition, Wiley India Pvt. Ltd. 7. Fundamentals of Network Security by E. Maiwald, McGraw Hill |

**COURSE DESIGNERS**

| S. No. | Name of the Faculty | Designation | Department | Mail ID |
|---|---|---|---|---|
| 1. | Dr.R.Jaichandran | Assistant professor G-II | CSE | rjaichandran@avit.ac.in |

| | | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| **34721O01** | **DESIGN OF ELECTRONIC EQUIPMENT** | **OE-EA** | **3** | **0** | **0** | **3** |

**PREAMBLE**

The objective of this course is to sensitise a registrant to various aspects of an electronics product. Specifically on non-Electrical aspects like mechanical design and detailing. Starting from a need translated into specifications, leading to design and prototyping and ending up in a manufacturable physical prototype.

**PREREQUISITE –Nil**

**COURSE OBJECTIVES**

| | |
|---|---|
| 1 | To understand the various Concept of Industrial Design process. |
| 2 | To apply the basic Concept of electronic Product designs methodology. |
| 3 | To classify the Concept of Ergonomics & aesthetics in product design. |
| 4 | To understand the Knowledge regarding the design of product packaging and working environment. |
| 5 | To understand the Knowledge of different industrial standard and value analysis. |

**COURSE OUTCOMES**

On the successful completion of the course, students will be able to

| | |
|---|---|
| CO1. Visualize the concept for product design with respect to ergonomics and aesthetics. | Remember |
| CO2. Analyze, design and implement control panels of electronic equipment | Apply |
| CO3. Apply creativity in the design of system by formulating architecture with proper placement of components. | Apply |
| CO4. Apply the concept of visual communication techniques in product design. | Apply |
| CO5. Apply the process of value analysis in existing product. | Apply |

**MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES**

| **COS** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | M | L | - | - | S | - | - | L | M | L | - | - | S | - | - |
| CO2 | M | L | - | M | S | - | - | L | M | L | - | - | S | - | - |
| CO3 | M | L | - | M | S | - | - | L | M | L | - | L | S | - | M |
| CO4 | S | M | L | - | S | - | - | L | M | L | - | L | S | M | M |
| CO5 | S | M | L | - | S | - | - | M | L | L | - | L | S | M | M |

S- Strong; M-Medium; L-Low

**SYLLABUS**

**MODULE 1: INTRODUCTION**

Introduction to industrial design, Role of industrial design in the domain of industry, Generic product development process, ID process, Product innovations, tools and methods.

**MODULE 2: PRODUCT PROTOTYPES**

Management of ID process, Product architecture, Structure: standard and non-standard structures. Product prototypes.

**MODULE 3: PRODUCT DESIGN AND PLANNING**

Electronic product design and development Methodology, Creativity techniques, brainstorming documentation. Product planning: Defining the task, scheduling the task and its execution. Costing and Pricing of Industrial design,

**MODULE 4: ERGONOMICS**

Ergonomics: Ergonomics of electronic equipment, Ergonomics of control panel design. Use of ergonomics at work places and plant layout. Aesthetics: Elements of aesthetics, aesthetics of control panel design.

**MODULE 5: CASE STUDIES**

Value engineering, Product quality and design management. Industrial standards, Graphics and packaging

**TEXTBOOKS:**

1. Carl T. Ulrich, Steven. D. Eppinger," "Product Design and Development", McGraw Hill Companies.

**REFERENCE BOOKS:**

1. Ernest J Mccormick ,"Human factors in Engineering and Design" -, McGraw-Hill Co.

2. Yammiyavar P," Control Panel Design and Ergonomics", CEDT/IISc Publication.

3. Murrell K, Chapman," Ergonomics: Man in his Working Environment", &Hall. London. Flurschiem C H, "Industrial Design and Engineering Design ", Council, London and Springer Verlag, 1983

**COURSE DESIGNERS**



| S.No | Name of the Faculty | Designation | Department | Mail ID |
|---|---|---|---|---|
| **1** | Mr.Rajat Kumar Dwibedi | Assistant Professor | ECE | rajatkumar.ece@avit.ac.in |
| **2** | Dr. L.K.Hema | Prof. & Head/ ECE | ECE | hodece@avit.ac.in |
| **3** | Mr.G.Murali | Assistant Professor | ECE | muralig@vmkvec.edu.in |

| | | | | | | |
|---|---|---|---|---|---|---|
| **34721O02** | **INTRODUCTION TO INDUSTRY 4.0 AND INDUSTRIAL INTERNET OF THINGS** | **Category** | **L** | **T** | **P** | **Credit** |
| | | **OE-EA** | **3** | **0** | **0** | **3** |

**PREAMBLE**

Industry 4.0 and Industrial Internet of Things is the pioneer of today's modern technology. To match the engineering skills with the industry skills this subject will induce and impart the knowledge among the young professionals.

**PREREQUISITE**

Basic knowledge of computer and internet

**COURSE OBJECTIVES**

| | |
|---|---|
| 1 | Industry 4.0 concerns the transformation of industrial processes through the integration of modern technologies such as sensors, communication, and computational processing. |
| 2 | Technologies such as Cyber Physical Systems (CPS), Internet of Things (IoT), Cloud Computing, Machine Learning, and Data Analytics are considered to be the different drivers necessary for the transformation. |
| 3 | Industrial Internet of Things (IIoT) is an application of IoT in industries to modify the various existing industrial systems. |
| 4 | IIoT links the automation system with enterprise, planning and product lifecycle. |
| 5 | Real case studies. |

**COURSE OUTCOMES**

On the successful completion of the course, students will be able to

| | |
|---|---|
| CO1. Apply & Analyzing the transformation of industrial process by various techniques. | Analyze |
| CO2. Evaluate the transformation technologies are considered to be the different drivers. | Apply |
| CO3. Existing industrial systems will adopt the applications of IIoT. | Apply |
| CO4. Intensive contributions over automation system with enterprise, planning and product life cycle | Analyze |
| CO5. Analyze of various Real time case studies. | Analyze |

**MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES**

| COS | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | S | M | - | M | - | - | - | - | - | - | M | S | M | - |
| CO2 | S | S | S | M | M | - | - | - | - | - | - | M | S | M | M |
| CO3 | S | S | S | M | M | - | - | - | - | - | - | M | S | M | M |
| CO4 | S | S | S | M | M | - | - | - | - | - | - | M | S | M | M |
| CO5 | S | S | S | S | M | - | - | - | - | - | - | M | S | M | M |

S- Strong; M-Medium; L-Low

**SYLLABUS**

**INTRODUCTION TO INDUSTRY 4.0 ANDINDUSTRIAL INTERNET OF THINGS**

Introduction: Sensing & actuation, Communication-Part I, Part II, Networking-Part I, Part II.Industry 4.0: Globalization, The Fourth Revolution, LEAN Production Systems, Cyber Physical Systems and Next Generation Sensors,Collaborative Platformand Product Lifecycle Management

**INDUSTRIAL INTERNET OF THINGS& IT'S LAYERS**

Cybersecurity in Industry 4.0, Basics of Industrial IoT: Industrial Processes-Part I, Part II, Industrial Sensing & Actuation. IIoT-Introduction, Industrial IoT: Business Model and Reference Architecture: IIoT-Business Models-Part I, Part II, IIoT Reference Architecture-Part I, Part II, Industrial IoT- Layers: IIoT Sensing-Part I, Part II, IIoT Processing-Part I, Part II.

**IIoT COMMUNICATION**

Communication-Part I, Industrial IoT- Layers: IIoT Communication, IIoT Networking-Part I, Part II, Part III. Industrial IoT: Big Data Analytics and Software Defined Networks: SDN in IIoT-Part I, Part II, Data Center Networks, Industrial IoT

**IIoT BIG DATA & SDN APPLICATIONS**

Industrial IoT: Security and Fog Computing - Fog Computing in IIoT, Security in IIoT-Part I, Part II, Industrial IoT- Application Domains. Industrial IoT- Application Domains: Healthcare, Power Plants, Inventory Management & Quality Control, Plant Safety and Security (Including AR and VR safety applications), Facility Management.

**APPLICATIONS & REAL TIME CASE STUDIES**

Industrial IoT- Application Domains: Oil, chemical and pharmaceutical industry, Applications of UAVs in Industries, Real case studies - Virtual reality lab, Manufacturing industries – part one, Manufacturing industries – part two, Milk processing and packaging industries, Steel technology lab, Student projects – part one, Student projects – part two

**TEXT BOOKS:**

1. Anandarup Misra, Sudip | Roy, Chandana | Mukherjee, "Introduction to Industrial Internet of Things and Industry 4.0, CRC press, 2003.

**REFERENCE BOOKS:**

1. Gilchrist, Alasdair, "Introduction to IoT", Apress, 2016
2. Gilchrist, Alasdair "IIoT Reference Architecture", Apress, 2016

**COURSE DESIGNERS**



| S.No. | Name of the Faculty | Designation | Department | Mail ID |
|---|---|---|---|---|
| **1** | Dr. L.K.Hema | Prof.&Head/ECE | ECE | hodece@avit.ac.in |
| **2** | Dr.T.Muthumanickam | Professor | ECE | hodece@vmkvec.edu.in |

| | | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| **34621O01** | **GREEN POWER GENERATION SYSTEMS** | **OE-EA** | **3** | **0** | **0** | **3** |

**PREAMBLE**

The course presents the various sources of renewable energy including wind, solar, and biomass as potential sources of energy and investigates the contribution they can make to the energy profile of the nation. The technology used to harness these resources will be presented. Discussions of economic, environment, politics and social policy are integral components of the course.

**PREREQUISITE:** NIL

**COURSE OBJECTIVES**

| | |
|---|---|
| 1 | Understand the nexus between energy, environment, and sustainable development. |
| 2 | Appreciate energy ecosystems and its impact on environment. |
| 3 | Learn basics of various types of renewable and clean energy technologies. |
| 4 | Serve as bridge to advanced courses in renewable energy. |

**COURSE OUTCOMES**

On the successful completion of the course, students will be able to

| | |
|---|---|
| CO1: Explain renewable energy sources & systems. | Understand |
| CO2: Apply engineering techniques to build solar, wind, tidal, geothermal, biofuel, fuel cell, Hydrogen, and sterling engine. | Apply |
| CO3: Analyze and evaluate the implication of renewable energy. Concepts in solving numerical problems pertaining to solar radiation geometry and wind energy systems. | Analyze |
| CO4: Demonstrate self -learning capability to design & establish renewable energy systems. | Analyze |
| CO5: Conduct experiments to assess the performance of solar PV, solar thermal and biodiesel systems | Apply |

**MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES**

| **COS** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | - | - | - | M | - | L | L | - | - | - | - | M | - | - |
| CO2 | S | M | S | L | M | - | L | M | - | M | - | - | - | - | - |
| CO3 | S | - | - | - | M | - | - | M | M | - | - | - | L | - | - |
| CO4 | S | - | - | - | M | - | L | - | - | - | - | M | - | - | - |
| CO5 | S | M | S | L | M | - | L | M | - | M | M | - | M | L | - |
| CO6 | S | - | - | - | M | - | L | L | - | - | - | - | - | - | - |

S- Strong; M-Medium; L-Low

**SYLLABUS**

**ENERGY**

Introduction to the nexus between energy, environment and sustainable development, Energy sources overview and classification, sun as the source of energy, fossil fuel reserves and resources - overview of global/ India's energy scenario. Energy consumption models – Specific Energy Consumption

**ECOLOGY AND ENVIRONMENT**

Concept and theories of ecosystems, - energy flow in major man-made ecosystems- agricultural, industrial and urban ecosystems - sources of pollution from energy technologies and its impact on atmosphere - air, water, soil, and environment - environmental laws on pollution control, The environmental protection act: Effluent standards and ambient air quality, innovation and sustainability, eco-restoration: Phyto-remediation.

**RENEWABLE SOURCES OF ENERGY**

Solar Energy: Solar radiation: measurements and prediction. Indian's solar energy potential and challenges, solar energy conversion principles and technologies: Photosynthesis, Photovoltaic conversion, and Photo thermal energy conversion. Wind Energy: Atmospheric circulations, atmospheric boundary layers, classification, factors influencing wind, wind shear, turbulence, wind energy basics and power Content, wind speed monitoring, Betz limit, wind energy conversion system: classification, characteristics, and applications. Ocean Energy: Ocean energy resources-ocean energy conversion principles and technologies: ocean thermal, ocean wave & ocean tide

**BIOENERGY**

Biomass as energy resources; bio-energy potential and challenges, Classification, and estimation of biomass; Source and characteristics of biofuels: Biodiesel, Bioethanol, Biogas. Types of biomass energy conversion systems - waste to energy conversion technologies

**OTHER ENERGY SOURCES AND SYSTEMS**

Hydropower, Nuclear fission, and fusion-Geothermal energy: Origin, types of geothermal energy sites, site selection, geothermal power plants; hydrogen energy, Magneto-hydro-dynamic (MHD) energy conversion – Radioisotope Thermoelectric Generator (RTG), Bio-solar cells, battery & super capacitor, energy transmission and conversions.

**TEXTBOOKS:**


1. Energy and the Environment, Ristinen, Robert A. Kraushaar, Jack J. AKraushaar, Jack P. Ristinen, Robert A., 2nd Edition, John Wiley, 2006,
2. Energy and the Challenge of Sustainability, World Energy assessment, UNDP, N York, 2000.


**REFERENCE BOOKS:**


1. Ocean Energy: Tide and Tidal Power by R. H. Charlier and Charles W. Finkl, Springer 2010
2. Introduction to Electrodynamics (3rd Edition), David J. Griffiths, Prentice Hall, 2009


**COURSE DESIGNERS**


| S. No. | Name of the Faculty | Designation | Department | Mail ID |
|---|---|---|---|---|
| 1 | Dr. R. Devarajan | Professor | EEE | devarajan@vmkvec.edu.in |
| 2 | Mr. R. Sathish | Assistant Professor | EEE | sathish@vmkvec.edu.in |
| 3 | Mr. V.Rattankumar | Assistant Professor | EEE | rattankumar@avit.ac.in |

| | | Category | L | T | P | C |
|---|---|---|---|---|---|---|
| **34621O02** | **INDUSTRIAL DRIVES AND AUTOMATION** | **OE-EA** | **3** | **0** | **0** | **3** |

**Preamble**

To introduce foundation on the principles of drives & automation and their elements with the implementation.

**PREREQUISITE :** NIL

**COURSE OBJECTIVES**

| | |
|---|---|
| 1 | To explore the various AC,DC & Special Machine Drives for industrial Application. |
| 2 | To study about the various Open loop and closed loop control schemes for drives. |
| 3 | To know about hardware implementation of the controllers using PLC. |
| 4 | To study the concepts of Distributed Control System. |
| 5 | To understand the implementation of SCADA and DCS. |

**COURSE OUTCOMES**

**On successful completion of the course, the students will be able to**

| | | |
|---|---|---|
| CO 1 | To understand working principles of various types of motors, differences, characteristics and selection criteria. | Understand |
| CO 2 | To apply the knowledge in selection of motors, heating effects and braking concepts in various industrial applications | Apply |
| CO 3 | To explain control methods of special drives | Understand |
| CO 4 | To carry out programming using PLC and use of various PLCs to Automation problems in industries. | Understand |
| CO 5 | To discuss supervisory control and data acquisition method and use the same in complex automation areas | Understand |
| CO6 | To understand and use logical elements and use of Human Machine Interfacing devices to enhance control & communication aspects of Automation | Understand |

**Mapping with Programme outcomes and Programme Specific Outcomes**

| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | S | L | - | | S | S | - | | L | - | - | - | - | L |
| CO2 | M | - | M | - | S | L | M | - | M | L | - | - | L | - | - |
| CO3 | M | - | M | - | S | L | M | - | | L | - | - | - | M | - |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO4 | S | - | S | - | S | M | M | L | - | L | M | - | - | - | L |
| CO5 | S | M | S | S | S | M | S | - | M | L | L | M | - | L | M |

**SYLLABUS**

**INTRODUCTION**

Working principle of synchronous, Asynchronous & stepper motors, Difference between Induction and servo motors, Torque v/s speed characteristics, Power v/s. Speed characteristics, Vector duty induction motors, Concepts of linear and frameless motors, Selection of feedback system, Duty cycle, , V/F control, Flux Vector control.

**INDUSTRIAL DRIVES**

Electric drive – Definition – Parts – Types -Individual – Group – Multi motor. Stepper motor – Definition – Step angle – Slewing rate -Types -Variable reluctance -Hybrid – Closed loop control of stepper motor – Drive system(any one) – logic sequencer – Optical encoder. Servo motor – Definition – Types -DC servo motor – Permanent magnet DC motors – Brushless motor – AC servo motor -Working of an AC servo motor in control system – Induction motors – Eddy current drive for speed control of induction motors.

**PROGRAMMABLE LOGIC CONTROLLER**

Definition Conventional Hard wired logicRelays- Features of PLC- Advantages of PLC over relay logic – Block diagram of PLC -Programming basics of PLC – Ladder logic -Symbols used in ladder logic – Logic functions – Timers – Counters – PLC networking – Steps involved in the development of Ladder logic program – Program execution and run operation by PLC – Ladder logic diagram for liquid level operation. List of various PLCs and their manufactures.

**DISTRIBUTED CONTROL SYSTEM**

Evolution of distributed control system -Definition of DCS – Functional elements of DCS – Elements of local control unit -Interfaces-Types of information displays – Architecture of anyone commercial DCS – Advantages of DCS -Selection of DCS – List of various DCS and their manufactures.

**SUPERVISORY CONTROL & DATA ACQUISITIONS**

Introduction to Supervisory control & data Acquisitions, distributed Control System (DCS): computer networks and communication in DCS. different BUS configurations used for industrial automation – GPIB, HART and OLE protocol, Industrial field bus – FIP (Factory Instrumentation Protocol), PROFIBUS (Process field bus), Bit bus. Interfacing of SCADA with controllers, Basic programming of SCADA, SCADA in PC based Controller / HMI.

**TEXTBOOK**


1. G.K.Dubey, Fundamentals of Electrical Drives', Narosa Publication,2002.
2. FrankD.petruzellaprogrammable logic controlsthird edition TATA mc graw-hill edition 2010.
3. M.S.Berde, Electric Motor Drives Khanna publishers.2008


**REFERENCES**

1. Pradheepkumarsrivastava, Programmable logic controllers with applications', BPB publications.2004.
2. John W.Webb, Ronald A.Reis, Programmable logic controllers-Principles and Applications', Fifth Edition, Prentice Hall of India.
3. Michel P.Lukas, Distributed Control system', van Nostrand Reinhold Co, 1986
4. R.SrinivasanSpecial electrical Machines lakshmi publication.2012
5. Process Control Instrumentation Technology, Johnson Curties, Prentice hall of India, 8th edition
6. Andrew Parr, Industrial drives, Butterworth – Heineaman

**COURSE DESIGNERS**



| Sl No | Name of the Faculty | Designation | Department | Mail ID |
|---|---|---|---|---|
| **1** | Dr.L.Chitra | Professor | EEE/AVIT | chitra@avit.ac.in |
| **2** | Dr.R.Devarajan | Professor | EEE/VMKVEC | devarajan@vmkvec.edu.in |

| | | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| 36921O01 | BIOMOLECULES-STRUCTURE AND FUNCTION | OE-EA | 3 | 0 | 0 | 3 |

**PREAMBLE**

Biomolecules like carbohydrates, proteins, fat are vital components of any living system. Basic knowledge about them helps in maintaining a healthy lifestyle, free of sickness and a general awarenessabout hygiene.

**PREREQUISITE** NIL

**COURSE OBJECTIVES**

| | |
|---|---|
| 1 | To give an overview of importance of biomolecules. |
| 2 | To elaborate the structure of proteins and nucleic acids and its role in disease. |
| 3 | To enumerate the role of carbohydrates and their cellular function in physiology and pathology. |
| 4 | To enumerate the role of lipids and their cellular function in physiology and pathology. |
| 5 | To briefly cholesterol and its role in diseases. |

**COURSE OUTCOMES**

After the successful completion of the course, learner will be able to

| | |
|---|---|
| CO1. Relate the basics of biomolecules in and around him | Understand |
| CO2. Understand the structure of biomolecules such as proteins and nucleic acids | Understand |
| CO3. Discover the role of carbohydrates in healthy and diseased conditions | Apply |
| CO4. Relate disfunctioning of lipids with disease | Analyse |
| CO5. Criticize the role of cholesterol in diseases. | Evaluate |

**MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES**

| COS | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | M | L | L | - | - | L | - | - | - | - | - | - | - | L | - |
| CO2 | S | M | S | - | - | M | - | - | - | - | - | - | - | L | - |
| CO3 | M | L | M | M | - | S | - | - | - | - | - | - | - | L | - |
| CO4 | L | L | L | L | S | L | - | - | S | - | - | M | L | M | M |
| CO5 | S | - | L | L | - | M | - | - | - | - | - | S | S | M | - |

**S- Strong; M-Medium; L-Low**

**SYLLABUS**

**PROTEINS**

Protein – Structure – primary, secondary, tertiary. Types of proteins and their function. Role of each type of Protein in Health and Disease.

**NUCLEIC ACIDS**

Nucleic Acids – Components of nucleic acids, Conformational parameters. Nucleic acids – Types of DNA and RNA. DNA Polymorphism, Circular DNA, Supercoil DNA, DNA-Protein interactions. Role of nucelic acids in Health and disease

**CARBOHYDRATES**

Carbohydrates – Introduction. Types – monosaccharide, disaccharide, oligosaccharide and polysaccharides. Structure of each type. Artificial sugars. Role of carbohydrates in Health and Disease

**FATTYACIDS AND LIPIDS**

Fatty acids- Introduction, nomenclature, types - Saturated and unsaturated fatty acids, Essential and non-essential fatty acids.

Lipids – Introduction, Classification - simple and compound lipids, phospholipids, Cholesterol and its role in health and disease, Micelles and Liposomes : Applications in biology and medicine

**CELL MEMBRANE AND CELL SIGNALING**

Cell membrane - components and architecture, Various membrane models including Fluid-mosaic model. Ion channels, Receptors, Signaling molecules, Signaling mechanism, Role of cell signaling in Health and Disease. Inter-relationship of biomolecules.

**TEXTBOOKS**

1. Biophysical Chemistry, Part II, Techniques for the study of biological structure and function, by Cantor C.R. and Schimmel P R., W.H. Freeman and Company, 1980.

2. Nucleic Acids in chemistry and Biology, by Blackburn G.M. and gait M.J., IRL Press, 1990.

3. Biochemistry, by Voet D. and Voet J.G., John Wiley and sons, 1995.

4. Physical Biochemistry, by Freifelder D., W.H. Freeman and company, 1976-1982.

**COURSE DESIGNERS**

| S.No | Name of the Faculty | Designation | Department | Mail ID |
|---|---|---|---|---|

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| **2** | Ms.S.Sowmiya | Assistant Professor | Pharmaceutical Engineering | sowmiya.vmkvec@vmrf.edu.in |

| | | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| **36921O02** | **PHARMACOGENOMICS** | **OE-EA** | **3** | **0** | **0** | **3** |

**PREAMBLE**

Pharmacogenomics involves the study of the relationship between an individual's genetic makeup and his or her response to a drug. Pharmacogenetics, a component of pharmacogenomics, is the study of the relationship between a single gene and its response to a drug.

**PREREQUISITE -** NIL

**COURSE OBJECTIVES**

| | |
|---|---|
| 1 | Discuss about the basic knowledge about pharmacogenomics and drug design using genomic applications for drug action and toxicity. |
| 2 | Perform how individualization of drug therapy can be achieved based on a person's genetic makeup while reducing unwanted drug effects. |
| 3 | Outline the Pharmacogenomics studies on how genetic differences between individuals can affect responses to various drugs. |
| 4 | Formulate on medicine skills acquired by the student and his action in different pathologies. |
| 5 | Develop acquire knowledge about the influence of genetic alterations on the therapeutic effect and adverse reactions of the drugs, from a perspective of individualized therapy. |

**COURSE OUTCOMES**

After the successful completion of the course, learner will be able to

| | |
|---|---|
| CO1.Recognize the effect of genetic differences between individuals in the outcome of | Remember |
| CO2. Describe the role of single nucleotide polymorphism as a biomarker for the | Understand |
| CO3. Utilize and manage the new genomics based tools as they become available as | Understand |
| CO4. Examine the applications of genomics principles in drug action and toxicology | Analyze |
| CO5. Validation of case studies related to pharmacogenomics | Analyze |

| MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **COS** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
| CO1 | L | L | L | L | L | L | L | - | L | L | L | L | L | L | |
| CO2 | M | M | M | M | L | - | - | - | M | - | L | L | L | L | - |
| CO3 | S | S | S | S | L | - | - | - | M | - | L | L | L | L | - |
| CO4 | M | M | M | M | M | - | - | - | S | - | L | L | M | L | - |
| CO5 | L | L | L | L | S | - | - | - | M | - | M | M | S | M | - |
| **S- Strong; M-Medium; L-Low** | | | | | | | | | | | | | | | |

**SYLLABUS**

**PHARMACOGENOMICS AND PERSONALIZED MEDICINE**

Pharmacogenetics - Roots of pharmacogenomics and it is not just pharmacogenomics, Genetic drug response profiles, the effect of drugs on Gene expression, pharmacogenomics in drug discovery and drug development. Concept of individualized drug therapy, Drivers and the promise of personalized medicine, Strategies for application of pharmacogenomics to customize therapy, Barriers.

**HUMAN GENOME**

Expressed sequence Tags (EST) and computational biology, Microbial genomics, computational analysis of whole genomes, computational genome analysis, Genomic differences that affect the outcome of host pathogen interactions, Protein coding genes, repeat elements, genome duplication, analysis of proteome, DNA variation, Biological complexity. Single nucleotide polymorphisms (SNP's) in Pharmacogenomics - approaches, number and types of SNPs, Study design for analysis, Analytical issues, Development of markers.

**ASSOCIATION STUDIES IN PHARMACOGENOMICS**

Viability and Adverse drug reaction in drug response, Multiple inherited genetic factors influence the outcome of drug treatments, Association studies in pharmacogenomics, Strategies for pharmacogenomics Association studies, Benefits of Pharmacogenomics in Drug R & D.

**GENOMICS APPLICATIONS FOR DRUG ACTION, TOXICITY AND DESIGN**

Platform technologies and Pharmaceutical process, its applications to the pharmaceutical industry, Understanding biology and diseases, Target identification and validation, Drug candidate identification and optimization, safety and toxicology studies. The need of protein structure information, protein structure and variation in drug targets-the scale of problem, Mutation of drug targets leading to change in

the ligand binding pocket.

**PHARMACOGENOMICS – CASE STUDIES**

Study of pharmacogenomics of human P-Glycoprotein, drug transporters, lipid lowering drugs, chemotherapeutic agents for cancer treatment.

**TEXT BOOKS**


1. Martin M. Zdanowicz, M.M. “Concepts in Pharmacogenomics” Second Edition, American Society of Health-System Pharmacists, 2017.
2. Licinio, J and Wong, Ma-Li. “Pharmacogenomics: The Search for the Individualized Therapies”, Wiley-Blackwell, 2009.
3. Yan Q, “Pharmacogenomics in Drug Discovery and Development” Humana Press, 2nd Edition, 2014.


**REFERENCES**


1. Brazeau, D.A. and Brazeau, G.A. “Principles of the Human Genome and Pharmacogenomics” American Pharmacist Association, 2011
2. Werner, K., Meyer, U.A., Tyndale, R.F. “Pharmacogenomics”, Second Edition, Taylor and Francis, 2005.
3. Langman, L.J. and Dasgupta, A. "Pharmacogenomics in Clinical Therapeutics", Wiley – Blackwell, 2012


**COURSE DESIGNERS**


| S.No. | Name of the Faculty | Designation | Department | Mail ID |
|---|---|---|---|---|
| 1 | Ms. R. Jaishri | Assistant Professor | Pharmaceutical Engineering | jaishri@vmkvec.edu.in |

# MANDATORY COURSES

| Course Code | Course Title | Category | L | T | P | C |
|---|---|---|---|---|---|---|
| 34121Z81 | YOGA AND MEDITATION | AC | 0 | 0 | 2 | 0 |

**OBJECTIVES:**

Yoga is derived from a Sanskrit word 'yuj' which loosely means 'union.' It is a path through which an individual unites with the entire existence. Sounds heavy, right? It basically means how you are not a separate entity but part of a greater energy. It increases your consciousness and makes you realize your true self-clearing the clutter of all that you imbibed as part of your culture, family, and education. It makes you realize that there is something more than what you see around. It is a deeply spiritual practice that is part philosophy, religion, science, and exercise.

**COURSE CONTENT**

- Surya namaskar,Padmasana, Uttakatasana
- Surya pranayama, BrahmariPranayama
- Anjalimudra, Mahamudra, Chin Mudra
- Kapalabathikriya,Bhastrika, Tratakkriya
- Simple Meditation,YogaBreath awareness meditation,.

**OUTCOMES :**

- It incorporates breathing exercises, meditation and poses designed to encourage relaxation and reduce stress.
- Practicing yoga is said to come with many benefits for both mental and physical health.
- Yoga is known for its ability to ease stress and promote relaxation.
- Many people begin practicing yoga as a way to cope with feelings of anxiety.
- Could Improve Heart Health
- Improves Quality of Life.
- Could Promote Sleep Quality.
- Improves Flexibility and Balance.
- Could Help Improve Breathing.
- Promotes Healthy Eating Habits.
- Can Increase Strength.

**TEXT BOOK:**

YogacharyaSundaram, *Sundra Yoga Therapy*, Asana Publications, 2009

**REFERENCES:**


1. Dr.V.Krishnamoorthy, *Simple Yoga for Health*, Sri MathiNilayam, 2012.
2. Dr.AnandaBalayogiBhavanani, *A Primer of Yoga Theory*, Dhivyananda Creations,2008.
3. Dr.S.Hema, Easy *Yoga for Beginners*, Tara yoga Publications,2008.
4. Dr.AsanaAndiappan, *Ashtanga Yoga*, Asana Publications, 2009.
5. Dr.JohnB.Nayagam, *MudumaikkuMutrupulliVaikkumMuthiraigal*, SaaruPrabha Publications, 2010.

| Course Code | Course Title | category | L | T | P | C |
|---|---|---|---|---|---|---|
| 34121Z84 | INDIAN CONSTITUTION | AC | 0 | 0 | 2 | 0 |

**Course Objectives:**

On completion of this course, the students will be able:

1 To understand the nature and the Philosophy of the Constitution.

2 To understand the outstanding Features of the Indian Constitution and Nature of the Federal system.

3 To Analyse Panchayat Raj institutions as a tool of decentralization.

4 To Understand and analyse the three wings of the state in the contemporary scenario.

5 To Analyse Role of Adjudicatory Process.

5 To Understand and Evaluate the recent trends in the Indian Judiciary.

**Course Content**

**UNIT I**

**The Constitution - Introduction**

The Historical background and making of the Indian Constitution –Features of the Indian Constitution- Preamble and the Basic Structure - Fundamental Rights and Fundamental Duties –Directive Principles State Policy

**UNIT II –Government of the Union**

The Union Executive- Powers and duties of President –Prime Minister and Council of Ministers - Lok Sabha and Rajya Sabha

**UNIT III –Government of the States**

The Governor –Role and Powers - Cheif Minister and Council of Ministers- State Legislature

**UNIT IV – Local Government**

The New system of Panchayat, Municipalities and Co-Operative Societies

**UNIT V – Elections**

Powers of Legislature -Role of Chief Election Commissioner-State Election Commission

**TEXTBOOKS AND REFERENCE BOOKS:**

1 Ethics and Politics of the Indian Constitution Rajeev Bhargava Oxford University Press, New Delhi, 2008

2 The Constitution of India B.L. Fadia Sahitya Bhawan; New edition (2017)

3 Introduction to the Constitution of India DD Basu Lexis Nexis; Twenty-Fourth 2020 edition Suggested.

**Total Hours: 30 hours**

**Software/Learning Websites:**

1. https://www.constitution.org/cons/india/const.html
2. http://www.legislative.gov.in/constitution-of-india
3. https://www.sci.gov.in/constitution
4. https://www.toppr.com/guides/civics/the-indian-constitution/the-constitution-of india/

**Alternative NPTEL/SWAYAM Course:**

| S.NO | NPTEL ID | NPTEL Course Title | Course Instructor |
|---|---|---|---|
| 1 | 12910600 | CONSTITUTION OF INDIA AND ENVIRONMENTAL GOVERNANCE: ADMINISTRATIVE AND ADJUDICATORY PROCESS | PROF. M. K. RAMESH NATIONAL LAW SCHOOL OF INDIA UNIVERSITY |

| COURSE DESIGNER | | | | |
|---|---|---|---|---|
| S.NO | NAME OF THE FACULTY | DESIGNATION | NAME OF THE INSTITUTION | MAIL ID |
| 1 | Dr.Sudheer | Professor | AV School of Law | Sudheersurya18@gmail.com |

| Course Code | Course Title | Category | L | T | P | C |
|---|---|---|---|---|---|---|
| 34121Z83 | **ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE** | AC | 0 | 0 | 2 | 0 |

**Course Objectives:**

1. To facilitate the students with the concepts of Indian traditional knowledge and to make them understand the Importance of roots of knowledge system.
2. To make the students understand the traditional knowledge and analyse it and apply it to their day to day life

**Course Outcomes:**

At the end of the Course, Student will be able to:

1. Identify the concept of Traditional knowledge and its importance.
2. Explain the need and importance of protecting traditional knowledge.
3. Illustrate the various enactments related to the protection of traditional knowledge.
4. Interpret the concepts of Intellectual property to protect the traditional knowledge.
5. Explain the importance of Traditional knowledge in Agriculture and Medicine.

UNIT-I:

**Introduction to traditional knowledge:** Define traditional knowledge, nature and characteristics, scope and importance, kinds of traditional knowledge, Indigenous Knowledge (IK), characteristics, traditional knowledge vis-a-vis indigenous knowledge, traditional knowledge Vs western knowledge traditional knowledge

UNIT-2:

**Protection of traditional knowledge:** The need for protecting traditional knowledge Significance of TK Protection, value of TK in global economy, Role of Government to harness TK.

UNIT-3:

**Legal framework and TK:** The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, Plant Varieties Protection and Farmer's Rights Act, 2001 (PPVFR Act); The Biological Diversity Act 2002 and Rules 2004, the protection of traditional knowledge bill, 2016.

UNIT-4:

**Traditional knowledge and intellectual property:** Systems of traditional knowledge protection, Legal concepts for the protection of traditional knowledge, Patents and traditional knowledge, Strategies to increase protection of traditional knowledge

UNIT-5:

**Traditional Knowledge in Different Sectors:** Traditional knowledge and engineering, Traditional medicine system, TK in agriculture, Traditional societies depend on it for their food and healthcare needs, Importance of conservation

and sustainable development of environment, Management of biodiversity, Food security of the country and protection of TK

**Text Books:**

1. Traditional Knowledge System in India, by Amit Jha, 2009.

Reference Books:

1. Traditional Knowledge System in India by Amit Jha Atlantic publishers, 2002.

2. "Knowledge Traditions and Practices of India" Kapil Kapoor1, Michel Danino2.

**Web Links:**

1.https://www.youtube.com/watch?v=LZP1StpYEPM

| 34121Z82 | Gender Equity and Law<br>(Common to all Branches) | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | AC | 0 | 0 | 2 | 0 |

Gender Equity is the provision of fairness and justice in the distribution of benefits and responsibilities between Men, Women, Transgender, and Gender non-binary individuals. Gender equity is important because, historically, societies around the world have deemed females, transgender people, and no binary people as "weaker" or less important than males. Gender equity emphasizes respecting individuals without discrimination, regardless of their gender. There are legal provisions that address issues like inequalities that limit a person's ability to access opportunities to achieve better health, education, and economic opportunity based on their gender.

**PREREQUISITE: NIL**

**COURSE OBJECTIVES**

| | |
|---|---|
| 1 | To sensitize the students regarding the issues of gender and the gender inequalities prevalent in society. |
| 2 | To raise and develop social consciousness about gender equity among the students. |
| 3 | To build a dialogue and bring a fresh perspective on transgender and gender non-conforming individuals. |
| 4 | To create awareness among the students and to help them face gender stereotype issues. |
| 5 | To help the students understand the various legal provisions that are available in our society. |

**COURSE OUTCOMES**

On the successful completion of the course, students will be able to

| | |
|---|---|
| CO1.Understand the importance of gender equity | Understand |
| CO2.Initiate the awareness and recognize the social responsibility with regards to gender equity. | Apply |
| CO3.To develop a sense of inclusiveness and tolerance towards various genders without any discrimination. | Apply |
| CO4. To evaluate the social issues and apply suitable gender-related regulations for inclusive living. | Evaluate |
| CO5.To identify and analyze the existing gender inequality problems faced in various institutions. | Analyse |

**MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES**

| COS | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | M | L | - | - | S | S | S | - | - | - | S | - | - | - |
| CO2 | S | M | M | - | - | S | S | S | - | - | - | S | - | - | - |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO3 | S | L | M | - | - | S | S | S | - | - | - | S | - | - | - |
| CO4 | S | S | S | L | - | S | S | S | - | - | - | S | - | - | - |
| CO5 | S | S | S | M | - | S | S | S | - | - | - | S | - | - | - |

S- Strong; M-Medium; L-Low

**SYLLABUS**

**UNIT –I INTRODUCTION TO GENDER AND SEX**

**6hrs**

Definition of Sex – Definition of Gender - Sex Vs. Gender - Social Construction of Gender and Gender Roles – Gender Stereotypes - Gender Division of Labour - Patriarchy, Masculinity and Gender Equality -Feminism and Patriarchy.

**UNIT –II - GENDER BIAS**

**6 hrs**

Introduction to Gender Inequality in India - Gender Bias in Media - Misleading Advertisement And

Poor Portrayal of Women and gender non-conforming individuals- Objectification of Women, Transgender, and gender non-conforming individuals - Differential Treatment of Women, Transgender, Exploitation Caused by Gender Ideology - Female Infanticide - Honor Killing.

**UNIT –III GENDER SENSITIZATION AND INTERNATIONAL CONVENTIONS 6 hrs**

**Gender Sensitization** -Need and Objective - Gender Sensitivity Training at Workplace – Gender Sensitization in Judiciary - Gender Sensitization in School Curriculum.

**UNIT-IV - SEXUAL OFFENCES AGAINST WOMEN 6 hrs**

Indian Penal Code, 1860 - S., 304B, 354, 354C, 354d, 376, 498A & 509 - The Immoral Traffic Prevention Act 1986 - The Sexual Harassment of Women at Workplace (Prevention, Prohibition and Redressal) Act, 2013 - Protection of Women from Domestic Violence Act, 2005- Indecent Representation of Women Act, 1986**.**

**UNIT-V ROLE OF GOVERNMENT FOR INCLUSIVE DEVELOPMENT**

**6hrs**

Initiatives of NCERT -Role of Ministry of Women and Child Development - Governmental Initiatives: Beti BachaoBeti Padhao (BBBP) - Ujjawala Scheme - Working Women Hostels (WWH), National Council for Transgender Persons.

**TEXT BOOKS**

1. IGNOU: Gender Sensitization: Society, Culture and Change (2019) BGSE001, New Delhi IGNOU
2. Jane Pilcher and Imelda Whelehan (2005): Fifty Key Concepts in Gender Studies

**REFERENCES:**

1. Women's Empowerment & Gender Parity: @Gender Sensitization, Dr. Shikha Bhatnagar, Repro Books (2020).

2. Gender Sensitization: Issues and Challenges, Anupama Sihag Raj Pal Singh, Raj Publications (2019).

3. Violence Against Women: Current Theory and Practice in Domestic Abuse, Sexual Violence, andExploitation (Research Highlights in Social Work), Jessica Kingsley Publishers (2012).

4. Gill, Rajesh, Contemporary Indian Urban Society- Ethnicity, Gender and Governance, BookwellPublishers, New Delhi (2009).

5. Sexual Violence Against Women: Penal Law and Human Rights Perspectives, Lexis Nexis (2009) 6. Chatterjee, Mohini, Feminism and Gender Equality, Aavishkar, Jaipur,2005.

7. Mies, Maria, Indian Women and Patriarchy, Concept Publishing Company, New Delhi, 2004.

**COURSE DESIGNERS**



| S.No. | Name of the Faculty | Mail ID |
|---|---|---|
| 1. | Gnana Sanga Mithra.S | sangamithra@avil.edu.in |
| 2. | Aarthy.G | aarthy@avil.edu.in |