**COIMBATORE INSTITUTE OF ENGINEERING AND TECHNOLOGY**
**An Autonomous Institute, Affiliated to Anna University, Chennai**
**Approved by AICTE, New Delhi, Accredited by NAAC with 'A' Grade**
**Vellimalaipattinam, Narasipuram(po), Coimbatore- 641 109**

# B.E MECHATRONICS ENGINEERING

# REGULATION - 2019

# Curriculum & Syllabus

## B.E. MECHATRONICS ENGINEERING Regulations 2019

**Minimum credits to be earned: 160**

| Course Code | Course Title | Periods / week | | | Credits | CAT |
|---|---|---|---|---|---|---|
| | | Lecture | Tutorial | Practical | | |
| **SEMESTER 1** | | | | | | |
| U19EGE01 | Technical English | 2 | 0 | 2 | 3 | HS |
| U19MAT01 | Engineering Mathematics I | 3 | 1 | 0 | 4 | BS |
| U19CYE01 | Applied Chemistry | 3 | 0 | 2 | 4 | BS |
| U19ECT01 | Elements of Electrical, Electronics and Information Science | 3 | 0 | 0 | 3 | ES |
| U19MET01 | Engineering Graphics | 2 | 0 | 4 | 4 | ES |
| U19EEP01 | Engineering Practices Laboratory | 0 | 0 | 4 | 2 | ES |
| U19MTA01 | Induction Program* | 0 | 0 | 0 | 0 | MC |
| | **Total 26 Periods** | **13** | **1** | **12** | **20** | |
| **SEMESTER 2** | | | | | | |
| U19EGE02 | Communicative English | 2 | 0 | 2 | 3 | HS |
| U19MAT02 | Engineering Mathematics II | 3 | 1 | 0 | 4 | BS |
| U19PYE02 | Applied Physics | 3 | 0 | 2 | 4 | BS |
| U19CSE01 | Problem Solving and Python Programming | 3 | 0 | 2 | 4 | ES |
| U19MET03 | Engineering Mechanics | 3 | 1 | 0 | 4 | ES |
| U19MEP01 | Computer Aided Drafting Laboratory | 0 | 0 | 4 | 2 | ES |
| | **Total 26 Periods** | **14** | **2** | **10** | **21** | |
| **SEMESTER 3** | | | | | | |
| U19MAT04 | Transforms and Boundary Value Problems | 3 | 1 | 0 | 4 | BS |
| U19MCT01 | Strength of Materials | 3 | 0 | 0 | 3 | PC |
| U19MCE01 | Fluid Mechanics and Machinery | 3 | 0 | 2 | 4 | PC |
| U19MCE02 | Electrical Machines | 3 | 0 | 2 | 4 | ES |
| U19MCT02 | Digital Electronics | 3 | 0 | 0 | 3 | ES |
| U19MCA01 | Interpersonal skills/ Listening and Speaking | 0 | 0 | 2 | 1 | EEC |
| | **Total 22 Periods** | **15** | **1** | **6** | **19** | |

* As per norms

CAT - Category; BS - Basic Science; HS - Humanities and Social Sciences; ES - Engineering Sciences;
PC - Professional Core; PE - Professional Elective; OE - Open Elective; EEC - Employability Enhancement Course;
MC – Mandatory Course.

## B.E. MECHATRONICS ENGINEERING Regulations 2019

**Minimum credits to be earned: 160**

| Course Code | Course Title | Periods / week | | | Credits | CAT |
|---|---|---|---|---|---|---|
| | | Lecture | Tutorial | Practical | | |
| **SEMESTER 4** | | | | | | |
| U19MAT08 | Statistics and Numerical Methods | 3 | 1 | 0 | 4 | BS |
| U19MCT03 | Control System Engineering | 3 | 0 | 0 | 3 | PC |
| U19MCT04 | Kinematics and Dynamics of Machinery | 3 | 1 | 0 | 4 | PC |
| U19MCE03 | Manufacturing Technology | 3 | 0 | 2 | 4 | PC |
| U19MCT_ | Professional Elective I | 3 | 0 | 0 | 3 | PE |
| U19MCE04 | Sensors and Instrumentation | 3 | 0 | 2 | 4 | PC |
| U19MCP01 | Computer Aided Machine Drawing Laboratory | 0 | 0 | 4 | 2 | PC |
| U19MTT01 | Environmental Science* | 2 | 0 | 0 | 0 | MC |
| | **Total 30 Periods** | **20** | **2** | **8** | **24** | |
| **SEMESTER 5** | | | | | | |
| U19MCE05 | Power Electronics and Drives | 3 | 0 | 2 | 4 | PC |
| U19ECE09 | Microprocessor and Microcontroller | 3 | 0 | 2 | 4 | PC |
| U19MET08 | Design of Machine Elements | 3 | 0 | 0 | 3 | PC |
| U19MCT05 | Design of Mechatronics Systems | 3 | 0 | 0 | 3 | PC |
| U19MGT01 | Principles of Management and Ethics | 3 | 0 | 0 | 3 | HS |
| U19__ | Open Elective I | 3 | 0 | 0 | 3 | OE |
| U19MCO02 | Verbal Ability | 0 | 0 | 2 | 1 | EEC |
| U19MTT02 | Indian Constitution* | 3 | 0 | 0 | 0 | MC |
| | **Total 27 Periods** | **21** | 0 | 6 | **21** | |
| **SEMESTER 6** | | | | | | |
| U19MCE06 | PLC and Automation | 3 | 0 | 2 | 4 | PC |
| U19MCE07 | Fluid Power System and Automation | 3 | 0 | 2 | 4 | PC |
| U19__ | Open Elective II | 3 | 0 | 0 | 3 | OE |
| U19MGT02 | Total Quality Management | 3 | 0 | 0 | 3 | HS |
| U19__ | Open Elective III | 3 | 0 | 0 | 3 | OE |
| U19MCJ01 | Innovation Project | 0 | 0 | 4 | 2 | EEC |
| U19MCO03 | Quantitative Aptitude | 0 | 0 | 2 | 1 | EEC |
| | **Total 25 Periods** | **15** | **0** | **10** | **20** | |

## B.E. MECHATRONICS ENGINEERING **Regulations 2019**

**Minimum credits to be earned: 160**

* As per norms

CAT - Category; BS - Basic Science; HS - Humanities and Social Sciences; ES - Engineering Sciences; PC - Professional Core; PE - Professional Elective; OE - Open Elective; EEC - Employability Enhancement Course; MC – Mandatory Course.

| Course Code | Course Title | Periods / week | | | Credits | CAT |
|---|---|---|---|---|---|---|
| | | Lecture | Tutorial | Practical | | |
| **SEMESTER 7** | | | | | | |
| U19MCE08 | Computer Aided Design and Manufacturing | 3 | 0 | 2 | 4 | PC |
| U19MCE09 | Robotics and Machine Vision System | 3 | 0 | 2 | 4 | PC |
| U19___ | Professional Elective II | 3 | 0 | 0 | 3 | PE |
| U19___ | Open Elective IV | 3 | 0 | 0 | 3 | OE |
| U19MCT__ | Professional Elective III | 3 | 0 | 0 | 3 | PE |
| U19MCT__ | Professional Elective IV | 3 | 0 | 0 | 3 | PE |
| | **Total 22 Periods** | **18** | **0** | **4** | **20** | |
| **SEMESTER 8** | | | | | | |
| U19MCT__ | Professional Elective V | 3 | 0 | 0 | 3 | PE |
| U19MCT__ | Professional Elective VI | 3 | 0 | 0 | 3 | PE |
| U19MCJ02 | Project Work | 0 | 0 | 20 | 10 | EEC |
| | **Total 26 Periods** | **6** | **0** | **20** | **16** | |

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## B.E. MECHATRONICS ENGINEERING **Regulations 2019**

**Minimum credits to be earned: 160**

**PROFESSIONAL ELECTIVES**

| Course Code | Course Title |
|---|---|
| U19MCT51 | Thermo Dynamics and Heat Transfer |
| U19MET66 | Non-Traditional Machining Processes |
| U19MET54 | Refrigeration and Air Conditioning |
| U19MET73 | Computational Fluid Dynamics |
| U19MET74 | Design of Jigs, Fixtures and Press Tools |
| U19ECE07 | Digital Signal Processing |
| U19MCT52 | Fundamentals of Nano Science |
| U19MET65 | Maintenance Engineering |
| U19MET62 | Process Planning and Cost Estimation |
| U19MCT53 | Advanced Manufacturing Technology |
| U19MCT54 | Avionics |
| U19MET60 | Additive Manufacturing |
| U19ECT60 | Digital Image Processing |
| U19MCT55 | Medical Mechatronics |
| U19MCT56 | Virtual Instrumentation |
| U19MCT57 | Disaster Management |
| U19CST04 | Artificial Intelligence |
| U19MCT58 | Modeling and Simulation |
| U19MET78 | Micro Electro Mechanical Systems |
| U19MCT59 | Internet of Things |
| U19MET76 | Product Design |
| U19MCT60 | Artificial Intelligence for Robotics |
| U19MCT61 | Industry 4.0 |
| U19MCT62 | Automotive Electronics |

## B.E. MECHATRONICS ENGINEERING **Regulations 2019**

**Minimum credits to be earned: 160**

**SUMMARY OF CREDIT DISTRIBUTION**

| CAT | Credits / Semester | | | | | | | | Total Credits |
|---|---|---|---|---|---|---|---|---|---|
| | I | II | III | IV | V | VI | VII | VIII | |
| **HS** | 3 | 3 | 0 | 0 | 3 | 3 | 0 | 0 | **12** |
| **BS** | 8 | 8 | 4 | 4 | 0 | 0 | 0 | 0 | **24** |
| **ES** | 9 | 10 | 7 | 0 | 0 | 0 | 0 | 0 | **26** |
| **PC** | 0 | 0 | 7 | 17 | 14 | 8 | 8 | 0 | **54** |
| **PE** | 0 | 0 | 0 | 3 | 0 | 0 | 9 | 6 | **18** |
| **OE** | 0 | 0 | 0 | 0 | 3 | 6 | 3 | 0 | **12** |
| **EEC** | 0 | 0 | 1 | 0 | 1 | 3 | 0 | 10 | **15** |
| **Total** | | | | | | | | | **161** |

CAT - Category; BS - Basic Science; HS - Humanities and Social Sciences; ES - Engineering Sciences;
PC - Professional Core; PE - Professional Elective; OE - Open Elective; EEC - Employability Enhancement Course;
MC – Mandatory Course.

| U19EGE01 | TECHNICAL ENGLISH | L | T | P | C |
|---|---|---|---|---|---|
| | (Common to all Departments) | 2 | 0 | 2 | 3 |

**Pre-Requisites :** None

**Objectives:**

To make the students to

- learn technical and non- technical vocabulary in speaking and writing
- read and comprehend engineering and technical texts
- learn the required format for business and official communication
- familiarize technical communication portfolio
- practice to speak and write in English

**Course Outcomes**:

At the end of this course students will demonstrate the ability to

**CO1 :** use more technical and non- technical vocabulary in speaking and writing

**CO2 :** read and comprehend engineering and technical texts

**CO3 :** the required format for business and official communication

**CO4 :** apply technical communication portfolio wherever necessary

**CO5 :** will be able to speak and write in English

**Unit I INTRODUCTION TO TECHNICAL ENGLISH 9**

Listening: Listening to scientific and technical talks. Speaking: Self Introduction, introducing others. Reading: Skimming and scanning the text and finding the answers for the given questions. Writing: Parts of speech, word Formation- prefix and suffix, One word Substitutes, , Synonyms & Antonyms, Countable and Uncountable Nouns, technical Paragraph Writing, short essays related to various fields of engineering.

**Unit II WORDS AND SENTENCES 9**

Listening: Listening to longer technical talks and completing exercises based on that. Speaking: Describing a process, Reading: Note making on the given text. Writing: Matching words and phrases, Different forms of words, Types of sentences, Direct and Indirect Speech. instructions, Recommendations.

**Unit III ENGLISH FOR BUSINESS COMMUNICATION 9**

Listening: Listening to talks on latest technology. Speaking: Giving summary of an article. Reading; Reading technical texts Journals/ Articles. Writing; - tenses, question tags. Writing reports, report on various projects, Formal Letter- business letter- calling for quotation, placing orders.

**Unit IV TECHNICAL COMMUNICATION PORTFOLIO 9**

Listening: Listening to documentaries. Speaking: Discussion on the documentaries related to the documentaries listened. Reading: Reading for technical information and comprehending. Writing: Gerund, Technical vocabulary, 'If' conditionals, Expansion of compound nouns, writing notice, e-mails, Agenda & Minutes of Meeting.

**Unit V ESSENTIAL SOFTSKILLS FOR ENGINEERS 9**

Listening: Listening to TED talks. Speaking: Group Discussion. Reading; Pre Reading and post reading and answering comprehension questions. Writing: Gap fillers, Punctuation for effective writing, collocations, Active and Passive voice, Formal Letter- official letter Article Writing for journals

**Total Periods: 45**

**List of Exercise:**

1. Listening to scientific and technical talks
2. Speaking: Self Introduction, introducing others
3. Listening to longer technical talks and completing exercises based on that.

4. Speaking: Describing a process,
5. Listening to talks on latest technology.
6. Speaking: Giving summary of an article
7. Listening to documentaries.
8. Speaking: Discussion on the documentaries related to the documentaries listened.
9. Listening to TED talks.
10. Speaking: Group Discussion.

**Text Books:**

| S. No. | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1. | Jawahar Jewelcy and Dr. Ratna P | Technical English | VRB | 2013 |

**Reference Books:**

| S. No. | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1. | Mccarthy | Cambridge Grammar of English | Cambridge University press | 2010 |
| 2. | Peck, J. and Coyle, M. | 'The student's guide to writing' | Macmillan | 2005. |
| 3. | Thornbury, S | Uncovering grammar | Macmillan Education | 2005 |

**Web URL(s):**

1. https://www.google.com/search?client=ubuntu&channel=fs&q=ted+talk&ie=utf-8&oe=utf-8

| U19MAT01 | ENGINEERING MATHEMATICS - I | L | T | P | C |
|---|---|---|---|---|---|
| | (Common to All Branches) | 3 | 1 | 0 | 4 |

**Pre-Requisites :** Concepts of basic matrices, differentiation and integration

**Objectives:**

- Interpret the introductory concepts of matrices which will enable the students to model and analyze physical phenomenon involving the multidimensional variable.
- Demonstrate the methodologies involved in solving problems using Jacobian method(at later stage).
- Understand differential calculus through geometrical interpretation.
- Exemplify the concepts of integration through various techniques.
- Develop enough confidence to identify the modern mathematical pattern in real world and offer an appropriate solution using the skills learned in their interactive and supporting environment.

**Course Outcomes:**

At the end of this course students will demonstrate the ability to

**CO1 :** Apply the knowledge of matrices to solve the problems for respective areas of specialization

**CO2 :** Implement the various differentiation and integral techniques in solving the system.

**CO3 :** Apply the knowledge of calculus that are essential for engineering and technology.

**CO4 :** Explore the basic concepts of integration methods through geometrical representation.

**CO5 :** Evaluate the functions to get the surface area and volume using multiple integrals.

**Unit I MATRICES 9+3**

Linear Independence and dependence, Determinant, Gramer's rule. Eigen values and eigenvectors of a real matrix, Properties of eigenvalues and eigenvectors, Cayley – Hamilton theorem (statement), Orthogonal matrices, Application-Elastic Membrane.

**Unit II FUNCTIONS OF SEVERAL VARIABLES 9+3**

Limits and Continuity(Geometrical interpretations) –Properties of continuous function – Partial derivatives-Total derivatives- Jacobians - Taylor's series for two variables.

**Unit III DIFFERENTIAL CALCULUS 9+3**

Curvature of a curve (Cartesian co-ordinates) , centre and radius of curvature , circle of Curvature, Cartesian co-ordinates -Evolutes, Envelopes of family of curves.

**Unit IV INTEGRATION METHODS 9+3**

Basic integration formulae for algebraic and transcendental functions- Integration by special devices : Integration by parts – rationalizing substitution or trigonometric substitution-partial fraction – reduction formula's – Improper integrals.

**Unit V MULTIPLE INTEGRALS 9+3**

Double integration( Cartesian coordinates)-Region of integration, Triple integration in Cartesian Coordinates -Meaning and Application.

**Total Periods 45+15**

**Text Books:**

| S. No. | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1. | B.S.Grewal | Higher Engineering Mathematics, | Khanna Publishers,43rd EditionDelhi | 2015 |
| 2. | E.Kreyszig | Advanced Engineering Mathematics, | John Wiley and Sons(Asia)Ltd,Tenth Edition. Singapore | 2015 |

**Reference Books:**

| S. No. | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1. | Glyn James | Advanced Modern Engineering Mathematics | Wiley India | 2014 |
| 2. | Samantha Pal, Subodha .C.Bhunia | Engineering Mathematics | Oxford University | 2015 |
| 3. | C.Ray.Wylie, Loui's C.Barrett | Advanced Engineering Mathematics, $6^{th}$ edition | McGrawhill, $6^{th}$ edition, New Delhi | 2014 |

| U19CYE01 | APPLIED CHEMISTRY | L | T | P | C |
|---|---|---|---|---|---|
| | (Common to CIVIL, MECH and MCT) | 3 | 0 | 2 | 4 |

**Pre-Requisites :** None

**Objectives:**

To make the students

- understand the requirements of Boiler feed water, its problems and water treatment methods.
- familiar with the manufacture and properties of various engineering materials.
- learn the principles and generation of energy in solar cells, fuel cells and batteries.
- understand the basic concepts of phase rule and its application to one and two component systems and appreciate the purpose and significance of alloys.
- familiar with the nature of fuels and its combustion

**Course Outcomes**:

At the end of this course students will demonstrate the ability to

**CO1 :** explain the various water treatment process, which make it fit for industrial and domestic purpose.

**CO2 :** explain methods involved in the synthesis of different engineering materials and its properties.

**CO3 :** analyse various sources of energy and its storage in different batteries, which find its application in society including engineering fields.

**CO4 :** explain the principles involved in alloying metals and also its properties.

**CO5 :** analyse the combustion characteristics in engines and apply them in the design of combustion chambers.

**Unit I WATER TECHNOLOGY 9**

Hardness of water-types -expression-units-estimation of hardness of water by EDTA-numerical problems-boiler feed water-disadvantages of hard water in boilers-boiler troubles (scale & sludge, boiler corrosion)-water treatment-zeolite process, Ion exchange process-desalination-reverse osmosis-instrumental methods for water analysis-AAS, flame emission spectroscopy and photocolorimetry.

**Unit II ENGINEERING MATERIALS 9**

Refractories-classification-properties (refractoriness, RUL, dimensional stability, thermal spalling, thermal expansion, porosity)-manufacture of silica and magnesite bricks-Abrasives-classification-properties-manufacture of SiC, alundum, norbide-Portland Cement-manufacture (wet process)-properties-setting and hardening of cement-special cement-alumina cement and water proof cement.

**Unit III ENERGY SOURCES AND STORAGE DEVICES 9**

Energy sources-types-nuclear energy-nuclear fission-controlled nuclear fission-nuclear fusion-nuclear reactor power generator-breeder reactor-solar energy-solar energy conversion-wind energy-Batteries - primary (alkaline battery) - Secondary (lead storage battery, NICAD battery and lithium ion battery)-Fuel cells ($H_2$-$O_2$ , direct methanol and solid oxide)-super capacitors.

**Unit IV PHASE RULE AND ALLOYS 9**

Phase Rule: Introduction-definition of terms with examples-one component system-water system-reduced phase rule – thermal analysis and cooling curves-two component system-lead-silver system-pattinson process.

Alloys: Introduction-definition-properties of alloys-significance of alloying, functions and effect of alloying elements-ferrous alloys (Nichrome and Stainless steel )-Heat treatment of steel-non ferrous alloys (Brass and Bronze).

**Unit V FUELS AND COMBUSTION 9**

Fuels: Introduction-classification of fuels-coal-analysis of coal (proximate and ultimate)-carbonization- manufacture of metallurgical coke (Otto Hoffmann method)-petroleum-manufacture of synthetic petrol (Bergius process)-knocking-octane number-diesel oil-cetane number-natural gas-compressed natural gas (CNG)-liquefied petroleum gases (LPG)-power alcohol and bio diesel.

Combustion of fuels: Introduction-HCV and LCV-theoretical calculation of calorific value-ignition temperature-explosive range-flue gas analysis (gas chromatography).

**Total Periods 45**

**List of Experiments:**

1. Estimation of Total, Temporary and Permanent Hardness of Water Sample by EDTA method.
2. Determination of DO content in Water by Winkler's method.
3. Determination of strength of acids in a mixture using conductivity meter.
4. Determination of strength of an acid using pH meter.
5. Estimation of iron content of the given solution using potentiometer.
6. Determination of calcium oxide in cement.
7. Estimation of Iron in a given sample by photocolorimetry

**Text Books:**

| S. No. | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1. | Jain P.C. and Monica Jain | Engineering Chemistry, 16 th edition | Dhanpat Rai Publishing Company (P) Ltd., New Delhi. | 2017 |
| 2. | O.G.Palanna | Engineering Chemistry, 2nd edition | McGraw Hill Education (India) Pvt. Ltd., Chennai. | 2017 |

**Reference Books:**

| S. No. | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1. | Dara S.S<br>Umare S.S | Engineering Chemistry, 12th edition | S.Chand & Company Ltd., New Delhi | 2013 |
| 2. | Sivasankar.B | Engineering Chemistry | Tata McGraw-Hill Publishing Company, Ltd., NewDelhi | 2008 |
| 3. | S.Vairam<br>P.Kalyani<br>Suba Ramesh | Engineering Chemistry | Wiley India Pvt. Ltd, New Delhi, 1st Reprint | 2014 |

**Web URL(s):**

http://www.erforum.net/2016/01/engineering-chemistry-by-jain-and-jain-pdf-free-ebook.html

https://www.mhhe.com/palanna/ec2e

| U19ECT01 | ELEMENTS OF ELECTICAL, ELECTRONICS AND INFORMATION SCIENCE | L | T | P | C |
|---|---|---|---|---|---|
| | (Common to Mechanical, Civil, Mechatronics) | 3 | 0 | 0 | 3 |

**Pre-Requisites :** Mathematics and Physics at 10+2 level or equivalent level

**Objectives:**

- To understand the fundamental concepts of circuit elements, electrical connections, laws and networks.
- To realize the operational behaviour of semiconductor devices
- To impart the concepts of digital electronics.
- To categorize various types of communication systems.
- To Familiar with the concepts in Emerging fields of computer science.

**Course Outcomes**:

At the end of this course students will demonstrate the ability to

**CO1 :** Apply knowledge of fundamental concepts of circuits in engineering domains

**CO2 :** Understand and apply the concepts of semiconductor devices in engineering field

**CO3 :** Apply knowledge of digital electronics in engineering domain

**CO4 :** Understand different communication systems

**CO5 :** Get an exposure about various emerging areas

**Unit I Electric Circuits** **9**

Circuit Elements – Voltage, Current, Power and Energy, R, L and C - Series and parallel connections, Energy Sources, Source Transformation, Voltage division, Current division, Ohm's Law, Kirchhoff's Law – Voltage law, Current Law. Star and Delta Transformation, Power in series and parallel circuit

**Unit II Analog Electronics** **9**

Diode - Characteristics & Applications (Zener Diode, LED, Photo diode Rectifier, Clipping circuits,). BJT Transistor and its configuration, Transistor applications. Op-amps characteristics-Inverting and Non-inverting amplifier-Instrumentation amplifier as signal conditioning Circuit

**Unit III Digital Electronics** **9**

Introduction to numbers systems, basic Boolean laws, logic gates. Universal gates, Combinational circuit (Half-Adder, Full-Adder, Decoder), Sequential Circuit - Latch, Flip-Flop, Counters and Registers, Introduction to CMOS-Design of Universal gates using CMOS logic

**Unit IV Communication Fundamentals** **9**

Analog Communication-Need for Modulation- AM and FM modulation. Introduction to Digital Communication-Sampling and Quantization-PCM; Digital Modulation -ASK, FSK, PSK. Introduction to Wireless Technology-Wifi, ZigBee, Bluetooth

**Unit V Computer and Information Technology** **9**

Introduction: Artificial Intelligence, Cloud Computing, Big data Analysis, Parallel Computing, Cyber Security, Machine Learning, IoT

**Total Periods: 45**

**Text/ Reference Books:**

| S. No. | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1. | Sudhakar A, Shyammohan S Pillai | Circuits and Networks Analysis and Synthesis | TMGH | 2011 |
| 2. | Robert L. Boylestad, Louis Nasheresky | Electronic Devices and Circuit Theory | Pearson Education | 2013 |
| 3. | M. Morris Mano, Michael D. Ciletti | Digital Design,With an Introduction to the Verilog HDL | Pearson | 2013 |
| 4. | Wayne Tomasi | Electronic Communication Systems | Pearson Education | 2004 |

**Web URL(s):**

1. https://nptel.ac.in/courses
2. www.electronics-tutorials.ws/dccircuits/dcp_6.html
3. https://www.mrt.ac.lk/web/sites/default/files/elect/files/EE201_network_theorems_Nov07.pdf

| | Engineering Graphics | L | T | P | C |
|---|---|---|---|---|---|
| U19MET01 | (Common to MCT, MECH, CIVIL) | 2 | 0 | 4 | 4 |

**Pre-Requisites :** None

**Objectives:**

- To develop in students, graphic skills for communication of concepts, ideas and design of engineering products.
- To expose them to existing national standards related to technical drawings.

**Course Outcomes**:

At the end of this course students will demonstrate the ability to

**CO1 :** Perform free hand sketching of basic geometrical constructions and multiple views of objects.

**CO2 :** do orthographic projection of lines and plane surfaces

**CO3 :** draw projections and solids and development of surfaces

**CO4 :** Prepare isometric and perspective sections of simple solids.

**CO5 :** Demonstrate computer aided drafting.

**Unit I Projection of Points, Lines and Plane Surfaces 9**

Orthographic projection- principles-Principal planes-First angle projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method. Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

**Unit II Projection of Solids 9**

Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes by rotating object method.

**Unit III Projection of Sectioned Solids and Development of Surfaces 9**

Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones.

**Unit IV Free Hand Sketching 9**

Visualization concepts and Free Hand sketching: Visualization principles –Representation of Three Dimensional objects – Layout of views- Free hand sketching of multiple views from pictorial views of objects.

**Unit V Isometric and Perspective Projections 9**

Principles of isometric projection – isometric scale –Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions and conversion of orthographic views to isometric. Introduction to perspective projection of simple solids- Prisms, pyramids and cylinders.

**Total Periods: 45**

**Text Books:**

| S. No. | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1. | Venugopal K. and Prabhu Raja V | "Engineering Graphics" | New Age International (P) Limited | 2008. |
| 2. | Natrajan K.V., | A text book of Engineering Graphics | Dhanalakshmi Publishers Chennai, | 2009 |

**Reference Books:**

| S. No. | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1. | Bhatt N.D. and Panchal V.M | Engineering Drawing | Charotar Publishing House50th Edition, | 2010. |
| 2. | Gopalakrishna K.R., | "Engineering Drawing" (Vol. I&II combined), | Subhas Stores Bangalore, | 2007 |
| 3. | Luzzader, Warren.J . and Duff,John M | "Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production | Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi. | 2005 |

| U19EEP01 | Engineering Practices Laboratory | L | T | P | C |
|---|---|---|---|---|---|
| | (Common for all the departments) | 0 | 0 | 4 | 2 |

**Pre-Requisites :** None

**Objectives:**

- To know about the usage of appropriate tools and equipment's used in plumbing and carpentry
- To acquaint metal joining process
- To understand working methodologies in lathe and sheet metal.
- To impart knowledge in electrical wiring concepts for house hold and calculations of power and energy.
- To familiarize with various electronic components and equipments.
- To learn the basic skills of soldering electronic components and wires

**Course Outcomes**:

At the end of this course students will demonstrate the ability to

**CO1 :** use proper tools for plumbing and carpentry

**CO2 :** Join metals using arc welding

**CO3 :** create models in sheet metal and perform basic machining operations in lathe

**CO4 :** carry out basic home electrical works and measure electrical quantities

**CO5** possess the knowledge on various electronics components and equipments

**CO6 :** elaborate on soldering practices

**List of Experiments**:

**MECHANICAL AND CIVIL EENGINEERING PRACTICES**

1. Study of plumbing and carpentry components of residential and industrial building
2. Hands-on-exercise: Wood work, joints by sawing, planning and cutting
3. Preparation of butt joints, lap joints and T- joints by metal arc welding
4. Study of Lathe, centrifugal pump and air conditioner
5. Hands-on-exercise: Simple Turning, Taper Turning and Drilling Practice
6. Sheet Metal Works: Model making – Trays and funnels

**ELECTRICAL AND ELECTRONICS ENGINEERING PRACTICES**

1. Residential house wiring and staircase wiring.
2. Measurement of power and energy
3. Measurement of earth resistance
4. Study of different types of electronic components resistors, capacitors, inductors, function generator and DC power supply.
5. Study of CRO and measurement of AC signal parameter (peak-peak, rms period, frequency).
6. Soldering practice using general purpose PCB

| U19EGE02 | COMMUNICATIVE ENGLISH | L | T | P | C |
|---|---|---|---|---|---|
| | (Common to All Branches) | 2 | 0 | 2 | 3 |

**Pre-Requisites :** Concepts of Differentiation and Integration

**Objectives:**

- know the importance of listening skill for effective communication
- practice conversation and public speaking in English
- prepare for competitive examinations
- comprehend the format of business communication
- gain knowledge on communication abilities and language skills

**Course Outcomes**:

At the end of this course students will demonstrate the ability to

**CO1 :** communicate effectively

**CO2 :** do public speaking

**CO3 :** take up competitive examinations

**CO4 :** communicate officially

**CO5 :** master the language

**Unit I INTRODUCTION TO COMMUNICATIVE ENGLISH 9**

Listening: Listening to longer texts and filling up the table. Speaking: Describing a product. Reading: Reading Biography/ Autobiography of Scientists/ eminent personalities and answering the questions. Writing: simple, Compound and Complex sentences, One word Substitutes, Essay Writing

**Unit II ENGLISH FOR COMPETITIVE EXAMS 9**

Listening: listening to personal information. Speaking: Sharing personal information (likes and dislikes), Reading: Reading scientific blogs- projects related to engineering. Writing; Sample questions from International English Language Testing System (IELTS), Test of English as foreign language (TOEFL) & Civil Service (Language related)

**Unit III FORMAL COMMUNICATION 9**

Listening: Listening to formal conversation, Speaking: Role- play. Reading: Cloze Reading. Writing: Preposition, Phrasal Verbs, Singular or Plural Words, Degrees of Comparison, Job Application- Cover letter and Resume, Writing Circulars

**Unit IV VERBAL AND NON- VERBAL COMMUNICATION 9**

Listening; Listening to Mock Group Discussion and evaluating. Speaking: Making Presentation on the given topic Reading; Interpreting pictures and graphs- pie chart, flow chart, bar diagram and line graph. Writing: Infinitives and Gerunds, Regular and Irregular Verbs, Indefinite and Definite Articles

**Unit V LANGUAGE SKILLS 9**

Listening to Interviews. Speaking: Discussing company information/ describing the given data, trends and sales, Problem Solving techniques, Reading: Reading essays on global warming and other prevailing social issues. Writing: Contractions, Conjunctions or 'Joining Words, Subject -Verb Agreement, Proposal writing, Poster making

**Total Periods: 45**

**List of Experiments**:

1. Listening to longer texts and filling up the table.
2. Speaking: Describing a product.
3. Listening to personal information.
4. Speaking: Sharing personal information (likes and dislikes),

5. Listening to formal conversation,
6. Speaking: Role- play.
7. Listening to Mock Group Discussion and evaluating.
8. Speaking: Making Presentation on the given topic
9. Listening to Interviews.
10. Speaking: Discussing company information/ describing the given data, trends and sales, Problem Solving techniques

**Text Books:**

| S. No. | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1. | Dhanavel.S. N | English and Communication Skills | Orient LongSwan | 2013 |
| 2. | Lakshmana Perumal. N | Communicative English | Sri Krishna | 2018 |

**Reference Books:**

| S. No. | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1. | Mccarthy | Cambridge Grammar of English | Cambridge University press | 2010 |
| 2. | Rayadu, C.S | Communication | Himalaya Publishing House | 2007 |
| 3. | Murphy, R. and Smalzer, W. R | Grammar in use | Cambridge University Press | 2000 |

**Web URL(s):**

1. https://www.google.com/search?client=ubuntu&channel=fs&q=ted+talk&ie=utf-8&oe=utf-8

| U19MAT02 | ENGINEERING MATHEMATICS - II | L | T | P | C |
|---|---|---|---|---|---|
| | (Common to All Branches) | 3 | 1 | 0 | 4 |

**Pre-Requisites :** Concepts of Differentiation and Integration

**Objectives:**

- Understand the concepts of gradient, divergence and curl through vector differentiation.
- Distinguish line integral, double integral, triple integral using vector integration.
- Interpret the solution of second order differential equation.
- Exemplify the concept of Laplace transforms that converts time domain to frequency domain.
- Represent the concept of inverse Laplace transform for engineering problems.

**Course Outcomes**:

At the end of this course students will demonstrate the ability to

**CO1 :** Compute gradient, curl and divergence using vector differentiation.

**CO2 :** Evaluate line integral, double integral and volume integral using vector integration.

**CO3 :** Analyze and model the real time problems using differential equations.

**CO4 :** Apply the knowledge of Laplace transforms for periodic functions.

**CO5 :** Analyze and model the differential equations using Laplace transform.

**Unit I VECTOR DIFFERENTIATION 9+3**

Vector of scalar fields, directional derivative, gradient of a scalar field, surfaces, scalar potential, divergence and curl-Line integrals and independent of path, conservative vector fields-work done by a force.

**Unit II VECTOR INTEGRATION 9+3**

Double integrals, surface integral-flux, Green's theorem, triple integral- Gauss divergence theorem-Stoke's theorem

**Unit III LINEAR DIFFERENTIAL EQUATION OF SECOND ORDER 9+3**

Linear equations of second order with constant and variable coefficients (Euler,Cauchy's and Legendre's), Method of variation of parameter-Applications:electric circuit.

**Unit IV LAPLACE TRANSFORM 9+3**

Laplace transform: Linearity, shifting, transform of derivatives and integrals, Periodic function.

**Unit V INVERSE LAPLACE TRANSFORM 9+3**

Inverse linear transform: Convolution theorem(Statement only) ,partial fraction ,unit step and impulse function, Initial and Final value theorem,(Statements) Applications: differential equations .

**Total Periods 45+15**

**Text Books:**

| S. No. | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1. | B.S.Grewal | Higher Engineering Mathematics, | Khanna Publishers, 43rd Edition,Delhi | 2015 |
| 2. | E.Kreyszig | Advanced Engineering Mathematics | John Wiley and Sons(Asia)Ltd Tenth Edition ,Singapore | 2015 |

**Reference Books:**

| S. No. | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1. | Glyn James | Advanced Modern Engineering Mathematics | Wiley India | 2014 |
| 2. | Samantha Pal, Subodha .C.Bhunia | Engineering Mathematics | Oxford University | 2015 |
| 3. | C.Ray.Wylie, Loui's C.Barrett | Advanced Engineering Mathematics, | $6^{th}$ edition,McGrawhill, New Delhi | 2014 |

| | APPLIED PHYSICS | L | T | P | C |
|---|---|---|---|---|---|
| **U19PYE02** | (Common to CIVIL, MECH and MCT) | **3** | **0** | **2** | **4** |

**Pre-Requisites :** None

**Objectives:**

To make the students

- know about the elastic properties of materials.
- understand the different aspects of sound and production of ultrasaonic.
- comprehensive knowledge about diodes and identify its terminals.
- learn to apply the lever rule to determine the percentage of Phase present in ferrous alloys .
- understand the concept of ceramics, composites, metallic glasses and shape memory alloys.

**Course Outcomes**:

At the end of this course students will demonstrate the ability to

**CO1 :** apply the elastic properties of materials in engineering design.

**CO2 :** analyze the aspect of sound in audio and noise control industries.

**CO3 :** explain the types of semiconductors and its applications in electronic devices.

**CO4 :** apply the principle of iron carbon diagram to determine the phases in ferrous alloy materials in steel industries.

**CO5 :** select appropriate materials for latest automotive and aerospace industries.

**Unit I Properties of Matter** **9**

Elasticity – Stress-strain relationship - factors affecting elastic modulus and tensile strength – twisting couple - torsion pendulum: theory and experiment - bending of beams - bending moment – cantilever: theory and experiment – uniform and non-uniform bending: theory and experiment - Mechanical properties of Engineering materials - Tensile strength, Hardness, Fatigue.

**Unit II Acoustics and Ultrasonics** **9**

Classification of sound- decibel- Weber–Fechner law – Sabine's formula (No derivation) - Absorption Coefficient and its determination –factors affecting acoustics of buildings (Optimum reverberation time, loudness, focusing, echo, echelon effect, resonance and noise) and their remedies.

Ultrasonics – Principle- - Production of ultrasonics by Magnetostriction and piezoelectric methods-Non Destructive testing – pulse echo system through transmission and reflection modes.

**Unit III Semi Conducting Materials** **9**

Elemental and compound semiconductors - intrinsic semiconductors: carrier concentration – electrical conductivity-band gap. Extrinsic semiconductors: carrier concentration - variation of Fermi level. Hall effect: theory and experimental determination -applications of Hall effect**,** Light emitting diode, Photo diode.

**Unit IV Phase Diagrams and Ferrous Alloys** **9**

Solid solutions – Hume Rothery's rules – the phase rule – single component system – one component system of iron – binary phase diagrams – isomorphous systems – the tie-line rule – the lever rule – isomorphous system – eutectic phase diagram – free energy composition curve for binary systems – microstructural change during cooling. The iron – carbon equilibrium diagram phases, invariant reactions – eutectoid steel, hypo and hypereutectoid steels.

**Unit V Advanced Materials** **9**

Ceramics – types and applications – Composites – classification, role of matrix and reinforcement, processing of fiber reinforced plastics - Metallic glasses: types , glass forming ability of alloys, melt spinning process, applications -shape memory alloys: phases, shape memory effect, pseudoelastic effect, NiTi alloy, applications .

**Total Periods 45**

**List of Experiments:**

1. (a) Determination of Wavelength, and particle size using Laser.

   (b) Determination of acceptance angle in an optical fiber.
2. Determination of Young's modulus by uniform bending method.
3. Determination of thickness of a thin wire by Air wedge method.
4. Determination of thermal conductivity of a bad conductor–Lee's Disc method.
5. Determination of wavelength of mercury spectrum–spectrometer grating.
6. Determination of band gap of a semiconductor.

**Text Books:**

| S. No. | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1. | Brijlal, N.Subrahmanayam | Properties of Matter | S.Chand & Company Ltd., New Delhi. | 2001 |
| 2. | William D. Callister,Jr | Materials Science and Engineering, 9th edition | John Wiley and sons,Inc, | 2014 |

**Reference Books:**

| S. No. | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1. | Rajendran.V | Engineering Physics | Tata McGraw Hill Education private limited, New Delhi. | 2012 |
| 2. | Lawrence E.Kinsler, Austin R.Frey, Alan B.Coppens, James V.Sanders | Fundamentals of Acoustics, Fourth edition | Jonwiley and sons inc.UK. | 2010 |
| 3. | Dr.G.Senthil Kumar | Materials science, Revised edition | VRB Publications, Chennai. | 2018 |

| | Problem Solving and Python Programming | L | T | P | C |
|---|---|---|---|---|---|
| U19CSE01 | (Common to CSE, IT, ECE, EEE) | 3 | 0 | 2 | 4 |

**Pre-Requisites :** None

**Objectives:**

- To know the basics of algorithmic problem solving
- To read and write simple Python programs.
- To develop Python programs with conditionals and loops.
- To define Python functions and call them.
- To use Python data structures – lists, tuples, dictionaries.
- To do input/output with files in Python

**Course Outcomes**:

At the end of this course students will demonstrate the ability to

**CO1 :** Develop algorithmic solutions to simple computational problems

**CO2 :** Read, write, execute by hand simple Python programs.

**CO3 :** Structure simple Python programs for solving problems.

**CO4 :** Decompose a Python program into functions.

**CO5 :** Represent compound data using Python lists, tuples, and dictionaries.

**Unit I Problem Solving Techniques** **9**

General problem Solving concepts-: Algorithm, Pseudo-code and Flowchart Problem Solving with Sequential Logic Structure - Problem Solving with Decisions - Problem Solving with Loops. **Case Study:** Raptor and Scratch Tools.

**Unit II Basics of Python Programming** **8**

Features of Python, History of Python, The Future of Python, Literal Constants, Variables and Identifiers, Data Types, Input Operation, Comments, Reserved Words, Indentation, Operators and Expressions, Expressions in Python, Operations on Strings, Other Data Types, Type Conversion, String-String functions and methods

**Unit III Decision Control Statements** **9**

Introduction to Decision Control, Selection/Conditional Branching Statements, Basic Loop Structures/ Iterative Statements, Nested Loops, The break Statement, The continue Statement ,The pass Statement, The else Statement used with Loops. Case Study: Simple Calculator, Generating a Calendar

**Unit IV Lists, Tuples, Dictionaries** **10**

Sequence, Lists- Access Values in Lists, Updating Values in Lists, Nested Lists, Cloning Lists, Basic List Operations , List Methods , Looping in Lists , Tuple- Creating Tuple , Accessing Values in a Tuple , Basic Tuple Operations , Tuple Assignment ,Sets, dictionaries- Creating a Dictionary, Accessing Values, Adding and Modifying an Item in a Dictionary, Modifying an Entry, Deleting Items, Sorting Items in a Dictionary, Looping over a Dictionary, Nested Dictionaries

**Unit V Functions, Modules and Packages** **9**

Introduction, Function Definition, Function Call, Variable Scope and Lifetime, The return statement, Recursive Functions, Modules, Packages in Python, Standard Library modules. Case Study: Tower of Hanoi, Shuffling a Deck of Cards

**Total Periods: 45**

**List of Experiments**:

1. Draw Flowchart using Raptor Tool
   a. Simple Flow Chart
   b. Decision Making
   c. Looping[ Pre test & Post test]
2. Create Animation / Gaming /Application using Scratch Tool
3. Programs on Operators and expressions.
4. Program using Decision Making Statement

5. Programs using Looping Statements
6. Programs on List (Searching , Sorting)
7. Programs on Tuple
8. Program on Dictionaries
9. Programs using Strings Operations
10. Program using Functions
11. Programs using Modules and Packages

**Text Books:**

| S. No. | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1. | M. Sprankle | Problem Solving and Programming Concepts | Pearson Education | 2011 |
| 2. | Reema Thareja | Python Programming using problem solving | Oxford University | 2017 |

**Reference Books:**

| S. No. | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1. | Allen B. Downey | Think Python | O'Reilly Media | 2012 |
| 2. | Mark Lutz. | Learning Python | O'Reilly Media | 2013 |
| 3. | Alex | Python in a Nutshell | O'Reilly Media | 2006 |

**Web URL(s):**

1. https://docs.python.org/3/tutorial/
2. https://www.tutorialspoint.com/python/
3. https://nptel.ac.in/courses/106106182/
4. https://scipy-lectures.org/intro/language/python_language.html

| U19MET03 | Engineering Mechanics | L | T | P | C |
|---|---|---|---|---|---|
| | (Common to Mechanical, Mechatronics and Civil) | 3 | 1 | 0 | 4 |

**Pre-Requisites :** None

**Objectives:**

- To apply the laws of Mechanics to solve basic problems in day to day life.
- To develop capacity to predict the effect of force and motion in the course of carrying out the design functions of engineering.
- To develop the ability to understand the properties of surfaces and solids
- To apply the laws of friction to solve the simple life problems
- To develop the ability, in the engineering student, to understand the laws of motion and dynamic forces.

**Course Outcomes**:

At the end of this course students will demonstrate the ability to

**CO1 :** Analyze the effect of forces, its magnitudes and direction

**CO2 :** Analyze the rigid body in equilibrium

**CO3 :** Evaluate the properties of surfaces and solids

**CO4 :** Determine the frictional resistance and the effects by the laws of friction

**CO5 :** Calculate dynamic forces exerted on rigid body

**Unit I Statics of Particles 12**

Introduction to Mechanics – Fundamental Principles – Laws of Mechanics, Lame's theorem, Parallelogram and triangular Law of forces, Coplanar forces – Resolution of forces –Equilibrium of particle in space

**Unit II Statics of Rigid Bodies 12**

Free body diagram – Types of supports and their reactions – Moments and Couples – Moment of a force about a point and about an axis – Varignon's theorem – Single equivalent force -Equilibrium of Rigid bodies in two dimensions

**Unit III Properties of Sections 12**

Centroid - Rectangular, circular, triangular areas – T section, I section, Angle section, – Area moments of inertia of plane areas – Rectangular, circular, triangular areas by integration – T section, I section, Angle section, – Parallel axis theorem and perpendicular axis theorem –Principal moments of inertia of plane areas – Product of inertia and Mass moment of inertia of Cylinder, Cone and combination.

**Unit IV Dynamics of Particles and Friction 12**

Displacements, Velocity and acceleration, their relationship – relative motion – Curvilinear motion - Projectiles– Newton's law of motion – Work Energy Equation of particles – Impulse and Momentum – Impact of elastic bodies- Impact - direct and central impact – coefficient of restitution.
Friction - Characteristics and Laws of Dry friction - Problems involving dry and ladder friction

**Unit V Dynamics of Rigid Bodies 12**

General plane motion –Velocity and Acceleration- Absolute and Relative motion method - Equilibrium of rigid bodies in plane motion- D'Alembert's Principle- Work Energy Principle-Principle of impulse momentum for rigid bodies in plane motion

**Total Periods 60**

**Text Books:**

| S. No. | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1. | Vela Murali | Engineering Mechanics | Oxford University Press | 2010 |
| 2. | Ferdinand P. Beer, E. Russell Johnston. | Vector Mechanics for Engineers: Statics and Dynamics ($9^{th}$ Edition) | Tata McGraw-Hill International Edition | 2010 |

**Reference Books:**

| S. No. | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1. | J. L. Meriam and L. G. Kraige | Engineering Mechanics: Statics and Dynamics ($6^{th}$ Edition) | Wiley Publishers | 2006 |
| 2. | Rajasekaran S and Sankarasubramanian G. | Engineering Mechanics Statics and Dynamics", 3rd Edition | Vikas Publishing House Pvt. Ltd. | 2005 |
| 3. | Kumar, K.L., | Engineering Mechanics, 3rd Revised Edition, | Tata McGraw-Hill Publishing company, New Delhi. | 2008 |

| U19MEP01 | COMPUTER AIDED DRAFTING LABORATORY | L | T | P | C |
|---|---|---|---|---|---|
| | (Common to Mech, MCT and Civil) | 0 | 0 | 4 | 2 |

**Pre-Requisites :** If any

**Objectives:**

- To draw simple figures with title block using CAD software commands.
- To sketch curves like parabola, spiral and involute of square & circle and draw the orthographic projection of simple solids.
- To prepare orthographic projection of simple machine parts and draw a plan of residential building
- To develop skill in sketching simple steel truss and sectional views of simple solids.
- To develop skill to use software to create 2D and 3D models.

**Course Outcomes**:

At the end of this course students will demonstrate the ability to

**CO1 :** Sketch simple figures with title block using CAD software commands.

**CO2 :** Sketch curves like parabola, spiral and involute of square & circle and draw the orthographic projection of simple solids.

**CO3 :** Prepare orthographic projection of simple machine parts and draw a plan of residential building

**CO4 :** Sketch simple steel truss and sectional views of simple solids.

**CO5 :** Prepare 2D multi view drawing from 3D model

**List of Experiments**:

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

| U19MAT04 | TRANSFORMS AND BOUNDARY VALUE PROBLEMS | L | T | P | C |
|---|---|---|---|---|---|
| | (Common to CIVIL,ECE,EEE,MECH,MCT) | 3 | 1 | 0 | 4 |

**Pre-Requisites :** Types of integration and differentiation

**Objectives:**

To make the students

- Equip the students the effective mathematical tools to solve several physical problems by applying the solutions of partial differential equations .
- Fourier series analysis is introduced which is central to many applications in engineering apart from its use in solving boundary value problems
- Learn the concepts of Fourier transform.
- Improve the ability in solving applications of partial differential equations.
- Understand the concepts of Z transform techniques for discrete time systems and to solve the difference equations.

**Course Outcomes**:

At the end of this course students will demonstrate the ability to

1. Determine types of partial differential equations and to solve it.
2. Solve geometrical applications of Fourier series.
3. Expand the Fourier transform, student will be able to apply the transform to compute the solution.
4. Analyze and solve partial differential equations for application in their field of engineering.
5. Explain how to solve Z transform for application in the field of engineering.

**Unit I PARTIAL DIFFERENTIAL EQUATIONS 12**

Formation of Partial Differential equation by elimination arbitrary constants and arbitrary functions, Solution of standard types of first order equations, Lagrange's equation, linear partial Differential equation of second and higher order with constant coefficients.

**Unit II FOURIER SERIES 12**

Dirichlet's conditions, General Fourier series, Half Range Sine and Cosine series, Parseval's identity, Harmonic Analysis.

**Unit III FOURIER TRANSFORM 12**

The infinite Fourier transform , sine and cosine transform, properties, inversion theorem, Parseval's identity and convolution theorem ( statement only)

**Unit IV BOUNDARY VALUE PROBLEMS 12**

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 solution in cartesian coordinates

**Unit V Z – TRANSFORMS 12**

Definition and properties, Elementary Problems, convolution theorem (statement only), Inverse Z transforms (partial fraction method and residue method), Application of Z – Transforms in solving difference equations.

**Total Periods 60**

**Text/Reference Books:**


1. B.S.Grewal (2001). Higher Engineering Mathematics. 42th Edition. Khanna Publishers,Delhi.
2. B.V.Ramana, Higher Engineering Mathematics,Mc.Graw Hill Education ( India) Pvt.Ltd.
3. Bali.N. P and Manish Goyal, "A Textbook of Engineering Mathematics", 7th Edition, Laxmi Publications Pvt Ltd, 2007.
4. E.Kreyszig (2001). Advanced Engineering Mathematics. Tenth Edition. John Wiley and Sons (Asia)Ltd, Singapore.
5. T.Veerarajan,Engineering Mathematics (for Semester III). Tata McGraw – Hill Publishing Company Limited, second reprint,New Delhi , 2012

| U19MCT01 | STRENGTH OF MATERIALS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**Pre-Requisites :** Basic knowledge in Engineering Mechanics and Material science

**Objectives:**

- To study and estimate the mechanical properties of materials including its deformations under different loading conditions through experiments.
- To learn two dimensional stress systems and stresses in thin cylinders and spherical shells.
- To understand the deformation of shaft under torsion and deflection of closed helical springs.
- To gain knowledge on shear force and bending stress distribution in different beams under various loads.
- To impart knowledge on finding slope and deflection of beams and buckling of columns for various boundary conditions.

**Course Outcomes**:

At the end of this course students will demonstrate the ability to

**CO1 :** Evaluate the stresses and strains in regular and composite structures subjected to axial loads.

**CO2 :** Examine the stresses in two dimensional systems, thin cylinders and spheres.

**CO3 :** Examine the stresses induced in shaft and closed coil helical springs subjected to torsion.

**CO4 :** Examine the shear force, bending moment and shear stress of various beams under different loading conditions

**CO5 :** Evaluate the slope and deflection of beams and buckling loads of columns with different boundary conditions.

**Unit I STRESS, STRAIN AND DEFORMATION OF SOLIDS 9**

Introduction to mechanical properties - stresses and strains due to axial force, shear force, impact force and thermal stresses - stepped and composite bars - uniformly varying cross section. Stress-strain curve for ductile and brittle materials-Hooke law-Factor of safety –Poisson ratio - Elastic constants and their relationship.

**Unit II ANALYSIS OF STRESSES, THIN CYLINDERS AND SPHERES 9**

State of stresses at a point-Normal and shear stresses on inclined planes-Principal planes and stresses-Plane of maximum shear stress-Mohr's circle for bi-axial stress with shear stress - Hoop and longitudinal stresses in thin cylindrical and spherical shells-Changes in dimensions and volume.

**Unit III TORSION IN SHAFT AND HELICAL SPRING 9**

Analysis of torsion of circular solid and hollow shafts-stepped shaft-compound shaft- angle of twist and torsional stiffness. Closed coil helical spring-stresses and deflection under axial load-Maximum shear stress in spring section including Wahl's Factor - applications.

**Unit IV LOADS AND STRESSES IN BEAMS 9**

Types of beams-Supports and Loads, Shear force and Bending Moment in beams, Cantilever, simply supported and overhanging beams-Point of contra flexure. Theory of simple bending - bending and shear stress - stress variation along the length and section of the beam.

**Unit V DEFLECTION OF BEAMS AND COLUMNS 9**

Slope and Deflection of cantilever, simply supported and overhanging beams- Double integration method and Macaulay's method. Columns-types-Equivalent length- Euler and Rankine formulae – Slenderness.

**Total Periods 45**

**Text Books:**

| S. No. | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1. | R.K.Bansal | A Textbook of Strength of Materials | Laxmi Publications | 2016 |
| 2. | Jindal U.C., | Strength of Materials | Asian Books Pvt. Ltd., New Delhi | 2007 |

**Reference Books:**

| S. No. | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1. | S.S.Rattan | Strength of Materials Second Edition | Tata McGraw Hill, Delhi | 2011 |
| 2. | F. P. Beer and R. Johnston | Mechanics of Materials Third edition | Tata McGraw Hill Publishing Company Pvt Ltd., New Delhi, | 2002 |
| 3. | Egor P. Popov | Engineering Mechanics of Solids | Prentice Hall of India Learning Pvt. Ltd, New Delhi, | 2010 |

**Web URL(s):**

1. https://nptel.ac.in/courses/112107147/
2. https://swayam.gov.in/nd1_noc19_ce18/

| U19MCE01 | FLUID MECHANICS AND MACHINERY | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 2 | 4 |

**Pre-Requisites** : Knowledge of Engineering Mechanics

**Objectives:**

- To understand the basic principles involved in fluid mechanics and machinery..
- To learn the behavior of fluid particles under rest and moving conditions.
- To understand the moment principle in fluid mechanics and its application in flow through pumps as well as turbines.

**Course Outcomes**:

At the end of this course, students will demonstrate the ability to

**CO1 :** Apply basic principles to predict the fluid properties and study the fluid principles at rest.

**CO2 :** Study the physical behavior of fluids system and equations under moving conditions.

**CO3 :** Apply the concept of dimensional analysis for model study.

**CO4 :** Conduct the performance test on different types of turbines

**CO5 :** Conduct the performance study and selection of pumps for different applications.

**Unit I FLUID PROPERTIES 9**

Units and Dimensions – Fluid properties – Density, Specific gravity, Viscosity, Surface tension, Capillarity, Compressibility and Bulk modulus – Pascal's Law – pressure measurements – manometers - Fluid statics - Total pressure and centre of pressure on submerged surfaces

**Unit II FLUID KINEMATICS AND DYNAMICS** 9

Types of fluid flow and flow lines – control volume – continuity equation in one-dimension and three dimension – velocity potential and stream function -Energy equation – Euler and Bernoulli's equations – Applications of energy equations- Flow meters - Laminar and Turbulent flow through pipes – Hagen Poisullie equation- Darcy Weisbach formula- applications

**Unit III DIMENSIONAL ANALYSIS 9**

Need for dimensional analysis – Dimensional Homogeneity – Rayleigh's and Buckingham methods of dimensional analysis –Problems. Model study and Similitude – scale effects and distorted model.

**Unit IV HYDRAULIC TURBINES 9**

Impact of Jets- Euler's equation- Theory of rotodynamic machines- Velocity components at the entry and exit of the rotor- Classification of turbines-Axial, Radial and mixed flow turbines- – construction, working principles, Velocity triangles and design of Pelton wheel, Francis and Kaplan Turbines - head, losses, work done and efficiency - specific speed – operating characteristics - Governing of Turbines – Problems.

**Unit V PUMPS 9**

Classification of pumps - Centrifugal pump - working principle and Velocity triangle - discharge, work done and efficiencies – Gear oil and Multistage pumps - Reciprocating pumps - work done and efficiencies -Problems.

**Total Periods 45**

**LIST OF EXPERIMENTS:**

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

**Text Books:**

| S.No | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1. | Rajput.R.K | A text Book of Fluid Mechanics and Machinery | S. Chand and Company New Delhi | 2009 |
| 2. | Modi.P.N. and Seth.S.M., | Hydraulics and Fluid Mechanics including Hydraulic Machines | Standard book house, Delhi | 2015 |
| 3. | Bansal R K | Fluid Mechanics and Hydraulic Machines | Laxmi Publications New Delhi | 2015 |

**Reference Books:**

| S.No | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1. | Streeter, Victor L . and Wylie, E. Benjamin | Fluid Mechanics | Tata McGraw Hill, Delhi | 2017 |
| 2. | Natarajan.M.K | Fluid Machines | Anuradha Agencies, Vidayal Karuppur, Kumbakonaam | 1998 |
| 3. | Kumar.K.L | Engineering Fluid Mechanics | Eurasia Publishing House (P) Ltd., New Delhi | 2008 |

**Web URL(s):**

1. https://nptel.ac.in/courses/112105206/

| U19MCE02 | ELECTRICAL MACHINES | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 2 | 4 |

**Pre-Requisites :** Nil

**Objectives:**

- To understand the working principle and performance characteristics of DC Generator and DC Motor.
- To understand the working principle of transformers.
- To understand the working principle of induction machines and synchronous machines.
- To impart knowledge on special electrical machines.

**Course Outcomes**:

At the end of this course students will demonstrate the ability to

**CO1 :** Compare the excitation and magnetization characteristics of DC Machines.

**CO2 :** Ability to acquire the knowledge in construction details and equivalent circuit of transformers.

**CO3 :** Carry out various operating characteristics of synchronous motor to find the regulation.

**CO4 :** Compute the essential parameters for slip-speed characteristics of induction motor.

**CO5 :** Identify the special electrical machines for specified application

**Unit I DC MACHINES 9**

Constructional details – EMF equation – Methods of excitation – Self and separately excited generators – Characteristics of series, shunt and compound generators –Principle of operation of D.C. motor – Back EMF and torque equation – Characteristics of series, shunt and compound motors - Starting of D.C. motors –- Speed control of D.C. shunt motors.

**Unit II TRANSFORMERS 9**

Constructional details – Principle of operation – EMF equation – Transformation ratio –Equivalent circuit– Regulation and Efficiency –Three phase transformers-Autotransformers.

**Unit III SYNCHRONOUS MACHINES 9**

Constructional details - Types of rotors, operating characteristics - EMF equation - Synchronous reactance - Armature reaction - Voltage regulation - Synchronous motor: Principle of operation - Torque equation - Starting methods – Applications.

**Unit IV INDUCTION MACHINES 9**

Three phase induction motor: Principle of working - Construction - Production of RMF - Torque-slip characteristics, torque equation - Starting and Speed control–Single phase induction motors: Double field revolving Theory -Types-Applications.

**Unit V SPECIAL ELECTRICAL MACHINES 9**

Construction and Principle of operation of Reluctance motor-Hysteresis motor -Stepper motor-PMBLDC-Universal motor-Servomotor: Construction-Working principle-Types and their applications in Robotics and Automation.

**Total Periods 45**

**List of Experiments**:

1. Load test on D.C. shunt motor.
2. Load test on D.C. series motor.
3. Speed control of D.C. shunt motor.
4. Load characteristics of separately excited DC generator.
5. Load test on three phase induction motor.
6. Load test on single phase induction motor.
7. Performance characteristics of single phase transformer.
8. Performance characteristics of stepper motor.

**Text Books:**

| S. No. | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1. | Stephen J Chapman | Electric Machinery Fundamental | McGraw-Hill; 4th Edison | 2010 |
| 2. | Er.Rajput.R.K | Electrical Machines | Laxmi Publications (P) Ltd; 6th Edison | 2008 |
| 3. | Bhattacharya.S.K | Electrical Machines | Tata McGraw Hill Publishing company Ltd; Fourth edition | 2014 |
| 4. | Theraja.B.L, Theraja.A.K | A Textbook of Electrical Technology", Vol.II "AC & DC Machines | S.Chand & Company Ltd,New Delhi | 2005 |
| 5. | V.K.Mehta and Rohit Mehta | Principles of Electrical Machines | S.Chand Company New Delhi; 3rd Edison | 2013 |

**Reference Books:**

| S. No. | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1. | Guru.Sand Hiziroglu.H.R | Electrical Machinery and Transformers | Oxford University Press, 3rd Edison | 2003 |
| 2. | A.E.Fitzgerald, Charles Kingsley, Stephen.D.Umans | Electric Machinery | Mc Graw Hill publishing Company Ltd | 2003 |
| 3. | D P Kothari I J Nagrath | Basic Electrical Engineering | Tata McGraw Hill Education Private Limited New Delhi, 3rd Edison | 2010 |

**Web URL(s):**

1. https://nptel.ac.in/courses/108102146/
2. https://nptel.ac.in/courses/108/102/108102156/

| U19MCT02 | DIGITAL ELECTRONICS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**Pre-Requisites :** Elements of Electrical, Electronics and Information Science

**Objectives:**

- To introduce basic postulates of Boolean algebra and shows the correlation between Boolean expressions
- To introduce the methods for simplifying Boolean expressions
- To outline the formal procedures for the analysis and design of combinational circuits and sequential circuits
- To introduce the concept of memories and programmable logic devices.
- To illustrate the concept of synchronous and asynchronous sequential circuits

**Course Outcomes**:

**CO1 :** Introduce basic postulates of Boolean algebra and shows the correlation between Boolean expressions

**CO2 :** Study the formal procedures for the analysis and design of combinational circuits and sequential circuits

**CO3 :** Learn the concept of synchronous sequential circuits

**CO4 :** Learn the concept of asynchronous sequential circuits

**CO5 :** Introduce the concept of memories

**Unit I MINIMIZATION TECHNIQUES AND LOGIC GATES 9**

**Minimization Techniques:** Boolean postulates and laws – De-Morgan‟s Theorem - Principle of Duality - Boolean expression - Minimization of Boolean expressions — Minterm – Maxterm - Sum of Products (SOP) – Product of Sums (POS) – Karnaugh map Minimization – Don‟t care conditions – Quine - Mc Cluskey method of minimization.
**Logic Gates:** AND, OR, NOT, NAND, NOR, Exclusive–OR and Exclusive–NOR Implementations of Logic Functions using gates, NAND–NOR implementations – Multi level gate implementations- Multi output gate implementations. TTL and CMOS Logic and their characteristics – Tristate gates

**Unit II COMBINATIONAL CIRCUIT DESIGN 9**

Design of Half and Full Adders, Half and Full Subtractors, Binary Parallel Adder – Carry look ahead Adder, BCD Adder, Multiplexer, Demultiplexer, Magnitude Comparator, Decoder, Encoder, Priority Encoder-Parity Generator and Parity Checker

**Unit III SYNCHRONOUS SEQUENTIAL CIRCUITS 9**

Flip flops – SR, JK, T, D, Master/Slave FF – operation and excitation tables, Triggering of FF, Analysis and design of clocked sequential circuits – Design - Moore/Mealy models, state minimization, state assignment, circuit implementation – Design of Counters- Ripple Counters, Ring Counters, Shift registers, Universal Shift Register

**Unit IV ASYNCHRONOUS SEQUENTIAL CIRCUITS 9**

Stable and Unstable states, output specifications, cycles and races, state reduction, race free assignments, Hazards, Essential Hazards, Pulse mode sequential circuits, Design of Hazard free circuits.

**Unit V MEMORY DEVICES 9**

Basic memory structure – ROM -PROM – EPROM – EEPROM –EAPROM, RAM – Static and dynamic RAM - Programmable Logic Devices – Programmable Logic Array (PLA) - Programmable Array Logic (PAL) – Field Programmable Gate Arrays (FPGA) - Implementation of combinational logic circuits using PLA, PAL.

**Total Periods 45**

**Text Books:**

| S. No. | Author(s) | Title of the Book | Publisher/Edition | Year of Publication |
|---|---|---|---|---|
| 1. | M. Morris Mano and Michael D. Ciletti | Digital Design | Pearson | 2014 |
| 2. | Charles H.Roth | Fundamentals of Logic Design | Thomson Learning | 2013 |
| 3. | Thomas L. Floyd | Digital Fundamentals | Pearson | 2011 |
| 4. | S.Salivahanan and S.Arivazhagan | Digital Electronics | Vikas Publishing House | 2012 |

**Reference Books:**

| S. No. | Author(s) | Title of the Book | Publisher/Edition | Year of Publication |
|---|---|---|---|---|
| 1. | A.Anand Kumar | Fundamentals of Digital Circuits | 4th Edition, PHI Learning Private Limited | 2016 |
| 2. | Anil K.Maini | Digital Electronics | Wiley | 2014 |
| 3. | Soumitra Kumar Mandal | Digital Electronics | McGraw Hill Education Private Limited | 2016 |

**Web URL(s):**

1. https://swayam.gov.in/nd1_noc20_ee32
2. https://swayam.gov.in/nd1_noc19_ee51

| U19MCA01 | Interpersonal skills Listening and speaking | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 2 | 1 |

**Pre-Requisites :** Nil

**Objectives:**

- Equip students with the English language skills required for the successful undertaking ofacademic studies with primary emphasis on academic speaking and listening skills.
- Provide guidance and practice in basic general and classroom conversation and to engage inspecific academic speaking activities.
- Improve general and academic listening skills
- Make effective presentations

Course Outcomes:

- Listen and respond appropriately.
- Participate in group discussions
- Make effective presentations
- Participate confidently and appropriately in conversations both formal and informal

| | | |
|---|---|---|
| Unit I | Listening as a key skill- its importance- speaking - give personal information - ask for personal information - express ability - enquire about ability - ask for clarification Improving pronunciation -pronunciation basics taking lecture notes - preparing to listen to a lecture - articulate a complete idea as opposed to producing fragmented utterances. | 3 |
| | | |
| Unit II | Listen to a process information- give information, as part of a simple explanation – conversation starters: small talk - stressing syllables and speaking clearly - intonation patterns - compare and contrast information and ideas from multiple sources- converse with reasonable accuracy over a wide range of everyday topics. | 3 |
| | | |
| Unit III | Lexical chunking for accuracy and fluency- factors influence fluency, deliver a five-minute informal talk - greet - respond to greetings - describe health and symptoms - invite and offer - accept - decline -take leave - listen for and follow the gist- listen for detail | 3 |
| | | |
| Unit IV | Being an active listener: giving verbal and non-verbal feedback - participating in a group discussion - summarizing academic readings and lectures conversational speech listening to and participating in conversations - persuade. | 3 |
| | | |
| Unit V | Formal and informal talk - listen to follow and respond to explanations, directions and instructions in academic and business contexts - strategies for presentations and interactive communication -group/pair presentations - negotiate disagreement in group work. | 3 |
| | | |
| | Total Periods | 15 |

**Text Books:**

| S. No. | Author(s) | Title of the Book | Publisher/Edition | Year of Publication |
|---|---|---|---|---|
| 1. | Brooks,Margret | Skills for Success. Listening and Speaking. Level 4 | Oxford University Press,Oxford | 2011 |
| 2. | Richards,C. Jack. & David Bholke | Speak Now Level 3. Oxford | Oxford University Press, | 2010 |

**Reference Books:**

| S. No. | Author(s) | Title of the Book | Publisher/Edition | Year of Publication |
|---|---|---|---|---|
| 1. | Bhatnagar, Nitin and MamtaBhatnagar | Communicative English for Engineers and Professionals | Pearson: New Delhi | 2010 |
| 2. | Hughes, Glyn and Josephine Moate | Practical English Classroom | Oxford University Press | 2014 |

| U19MAT08 | STATISTICS AND NUMERICAL METHODS | L | T | P | C |
|---|---|---|---|---|---|
| | (Common to MECH & MCT) | 3 | 1 | 0 | 4 |

**Pre-Requisites :** Concepts of integration, differentiation and basic of probability and standard distributions

**Objectives:**

To provide the necessary basic concepts and procedures for solving numerically, different kinds of problems occurring in engineering and technology.

- The roots of nonlinear equations, solutions of large system and problem of matrix can be obtained numerically where analytical methods fail to give solution
- When huge amounts of experimental data are involved, the methods discussed on interpolation will be useful in constructing approximate polynomial to represent the data and to find the intermediate values.
- The numerical differentiation and integration find application when the function in the analytical form is too complicated or the huge amounts of data are given such as series of measurements, observations or some other empirical information.
- Since many physical laws are couched in terms of rate of change of one /two or more independent variables, most of the engineering problems are characterized in the form of either nonlinear ordinary differential equations or partial differential equations. The methods introduced in the solution of ordinary differential equations will be useful in attempting any engineering problems.
- It helps the students to have a clear perception of the power of statistical and numerical techniques, ideas and would be able to demonstrate the applications of these techniques to problems drawn from industry, management and other engineering fields.

**Course Outcomes**:

At the end of this course students will demonstrate the ability to

1. Analyze numerical techniques, ideas and would be able to demonstrate the applications of these techniques to problems drawn from industry, management and other engineering fields.
2. Apply the numerical techniques to solve the differentiation and integration.
3. Analyze and solve ordinary differential equations for application in their field of engineering
4. Demonstrate the testing hypothesis in the real life.
5. Explain how to find the solution of industrial and agriculture problems using design of experiments.

**Unit I NUMERICAL SOLUTION OF LINEAR EQUATIONS 9+3**

Solution of algebraic and transcendental equations– Newton Raphson method - Solution of linear system of equations - Gauss elimination method – Pivoting - Gauss Jordan method – Iterative methods of Gauss Jacobi and Gauss Seidel - Matrix Inversion by Gauss Jordan method.

**Unit II INTERPOLATION, NUMERICAL DIFFERENTIATION AND INTEGRATION 9+3**

Interpolation with equal intervals - Newton's forward and backward difference formulae, Interpolation with unequal intervals - Lagrange's interpolation– Approximation of derivatives using interpolation polynomials – Numerical solution of single and double integrations using Trapezoidal and Simpson's rules.

**Unit III NUMERICAL SOLUTION OF ODE GIVEN INITIAL VALUES 9+3**

Ordinary differential equations: Initial value problems, Taylor series, fourth order Runge - Kutta methods, Predictor Corrector methods, Milne's and Adams Bash forth Method.

**Unit IV TESTING OF HYPOTHESIS 9+3**

Large sample test based on Normal distribution for single mean and difference of means – Tests based on t,chi-square and F distributions for testing means and variances –Contingency table (Test for Independency) - Goodness of fit.

**Unit V DESIGN OF EXPERIMENTS 9+3**

One way and two way classifications - Completely randomized design – Randomized block design – Latin square design.

**Total Periods 45+15**

**Text/Reference Books:**


1. Grewal. B.S., and Grewal. J.S.,"Numerical methods in Engineering and Science", Khanna Publishers, 9th Edition,New Delhi ,2007.
2. Gerald. C. F., and Wheatley. P. O., "Applied Numerical Analysis", Pearson Education,Asia, 6th Edition, New Delhi,2006.
3. Richard L.Burden ,J.Douglas Faires and Annette Burden "Numerical Analysis" ,Cengage Learning ,10th edition,2015.
4. P.Kandasamy, K.Thilagavathy and K.Gunavathy(2005). Numerical Methods. S.Chand &Co.Ltd, Delhi.
5. Douglas.C.Montgomery and George.C.Runger "Applied Statistics and Probability for Engineers" John Wiley and Sons, 5th Edition, 2011.


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| U19MCT03 | CONTROL SYSTEM ENGINEERING | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**Pre-Requisites :** Basic knowledge in Partial Differential Equations and Laplace Transforms

**Objectives:**

- To impart the basic concepts of control systems components and its feedback control.
- To understand and perform time domain and frequency domain analysis of control systems required for stability analysis.
- To understand the compensation techniques that can be used to stabilize control systems.
- To introduce state variable representation of physical systems.

**Course Outcomes**:

At the end of this course students will demonstrate the ability to

**CO1 :** Identify the various control system components and their representations.

**CO2 :** Analyse the performance of first and second order system and compute the steady state error for different test signals.

**CO3 :** Analyse the frequency domain response and determine the phase margin and gain margin using bode plot, polar plot.

**CO4 :** Calculate the stability of the system using Routh Hurwitz, Nyquist, Root Locus techniques and design the compensation technique that can be used to stabilize control systems.

**CO5 :** Check the system controllability and observability using state space approach.

**Unit I SYSTEMS AND THEIR REPRESENTATION 9**

Basic elements in control systems – open and closed loop systems with applications – Mathematical model, Translational & Rotational systems – Transfer function – Block diagram reduction techniques – signal flow graph-Transfer function of DC and AC servomotor.

**Unit II TIME RESPONSE ANALYSIS 9**

Time response-Time domain specifications-Types of systems inputs- First and second order system response- Steady state error constants – Generalized error constants-Effect of P, PI, PID controllers.

**Unit III FREQUENCY RESPONSE ANALYSIS 9**

Frequency Response – frequency domain specifications- correlation between time domain and frequency domain specifications-Bode Plot, Polar Plot.

**Unit IV STABILITY ANALYSIS 9**

Characteristics equation-Routh Hurwitz criterion for stability- Nyquist stability criterion-Root locus concept- Guidelines for sketching root locus. **Compensator Design**: Performance criteria - effects of Lag, lead and lag-lead networks and Compensator design using bode plot.

**Unit V STATE VARIABLE ANALYSIS 9**

State variable representation-Conversion of state variable models to transfer functions-Conversion of transfer functions to state variable models-Solution of state equations-Concepts of Controllability and Observability.

**Total Periods 45**

**Text Books:**

| S.No. | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1. | I.J.Nagrath and M.Gopal | “Control System Engineering” | New Age International Publishers; | 2017 |
| 2. | Benjamin.C.Kuo | “Automatic control systems” | Wiley | 2014 |

**Reference Books:**

| S.No. | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1. | Katsuhiko Ogata | “Modern Control Engineering” | Pearson | 2015 |
| 2. | Rames C.Panda and T. Thyagarajan | “An Introduction to Process Modelling Identification and Control of Engineers” | Narosa Publishing House | 2017 |
| 3. | B.C. Kuo | “Automatic Control Systems” | Prentice Hall of India Pvt. Ltd., New Delhi | 2014 |
| 4. | Richard C. Dorf and Bishop, R.H | “Modern Control Systems” | Pearson Education, 12th Edison | 2011 |

**Web URL(s):**

1. https://nptel.ac.in/courses/108106098/
2. https://nptel.ac.in/courses/108103008/

| | | L | T | P | C |
|---|---|---|---|---|---|
| **U19MCT04** | **KINEMATICS AND DYNAMICS OF MACHINERY** | **3** | **1** | **0** | **4** |

**Pre-Requisites :** Nil.

**Objectives:**

- To understand various mechanisms and find their velocity and acceleration.
- To study and construct the cam profile for various types of follower motion and to understand the effects of friction in motion transmission and in machine components.
- To perform force analysis in IC Engine and balancing of rotating masses.
- To learn the concept of free and forced vibration, transverse and torsional vibration.
- To understand the basic concepts of toothed gearing.

**Course Outcomes**:

**CO1 :** Examine the basic of mechanism based on given application and Calculate velocity and acceleration in simple mechanisms

**CO2 :** Construct the cam profile for different follower motion and analyse the amount of power transmitted by friction drive.

**CO3 :** Perform dynamic force analysis and estimate the balancing of rotating and reciprocating masses.

**CO4 :** Calculate the natural frequency of free and forced vibration, transverse and torsional vibration of single, two and three rotors system.

**CO5 :** Estimate the speed ratio of different types of gear train.

**Unit I KINEMATICS AND ANALYSIS OF MECHANISMS 12**

Basic Elements of Mechanisms – Introduction to kinematic links, pairs, chain, machine and structure, degrees of freedom. Grashoff's law, Kutzback criterion. Kinematic inversions of four-bar and slider crank chain, Tensegrity Table. Velocity and acceleration analysis for Four bar chain and single slider crank mechanism.

**Unit II KINEMATICS OF CAM MECHANISMS AND FRICTION ELEMENTS 12**

Classification of cams and followers – Terminology and definitions – Displacement diagrams –Uniform velocity, simple harmonic, uniform acceleration and retardation and cycloidal motions – Friction drives – Friction in screw threads – Flat Belt, V Belt and rope drives.

**Unit III FORCE ANALYSIS AND BALANCING 12**

Dynamic force analysis – Inertia force and Inertia torque – D Alembert’s principle – Force Analysis in reciprocating engines – Turning moment diagrams – Fly Wheels – Balancing rotating masses – several masses rotating in the same plane and different planes – Balancing reciprocating masses – Balancing coupled locomotives.

**Unit IV VIBRATION 12**

Types of vibration – Free undamped vibration, Free Damped vibration (Viscus Damping) – Transverse vibration of shafts and beams, Shaft carrying several loads, whirling of shafts – Torsional vibration – Torsionally equivalent Shaft, single rotor, two rotor and three rotor system. Forced damped vibration – Disturbance caused by unbalance – Vibration isolation – Transmissibility.

**Unit V GEAR AND GEAR TRAINS 12**

Law of toothed gearing – Involutes and cycloidal tooth profiles – Spur gear terminology and definitions Gear tooth action – Interference and undercutting – Contact ratio – Helical, bevel, worm, rack and pinion gears (Basics only) - Introduction to gear correction gear trains Speed ratio, train value, Parallel axis gear trains, Epicyclic gear trains.

**Total Periods: 60**

**Text Books:**

| S. No. | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1. | Rattan SS | Theory of Machines | Tata McGraw-Hill Publishing Company Ltd., New Delhi. 5th Edition | 2020 |
| 2. | Uicker, J.J., Pennock G.R and Shigley, J.E., | Theory of Machines and Mechanisms | Oxford University Press, 4th Edition | 2014 |

**Reference Books:**

| S. No. | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1. | R. S. Khurmi | Theory of Machines | S Chand Publications | 2005 |
| 2. | R.K. Bansal | Theory of Machines | Lakshmi publications pvt.ltd., | 2011 |
| 3. | Robert L. Norton | Kinematics and Dynamics of Machinery | Tata McGraw-Hill Publishing Company Ltd, New Delhi. | 2009 |
| 4. | Sadhu Singh | Theory of Machines | Prentice Hall of India Learning, New Delhi. | 2012 |
| 5. | Thomas Beven | Theory of Machines | CBS Publishers and Distributors, 3rd edition | 2013 |
| 6. | Henry T. Brown | 507 Mechanical Movements | Brown & Seward Publisher. | 1901 |

**Web URL(s):**

1. https://nptel.ac.in/courses/112104114/9
2. https://onlinecourses.nptel.ac.in/noc19_me29/preview

| U19MCE03 | MANUFACTURING TECHNOLOGY | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 2 | 4 |

**Pre-Requisites :** Nil.

**Objectives:**

- To learn about different methods of manufacturing applied to mechanical oriented industries.
- To understand the manufacturing processes in correlation with material properties which change the shape, size and form of the raw materials into the desirable product by conventional methods
- To learn stateof the art digital manufacturing methods.

**Course Outcomes**:

At the end of the course, students will be able to:

**CO1 :** Learn the basic principles of foundry practices,process capabilities and various operations involved in metal casting processes.

**CO2 :** Understand the different types of joining processes and their process capabilities.

**CO3 :** Know the various bulk deformation processes and their applications.

**CO4 :** Select the appropriate conventional machining process and understand the metal removal capability

**CO5 :** Know the role of variousplastic forming processes and Additive Manufacturing processes according to industrial requirements

**Unit I METAL CASTING PROCESS** **9**

Patterns- Pattern materials, types of pattern, Pattern allowances-types of molding sand and its properties, mold sand composition- Sand Casting- Core Making-Methods of sand testing- Melting Practices: cupola, Induction furnaces - Casting cleaning and casting defects-Inspection methods. Special casting processes: Investment casting process, Die casting process, shell molding process-centrifugal casting process-$CO_2$ Process

**Unit II JOINING PROCESSES** **9**

Fusion welding processes-Types of Gas Welding-Fuel Gases, Oxy-Acetylene Welding Equipment-Flame characteristics- Filler and Flux materials, Electric-Arc Welding, Electrodes, Coated electrode designation for manual metal arc welding, Inert-Gas Shielded Arc Welding, Tungsten Inert-Gas Welding (TIG), Metal Inert Gas Welding (MIG), Submerged Arc-Welding (SAW), Resistance Welding-Welding Defects. Basic principles of ThermitWelding.

**Unit III BULK DEFORMATION PROCESSES** **9**

Hot working and cold working of metals-Forging processes-Open, impression and closed die forging-types of Forging machines-Typical forging operations-Swaging-Rolling of metals-Types of rolling mills-Flat strip rollingShape rolling operations-Defects in rolled parts-principle of rod and wire drawing-Tube drawing-Principles of extrusion-Types of Extrusion-hot and cold extrusion-Equipment used.

**Unit IV CONVENTIONAL MACHINING PROCESSES** **9**

Centre lathe - various turning operations, taper turning methods, special attachments, Capstan and turret lathes – automats –Reciprocating machine tools: Shaper, Planner. Milling: types, milling cutters, operations –Hole making: Drilling – Reaming- Boring -Tapping – Introduction of CNC Machining and Programming.

**Unit V FORMING & SHAPING OF PLASTICSAND ADDITIVE MANUFACTURING PROCESSES** **9**

Processing of plastics: General aspects-Plastic processing methods-compression moulding-Transfer moulding-Injectionmoulding, rotational moulding-blow moulding-Extrusion-Thermoforming.
Basic Additive Manufacturing (AM) processes – Materials for AM

**Total Periods: 45**

**LIST OF EXPERIMENTS**

1.Plain,Taper and Step turning in lathe machine

2.Thread cutting in lathe machine

3.Drilling,Tapping and Reaming in Drilling machine

4. Spur/Helical Gear cutting in Horizontal milling machine

5.Cutting of keyways and Dove tail cutting in Shaping machine

6. Preparation of sand mould using solid and split patterns

7. Fabrication of Butt and T joints by Tig Welding equipment

**Total Periods: 15 Hours**

**Text Books:**

| S. No. | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1. | HajraChoudhury | Elements of work shop Technology -Vol.I and II | Media Promoters and Publishers Pvt Ltd | 2005 |
| 2. | Sharma P.C | A Text book of Production Technology | S. Chand and Co. Ltd | 2009 |
| 3. | Chua C.K., Leong K.F., and Lim C.S | Rapid Prototyping: Principles and Applications | Third Edition, World Scientific Publishers | 2010 |

## Reference Books:

| S. No. | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1. | Jain R.K and S.C .Gupta | Production Technology | Khanna Publishers | 2001 |
| 2. | ------- | H.M.T Production Technology - Hand book | Tata McGraw-Hill | 2000 |
| 3. | Adithan M & Gupta A B | Manufacturing Technology | New Age | 2006 |
| 4. | Roy.A.Linberg | Process and materials of manufacture | PHI | 2000 |

**Web URL(s):**

https://nptel.ac.in/courses/112/107/112107145/#

| U19MCE04 | SENSORS AND INSTRUMENTATION | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 2 | 4 |

**Pre–Requisites : None**

**Objectives:**

- To understand the concepts of measurement technology.
- To learn the various sensors used to measure various physical parameters.
- To learn the fundamentals of signal conditioning, data acquisition and communication systems used in Mechatronics system development.

**Course Outcomes**:

At the end of this course students will demonstrate the ability to

**CO1 :** Familiar with various calibration techniques and signal types for sensors.

**CO2 :** Apply the various sensors in the Automotive and Mechatronics applications.

**CO3 :** Describe the working principle and characteristics of force and optical sensors.

**CO4 :** Understand the basic principles of various ranging, smart sensors for automation.

**CO5 :** Ability to implement the DAQ systems with different sensors for real time applications.

**Unit I INTRODUCTION 9 Hours**

Basics of Measurement – Classification of errors – Error analysis – Static and dynamic characteristics of transducers – Performance measures of sensors – Classification of sensors – Sensor calibration techniques – Sensor Output Signal Types.

**Unit II MOTION ,PRESSURE AND TEMPERATURE SENSORS 10 Hour**

Motion Sensors – Potentiometers – Encoders – Optical, Magnetic, Inductive, Capacitive – LVDT – RVDT – Synchro – Microsyn – Diaphragm, Bellows – Piezoelectric– Vibration sensors – Temperature – Thermistor, RTD, Thermocouple– Acoustic Sensors.

**Unit III FORCE AND OPTICAL SENSORS 8 Hours**

Strain Gage – Load Cell – Magnetic sensors – Magneto resistive – Hall Effect– Compass, Gyroscope – Inclinometers – Accelerometer – Dynamometer – Photo conductive cell, photo voltaic, Photo resistive, LDR – Fibre optic sensors.

**Unit IV RANGING AND PROXIMITY SENSOR TECHNOLOGY 9 Hours**

Basics of Radar Technology – Ultrasonic Sonar Systems – LIDAR – RFID– NFC – BLE –BEACON– GPS – Smart Sensors – MEMS Sensors – Automotive sensors –Uses of Sensor Data Fusion – Introduction to IoT sensors.

**Unit V SIGNAL CONDITIONING AND DAQ SYSTEMS 9 Hours**

Amplification – Filtering – Sample and Hold circuits – Data Acquisition: Single channel and Multi channel data acquisition –Data logging – applications – Case study on Aerospace, Home appliances, Manufacturing, Environmental monitoring.

**Total Periods 45**

**List of Experiments :**

1. Design and testing of Digital Comparator
2. Design and testing of Analog to Digital Converters.
3. Comparison of capacitive and resistive type transducer for humidity measurement with their characteristics.
4. Displacement measurement using Potentiometer and plotting the characteristic curves.
5. Displacement measurement using LVDT and plotting the characteristic curves.
6. Measurement and calibration of Strain Gauge and Load Cell
7. Temperature measurement using Thermocouple, Thermistor and RTD and comparing the characteristics
8. Design and testing of ranging sensors for LED and servo control.
9. Study of LDR, Photo Diodes & Photo Voltaic cells.
10. Temperature measurement using NI DAQ and LabVIEW software

**Text Books:**

| S. No. | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1. | Ernest O Doebelin | Measurement Systems – Applications and Design | Tata McGraw–Hill | 2009 |
| 2. | Sawney A K and Puneet Sawney | A Course in Mechanical Measurements and Instrumentation and Control | 12th edition, Dhanpat Rai and Co, New Delhi | 2013 |
| 3. | Er. Sonal Sapra & J P Navani | Sensors and Instrumentation | S. Chand Publishing | 2014 |

**Reference Books:**

| S. No. | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1. | C. Sujatha , Dyer S.A | Survey of Instrumentation and Measurement | John Wiley and Sons, Canada | 2001 |
| 2. | H S Kalsi | Electronic Instrumentation | TMH 2nd edition | 2004 |
| 3. | Patranabis D | Sensors and Transducers | 2nd Edition, PHI, New Delhi | 2011 |
| 4. | Richard Zurawski | Industrial Communication Technology Handbook | 2nd edition, CRC Press | 2015 |
| 5. | John G. Webster Halit Eren | Measurement, Instrumentation, and Sensors Handbook | 2nd edition, CRC Press | 2017 |

**Web URL(s):**

1. https://nptel.ac.in/courses/108108147/
2. https://swayam.gov.in/nd1_noc19_ee41/preview
3. http://www.ni.com/data–acquisition/what–is/
4. Sensor virtual lab – http://sl–coep.vlabs.ac.in/

| U19MCP01 | COMPUTER AIDED MACHINE DRAWING LABORATORY | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 4 | 2 |

**Pre-Requisites :** Nil.

**Objectives:**

- To provide knowledge on reading of machine drawing with Geometric Dimensioning and Tolerancing with symbols.
- To familiarize the representation of various machine element drawings.
- To impart the significance of sectional views.
- To provide knowledge on 3D modeling features and assembly concepts.
- To prepare assembly drawings of various components by both manually and using standard CAD packages

**Course Outcomes**:

**CO1 :** Describe the basics of machine drawing standards, Fits and Geometric Dimensioning and Tolerancing

**CO2 :** Represent the machine elements with respect to industrial application.

**CO3 :** Re-create part drawings, sectional views and assembly drawings as per standards.

**CO4 :** Perform 3D features and draw the sectional views of mechanical components.

**CO5 :** Sketch the assembly drawings of various mechanical components

**Unit I INTRODUCTION TO MACHINE DRAWING & FITS AND TOLERANCES 5**

Importance of Machine Drawing – BIS specification – Classification of Machine Drawings: Assembly drawing, production drawing, detailed drawing, catalogues drawing, patent drawing – Geometric Dimensioning & Tolerances – symbols – Fundamentals of Limits & Fits – Weld Symbols.

**Unit II REPRESENTATION OF MACHINE ELEMENTS 5**

Representation of hexagonal bolt and nut – Forms and proportions of rivet heads: chain and zigzag type – Representation of screws, taper keys, pins and drill holes.

**Unit III INTRODUCTION TO 2D DRAFTING AND SECTIONAL VIEWS 9**

Drawing – Editing – Dimensioning – Layering – Fillet – Chamfer – Hatching – Block – Array – Detailing – Detailed drawing – Cutting plane and its representation – hatching of sections – full section – half section – local sections – revolved sections – thin sections – Sectional views of : Pedestal bearing, and non return valve.

**Unit IV 3D MODELING AND ASSEMBLY 9**

Sketcher – Datum planes – Protrusion – Holes – Part modeling – Extrusion – Revolve – Sweep – Loft – Blend – Fillet – Pattern – Chamfer – Round – Mirror – Section – Assembly – Bill of materials – Sectional views of assembled drawings.

**Unit V ASSEMBLY DRAWINGS 32**

Assembly of : Gib and Cotter joint – Flange coupling – Universal coupling – Stuffing box – Screw jack – Plummer block – Machine Vice – Gear pump – Robotic arm - Piston and connecting rod of IC engine.

**Total Periods: 60**

**Note:**

- Five assembly drawings must be done manually in 2D and remaining five assembly drawings must be done by using any CAD software in 3D.
- Prefer any 3D Modeling software like SOLIDWORKS, CREO, CATIA, AutoCAD, FreeCAD etc.

**Text Books:**

| S. No. | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1. | Gary R.Bertoline, Eric N.Wiebe, | Technical Graphics Communication | IR WIN Graphic Series, 4th edition, Tata McGraw Hill. | 2017 |
| 2. | Brian Griffths, | Engineering Drawing for Manufacture | Kogan Page Science. | 2012 |

**Reference Books:**

| S. No. | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1. | K.L. Narayana, P. Kannaiah, K.Venkata Reddy | Machine Drawing | New age International Publishers, 5th Edition. | 2012 |
| 2. | N.D. Bhatt, | Machine Drawing | Charotar Publishing House Pvt. Ltd., | 2014 |
| 3. | K.R. Gopalakrishna, | Machine Drawing | Subash stores, 20th edition. | 2012 |

**Web URL(s):**

1. https://nptel.ac.in/syllabus/112106075/

| U19MTT01 | Environmental Science | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 0 | 0 | 0 |

**Pre-Requisites :** Applied Chemistry

**Objectives:**

- To study the integrated themes and biodiversity, natural resources, pollution control and waste management.

**Course Outcomes**:

At the end of this course, the student will be able to

**CO1 :** To study the nature and facts about environment.

**CO2 :** To finding and implementing scientific, technological, economic and political solutions to environmental problems.

**CO3 :** To study the interrelationship between living organism and environment.

**CO4 :** To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.

**CO5 :** To study the dynamic processes and understand the features of the earth's interior and surface.

**Unit I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY 5**

Definition - scope of environment - concept of an ecosystem - structure and function of an ecosystem - producers, consumers and decomposers - ecological succession processes - Introduction, types, characteristic features, structure and function of the various ecosystems. Introduction to biodiversity- definition: genetic, species and ecosystem diversity - threats to biodiversity - endangered and endemic species of India - conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.

**Unit II NATURAL RESOURCES 7**

Forest resources: Use and over - exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people -Water resources: Use and overutilization of surface and ground water - Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies - Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies - Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Case studies: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

**Unit III ENVIRONMENTAL POLLUTION 7**

Definition – Sources, causes, effects and control measures of Water pollution : Physical and chemical properties of terrestrial and marine water and their environmental significance; Water quality parameters - physical, chemical and biological; absorption of heavy metals- Air pollution - Chemical and photochemical reactions in the atmosphere - Control of particulate and gaseous emission, Control of SOX, NOX, CO and HC- Soil pollution - causes, effects and control measures- Marine pollution- Noise pollution- Thermal pollution-Nuclear hazards-role of an individual in prevention of pollution.

**Unit IV SOCIAL ISSUES AND THE ENVIRONMENTAL LEGISLATION 6**

From unsustainable to sustainable development - urban problems related to energy - water conservation, rain water harvesting, water shed management - resettlement and rehabilitation of people; its problems and concerns- role of non-governmental organization- environmental ethics: Issues and possible solutions. Environment protection act - Air act - Water act - Wildlife protection act - Forest conservation act -The Biomedical Waste (Management and Handling) Rules; 1998 and amendments- scheme of labeling of environmentally friendly products (Eco mark). Disaster management: floods, earthquake, cyclone and landslides.

**Unit V ENVIRONMENT IMPACT ASSESSMENT 5**

Environmental impact analysis (EIA) - Environmental Impact Statement (EIS) - Legal and Regulatory aspects in India – Types and limitations of EIA - Terms of Reference in EIA- Issues in EIA - national – cross sectoral - social and cultural - Case studies of EIA of developmental projects.

**Total Periods 30**

**Text Books:**

| S.No | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1. | Benny Joseph | Environmental Science and Engineering | Tata McGraw Hill, New Delhi | 2006 |
| 2. | Gilbert M.Masters | Introduction to Environmental Engineering and Science | 2nd edition, Pearson Education | 2004 |

**Reference Books:**

| S.No | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1. | Cunningham W.P.Cooper., T.H. Gorhani | Environmental Encyclopedia | Jaico Publishing House, Mumbai | 2001 |
| 2. | Dharmendra S. Sengar | Environmental law | Prentice hall of India PVT LTD, New Delhi, | 2007 |
| 3. | Rajagopalan R | Environmental Studies - From Crisis to Cure | Oxford University Press | 2005 |
| 4. | Petts. J | Handbook of Environmental Impact Assessment Vol. I and II | Blackwell Science | 2009 |

**Web URL(s):**

**1. https://nptel.ac.in/noc/courses/noc19/SEM2/noc19-ge22/**

| U19MCE05 | POWER ELECTRONICS AND DRIVES | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 2 | 4 |

**Pre-Requisites :** Basic Knowledge in Electrical & Electronics Engineering.

**Objectives:**

- To familiarize the characteristics of different types of power electronics devices.
- To impart knowledge on operation, characteristics and performance parameters of AC-DC converters and DC-DC Converters.
- To learn the different modulation techniques of pulse width modulated inverters and to understand the operation of AC-AC converters.
- To study the applications of Phase control rectifiers and choppers in DC motor Drives.
- To study the applications of Inverters and AC-AC converters in AC motor Drives.

**Course Outcomes**:

At the end of this course students will demonstrate the ability to

**CO1 :** Understand the characteristics of power electronics devices.

**CO2 :** Analyze the various AC-DC converters and DC-DC converters.

**CO3 :** Acquire knowledge in the operation of DC-AC converters, AC-AC converters and its applications.

**CO4 :** Identify the DC motor drives for various applications using the phase controlled rectifiers and choppers.

**CO5 :** Apply the AC motor drives for various applications using inverters and AC-AC converters.

**Unit I POWER ELECTRONICS DEVICES 9**

Introduction to Power Electronics -Construction, Operation, Static and dynamic characteristics of Power Diode, SCR, TRIAC, GTO, Power transistor, MOSFET, IGBT and IGCT – Introduction to Driver and snubber circuits.

**Unit II AC TO DC CONVERTERS AND DC-DC CONVERTERS 9**

Controlled Bridge Rectifiers - single phase and three phase half controlled and fully controlled rectifiers with R, RL Load- Effect of source Inductance- Dual converters- Applications -Light dimmer.
Choppers, Control Strategies, Types of Choppers, Buck, Boost, Buck-boost Converter-Applications-Battery operated vehicles, Solar PV systems.

**Unit III DC-AC CONVERTERS AND AC-AC CONVERTERS 9**

Single phase and three phase voltage source inverters (both120° mode and 180°mode) - Voltage control methods -PWM techniques: Multiple PWM, Sinusoidal PWM, modified sinusoidal PWM -Application-induction heating, UPS. AC voltage controllers- Principle of Phase control and Integral Cycle Control - Basic Principle of Cycloconverter -Applications-welding.

**Unit IV DC DRIVES 9**

Basic Elements - Types of Electric Drives- selection of drive- closed loop control of DC drives- Phase controlled rectifier fed separately excited DC motor drives-Four quadrant operation of chopper fed drives-stepper motor drive- BLDC motor drive.

**Unit V AC DRIVES 9**

Speed control of Induction motor drives-Closed loop control of Induction motor drive - Stator Voltage

Control - Variable frequency control - V/F Control - CSI and VSI fed drives - Cycloconverter Fed Drives - Slip power Recovery system - Permanent magnet Synchronous motor Drives- Microprocessor based control of PMSM

**Total Periods: 45+15=60**

**List of Experiments**:

1. Static and Dynamic characteristics of SCR.
2. Static and Dynamic characteristics of MOSFET and IGBT.
3. Single phase AC to DC half controlled and fully controlled converter.
4. Step down and Step up DC-DC converter.
5. IGBT based single phase PWM inverter.
6. Speed control of dc motor using three phase rectifier.
7. Speed control of brushless dc motor.
8. Speed control of 3 phase induction motor using PWM inverter.

**Text Books:**

| S. No. | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1. | Muhammad H. Rashid | Power Electronics: Circuits, Devices & Applications | Pearson, 4th Edition | 2014 |
| 2. | Dubey. G. K | Fundamentals of Electrical Drives | Narosa publishing house, 2nd edition, | 2010 |

**Reference Books:**

| S. No. | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1. | Joseph Vithayathil | Power Electronics – Principle and Applications | Tata McGraw-Hill Inc, New Delhi | 2010 |
| 2. | L.Umanand | Power Electronics: Essentials and Applications | Wiley | 2010 |
| 3. | P. S. Bimbhra | Power Electronics | Khanna Publishers, 6th Edition | 2018 |
| 4. | S.Rama Reddy | Fundamentals of Power Electronics | Narosa Publications | 2014 |
| 5. | Vedam Subramanyam | Thyristor Control of Electric Drives | Tata McGraw Hill | 2007 |

**Web URL(s):**

1. https://nptel.ac.in/courses/108/105/108105066/
2. https://nptel.ac.in/courses/108/108/108108077/

| | MICROPROCESSOR AND MICROCONTROLLER | L | T | P | C |
|---|---|---|---|---|---|
| **U19ECE09** | (Common to Electrical and Electronics, Electronics and Communication, Computer Science, IT and Mechatronics) | **3** | **0** | **2** | **4** |

**Pre-Requisites :** Nil.

**Objectives:**

- To understand the Architecture of 8086 microprocessor.
- To learn the design aspects of I/O and Memory Interfacing circuits.
- To interface microprocessors with supporting chips.
- To study the Architecture of 8051 microcontroller.
- To design a microcontroller based system

**Course Outcomes**:

**CO1 :** Understand and execute programs based on 8086 microprocessor.

**CO2 :** Study of microprocessor configurations.

**CO3 :** Interface memory and I/O circuits with 8086.

**CO4 :** Design and implement 8051 microcontroller based systems.

**CO5 :** Design and interface I/O circuits with 8051.Be familiar with 8086 and 8051 programs and MASM.

**Unit I The 8086 Microprocessor 9**

Introduction to 8085 and its operation - Introduction to 8086 – Microprocessor architecture – Addressing modes - Instruction set and assembler directives – Assembly language programming – Modular Programming - Linking and Relocation - Stacks - Procedures – Macros – Interrupts and interrupt service routines – Byte and String Manipulation

**Unit II 8086 SYSTEM BUS STRUCTURE 9**

8086 signals – Basic configurations – System bus timing –System design using 8086 – IO programming – Introduction to Multiprogramming – System Bus Structure - Multiprocessor configurations – Coprocessor, Closely coupled and loosely Coupled configurations – Introduction to advanced processors

**Unit III I/O INTERFACING 9**

Memory Interfacing and I/O interfacing - Parallel communication interface – Serial communication interface – Timer – Interrupt controller – DMA controller – Interfacing with DAC, ADC and A/D Keyboard /display controller

**Unit IV MICROCONTROLLER 9**

Architecture of 8051 – Special Function Registers(SFRs) - I/O Pins Ports and Circuits - Instruction set - Addressing modes - Assembly language programming.

**Unit V INTERFACING MICROCONTROLLER 9**

Programming 8051 Timers - Serial Port Programming - Interrupts Programming – LCD & Keyboard Interfacing - ADC, DAC & Sensor Interfacing - External Memory Interface- Stepper Motor and Waveform generation.

**Total Periods: 45+15 = 60**

**List of Experiments:**

8086 Microprocessor

1. Basic arithmetic and Logical operations
2. Code conversion
3. String manipulations
4. Sorting and searching
5. DAC/ADC Interface
6. Serial and Parallel interface

8051 Microcontroller

7. Basic arithmetic and Logical operations
8. Square and Cube program, Find 2‘s complement of a number
9. Unpacked BCD to ASCII
10. Interfacing Stepper Motor.

**Text Books:**

| S. No. | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1. | Yu-Cheng Liu, Glenn A.Gibson | Microcomputer Systems: The 8086 / 8088 Family - Architecture, Programming and Design, Second Edition | Prentice Hall of India | 2007 |
| 2. | Mohamed Ali Mazidi, Janice Gillispie Mazidi, Rolin McKinlay | The 8051 Microcontroller and Embedded Systems: Using Assembly and C, Second Edition | Pearson Education | 2011 |

**Reference Books:**

| S. No. | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1. | Doughlas V.Hall | Microprocessors and Interfacing, Programming and Hardware | TMH | 2012 |
| 2. | Walter A Triebel and Avtar Singh | . The 8088 and 8086 Microprocessors – Programming, Interfacing, software, Hardware and Applications. | Pearson Education, New Delhi | 2009 |

**Web URL(s):**

1. https://nptel.ac.in/courses/106/108/106108100/
2. https://nptel.ac.in/courses/108/103/108103157/

| U19MET08 | Design of Machine Elements | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 1 | 0 | 3 |

**Prerequisites :** Knowledge of Engineering Mechanics

**Objectives:**

- To familiarize the various steps involved in the Design Process
- To understand the principle involved in evaluating the shape and dimensions of a component to satisfy functional and strength requirements.
- To learn to use standard practices and standard data
- To learn to use catalogues and standard machine components

**Course Outcomes**:

At the end of this course, students will demonstrate the ability to

**CO1 :** Explain the influence of steady and variable stresses in machine component design

**CO2 :** Apply the concepts of design to shafts, keys and couplings

**CO3 :** Apply the concepts of design to temporary and permanent joints

**CO4 :** Apply the concepts of design to energy absorbing members, connecting rod and crank shaft.

**CO5 :** Apply the concepts of design to bearings

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

Introduction to the design process - factors influencing machine design, selection of materials based on mechanical properties - Preferred numbers, fits and tolerances – Direct, Bending and torsional stress equations – Impact and shock loading – calculation of principle stresses for various load combinations, eccentric loading – curved beams – crane hook and ‘C’ frame- Factor of safety - theories of failure – Design based on strength and stiffness – stress concentration – Design for variable loading.

**Unit II SHAFTS AND COUPLINGS** 9

Design of solid and hollow shafts based on strength, rigidity and critical speed – Keys, keyways and splines - Rigid and flexible couplings.

**Unit III TEMPORARY AND PERMANENT JOINTS 9**

Threaded fastners - Bolted joints including eccentric loading, Knuckle joints, Cotter joints – Welded joints, riveted joints for structures - theory of bonded joints.

**Unit IV ENERGY STORING ELEMENTS AND ENGINE COMPONENTS 9**

Various types of springs, optimization of helical springs - rubber springs - Flywheels considering stresses in rims and arms for engines and punching machines- Connecting Rods and crank shafts.

**Unit V BEARINGS 9**

Sliding contact and rolling contact bearings - Hydrodynamic journal bearings, Sommerfeld Number, Raimondi and Boyd graphs, -- Selection of Rolling Contact bearings

**Total Periods: 45**

**Text Books:**

| S.No | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Bhandari V | Design of Machine Elements, 4th Edition | Tata McGraw-Hill , New Delhi | 2016 |
| 2 | Joseph Shigley, Charles Mischke, Richard Budynas and Keith Nisbett | Mechanical Engineering Design, 9th Edition | Tata McGraw-Hill, New Delhi | 2011 |

**Reference Books:**

| S.No | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1. | Sundararajamoorthy T. V. and Shanmugam .N, | Machine Design | Anuradha Publications, Chennai, | 2015 |
| 2. | Robert C. Juvinall and Kurt M. Marshek | Fundamentals of Machine Design,4th Edition | John-Wiley | 2005 |
| 3. | R.B. Patel | Design of Machine Elements | MacMillan Publishers India P Ltd., Tech-Max Educational resources, | 2011 |
| 4. | P.C. Gope | Machine Design – fundamental and Application | PHI learning private ltd, New Delhi | 2012 |
| 5. | Ansel Ugural | Mechanical Design – An Integral Approach,1st Edition | Tata McGraw-Hill, New Delhi | 2003 |

**Web URL(s)**

1. https://nptel.ac.in/courses/112/105/112105125/
2. https://nptel.ac.in/courses/112/105/112105124/
3. https://nptel.ac.in/courses/112/106/112106137/

| U19MCT05 | DESIGN OF MECHATRONICS SYSTEMS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**Pre–Requisites :** Nil

**Objectives:**

- To familiarize the steps involved in the mechatronics system design process
- To understand the concepts of mechatronics system modelling
- To learn the theoretical and practical aspects of computer interfacing, real time data acquisition and control with Design of motion control, convention and automation control.
- To enable the student to understand the practical applications of mechatronics systems

**Course Outcomes**:

At the end of this course students will demonstrate the ability to

**CO1 :** Identify the necessary components for mechatronics system design

**CO2 :** Apply system modelling concepts to build mechatronics systems

**CO3 :** Create and develop various physical models for mechatronics systems

**CO4 :** select the suitable type of interface for mechatronics system

**CO5 :** Create and build the Mechatronics systems for real time applications

**Unit I INTRODUCTION TO DESIGN OF MECHATRONICS SYSTEM 9**

Key Elements – Mechatronics Design Process – Design Parameters – Mechatronics Traditional Design approach– Advanced Approaches in Mechatronics Design – Introduction to Industrial Design– Ergonomics and Safety.

**Unit II BASIC SYSTEM MODELLING 9**

Introduction to Modeling and Simulation – Model Categories – Model Development – Simulation Using Software – Verification and Validation – Mathematical Modeling of Dynamic Systems .

**Unit III MECHATRONIC SYSTEM MODELLING 8**

Engineering systems: Rotational – translational, electro–mechanical, pneumatic–mechanical, hydraulic–mechanical, micro electro mechanical system – Dynamic responses of system: first order, second order system – Performance measures.

**Unit IV REAL TIME INTERFACING 9**

Introduction – Selection of interfacing standards – elements of data acquisition and control systems – Overview of I/O process – general purpose I/O cards and its installation – Data conversion process – Application software – Man machine interface.

**Unit V CASE STUDIES ON DESIGN OF MECHATRONICS SYSTEM 10**

Motion control for motors – Temperature control of hot/cold reservoir – Pick and place robot – Car parking barriers – Mechatronics in Defence applications, vehicular systems, Medical systems – Renewable Energy based Mechatronics systems.

**Total Periods: 45**

**Text Books:**

| S. No. | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1. | Devdas shetty, Richard A. Kolk | Mechatronics System Design | 2nd Edition,Cengage Learning | 2011 |
| 2. | Georg pelz | Mechatronic Systems: Modeling and simulation with | HDL's, John wiley and sons Ltd | 2003 |

**Reference Books:**

| S. No. | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1. | Bishop, Robert H | Mechatronics Hand book | CRC Press | 2002 |
| 2. | Bradley, D.Dawson, N.C. Burd and A.J. Loader | Mechatronics: Electronics in Products and Processes | CRC Press 1991 , First Indian print | 2010 |
| 3. | De Silva, Taylor & Francis | Mechatronics: A Foundation Course | Indian Reprint | 2013 |

**Web URL(s):**

1.https://nptel.ac.in/courses/112103174/

2.https://swayam.gov.in/nd1_noc20_me37/preview

3.https://www.tutorialspoint.com/control_systems/control_systems_modelling_mechanical.html

| U19MGT01 | PRINCIPLES OF MANAGEMENT AND ETHICS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**Pre-Requisites :** NIL

**Objectives:**

- To help the students gain understanding of the functions and responsibilities of managers.
- To provide them tools and techniques to be used in the performance of the managerial job.
- To enable them to analyze and understand the environment of the organization.
- To enable the students to create an awareness on Engineering Ethics and Human Values to instill Moral and Social Values and Loyalty and to appreciate the rights of others.

**Course Outcomes**:

At the end of this course students will demonstrate the ability to

**CO1 :** Describe the basic of management and its types, skills, management roles, types of business organization and current trends in business.

**CO2 :** Explain the nature and purpose of planning, objectives of planning and decision process. Compare the different organization structures, human resource management and training and development

**CO3 :** Estimate the individual and group behavior, motivation, job satisfaction types and theories of leadership, Apply the knowledge using the various system and process of controlling, budgetary and non-budgetary control techniques.

**CO4 :** Understanding basic purpose of profession, professional ethics and various moral and social issues.

**CO5 :** Acquiring knowledge of various roles of Engineer In applying ethical principles at various professional levels

**Unit I INTRODUCTION TO MANAGEMENT 6**

Definition and functions of Management – types of managers – managerial roles and skills – Evolution of Management – Scientific, human relations, system and contingency approaches.

**Unit II PLANNING AND ORGANISING 10**

Nature and purpose of planning – planning process – types of planning – Planning Tools and Techniques – MBO – Decision making steps and process – organizing process – organization structure – Departmentation – Human Resource Management – HR Planning, Recruitment, selection, Training and Development.

**Unit III DIRECTING AND CONTROLLING 10**

Motivation – motivation theories – motivational techniques – leadership – types and theories of leadership – communication – process of communication – barrier in communication – effective communication System – budgetary and non-budgetary control techniques – use of computers and IT in Management control – direct and preventive control.

**Unit IV HUMAN VALUES 10**

Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self-confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management.

**Unit V ENGINEERING ETHICS 9**

Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models of professional roles - Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories.

**Total Periods: 45**

**Text Books:**

| S. No. | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1. | Stephen P. Robbins & Mary Coulter | Management | Prentice Hall (India)Pvt. Ltd. | 2018 |
| 2. | Mike W. Martin and Roland Schinzinger . | Ethics in Engineering | Tata McGraw Hill | 2017 |

**Reference Books:**

| S. No. | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1. | Stephen A. Robbins & David A. Decenzo & Mary Coulter | Fundamentals of Management | Pearson Education | 2011 |
| 2. | Harold Koontz & Heinz Weihrich | Essentials of Management | Tata McGraw Hill | 2012 |
| 3. | Laura P. Hartman and Joe Desjardins | Business Ethics: Decision Making for Personal Integrity and Social Responsibility” | Mc Graw Hill education, India Pvt. Ltd | 2013 |
| 4 | Charles B. Fleddermann | Engineering Ethics | Pearson Prentice Hall | 2011 |

| U19MCO02 | Verbal Ability | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 2 | 1 |

**Objectives:**

- To help the student understand the importance of having his language skills kept ready for effective use.
- To provide a host of varied opportunities for the student to hone his acquired language skills basic components, namely, Grammar, Vocabulary, Spelling and Comprehension.

**Course Outcomes**:

- At the end of this course, a student would have obtained a multitude of opportunities in testing and applying his/her Grammar, Vocabulary, Spelling and Comprehension resulting in the refinement of his/her language skills and the ability to use the skills for effective communication.

**Unit I** 3

- Antonyms and Synonyms
- Spellings
- Selecting words
- Vocabulary exercises

**Unit II**

- One word substitutes
- Verbal analogies and reasoning
- Sentence formation
- Change of voice

**Unit III**

- Cloze Test
- Comprehension
- Paragraph formation
- Idioms and phrases

**Unit IV**

- Ordering sentences
- Sentence correction
- Change of speech

**Unit V**

- Articles
- Preposition
- Adjectives
- Spotting Errors

**Total Periods: 15**

**Text Books:**

| S.No | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1. | Dhanavel.S.N | English and Communication Skills | Orient Longswan | 2013 |
| 2. | Lakshmanaperumal | Communicative English | Sri Krishna | 2018 |

**Reference Books:**

| S.No | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1. | Mccarthy | Cambridge Grammar of English | Cambridge University Press | 2010 |
| 2. | Rayadu C.S | Communication | Himalaya Publishing House | 2007 |
| 3. | Murphy R, Smalzer | Grammar in use | Cambridge University Press | 2000 |

| U19MTT02 | Indian Constitution | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 0 |

**Objectives:**

- To impart the knowledge about Indian Constitution and its features..
- To learn about the functions of local administration. .
- To impart the knowledge about functions of State and Union governments/

**Course Outcomes**:

At the end of this course, students will demonstrate the ability to

**CO1 :** Obey the rules and regulations laid down by the state and union governments.

**CO2 :** Behave as a loyal citizen of the country

**CO3 :** Become a respectful leader in near future.

**CO4 :** Understand all the rules and regulations to become a good administrator..

**CO5 :** Understand the various procedures and processes of election Commission.

**Unit I INTRODUCTION** 9

Constitution- meaning of the term, Indian Constitution: Sources and constitutional history, Features: Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy

**Unit II UNION GOVERNMENT AND ITS ADMINISTRATION** 9

Structure of the Indian Union: Federalism, Centre- State relationship, President: Role, power and position, PM and Council of ministers, Cabinet and Central Secretariat, Lok Sabha, Rajya Sabha

**Unit III STATE GOVERNMENT AND ITS ADMINISTRATION 9**

Governor: Role and Position, Chief Minister and Council of ministers, State Secretariat: Organization, Structure and Functions

**Unit IV LOCAL ADMINISTRATION 9**

District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation, Pachayati raj: Introduction, PRI: Zila Pachayat, Elected officials and their roles, CEO Zila Pachayat: Position and role, Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy

**Unit V ELECTION COMMISSION 9**

Election Commission: Role and Functioning, Chief Election Commissioner and Election Commissioners, State Election Commission: Role and Functioning, Institute and Bodies for the welfare of SC/ST/OBC and women

**Total Periods: 45**

**Text/Reference Books:**

| S.No | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1. | D.D. Basu | Introduction to the Constition of India, 23rd Edition | Lexis Nexis, Gudgaon | 2015 |
| 2. | A. Avasti and A.P. Avasti | Indian Administration | Lakshmi Narain Agarwal Educational Publishers, Agra | 2017 |
| 3. | S.R. Maheswari | Indian Administration, 6th Edition | Orient Blackswan, Chennai | 2004 |

**Web Url(s)**

1. https://www.iitk.ac.in/wc/data/coi-4March2016.pdf
2. https://www.india.gov.in/sites/upload_files/npi/files/coi_part_full.pdf

| U19MCE06 | PLC AND AUTOMATION | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 2 | 4 |

**Pre-Requisites** : Sensors and Instrumentation

**Objectives:**

- To impart knowledge about automation and PLC hardware and software
- To understand the PLC programming methods using PLC functions
- To familiarize and develop applications using PLC
- To impart knowledge about automation tools like SCADA and DCS

**Course Outcomes**:

**CO1** : Outline the need of industrial automation and describe PLC hardware

**CO2** : Illustrate different PLC programming methods

**CO3** : Design ladder logic programming by utilizing various instruction sets

**CO4** : Explain the fundamental concepts of SCADA and DCS

**CO5** : Develop a suitable logical programming for given application

**Unit I Introduction to Industrial Automation and Programmable Logic Controllers(PLC)** **9**

Evolution of automation -Types of automation -Fixed, flexible and programmable automation
Introduction — Principles of operation – PLC Architecture and specifications – PLC hardware components Analog & digital I/O modules , CPU & memory module – Programming devices, Scan time of PLC -Interfacing computer and PLC: RS232, RS485, Ethernet, Selection criteria for PLC

**Unit II PLC Programming Methods** **9**

Programming methods - Ladder logic - Function block diagram(FBD)- Structure text - Ladder logic components: Converting simple relay ladder diagram in to PLC relay ladder diagram, Boolean logic using ladder logic programming

**Unit III PLC Instructions** **9**

Timers, Counters, Program Control Instructions, Math Instructions, Data Manipulation Instructions, Sequencer and Shift register instructions- Analog Instructions: PID Controller, Scaling Instructions

**Unit IV Supervisory Control And Data Acquisition (SCADA) and Distributed Control System (DCS)** **9**

Evolution of SCADA, Communication technologies, Monitoring and supervisory functions, SCADA System Components: Schemes- Remote Terminal Unit (RTU), Intelligent Electronic Devices (IED), Communication Network, Introduction to DCS – Various Architectures – Comparison – Local control unit – Process interfacing issues – Communication facilities Operator interface.

**Unit V Applications of PLC** **9**

Materials handling applications, Automatic control of warehouse door, Automatic lubrication of Conveyor belt, motor control, Automatic car washing machine, Bottle label detection, Elevators, Pneumatic stamping system, Traffic light control

**Total Periods: 45+15=60**

**List of Experiments:**

1. Development of Ladder Diagram (LD) and Structured Text (ST) programming in PLC for simple applications
2. Development of an application by using timer and counter
3. Solving simple problems using Functional Block Diagram (FBD) programming
4. Testing of Relays
5. Traffic light controller
6. PID based DC motor speed control
7. Development of SCADA application using open source software

**Text Books:**

| S. No. | Author(s) | Title of the Book | Publisher/Edition | Year of Publication |
|---|---|---|---|---|
| 1. | F.D. Petruzella | Programmable Logic Controllers | Tata Mc-Graw Hill, 4th Edition | 2016 |
| 2. | Gary Dunning | Introduction to Programmable Logic Controllers | Cengage Learning, 3rd Edition | 2007 |
| 3. | K S Manoj | Industrial Automation with SCADA: Concepts, Communications and Security | Notion Press, Ist Edition | 2019 |
| 4. | Krishna Kant | Computer Based Industrial Control | Prentice Hall of India, Second edition | 2010 |

**Reference Books:**

| S. No. | Author(s) | Title of the Book | Publisher/Edition | Year of Publication |
|---|---|---|---|---|
| 1. | Bolton | Programmable Logic Controllers | Newnes, 6th Edition | 2015 |
| 2. | John W Webb and Ronald A Resis | Programmable Logic Controller | Prentice Hall of India Pvt. Ltd | 2013 |
| 3. | William T. Shaw | Cyber Security for SCADA systems | Penn Well Books, 2nd edition | 2021 |

**Web URL(s):**

1. https://nptel.ac.in/courses/108/105/108105063/

| U19MCE07 | Fluid Power System and Automation | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 2 | 4 |

**Pre-Requisites** : Nil

**Objectives:**

- To make the students gain knowledge on properties of fluid and various types of losses in fluid
- To familiarize the students with the construction and working principle of various components used in hydraulic and pneumatic systems
- To appreciate the use of various software and hardware tools in designing hydraulic and pneumatic circuits for various applications

**Course Outcomes**:

At the end of this course, students will be able to

**CO1 :** Describe the concept of fluid power and different types of fluid power systems

**CO2 :** Classify hydraulic pumps and select suitable actuators used in hydraulic system

**CO3 :** Select the hydraulic valves for the given applications

**CO4 :** Summarize the working principles of compressors and pneumatic components

**CO5 :** Design the hydraulic and pneumatic circuits for a given application using various methods

**Unit I FUNDAMENTALS OF FLUID POWER** **7**

Introduction to fluid power, Advantages of fluid power, Applications of fluid power system in various sectors, Types of fluid power systems, Properties of hydraulic fluids- General types of fluids, fluid power symbols, Applications of Pascal's law, Laminar and turbulent flow- Reynold's number, Darcy's equation- Frictional losses, losses in valves and fittings.

**Unit II HYDRAULIC PUMPS AND ACTUATORS** 10

Positive and non-positive displacement pumps - Pumping theory and classification - Construction and working principle of Gear, Vane and Piston pumps - Variable Displacement Pumps (Vane and Piston), Pump performance curves - Hydraulic cylinders: Construction & Working principle - Single acting, Double acting, Tandem, Double rod and Telescopic cylinder, Cushioning mechanism, Hydraulic motors: Gear, Vane and Piston motors.

**Unit III HYDRAULIC VALVES, ACCUMULATORS AND CIRCUITS** 10

Directional control valve – 3/2 way valve – 4/2, 4/3 way valve – Shuttle valve – check valve. Pressure control valves, Flow control valve – Fixed and adjustable, electrical control solenoid valves, methods of valve actuation. Types of accumulators, Accumulators circuits, Intensifier – Circuit and Application, Speed control circuits, synchronizing circuit, Air-over-oil, double pump, regenerative and fail safe circuits- Hydrostatic transmission and industrial application circuits- press circuit

**Unit IV PNEUMATICS SYSTEM** 8

Introduction- Properties of air- gas laws- Compressors: Piston, Screw and Vane compressor. Fluid Conditioners: Air filters, Air pressure regulators, Air lubricators, Pneumatic silencers, Air dryers, Air control valves, Quick exhaust valves, Pneumatic Actuators: Pneumatic cylinders, rotary air motors and performance curves. Introduction to fluidics.

**Unit V DESIGN OF HYDRAULIC AND PNEUMATIC CIRCUITS** 10

Fluid power symbols- Basic circuit- Meter-in and Meter-out, Sequential circuit for simple applications: Cascade, Step-Counter and Karnaugh Veitch map method. Design of hydraulic circuits for drilling, planning, shaping and surface grinding- Design of pneumatic circuit for a pick and place application and tool handling in CNC machine- Low cost automation- Hydraulic and pneumatic power packs-Case studies, Trouble shooting and remedies in hydraulic and pneumatic systems.

**Total Periods: 45+15=60**

**LIST OF EXPERIMENTS:**

1. Design and testing of hydraulic circuits such as:

Pressure control
Flow control
Direction control
Design of circuit with programmed logic sequence, using an optional PLC in hydraulic Electro hydraulic Trainer.

2. Design and testing of pneumatic circuits such as:

Pressure control
Flow control
Direction control
Circuits with logic controls
Circuits with timers
Circuits with multiple cylinder sequences in Pneumatic Electro pneumatic Trainer.

3. Circuit design and working principle of hydraulic, pneumatic and electropneumatic circuits using simulation software.

**Text Books:**

| S.No | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1. | Anthony Esposito | Fluid power with applications | Pearson Education New Delhi | 2015 |
| 2. | Majumdar S.R. | Oil hydraulics system-principles and maintenance | Tata McGraw Hill | 2001 |

**Reference Books:**

| S.No | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1. | Srinivasan R | Hydraulic and pneumatic controls | Vijay Nicole imprints | 2008 |
| 2. | Shanmugasundaram K | Hydraulic and pneumatic controls | Chand & Co., | 2006 |
| 3. | Joji P | Pneumatic controls | John Wiley & Sons, India | 2008 |
| 4. | James A.Sullivan | Fluid power theory and applications | C.H.I.P.S, 4TH EDITION | 2007 |

**Web URL(s):** https://nptel.ac.in/courses/112105047

| U19MGT02 | TOTAL QUALITY MANAGEMENT | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**Pre-Requisites :** NIL

**Objectives:**

- To make the students understand the basic concepts of TQM and appreciate its importance in today's business environment.
- To enable them to acquire required diagnostic skills and use various quality tools.
- To familiarize the students about the Quality Management System.

**Course Outcomes**:

At the end of this course students will demonstrate the ability to

**CO1 :** Able to understand the dimensions of quality.

**CO2 :** Capable of applying TQM concepts for improving the quality of products and services.

**CO3 :** Assess the process approach in TQM .

**CO4 :** Use tools and techniques of TQM for continuous improvement in quality.

**CO5 :** Implement Quality Management System.

**Unit I INTRODUCTION 9**

Introduction and basic concepts - Definition of quality - Dimensions of quality - Evolution of TQM - TQM frame work – Barriers to TQM

**Unit II TQM IMPLEMENTATION 9**

Leadership for TQM - Deming's quality principle - TQM implementation - PDSA cycle - Quality Circles - Quality Council - Supplier Partnership.

**Unit III PROCESS APPROACH TO TQM 9**

Process approach - Juran's Trilogy - Taguchi's loss function – Kaizen - Quality by design - 5S - ESI (Early Supplier Involvement) 5M.

**Unit IV TOOLS AND TECHNIQUES 9**

7 Old quality control tools - Bench marking - Total productive maintenance - Failure mode and effect Analysis – POKAYOKE - Six Sigma.

**Unit V QUALITY MANAGEMENT SYSTEMS 9**

Management systems for TQM - ISO 9000 & 14000 Quality management systems - Auditing and certification Process - Korean and American QMS Quality Awards.

**Total Periods 45**

**Text Books:**

| S. No. | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1. | Dale H. Besterfieldetal | Total Quality Management | Pearson Education | 2013 |
| 2. | Subburaj Ramasamy | Total Quality Management | Tata McGraw Hill | 2008 |

**Reference Books:**

| S. No. | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1. | J.R. Evans and W.M. Lindsay | The management and control of quality | Cengage Learning | 2012 |
| 2. | Barrie G Date, Ton Van Der Wiet and Jos Van Iwaarden | Management Quality | Wiley Publications | 2012 |
| 3. | Greg Brue | Six Sigma for Managers | Tata McGraw Hill Publishing Co. Ltd | 2002 |

| `U19MCJ01 | Innovation Project | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 4 | 2 |

**Objectives:**

- To develop ability to apply the learned concepts of engineering in designing a working model, to get hands on training in the fabrication of designed models and to teach for the demonstration of their work through presentations

**Course Outcome(s):**

- Upon completion of the course the student will be able to design, fabricate and demonstrate a working model or real product/process

**Guidelines for the conduct of Course:**

- The students in convenient groups of not more than 4 members have to select a new product/process/process add-on/working model etc. for design and fabrication.
- Every project work shall have a guide who must be the member of the faculty of the department and if essential with an industry guide who may act as co-guide.
- Title of the project must illustrate that something is designed and fabricated
- Three review meetings may be adopted by the head of the department through a project coordinator who is appointed by him for internal assessments
- The students are required to design and fabricate the chosen item in the college and demonstrate its working apart from submitting the project report. The report should contain assembly drawing, parts drawings, process charts relating to fabrication.
- At the end of the semester, the project work shall be evaluated based on oral presentation, the project report and demonstration of working model jointly by external and internal examiners constituted by the Head of the Department.

**Total: 60 Periods**

| U19MCO03 | Quantitative Aptitude | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 2 | 1 |

**Objectives:**

- This course is designed to suit the need of the students and to acquaint them with frequently asked patterns in quantitative aptitude and logical reasoning during various examinations and campus interviews.

**Course Outcomes**:

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

- Understand the basic concepts of quantitative ability
- Understand the basic concepts of logical reasoning Skills
- Acquire satisfactory competency in use of reasoning

| **Unit I** | **Quantitative Ability (Basic Mathematics)** | 5 |
|---|---|---|
| o Number Systems<br>o LCM and HCF<br>o Decimal Fractions<br>o Simplification<br>o Square Roots and Cube Roots<br>o Average<br>o Problems on Ages<br>o Surds & Indices<br>o Percentages<br>o Problems on Numbers | | |
| **Unit II** | **Quantitative Ability (Applied & Engineering Mathematics)** | 5 |
| o Logarithm<br>o Permutation and Combinations<br>o Probability<br>o Profit and Loss<br>o Simple and Compound Interest<br>o Time, Speed and Distance<br>o Time & Work<br>o Ratio and Proportion<br>o Area<br>o Mixtures and Allegation | | |
| **Unit III** | **Logical Reasoning (Deductive Reasoning)** | **5** |
| o Analogy<br>o Blood Relation<br>o Directional Sense<br>o Number and Letter Series<br>o Coding – Decoding<br>o Calendars<br>o Clocks<br>o Venn Diagrams<br>o Seating Arrangement | | |

**Total Periods: 15**

**Text Books:**

| S.No | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | R S Agarwal | A Modern Approach To Verbal & Non Verbal Reasoning | S Chand Publishing, second edition | 2018 |
| 2 | B S Sijwali | Analytical and Logical reasoning | Arihant Publications, Second edition | 2014 |

**Reference Books:**

| S.No | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | R S Agarwal | Quantitative aptitude for Competitive examination | S Chand Publishing, Revised edition | 2017 |
| 2 | Abhijit Guha | Quantitative Aptitude for Competitive Examinations | McGraw Hill Education India, Fourth edition | 2018 |

**Web URL(s):**

**1.** https://www.indiabix.com/
2. https://www.javatpoint.com/

| U19MCE08 | COMPUTER AIDED DESIGN AND MANUFACTURING | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 2 | 4 |

**Pre-Requisites :** Nil

**Objectives:**

- To impart the parametric fundamentals to create and manipulate geometric models using curves, surfaces and solids
- To improve productivity and interchange of CAD documents between different offices and CAD programs in engineering.
- Create new or improve upon existing manufacturing setups to boost efficiency and reduce wastage

**Course Outcomes**:

At the end of this course students will demonstrate the ability to

**CO1 :** Apply the knowledge of 2D and 3D transformations, clipping algorithm, Manufacturing models and Metrics.

**CO2 :** Apply geometric transformations on the created wireframe, surface and solid models.

**CO3 :** Knowledge on different types of Standard systems used in CAD.

**CO4 :** Apply the concepts of machining for the purpose of selection of appropriate machining centers, machining parameters, select appropriate cutting tools for CNC milling and turning & equipment, set-up, program, and operate CNC milling and turning equipment.

**CO5 :** Create and validate NC part program data using manual data input for manufacturing of required component using CNC milling or turning applications.

**Unit I FUNDAMENTALS OF COMPUTER GRAPHICS 9**

Product cycle – Design process – sequential and concurrent engineering – Computer aided design – CAD system architecture – Computer graphics – co-ordinate systems – 2D and 3D transformations, homogeneous coordinates – Line drawing – Clipping- viewing transformation

**Unit II GEOMETRIC MODELING 9**

Representation of curves – Hermite curve – Bezier curve – B-spline curves-rational Curves – Techniques for surface modeling – surface patch – Coons and bicubic patches – Bezier and B-spline surfaces – Solid modeling techniques – CSG and B-rep

**Unit III CAD STANDARDS 9**

Standards for computer graphics – Graphical Kernel System (GKS) – standards for exchange images – Open Graphics Library (OpenGL) – Data exchange standards – IGES, STEP, CALS – communication standards.

**Unit IV INTRODUCTION TO CNC MACHINE TOOLS 9**

Evolution of CNC Technology, principles, features, advantages, applications, CNC and DNC concept, classification of CNC Machines – turning centre, machining centre, grinding machine, EDM, types of control systems, CNC controllers, characteristics, interpolators – Machine axis and Co-ordinate system

**Unit V CNC PROGRAMMING 9**

2D and 3D machining on CNC – Introduction of Part Programming, types – Detailed Manual part programming (FANUC) on Lathe & Milling machines using G codes and M codes – Cutting Cycles, Loops, Sub program and Macros – Introduction of CAM package.

**Total Periods(L) 45+15=60**

**LIST OF EXPERIMENTS:**

1. Modelling of a part using any CAD package.
2. Modelling and assembling of the mechanical assembly using any CAD package.
3. Structural analysis using FEA software – any analysis package.
4. Beam deflection analysis using FEA software – any analysis package.
5. Modelling and tool path simulation – turning using any CAM package.
6. Modelling and tool path simulation – milling using any CAM package.
7. NC code generation for milling using any CAM package.
8. NC code generation for turning using any CAM package.

NOTE - Any solid modelling and analysis using suitable software packages can be used for exercise.
CNC lathe – 1 no
CNC milling machine – 1 no

**Text Books:**

| S. No. | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1. | Mikell.P.Groover | Automation, Production Systems and Computer Integrated Manufacturing | Prentice Hall of India | 2019 |
| 2. | Radhakrishnan P, SubramanyanS.and Raju V | CAD/CAM/CIM | New Age International (P) Ltd, New Delhi | 2018 |
| 3. | HMT | Mechatronics | Tata McGraw-Hill , New Delhi | 2017 |
| 4. | Ibrahim Zeid | Mastering CAD CAM | Tata McGraw-Hill , New Delhi | 2009 |

**Reference Books:**

| S. No. | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1. | Donald Hearn and M. Pauline Baker | Computer Graphics | John-Wiley | 2002 |
| 2. | Foley, Wan Dam, Feiner and Hughes | Computer graphics principles & practice | Prentice Hall | 2013 |
| 3. | William M Neumann and Robert F.Sproul | Principles of Computer Graphics | McGraw Hill Book Co. Singapore | 2018 |
| 4. | Peter Smid | CNC Tips and Techniques: A Reader for Programmers | Industrial Press Inc | 2013 |
| 5. | James Madison | CNC Machining Hand Book | Industrial Press Inc | 1996 |

| U19MCE09 | ROBOTICS AND MACHINE VISION SYSTEM | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 2 | 4 |

**Pre-Requisites** : Kinematics and Dynamics

**Objectives:**

- To impart knowledge on components of robot and types of end effectors
- To understand kinematics of robot mechanisms
- To understand dynamics and trajectory planning of robot mechanisms
- To impart knowledge on machine vision system
- To describe the various programming techniques used in industrial robots

**Course Outcomes**:

**CO1** : Interpret the robotic terminologies for various configurations and gripper selection

**CO2** : Apply transformation matrix and Denavit- Hartenberg(DH) representation for kinematics analysis

**CO3** : Formulate robot dynamics using Lagrangian methods and trajectory planning techniques

**CO4** : Interpret the fundamental concepts of vision system and image processing techniques

**CO5** : Illustrate programming techniques for robotics applications

Unit I **Introduction to Robotics** 9

Robot anatomy-History, Definition, Laws of robotics, Classification, Robot configurations and concept of workspace, Terminology of Robotics-Resolution, Accuracy, Repeatability, Specifications of Robot, Harmonic Drives, End Effectors: Types of end effectors - Mechanical Gripper, Gripper force analysis, Vacuum cup and Magnetic gripper

Unit II **Kinematics of Robots** 9

Position, Orientation and Frames - Matrix representation: Point, vector, frame and rigid body - Homogeneous Transformation matrices – Representation: Translation, Rotational and Combined transformation, Forward and Inverse Kinematic Equations: Position, orientation, Denavit- Hartenberg Representation

Unit III **Dynamic Analysis and Trajectory Planning** 9

Manipulator dynamics: Lagrange-Euler Formulation, Newton - Euler formulation, equations of motion for the 2-DOF robot arm, Trajectory Planning- Joint space, Cartesian space

Unit IV **Machine Vision System** 9

Image Sensing and Digitizing - Image definition, Image acquisition devices, Lighting techniques, Sampling, Quantization and Encoding, Image Processing and Analysis- Data reduction – digital conversion and windowing, Segmentation – Thresholding, Edge detection, Morphological operations, Feature Extraction, Object recognition

Unit V **Programming and Applications** 9

Programming-Levels, methods, Classification, Robot Language-Structure, Elements, VAL system and Language-Palletizing, de-Palletizing, welding operation programming, Material handling, Assembly operations, Machine Vision in Manufacturing and Automotive Industries

Total Periods: 45+15=60

**List of Experiments:**

(I) Using Robo Analyzer Software

1. Visualization of Denavit- Hartenberg parameters
2. Forward and Inverse kinematic analysis of 2R Planar Robot Manipulator
3. Forward and Inverse kinematic analysis of 3R Planar Robot Manipulator
4. Forward and Inverse kinematic analysis of RP Planar Robot Manipulator
5. Forward and Inverse kinematic analysis of PR Planar Robot Manipulator

(II) Using MATLAB/SCILAB Software

1. Create a Robot Model and perform Kinematics operation using Robotics Toolbox
2. Trajectory Planning and control of 3R Planar Robot using Robotics Toolbox
3. Create Simulink Model for Kinematic Analysis of 2R Planar Robot

(III). Robot Simulation using Robot Operating System (ROS) and Gazebo

**Text Books:**

| S. No. | Author(s) | Title of the Book | Publisher/Edition | Year of Publication |
|---|---|---|---|---|
| 1. | Saeed B. Niku | Introduction to Robotics: Analysis, Control, Applications | 3rd edition, Wiley Publications | 2020 |
| 2. | P.Groover | Industrial robotics- Technology, programming and Applications | McGraw-Hill | 2016 |
| 3. | John.J.Craig | Introduction to Robotics: Mechanics & control | Pearson Publication, 4th edition | 2018 |

**Reference Books:**

| S. No. | Author(s) | Title of the Book | Publisher/Edition | Year of Publication |
|---|---|---|---|---|
| 1. | Sathya Ranjan Deb | Robotics Technology & flexible Automation | Tata Mcgraw-Hill Publication, 6th | 2011 |
| 2. | King Sun Fu, Rafael C. González, C. S. George Lee, | Robotics: control, sensing, vision, and intelligence | Tata Mcgraw-Hill Publication | 2014 |
| 3. | Jazar | Theory of Applied Robotics: Kinematics, Dynamics and | Springer, 2nd Edition | 2010 |
| 4. | R K Mittal, I J Nagrath | Robotics and Control | McGraw Hill Education India | 2017 |

**Web URL(s):**

1. https://onlinecourses.nptel.ac.in/noc20_de11/preview

| U19MCJ02 | Project Work | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 20 | 10 |

**Objectives:**

- To develop knowledge to formulate a real world problem and project's goals.
- To identify the various tasks of the project to determine standard procedures.
- To identify and learn new tools, algorithms and techniques.
- To understand the various procedures for validation of the product and analysis the cost effectiveness
- To understand the guideline to Prepare report for oral demonstrations

**Course Outcome(s):**
**After successful completion of this course, the students should be able to**
**CO1:** Design, analyze, realize / simulate a physical system by using the technology they learnt during the program.

**CO2:** Integrate various systems into one Mechatronics product.

**CO3:** Work in a team with confined time duration.

**CO4:** Disseminate his work both in oral and written format.

Students in the form of group, not exceeding 3 members in a group to carry out their main project. It should be a Mechatronics project. However, special considerations can be given for interdisciplinary measurement and computer based simulation projects. This exception should be recorded and approved by the department committee. Management related projects will not be allowed. The interdisciplinary projects will carry more weight age. It is mandatory to publish their main project in national/international level conferences to appear in the viva-voce exam.

**Total: 300 Periods**

| U19CST04 | ARTIFICIAL INTELLIGENCE | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**Pre-Requisites** Nil

**Objectives**

- To know the underlying structure behind intelligence mathematically.
- To know the logical implications in computational intelligence.
- To know the automated learning techniques.
- To study the techniques of knowledge representation.
- To explore the adaption of artificial intelligence techniques in real-time scenarios.

**Course Outcomes**:

At the end of this course students will demonstrate the ability to

**CO1 :** Understand the search techniques

**CO2 :** Apply the search techniques to real-time problems.

**CO3 :** Apply the reasoning techniques to real world problems.

**CO4 :** Understand the representation of knowledge.

**CO5 :** Understand the learning techniques.

**Unit I INTELLIGENT AGENTS AND SEARCH TECHNIQUES 9**

Agents and Environments – Good Behavior: The Concepts of Rationality – The Nature of Environments – The Structure of Agents – Problem Solving by Search – Uninformed Search – Searching with Costs – Informed State Space Search – Heuristic Search: Greedy – A* Search – Problem Reduction Search – Game Search – Constraint Satisfaction Problems.

**Unit II REASONING WITH LOWER ORDER LOGICS 9**

Logical Agent – Proposition Logic – Syntax and Semantics – Theorem Proving – Model Checking – Inference in First Order Logic: Forward Chaining – Backward Chaining – Resolution.

**Unit III KNOWLEDGE REPRESENTATION 9**

Knowledge Representation Issues – Approaches for Knowledge Representation: Simple Relational Knowledge – Inherited Knowledge – Semantic Nets – Frames – Semantic Web – Ontology.

**Unit IV AI PLANNING AND NATURAL LANGUAGE PROCESSING 9**

Classical Planning – Types – Partial Order Planning – Graph Plan and SAT Plan – Natural Language Processing Basics: Syntax – Semantics – Introduction to Statistical NLP.

**Unit V LEARNING AND APPLICATIONS 9**

Logical Formulation of Learning – Knowledge in Learning – Explanation-based Learning – Learning using Relevance Information – Application with NLP: Developing a Simple Chatbot – Types of Chatbot.

**Total Periods: 45**

**Text Books:**

| S. No. | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1. | S. Russell and P. Norvig, | Artificial Intelligence: A Modern Approach | Prentice Hall, Third Edition, | 2015 |
| 2 | Elaine Rich, Kevin Knight, Shivashankar B. Nair | Artificial Intelligence | Tata McGraw-Hill Education | 2008 |

**Reference Books:**

| S. No. | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1. | Dheepak Khemani | A first course in Artificial Intelligence | McGraw Hill Education Pvt Ltd., | 2013 |
| 2. | Steven Bird, Ewan Klein and Edward Loper | Natural Language Processing with Python | O'Reilly | 2009 |
| 3. | Nils J. Nilsson | Artificial Intelligence: A New Synthesis | Morgan Kaufmaan Publishers Inc | 2003 |

**Web URL(s):**

1. http://nptel.ac.in/courses/106105079/2.
2. https://in.udacity.com/course/intro-toartificial-intelligence--cs271.

| U19ECE07 | DIGITAL SIGNAL PROCESSING | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 2 | 4 |

**Pre-Requisites** : NIL

**Objectives:**

- To learn discrete Fourier transform, properties of DFT and its application to linear filtering
- To understand the characteristics of digital filters, design digital HR and FIR filters and apply thes filters to filter undesirable signals in various frequency bands
- To understand the effects of finite precision representation on digital filters
- To understand the fundamental concepts of multi rate signal processing and its applications To introduce the concepts of adaptive filters and its application to communication engineering

**Course Outcomes:**

At the end of this course students will demonstrate the ability to

CO1 : Apply DFT for the analysis of digital signals and systems

CO2: Design HR and FIR filters

CO3: Characterize the effects of finite precision representation on digital filters

CO4: Design multirate filters

CO5: Apply adaptive filters appropriately in communication systems

**Unit I DISCRETE FOURIER TRANSFORM** **9**

Review of signals and systems, concept of frequency in discrete-time signals, summary of analysis & synthesis equations for FT & DTFT, frequency domain sampling, Discrete Fourier transform (DFT) - deriving DFT from DTFT, properties of DFT - periodicity, symmetry, circular convolution. Linear filtering using DFT. Filtering long data sequences - overlap save and overlap add method. Fast computation of DFT - Radix-2 Decimation-in-time (DIT) Fast Fourier transform (FFT), Decimation-in-frequency (DIF) Fast Fourier transform (FFT). Linear filtering using FFT.

**Unit II INFINITE IMPULSE RESPONSE FILTERS** **9**

Characteristics of practical frequency selective filters. characteristics of commonly used analog filters - Butterworth filters, Chebyshev filters. Design of HR filters from analog filters (LPF, HPF, BPF, BRF) - Approximation of derivatives, Impulse invariance method, Bilinear transformation. Frequency transformation in the analog domain. Structure of HR filter - direct form I, direct form II, Cascade, parallel realizations.

**Unit III FINITE IMPULSE RESPONSE FILTERS** **9**

Design of FIR filters - symmetric and Anti-symmetric FIR filters - design of linear phase FIR filters using Fourier series method - FIR filter design using windows (Rectangular, Hamming and Hanning window), Frequency sampling method. FIR filter structures - linear phase structure, direct form realizations

**Unit IV FINITE WORD LENGTH EFFECTS** 9

Fixed point and floating point number representation - ADC - quantization - truncation and rounding - quantization noise - input / output quantization - coefficient quantization error - product quantization error - overflow error - limit cycle oscillations due to product quantization and summation - scaling to prevent overflow.

**Unit** V **INTRODUCTION TO DIGITAL SIGNAL PROCESSORS** 9

DSP functionalities - circular buffering — DSP architecture — Fixed- and Floating-point architecture principles — Programming — Application examples.

**Total Periods: 45**

**List of Experiments: MATLAB / EQUIVALENT SOFTWARE PACKAGE**

1. Generation of elementary Discrete-Time sequences
2. Linear and Circular convolutions
3. Auto correlation and Cross Correlation
4. Frequency Analysis using DFT
5. Design of FIR filters (LPF/HPF/BPF/BSF) and demonstrates the filtering operation
6. Design of Butterworth and Chebyshev HR filters (LPF/HPF/BPF/BSF) and demonstrate the filtering operations

**DSP PROCESSOR BASED IMPLEMENTATION**

1. Study of architecture of Digital Signal Processor
2. Perform MAC operation using various addressing modes
3. Generation of various signals and random noise
4. Design and demonstration of FIR Filter for Low pass, High pass, Band pass and Band stop filtering

**Total Periods: 30**

Text Books:

| S. No. | **Author(s)** | **Title of the Book** | **Publisher** | Year of **Publication** |
|---|---|---|---|---|
| 1. | John G. Proakis & Dimitris G.Manolakis | Digital Signal Processing — Principles, Algorithms & Applicationsll | Pearson Education | 2007 |
| 2. | Emmanuel C. Ifeachor & Barrie. W. Jervis | Digital Signal Processingll | Pearson Education | 2002 |
| 3. | A. V. Oppenheim, R.W. Schafer and J.R. Buck | Discrete-Time Signal Processingll | Pearson Education | 2004 |
| 4. | Sanjit K. Mitra | Digital Signal Processing — A Computer Based Approachll | Tata Mc Graw Hill | 2007 |

| U19ECT60 | DIGITAL IMAGE PROCESSING | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**Pre-Requisites :** NIL

**Objectives:**

- To become familiar with image processing fundamentals
- To get exposed to simple image enhancement techniques in Spatial and Frequency domain.
- To instill the concepts on degradation function and restoration techniques.
- To study the image segmentation and representation techniques.
- To become familiar with image compression and recognition methods

**Course Outcomes**:

At the end of this course students will demonstrate the ability to

**CO1 :** Analyze the basic image processing techniques such as digitization, sampling and quantization.

**CO2 :** Operate on images using the techniques of smoothing, sharpening and enhancement.

**CO3 :** Understand the restoration concepts and filtering techniques.

**CO4 :** Learn the basics of segmentation through features extraction.

**CO5 :** Analyze the image compression standards and to use texture and pattern for color models.

**Unit I IMAGE PROCESSING FUNDAMENTALS 9**

Elements of visual perception – Image sensing and acquisition – Image Formation Model, Image Sampling and Quantization, Representation of Digital Images, Spatial and Gray level Resolution, Zooming and Shrinking of Digital Images, Basic relationship between pixels – Basic gray level transformations. Color images – Color models - Chromaticity diagram.

**Unit II IMAGE ENHANCEMENT 9**

Histogram Processing, Fundamentals of Spatial Filtering- Smoothing, Sharpening, Frequency domain filters- Smoothing and Sharpening Filters – Homomorphic Filtering- Color image enhancement.

**Unit III IMAGE RESTORATION 9**

Image Restoration - degradation model, Properties, Noise models – Mean Filters – Order Statistics – Adaptive filters – Band reject Filters – Band pass Filters – Notch Filters – Optimum Notch Filtering – Inverse Filtering – Wiener filtering

**Unit IV IMAGE SEGMENTATION 9**

Edge detection, Edge linking via Hough transform – Thresholding - Region based segmentation – Region growing – Region splitting and merging – Morphological processing- erosion and dilation, Segmentation by morphological watersheds – basic concepts – Dam construction – Watershed segmentation algorithm.

**Unit V IMAGE COMPRESSION AND RECOGNITION 9**

Need for data compression, Huffman, Run Length Encoding, Shift codes, Arithmetic coding, JPEG standard, MPEG. Boundary representation, Boundary description, Fourier Descriptor, Regional Descriptors – Topological feature, Texture - Patterns and Pattern classes - Recognition based on matching.

**Total Periods: 45**

**Text Books:**

| S. No. | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1. | Rafael C. Gonzalez and Richard E. Woods | Digital Image Processing | Pearson | 2010 |
| 2. | Anil K. Jain | Fundamentals of Digital Image Processing | Pearson | 2002 |

**Reference Books:**

| S. No. | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1. | Kenneth R. Castleman | Digital Image Processing | Pearson | 2006 |
| 2. | D,E. Dudgeon and RM. Mersereau | Multidimensional Digital Signal Processing | Prentice Hall Professional Technical Reference | 1990 |
| 3. | William K. Pratt | Digital Image Processing | John Wiley | 2002 |
| 4. | Milan Sonka et al | Image processing, analysis and machine vision | VikasPublishing House | 1999 |

| U19ITE03 | Object Oriented Programming with JAVA | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 2 | 4 |

**Pre-Requisites :** NIL

**Objectives:**

- To understand Object Oriented Programming concepts and basic characteristics of Java.
- To introduce the principles of packages, inheritance and interfaces,collections.
- To introduce the concepts of I/O and Strings.
- To understand Exception handling and Multithreading.
- To design and build simple Graphical User Interfaces.

**Course Outcomes**:

At the end of this course students will demonstrate the ability to

**CO1 :** Solve real world problems using OOP techniques.

**CO2 :** Apply the concepts of packages, inheritance and interfaces to write simpleJava applications.

**CO3 :** Explore the importance of strings and stream classes.

**CO4 :** Develop Java applications with Exception handling and Multithreading.

**CO5 :** Design GUI based applications.

**Unit I INTRODUCTION TO OOP AND JAVA FUNDAMENTALS 8**

Introduction to OOP-Concepts of OOP- Java Fundamentals-An overview of Java-Characteristics,Java buzzword- Java Environment-Fundamental programming structure in Java- Defining classes-methods-constructors-Access specifiers –comments- static members-Data types - variables- operators -Control flow statements - Arrays.

**Unit II PACKAGES, INHERITANCE, INTERFACE AND COLLECTIONS 9**

Packages- Defining a Package, CLASSPATH, Access protection, importing packages : Inheritance –Super class, sub class- Types of inheritance- Method overriding- Polymorphism- Method overloading- Constructor overloading -Abstract class and methods - final class and methods :Interfaces– implementing and extending interfaces- Object cloning - Collections- ArrayList,Stack, Priority Queue.

**Unit III I/O AND STRINGS 9**

I/O basics-Byte streams and Character streams-
Reading console Input and Writing Console Output- File class- Reading and writing Files-Random access file operations- The Console class- Serialization. String handling – String operations – String methods – Wrapper classes.

**Unit IV EXCEPTION HANDLING AND MULTITHREADING 10**

Fundamentals of exception handling- Exception types- Uncaught exceptions- using try and catch-multiple catch clauses- nested try statements- throw- throws and finally- built- in exceptions-creating own exception sub classes. Multithreading-Differences between thread-based multitasking and process-based multitasking- Java thread model- creating threads- thread priorities- synchronizing threads- inter thread

communication- Generic Programming -Generic classes – generic methods – Bounded Types – Restrictions and Limitations.

**Unit V GUI PROGRAMMING WITH SWING 9**

Introduction, limitations of AWT- MVC architecture- components- containers. Understanding Layout Managers- Flow Layout- Border Layout- Grid Layout- Card Layout- Grid Bag Layout. Event Handling- The Delegation event model- Events- Event sources- Event Listeners- Event classes- Handling mouse and keyboard events- Adapter classes- Inner classes- Anonymous Inner classes. A Simple Swing Application- Applets – Applets and HTML- Security Issues- Applets and Applications- passing parameters to applets. Creating a Swing Applet- Painting in Swing- A Paint example- Exploring Swing Controls- JLabel and Image Icon, JText Field, The Swing Buttons- JButton- JToggle Button- JCheck Box- JRadio Button- JTabbed Pane- JScroll Pane- JList- JCombo Box- Swing Menus, Dialogs.

**Total Periods: 45+15=60**

**List of Experiments:**

1. Basic Java programs.
2. Programs on Packages.
3. Programs on Inheritance.
4. Programs on Interfaces.
5. Programs on ArrayList,Stack and Priority Queue.
6. Programs on File Handling.
7. Programs on String Handling.
8. Programs on Exception Handling.
9. Programs in Multithreading.
10. Event driven Programming.

**Text Books:**

| S. No. | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1. | Herbert Schildt | Java The complete reference, 11th Edition. | McGraw Hill Education (India) Pvt. Ltd. | 2019 |
| 2. | Cay S. Horstmann, Gary cornell | Core Java Volume –I Fundamentals", 9th Edition. | Prentice Hall. | 2013 |

**Reference Books:**

| S. No. | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1. | Paul Deitel, Harvey Deitel | Java SE 8 for programmers ,3rd Edition | Pearson, | 2015 |

| | | | | |
|---|---|---|---|---|
| 2. | Steven Holzner | Java 2 Black book | Dreamtech press | 2011 |
| 3. | Deitel and Deitel | Java: How to Program", Ninth Edition. | Prentice Hall,10th Edition | 2014 |
| 4. | Bruce Eckel | Thinking in Java", Fourth Edition. | Pearson Education | 2006 |

| U19MCT51 | THERMODYNAMICS AND HEAT TRANSFER | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**Pre-Requisites :** Physics at 10+2 level or equivalent level

**Objectives:**

- Expose the fundamentals of thermodynamics and to be able to use it in accounting for the bulk behaviour of the sample physical systems.
- Integrate the basic concepts into various thermal applications like IC engines, gas turbines, steam boiler, steam turbine, compressors, refrigeration and air conditioning.
- Enlighten the various modes of heat transfer and their engineering applications.
  (Use of standard steam tables, refrigeration tables and heat transfer data book are permitted)

**Course Outcomes**:

At the end of this course students will demonstrate the ability to

**CO1 :** Analyze the work and heat interactions associated with a prescribed process path and to perform an analysis of a flow system.

**CO2 :** Apply the concept of second law efficiency and energy principle to various thermal engineering applications.

**CO3 :** Describing the working of I.C engines and to determine its performance parameters

**CO4 :** Basic principles of refrigeration, air conditioning and psychometric chart

**CO5 :** Distinguishing the various modes of heat transfer and its applications

**Unit I BASIC CONCEPTS AND LAWS OF THERMODYNAMICS 9**

Thermodynamic systems - Boundary - Control volume - System and surroundings - Universe - Properties - State-process - Cycle - Equilibrium - Work and heat transfer - Point and path functions - First law of thermodynamics for open and closed systems - First law applied to a control volume - SFEE equations [steady flow energy equation]

**Unit II SECOND LAW OF THERMODYNAMICS 9**

Second Law of thermodynamics – statements – equivalents of Kelvin Plank and Clausius statements – Heat engines - Refrigerators and heat pumps - Carnot cycle - Carnot theorem - Clausius inequality - Reversibility – Irreversibility.

**Unit III INTERNAL COMBUSTION ENGINES 9**

Classification of IC engine - IC engine components and functions – Valve timing diagram and port timing diagram - Comparison of two stroke and four stroke engines – Comparison of petrol & diesel engine – Fuel supply systems - Ignition Systems - Lubrication system, Cooling system – MPFI, DTSI, CRDI.

**Unit IV REFRIGERATION AND AIR-CONDITIONING 9**

Principles of refrigeration, refrigerants, refrigerant properties, refrigerant selection – vapour compression refrigeration cycle – vapour absorption cycle – comfort air-conditioning, Psychrometry, humidification, de-humidification – air coolers.

**Unit V HEAT TRANSFER 9**

Heat transfer through conduction and convection – Fourier's law of conduction - Problems on steady state heat conduction – Extended surfaces: Fins,fin efficiency, fin effectiveness – Problems on Transient Heat conduction – Heat transfer through radiation, Stefan Boltzman Law, black body, grey body, shape factor.

**Total Periods: 45**

**Text Books:**

| S. No. | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1. | P.K.Nag | Engineering Thermodynamics | Tata McGraw-Hill Education | 2017 |
| 2. | R.K.Rajput | Thermal Engineering | Laxmi Publications | 2018 |

**Reference Books:**

| S. No. | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1. | Holman.J.P | Thermodynamics | McGraw-Hill | 1988 |
| 2. | Michael A. Boles, Yunus A. Cengel, YunusCengel | Thermodynamics | McGraw-Hill | 2017 |
| 3. | C.P.Kothandaraman | Heat and Mass Transfer | New Age International (P) Publishers | 2015 |

**Web URL(s):**

1. https://swayam.gov.in/nd1_noc20_me20/preview
2. https://swayam.gov.in/nd1_noc20_me42/preview
3. https://swayam.gov.in/nd1_noc20_me19/preview

| U19MCT52 | FUNDAMENTALS OF NANO SCIENCE | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**Pre-Requisites :** NIL

**Objectives:**

- To learn about basis of nanomaterial science.
- To acquire knowledge about different types of preparation method, techniques of nanomaterial and its applications.

**Course Outcomes**:

At the end of this course students will demonstrate the ability to

**CO1 :** Classify the different types of nano-structures and analyze their properties.

**CO2 :** Compare the different types of methods adopted for synthesizing nanomaterials.

**CO3 :** Characterize the nanomaterials through analytical and microscopy methods.

**CO4 :** Apply the assembly technique for inorganic semiconductor nano-structure Fabrication.

**CO5 :** Organize the nanomaterials developed for advanced technological applications.

**Unit I INTRODUCTION 9**

Introduction – Classification of nanostructures, nano scale architecture – effects of the nanometer length scale – Nano composites- Nano Tubes and Nano wires- effect of nanoscale dimensions on various properties – structural, thermal, chemical, mechanical, magnetic, optical and electronic properties.

**Unit II METHODS OF PREPARATION 9**

Top down processes - mechanical milling- lithography and nanofabrication - Optical lithography, Electron Beam Lithography and Dip-Pen Lithography -Bottom up process - Vapour deposition and different types of epitaxial growth techniques (CVD,MOCVD, MBE)-colloidal and sol-gel methods- self-assembly and self-organization.

**Unit III CHARACTERIZATION TECHNIQUES 9**

General classification of characterization methods - analytical imaging techniques - Optical microscopy- Scanning electron microscopy- Transmission Electron Microscopy- atomic force microscopy - Spectroscopy techniques - Infra-red spectroscopy - X-Ray diffraction spectroscopy

**Unit IV SEMICONDUCTOR NANOSTRUCTURES 9**

Quantum confinement in semiconductor nanostructures – quantum wells, quantum wires, quantum dots, super lattices –Organic FET – principle, description, requirements, integrated circuits – organic LEDs – basic processes, organic photovoltaic cells – carbon nano tubes – structure, synthesis and electronic properties.

**Unit V APPLICATIONS 9**

Applications – fuel cells – as fuel in IC engines- nano motors – Solar Photovoltaic cells – aerospace-defense biomedicines – Textile Technology – Electronic applications.

**Total Periods: 45**

**Text Books:**

| S. No. | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1. | Willam A. Goddard, Donald W.Brenner | Handbook of Nanoscience, Engineering, and Technology | CRC Press | 2012 |
| 2. | N John Dinardo | Nanoscale Charecterisation of surfaces & Interfaces | Weinheim Cambridge, Wiley-VCH; 2nd edition | 2000 |
| 3. | Akhlesh Lakhtakia | The HandBook of Nano Technology, Nanometer Structure, Theory, Modeling and Simulations | Prentice-Hall of India (P) Ltd, New Delhi | 2007 |

**Reference Books:**

| S. No. | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1. | Charles P. Poole Jr and. Frank J. Owens | Introduction to Nanotechnology | Wiley Interscience | 2007 |
| 2. | Guozhong Cao, Y. Wang | Nanostructures and Nanomaterials-Synthesis, Properties & Applications | Imperials College Press | 2011 |
| 3. | T.Pradeep | NANO: The Essentials Understanding Nanoscience and Nanotechnology | McGraw - Hill Education (India) Ltd | 2012 |
| 4. | Robert W. Kelsall, Ian W. Hamley, Mark Geoghegan | Nanoscale Science and Technology | John Wiley and Sons Ltd | 2006 |

**Web URL(s):**

1. https://nptel.ac.in/courses/118104008/
2. https://nptel.ac.in/courses/113106093/
3. https://www.sciencedirect.com/science/article/pii/B9780128029268000021

| U19MCT53 | ADVANCED MANUFACTURING TECHNOLOGY | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**Pre-Requisites :** Manufacturing Technology.

**Objectives:**

- To understand the advanced concepts of casting, machining and welding processes with its different types of operations and applications.
- To understand the principles of various advanced metal forming processes and its applications
- To understand the concepts of CNC machines and write simple programs for turning and milling operations

**Course Outcomes**:

**CO1 :** Understand the basics and working principles of various advanced casting processes

**CO2 :** Knowledge on various advanced machining processes with its applications

**CO3 :** Understand the various type of advanced welding process and its applications

**CO4 :** Understand the concept of advanced metal forming processes with its characteristics and application

**CO5 :** Understand the working of CNC machines and write manual part programs for turning and milling operations

**Unit I ADVANCED CASTING PROCESSES 9**

Metal moulding casting – Continuous casting – Squeeze casting- Vacuum mould casting – Evaporative pattern casting – ceramic shell casting

**Unit II ADVANCED MACHINING PROCESSES 9**

Ultrasonic machining (USM) – process and description of USM-applications and limitations- Electron Beam Machining (EBM)-Process principles of EBM-applications-process principles- Laser Beam Machining (LBM)-Laser beam production-applications-laser beam welding - Plasma Arc Machining (PAM)-Generation of plasma arc-process parameters-applications

**Unit III ADVANCED WELDING PROCESSES 9**

Basic principles of Thermit Welding, Laser Beam welding, Electron Beam Welding, Friction welding, Friction stir welding and Ultrasonic welding.

**Unit IV ADVANCED METAL FORMING PROCESSES 9**

Details of high energy rate forming(HERF) process, Electro-magnetic forming, explosive forming, Electro-hydraulic forming, Stretch forming and contour roll forming.

**Unit V CNC MACHINING 9**

Numerical Control (NC) machine tools – CNC types, constructional details, special features, machining centre, part programming fundamentals CNC – manual part programming of simple lathe and milling components

**Total Periods: 45**

**Text Books:**

| S. No. | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1. | DeGarmo, Black. E.P, Kohser. R.A | Materials and Processes in Manufacturing | Prentice Hall India | 2010 |
| 2. | Ghosh.A and Mallik. A. K. | Manufacturing Science | East-West Press Pvt. Ltd. New Delhi | 2010 |

**Reference Books:**

| S. No. | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1. | Singh. K.K | Unconventional Manufacturing Processes | Dhanpat Rai & Company, New Delhi | 2007 |
| 2. | Rao.P .N | Manufacturing Technology | Tata-McGraw Hill publishing co | 2000 |
| 3. | Radhakrishnan. P | Computer Numerical Control Machines | New Central Book Agency | 2002 |
| 4. | HMT | Mechatronics | Tata-McGraw Hill publishing co | 2005 |

**Web URL(s):**

1. https://nptel.ac.in/courses/112/107/112107078/

| U19MCT54 | AVIONICS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**Pre-Requisites :** Nil

**Objectives:**

- To know about the functioning of avionics systems in civil and military aircrafts.
- To know the architectures for integrating avionics systems.
- To know about the modern technology in cockpit display systems.
- To know about surveillance and navigation systems.
- To know the basic concepts in aircraft control systems and Autopilot.

**Course Outcomes**:

At the end of this course students will demonstrate the ability to

**CO1 :** Prepare preliminary design requirements for avionics systems.

**CO2 :** Ability to built Digital avionics architecture.

**CO3 :** Analyze the performance of various cockpit display technologies

**CO4 :** Analyze surveillance and navigation systems.

**CO5 :** Design autopilot for small aircraft.

**Unit I INTRODUCTION TO AVIONICS 9**

Need for Avionics in civil, military aircrafts and space systems - Typical Avionics Systems - Avionics Systems Integration - Avionics System Requirements - Avionics System Environment.

**Unit II DIGITAL AVIONICS ARCHITECTURE 9**

Digital System Concepts - Digital Computers - Avionics System Architectures: First Generation to Fourth Generation - Avionic Data Buses: MIL-STD-1553B - ARINC 429 - ARINC 629 - Avionics Full-Duplex Switched Ethernet.

**Unit III FLIGHT DECKS AND COCKPITS 9**

Display Technologies: CRT, LED, LCD, EL and Plasma panel - Data Entry and Control: Touch Screen, Direct Voice Input (DVI) and Speech Recognition, Civil and Military Cockpits: MFDS, HUD, MFK, HOTAS.

**Unit IV SURVEILLANCE AND NAVIGATION SYSTEMS 9**

Primary Radar, Secondary Radar, Transponder and its modes, TCAS, ADS-B, Weather Radar - Navigation Systems:
VOR/DME, RNAV, Doppler and Inertial Navigation, Satellite Navigation.

**Unit V FLIGHT CONTROL SYSTEMS AND AUTO PILOT 9**

Primary and Secondary Flight controls, Control Systems and Servos, Fly-by-Wire FCS, Autopilot Systems: Height control, Attitude control, Heading control, Airspeed control, Automatic Landing System.

**Total Periods 45**

**Text Books:**

| S. No. | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1. | R. P. G. Collinson | Introduction to Avionics Systems | Springer Science, London; Third Edition | 2011 |
| 2. | Cary R. Spitzer (Ed.), Uma Ferrell (Ed.) and Thomas Ferrell (Ed.) | Digital Avionics Handbook | CRC Press; Third Edition | 2014 |

**Reference Books:**

| S. No. | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1. | Albert Helfrick.D | Principles of Avionics | Avionics Communications Inc; Ninth Edition | 2015 |
| 2. | Cary R. Spitzer | Digital Avionics Systems: Principles and Practice | The Blackburn Press; Second Edition | 2001 |
| 3. | Mike Tooly and David Wyatt | Aircraft Communications and Navigation Systems: Principles, Maintenance and Operation" | Butterworth-Heinemann's Series | 2007 |

**Web URL(s):**

1. https://nptel.ac.in/courses/101104061/
2. https://nptel.ac.in/courses/101105059/
3. https://nptel.ac.in/courses/101101079/

| U19MCT55 | MEDICAL MECHATRONICS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**Pre-Requisites :** Nil

**Objectives:**

- To familiarize students with various aspects of measuring electrical parameters from living body.
- To study the need of transducers and signal conditioning circuits for measurement of Bio-Medical Instrumentation.
- To learn the use of various advanced equipment and real time technologies in medicine for data acquisition, diagnostic and therapy.
- To enable the students to understand patient monitoring system and technique of electrical safety in Hospitals.

**Course Outcomes**:

At the end of this course students will demonstrate the ability to

**CO1 :** Interpret the biological behavior of human cell and to relate the resting and action potential associated with the principle of ECG, EEG, and EMG Machines.

**CO2 :** Summarize the principle, working and application of different types of biomedical sensors and transducers.

**CO3 :** Represent the various signal conditioning, recording and display systems associated with the biomedical devices.

**CO4 :** Elaborate the construction and working of different biomedical patient measurement and scanning systems.

**CO5 :** Determine the need for various monitoring real time system used in medical mechatronics Course Content.

**Unit I INTRODUCTION 9**

**C**ell structure – electrode – electrolyte interface, electrode potential, resting and action potential , source of bioelectric potentials – electrodes for their measurement, ECG, EEG, EMG – machine description – methods of measurement .

**Unit II BIO-MEDICAL TRANSDUCERS & SENSORS 9**

Basic bio-medical transducers principle & types – resistive, inductive, capacitive, Photoelectric- Biochemical sensors - pH, pO2 and pCO2 - Blood Glucose Sensors - Noninvasive Blood-Gas Sensor SpO2 - Optical fiber temperature sensors – Immuno sensors – Bio, Nano sensors and application.

**Unit III SIGNAL CONDITIONING , RECORDING AND DISPLAY 8**

Input isolation, DC amplifier, Power amplifier, and differential amplifier – feedback, op-Amp, carrier Amplifier – instrument power supply, basis of signal conversion and digital filtering, data reduction technique – time and frequency domain technique.

**Unit IV MEDICAL SUPPORT SYSTEMS 10**

Blood pressure measurement: by ultrasonic method– Blood flow measurement by electromagnetic flow meter, cardiac output measurement by dilution method –Heart lung machine – artificial ventilator – Anesthetic machine – Basic ideas of CT scanner – MRI - Ultrasonic scanner – cardiac pacemaker – Defibrillator -Patient safety & Prevention - electrical shock hazards.

**Unit V REAL TIME MONITORING SYSTEMS 9**

Centralized patient monitoring system- real-time clinical data analysis- case study on assistive/rehabilitation robot development - case study on smart wearable sensors technology for medical applications-case study on MEMS devices for biomedical applications.

**Total Periods 45**

**Text Books:**

| S. No. | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1. | Andrew G. Webb | Principles of Biomedical Instrumentation | Cambridge University Press | 2018 |
| 2. | Cromwell, Weibell & Pfeiffer | Biomedical Instrumentation and Measurements | 2nd Edition, Printice Hall of india | 2012 |
| 3. | Arumugam M | Bio Medical Instrumentation | Anuradha agencies Publication | 2003 |

**Reference Books:**

| S. No. | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1. | Brown & Gann, | Engineering Principles in Physiology Vol.I | Academic Press | 2014 |
| 2. | Siamak Najarian | Mechatronics in Medicine – A Bio medical engg approach | McGraw – Hill Education | 2011 |
| 3. | Geddes L.A., and Baker, L.E. | Principles of Applied Bio-medical Instrumentation | 3rd Edition, John Wiley and Sons | 2010 |
| 4. | Khandpur, R.S | Handbook of Biomedical Instrumentation | TMH | 2009 |

## Web URL(s):

1. https://nptel.ac.in/content/storage2/nptel_data3/html/mhrd/ict/text/117105082/lec32.pdf
2. https://nptel.ac.in/content/storage2/nptel_data3/html/mhrd/ict/text/106105195/lec51.pdf
3. https://en.wikipedia.org/wiki/Remote_patient_monitoring

| U19MCT56 | VIRTUAL INSTRUMENTATION | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 0 | 2 | 3 |

**Pre-Requisites :** Basic knowledge on Sensor and Interfacing

**Objectives:**

- To make a student to understand about virtual versus traditional instruments, programming techniques.
- To understand the concepts of A/D and D/A converter and data acquisition.
- To familiarize about PC buses, Instrumentation buses and network protocols.
- To design using VI software of controllers
- To realize the real time applications in virtual instrumentation Software.

**Course Outcomes**:

At the end of this course students will demonstrate the ability to

**CO1** : Define virtual instrumentation concepts.

**CO2 :** Describe acquisition methodologies.

**CO3 :** Compare traditional and virtual instrumentation.

**CO4 :** Know about the implementation of various bus protocol required for virtual instrumentation.

**CO5 :** Work with graphical programming

**Unit I INTRODUCTION 9**

Virtual Instrumentation- Definition and Flexibility- Block diagram and Architecture for Virtual Instruments versus Traditional Instruments - Review of software in Virtual Instrumentation - VI Programming techniques - VI, sub VI, Loop and Charts, Arrays, Clusters and Graphs, Case and Sequence Structures, Formula nodes, String and File Input / Output.

**Unit II DATA ACQUISITION IN VI 9**

Typical on board DAQ card — Resolution and sampling frequency - Multiplexing of analog inputs — Single-ended and differential inputs — Different strategies for sampling of multi-channel analog inputs. Concept of universal DAQ card - Use of timer-counter and analog outputs on the universal DAQ card.

**Unit III COMMUNICATION NETWORKED MODULES 9**

Introduction to PC Buses — Local busses: ISA, PCI, RS232, RS422 and RS485 — Interface Buses: USB, PCMCIA, VXI, SCXI and PXI —Instrumentation Buses: Modbus and GPIB — Networked busses — ISO/OSI Reference model, Ethernet and TCP/ IP Protocols.

**Unit IV ANALYSIS TOOLS 9**

Fourier transform - Power spectrum - Correlation — Windowing and filtering tools – Software introduction – Simple Programs in VI

**Unit V REAL TIME CONTROL IN VI 9**

Designs using VI Software - ON/OFF controller — Proportional controller — Modeling and basic control of level and reactor processes – Image Processing and motion Control — Case studies on development of HMI, SCADA in VI.

**Total Periods: 45**

**Text Books:**

| S. No. | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1. | Sanjay Gupta | Virtual Instrumentation using Lab VIEW | McGraw Hill Education | 2010 |
| 2. | National Instruments Corporation | LabVIEW User Manual | National Instruments | 2003 |

**Reference Books:**

| S. No. | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1. | Gary W. Johnson, Richard Jennings | Lab-view Graphical Programming | McGraw Hill Professional Publishing, 4th Edition | 2011 |
| 2. | Kevin James | PC Interfacing and Data Acquisition: Techniques for Measurement, Instrumentation and Control | Newness, Oxford Auckland Boston Johannesburg, Melbourne, New Delhi | 2000 |
| 3. | Garry M Johnson | Lab view Graphical Programming | Tata McGraw Hill, 2nd Edition | 1996 |

**Web URL(s):**

1. https://www.ni.com/en-in/innovations/white-papers/06/virtual-instrumentation.html
2. https://www.youtube.com/watch?v=I8pc8-VcVFo

| U19MCT57 | DISASTER MANAGEMENT | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**Pre-Requisites :** Nil.

**Objectives:**

- To provide an exposure to disasters, their significance and types.
- To learn the concept of Disaster Management cycle and frame work.
- To ensure relationship between Disasters and Development.
- To enhance awareness of Disaster in the country.
- To develop rudimentary ability to respond to their surroundings response in areas where they live.

**Course Outcomes**:

**CO1 :** The students will be able to differentiate the types of disasters, causes and their impact on environment and society.

**CO2 :** Perform the Disaster management cycle and frame work.

**CO3 :** The students will be able to learn Disaster and Development methods.

**CO4 :** Draw the hazard and vulnerability profile of India, Scenarios in the Indian context, Disaster damage assessment and management.

**CO5 :** Study of recent and various Disaster cases.

**Unit I INTRODUCTION TO DISASTERS 9**

Definition: Disaster, Hazard, Vulnerability, Resilience, Risks –Types of disasters – Geological Disasters: Earthquake, Landslide, Tsunami, Mining – Hydro-meteorological Disaster: Floods, Cyclones, Lightning, Thunder-storms, Hail storms, Avalanches, Droughts, Cold and heat waves – Biological Disasters: Epidemics, Pest attacks, Covid-19, Forest fire – Technological Disaster: Chemical, industrial, radiological, nuclear – Man-made Disasters: Building collapse, Rural and urban fire, Road and rail accidents – Global trends in disasters – Urban disasters and Climate change – Emerging risk of disaster.

**Unit II DISASTER MANAGEMENT CYCLE AND FRAME WORK 9**

Disaster Management cycle – Paradigm shift in Disaster management – Pre-Disaster – Risk assessment and analysis – Risk mapping – Culture of safety – Prevention and mitigation of disasters – Early warning system – Preparedness –Capacity development – Awareness during Disaster –Disaster communication – Search and rescue – Emergency operating centre – Relief and Rehabilitation – Roles and responsibilities of- community, Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stake-holders – Institutional Processess and Framework at State and Central Level – State Disaster Management Authority(SDMA) – Post Disaster – Damage and needs assessment – Restoration of critical infrastructure – Early recovery – Reconstruction and redevelopment.

**Unit III INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT 9**

Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc.- Climate Change Adaptation- IPCC Scenario and Scenarios in the context of India – Relevance of indigenous knowledge, appropriate technology and local resources.

**Unit IV DISASTER MANAGEMENT IN INDIA 9**

Disaster profile of India – Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, and Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, Disaster Management Act and Policy – Other related policies, plans, programmes and legislation – Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment

**Unit V DISASTER CASE STUDIES AND FIELD WORKS 9**

Study of recent Disaster – Role of Engineers in Disaster management – Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial

Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.

**Total Periods: 45**

**Text/ Reference Books:**

| S. No. | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1. | Singhal J.P. | Disaster Management | Laxmi Publications, | 2010 |
| 2. | S.L Goyal, Deep and Deep | Encyclopaedia of Disaster management Vol-I, II and III | Disaster Management policy and administration, New Delhi. | 2006 |
| 3. | Tushar Bhattacharya, | Disaster Science and Management | McGraw Hill India Education Pvt. Ltd., | 2012 |
| 4. | Gupta Anil K, Sreeja S. Nair. | Environmental Knowledge for Disaster Risk Management, | NIDM, New Delhi | 2011 |
| 5. | Kapur Anu | Vulnerable India: A Geographical Study of Disasters | IIAS and Sage Publishers, New Delhi | 2010 |
| 6. | - | National Disaster management Policy | Government of India, New Delhi | 2009 |
| 7. | - | Disaster Management Act | Government of India New Delhi, | 2005 |
| 8. | - | Disaster Preparedness Kit | American red cross | - |

**Web URL(s):**

1. https://nptel.ac.in/courses/105104183/

| U19MCT58 | MODELLING AND SIMULATION | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**Pre-Requisites** : Basic knowledge on Probability Theory and Random Process

**Objectives:**

- To know the important elements of discrete event simulation and modeling paradigm
- To learn about various testing methods of random numbers
- To know about Data collection and analysis of data
- To develop skills on system identification and order determination
- Interpret the model and apply the results to resolve critical issues in a real-world environment

**Course Outcomes**:

At the end of this course students will demonstrate the ability to

**CO1** : Describe the role of important elements of discrete event simulation and modeling paradigm

**CO2** : Analyze the data used for simulation by means of different tests.

**CO3** : Conceptualize real world situations related to systems development decisions, originating from source requirements and goals.

**CO4** : Evaluate the system using mathematical model.

**CO5** : Categorize simulation software for various applications.

**Unit I INTRODUCTION** **9**

Simulation - Advantages, Disadvantages, Areas of application, System environment- components of a system, Model of a system, types of models, steps in a simulation study - Simulation examples in inventory system.

**Unit II RANDOM NUMBER AND VARIATE GENERATION** **9**

Properties of random numbers, Generation of Pseudo- random numbers, techniques of generating pseudo random numbers, Test for random numbers, Inverse transform technique - Exponential, Uniform, triangular, Weibull, empirical, uniform and discrete distribution, Acceptance rejection method.

**Unit III ANALYSIS OF DATA** **9**

Analysis of simulated Data, Data collection, identifying the distribution, Parameter estimation, goodness of fit tests, verification and validation of simulation models.

**Unit IV SYSTEM IDENTIFICATION** **9**

Concepts of System Identification — Identification using normal operating records (Integration method) — Identifiability conditions — System order determination

**Unit V SIMULATION SOFTWARE AND CASE STUDIES** **9**

Simulation Tools, Simulation Languages, Classification of Simulation Software, Desirable Software Features, GPSS/H, SIMAN, SIMSCRIPT 11.5, SLAM II and Related Software, Comparison of Simulation Languages and General-Purpose Languages, Case studies

**Total Periods: 45**

**Text Books:**

| S. No. | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1. | Jerry Banks, John S. Carson II, Berry L. Nelson and David M. Nicol | Discrete Event system simulation | Pearson Education Asia, 4th Edition | 2007 |
| 2. | Geoffrey Gordon | System Simulation | PHI publication, 2nd Edition | 2006 |
| 3. | Frank L. Severance | System Modeling and Simulation | Wiley Publications | 2001 |

**Reference Books:**

| S. No. | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1. | Narsingh Deo | Systems Simulation with Digital Computer | PHI Publication, 3rd Edition | 2004 |
| 2. | Averill M. Law and David Kelton W | Simulation Modelling & Analysis | McGraw Hill,3rd Edition | 2000 |

**Web URL(s):**

1. https://nptel.ac.in/courses/112107214/
2. https://www.tutorialspoint.com/modelling_and_simulation/index.htm

| | Internet of Things | L | T | P | C |
|---|---|---|---|---|---|
| **U19MCT59** | | **3** | **0** | **0** | **3** |

**Pre-Requisites :** Microcontrollers and Embedded Systems

**Objectives:**

- Understand the basic principles and architectures of IoT
- Explain the physical design, logical design and their technologies
- Explain various IoT communication protocols
- Understand the Cloud Storage Models & Communication APIs
- Explain the case studies with real time applications

**Course Outcomes**:

**CO1 :** Infer the architecture, design principles of Internet of Things and M2M & IoT fundamentals

**CO2 :** Analyze the design of Internet of Things

**CO3 :** Analyze the fundamental IoT protocols

**CO4 :** Analyze the cloud and cloud services in the context of IoT

**CO5 :** Apply/ Develop IoT infrastructure for real-time scenarios

**Unit I INTRODUCTION TO IOT 9**

Architectural Overview- Design Principles and needed capabilities- IoT applications- Sensing - Actuations -Basics of Networking - M2M and IoT Technology fundamentals -Devices and gateways - Data management- Business process in IoT- Everything as a Service(XaaS)- Role of cloud in IoT-Security aspects in IoT

**Unit II DESIGN OF INTERNET OF THINGS 9**

Design of Internet of Things: Physical Design of IoT, Logical Design of IoT, IoT Enabling Technologies, IoT Levels and Deployments, Introduction to Physical Devices and Endpoints

**Unit III PROTOCOLS 9**

PHY/MAC Layer -Wireless HART, Z-Wave, Bluetooth Low Energy, Zigbee Smart Energy, Network Layer-IPv4, IPv6, 6LoWPAN, Transport Layer (TCP, MPTCP, UDP, DCCP, SCTP)(TLS, DTLS) – Session Layer-HTTP, CoAP, XMPP, AMQP, MQTT

**Unit IV IOT PHYSICAL SERVERS 9**

Introduction to Cloud Storage Models & Communication APIs - Public, Private and Hybrid cloud platforms - WAMP - AutoBahn for IoT - Xively Cloud for IoT - Amazon Web Services for IoT: Amazon EC2, Amazon AutoScaling, Amazon S3, Amazon RDS, Amazon DynamoDB, Amazon Kinesis, Amazon SQS, Amazon EMR- SkyNet IoT Messaging Platform

**Unit V IOT APPLICATIONS 9**

Smart Lighting - Smart Parking - Weather Monitoring System - Air Pollution Monitoring – Smart Irrigation - IoT Printer

**Total Periods: 45**

**Text Books:**

| S. No. | Author(s) | Title of the Book | Publisher/Edition | Year of Publication |
|---|---|---|---|---|
| 1. | Vijay Madisetti, Arshdeep Bahga | Internet of Things- A Hands on Approach | University Press | 2015 |
| 2. | David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry | IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things | Cisco Press | 2017 |
| 3. | Peter Waher | Learning Internet of Things | Packt publishing,UK | 2015 |

**Reference Books:**

| S. No. | Author(s) | Title of the Book | Publisher/Edition | Year of Publication |
|---|---|---|---|---|
| 1. | Adrian McEwen, Hakim Cassimally | Designing the Internet of Things | Wiley Publishing | 2015 |
| 2. | Raj Kamal | Internet of Things: Architecture and Design | McGraw Hill | 2015 |
| 3. | Pethuru Raj and Anupama C. Raman | The Internet of Things: Enabling Technologies, Platforms, and Use Cases | CRC Press | 2014 |

**Web URL(s):**

https://onlinecourses.nptel.ac.in/noc17_cs22/course

https://www.coursera.org/specializations/internet-of-things

http://www.cse.wustl.edu/~jain/cse570-15/ftp/iot_prot/index.html

| U19MCT60 | Artificial Intelligence for Robotics | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**Pre-Requisites :** Nil.

**Objectives:**

- To Study the concepts of Artificial Intelligence
- To Learn the methods of solving problems using Artificial Intelligence
- To Learn about Planning and Reasoning concepts
- Introduce the concepts of Learning
- To understand the functions of AI in robotics

**Course Outcomes:**

CO1 : Understand the evolution and need of AI

CO2 : Identify problems that are amenable to solution by AI methods

CO3 : Understand the concepts of Planning and Reasoning

CO4 : Understand the concept of learning

CO5 : Study about the use of AI in robotics

**Unit I Introduction** 8

History, state of the art, Need for AI in Robotics. Thinking and acting humanly, intelligent agents, structure of agents

**Unit II Problem Solving Methods** 9

Solving problems by searching –Informed search and exploration–Constraint satisfaction problems– Adversarial search, knowledge and reasoning–knowledge representation – first order logic.

**Unit III Planning and Reasoning** 10

Planning with forward and backward State space search – Partial order planning – Planning graphs, Uncertainty – Probabilistic reasoning–Filtering and prediction–Hidden Markov models–Kalman filters– Dynamic Bayesian Networks

**Unit IV Learning** 9

Forms of learning – Knowledge in learning – Statistical learning methods –reinforcement learning, communication, perceiving and acting, Probabilistic language processing, and perception

**Unit V AI In Robotics** 9

Robotic perception, localization, mapping- configuring space, planning uncertain movements, dynamics and control of movement, Ethics and risks of artificial intelligence in robotics.

**Total Periods: 45**

**Text Books:**

| S. No. | Author(s) | Title of the Book | Publisher/Edition | Year of Publication |
|---|---|---|---|---|
| 1. | Stuart Russell, Peter Norvig | Artificial Intelligence: A modern approach | Pearson Education, India | 2016 |
| 2. | Negnevitsky, M | Artificial Intelligence: A guide to Intelligent Systems | Harlow: AddisonWesley | 2002 |

**Reference Books:**

| S. No. | Author(s) | Title of the Book | Publisher/Edition | Year of Publication |
|---|---|---|---|---|
| 1. | Robin Murphy, Robin R. Murphy, Ronald C. Arkin | Introduction to AI Robotics | MIT Press | 2000 |
| 2. | Francis.X.Govers | Artificial Intelligence for Robotics | Packt Publishing | 2018 |
| 3. | Huimin Lu, Xing Lu, | Artificial Intelligence and Robotics | Springer | 2017 |

**Web URL(s):**

1. https://onlinecourses.swayam2.ac.in/cec21_cs08
2. https://www.udacity.com/course/artificial-intelligence-for-robotics--cs373

**Industry 4.0**

| | L | T | P | C |
|---|---|---|---|---|
| **U19MCT61** | **3** | **0** | **0** | **3** |

**Pre-Requisites :** IOT Fundamentals

**Objectives:**

- To understand the basic principles of cyber physical systems
- To learn about the basics of Industrial IoT
- To understand the basics of smart design and fabrication
- To understand the smart industrial applications
- To develop smart manufacturing infrastructure for real time applications

**Course Outcomes**:

**CO1 :** Infer the Cyber Physical Systems and PLM

**CO2 :** Analyze the Architecture and models of IIOT

**CO3 :** Explain the concept of smart design and fabrication

**CO4 :** Develop smart industrial applications

**CO5 :** Apply smart manufacturing concepts in real time applications

**Unit I INDUSTRY 4.0** **9**

Cyber Physical Systems and Next Generation Sensors, Collaborative Platform and Product Lifecycle Management, Augmented Reality and Virtual Reality, Artifical Intelligence, Big Data and Advanced Analysis

**Unit II INDUSTRIAL IOT** **9**

IIoT-Introduction, Industrial IoT: Business Model and Reference Architerture: IIoT-Business Models, Industrial IoT- Layers: IIoT Sensing, IIoT Processing, IIoT Communication, IIoT Networking

**Unit III SMART DESIGN AND FABRICATION** **9**

Smart Design/Fabrication - Digital Tools, Product Representation and Exchange Technologies and Standards, Agile (Additive) Manufacturing Systems and Standards. Mass Customization, Smart Machine Tools, Robotics and Automation (perception, manipulation, mobility, autonomy), Smart Perception – Sensor networks and Devices

**Unit IV SMART APPLICATIONS** **9**

Online Predictive Modeling, Monitoring and Intelligent Control of Machining/Manufacturing and Logistics/Supply Chain Processes; Smart Energy Management of manufacturing processes and facilities

**Unit V SMART FACTORY AND SMART MANUFACTURING** **9**

Concepts of Industry 4.0 standard, Real-time information based scheduling, capacity planning, material planning, Real-time production monitoring techniques with smart sensors, Configuration of smart shop floor, traceability and call back of defective products

**Total Periods: 45**

**Text Books:**

| S. No. | Author(s) | Title of the Book | Publisher/Edition | Year of Publication |
|---|---|---|---|---|
| 1. | Alasdair Gilchrist | Industry 4.0: The Industrial Internet of Things | Apress/ I$^{st}$ Edition | 2017 |
| 2. | Sabina Jeschke, Christian Brecher, Houbing Song, Danda B. Rawat | Industrial Internet of Things: Cyber manufacturing Systems | Springer/ I$^{st}$ Edition | 2017 |
| 3. | A. McEwen and H. Cassimally | Designing the Internet of Things | Wiley/I$^{st}$ Edition | 2013 |

**Reference Books:**

| S. No. | Author(s) | Title of the Book | Publisher/Edition | Year of Publication |
|---|---|---|---|---|
| 1. | Jiafu Wan, IztokHumar, Daqiang Zhang | Industrial IoT Technologies and Applications | Springer/ I$^{st}$ Edition | 2016 |
| 2. | K. Wang, Y. Wang, J.O. Strandhagen, T. Yu | Advanced Manufacturing and Automation | WIT Press | 2016 |
| 3. | Yingfeng Zhang, Fei Tao | Optimization of Manufacturing Systems using the Internet of Things | Academic Press-Technology & Engineering/ 2$^{nd}$ Edition | 2017 |

**Web URL(s):**

1. https://nptel.ac.in/courses/106/105/106105195
2. https://onlinecourses.nptel.ac.in/noc20_cs69

| U19MCT62 | AUTOMOTIVE ELECTRONICS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**Pre-Requisites** : Sensors and Instrumentation

**Objectives:**

- To understand the need for electrical and electronics systems in automobiles
- To choose and understand the operation of the sensors used in Automotive Applications
- To study about different ignition and Injection Systems
- To study about the working of different Control System and in vehicle networking methods
- To understand the functions of Chassis, Safety and Fault diagnostics Systems

**Course Outcomes**:

**CO1** : Recognize the subsystems of Automotive vehicle architecture

**CO2** : Choose the correct sensor and determine its suitability in automotive vehicle

**CO3** : Summarize the electronic fuel injection/ignition components and their function

**CO4** : Evaluate the performance of ECU and In-vehicle networks used in engine management system

**CO5** : Interpret the need for vehicle chassis, safety and fault diagnostics system

**Unit I Automotive Fundamentals** **9**

Vehicle system architecture, Electrical and electronic systems in the vehicle , Electronic Control Unit, Digital Modules in the control unit, Starting System: requirements, starter circuits and starter motors, Charging systems: requirements, alternators and charging circuits, Starter batteries: function and requirements

**Unit II Sensor and Actuators in Automotives** **9**

Basics, Milestones, Smart sensors and calibration process, Sensor classification, Crank Shaft Sensor - Air Flow Rate Sensor – Throttle Angle Sensor – Coolant Sensor – Exhaust Gas Oxygen Sensor – Knock Sensor – Flex Fuel Sensor, Engine speed sensor, exhaust gas recirculation actuators, stepper motor actuator, vacuum operated actuator

**Unit III Ignition and Injection Systems** **9**

Ignition systems: Ignition fundamentals - Electronic ignition systems - Programmed Ignition - Distribution less ignition - Direct ignition - Spark Plugs. Electronic control of a diesel engine: requirements, components, Fuel injection control

**Unit IV Engine Management and Automotive Networking** **9**

Combined ignition and fuel management, Exhaust emission control, Complete vehicle control systems, **Automotive Networking :**Requirements, Classifications, Networking, In vehicle networks: CAN, LIN, FLEXRAY, MOST, KWP2000

**Unit V Chassis, Safety System and Fault diagnostics** **9**

Electronic transmission control-Traction control system – Adaptive cruise control – Antilock braking system - Electronic Stability Program – Electronic suspension system – airbag systems – Occupant protection systems, On-Board Diagnosis: passenger cars and light-duty trucks.

**Total Periods: 45**

**Text Books:**

| S. No. | Author(s) | Title of the Book | Publisher/Edition | Year of Publication |
|---|---|---|---|---|
| 1. | Konrad Reif | Automotive Mechatronics | Springer | 2016 |
| 2. | Tom Denton | Automobile Electrical and Electronics Systems | 5th Edition, Routledge Taylor and Francis Publishers, London | 2018 |
| 3. | Robert Bosch GmbH | Bosch Automotive Electrics and Automotive Electronics Systems and Components, Networking and Hybrid Drive | Springer | 2016 |

**Reference Books:**

| S. No. | Author(s) | Title of the Book | Publisher/Edition | Year of Publication |
|---|---|---|---|---|
| 1. | Ribbens William B | Understanding Automotive Electronics | 8th Edition, Butterworth-Heinemann, Burlington, | 2017 |
| 2. | James D Halderman | Automotive Electricity and Electronics | Pearson Education, 5th Edition | 2016 |
| 3. | Mandy Concepcion | Automotive Electronic Diagnostics | Automotive Diagnostics and Publishing | 2009 |

| U19MET54 | Refrigeration and Air Conditioning | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**Prerequisites :** Knowledge of Engineering Thermodynamics

**Objectives:**

- To understand the underlying principles of operations in different Refrigeration & Air conditioning systems and components.
- To provide knowledge on design aspects of Refrigeration & Air conditioning systems.

**Course Outcomes**:

At the end of this course, students will demonstrate the ability to

**CO1 :** Explain the basic concepts of Refrigeration

**CO2 :** Explain the Vapor compression Refrigeration systems and to solve problems.

**CO3 :** Discuss the various types of Refrigeration systems.

**CO4 :** Explain the concepts of Air conditioning

**CO5 :** Calculate load of Air conditioning systems

**UNIT I INTRODUCTION** **9**

Introduction to Refrigeration - Unit of Refrigeration and C.O.P.– Ideal cycles- Refrigerants Desirable properties – Classification - Nomenclature – ODP and GWP.

**UNIT II VAPOUR COMPRESSION REFRIGERATION SYSTEM** 9

Vapor compression cycle: p-h and T-s diagrams - deviations from theoretical cycle – sub cooling and super heating- effects of condenser and evaporator pressure on COP- multi pressure system - low temperature refrigeration - Cascade systems – problems. Equipments: Type of Compressors, Condensers, Expansion devices, Evaporators.

**UNIT III OTHER REFRIGERATION SYSTEMS** **9**

Working principles of vapour absorption systems and adsorption cooling systems – Steam jet refrigeration- Ejector refrigeration systems- Thermoelectric refrigeration- Air refrigeration - Magnetic - Vortex and Pulse tube refrigeration systems.

**UNIT IV AIR CONDITIONING SYSTEMS** **9**

Working of summer and winter air conditioning systems, Classifications, Layout of plants, Air distribution system, Filters; Air Conditioning Systems with Controls: Temperature, Pressure and Humidity sensors, Actuators and Safety controls.

**UNIT V LOAD ESTIMATION OF AIR CONDITIONG SYSTEM** **9**

Air conditioning loads: Outside and inside design conditions, Heat transfer through structure, Solar radiation, Electrical appliances, Infiltration and ventilation, internal heat load, Apparatus selection, fresh air load, human comfort and IAQ principles, effective temperature and chart, calculation of summer and winter air conditioning load

**Total Periods: 45**

**Text Books:**

| S.No | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Arora, C.P | Refrigeration and Air Conditioning, 3rd edition, | McGraw Hill, New Delhi | 2010 |

**Reference Books:**

| S.No | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Jones W.P | Air conditioning engineering, 5th edition, | Butterworth-Heinemann | 2020 |
| 2 | Roy J. Dossat | Principles of Refrigeration, $4^{th}$ edition, | Pearson Education Asia | 2009 |
| 3 | Stoecker, W.F. and Jones J. W | Refrigeration and Air Conditioning, $2^{nd}$ Edition | McGraw Hill, New Delhi | 1986 |

**Web URL(s)**

1. https://nptel.ac.in/courses/112/105/112105129/
2. https://nptel.ac.in/courses/112/107/112107208/
3. https://nptel.ac.in/courses/112/105/112105128/

| U19MET60 | Additive Manufacturing | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**Objectives:**

- To educate students with fundamental and advanced knowledge in the field of Additive Manufacturing technology and the associated Aerospace, Architecture, Art, Medical and Industrial applications

**Course Outcomes**:

At the end of this course, students will demonstrate the ability to

**CO1 :** Appreciate the importance of computers and modern tools in manufacturing to reducecost and matching the societal needs.

**CO2 :** Analyze 2D and 3D models using CAD modeling software and integratingwith manufacturing systems.

**CO3 :** Understand the various Additive Manufacturing (AM) techniques and apply them to theirpotential support in design as well as mass customized manufacturing..

**CO4 :** Apply knowledge on latest techniques of manufacturing in their field of career

**CO5 :** Monitor and control shop floor with the aid of computers

**UNIT I INTRODUCTION 9**

Need - Development of AM systems – AM process chain - Impact of AM on Product Development - Virtual Prototyping- Rapid Tooling – RP to AM - Classification of AM processes – Benefits – Applications. Software for AM- Case studies.

**UNIT II REVERSE ENGINEERING AND CAD MODELING 9**

Basic concept- Digitization techniques – Model reconstruction – Data Processing for Rapid Prototyping: CAD model preparation, Data requirements – Geometric modeling techniques: Wireframe, surface and solid modeling – data formats - Data interfacing, Part orientation and support generation, Support structure design, Model Slicing, Tool path generation.

**UNIT III LIQUIDAND SOLID BASED ADDITIVE MANUFACTURING SYSTEMS 9**

Stereo lithography Apparatus (SLA): Principle, pre-build process, part-building and post-build processes, photo polymerization of SL resins, part quality and process planning, recoating issues, materials, advantages, limitations and applications. Solid Ground Curing (SGC): working principle, process, strengths, weaknesses and applications. Fused deposition Modeling (FDM): Principle, details of processes, process variables, types, products, materials and application. Laminated Object Manufacturing (LOM): Working Principles, details of processes, products, materials, advantages, limitations and applications.

**UNIT IV POWDER BASED ADDITIVE MANUFACTURING SYSTEMS 9**

Selective Laser Sintering (SLS): Principle, process, indirect and direct SLS- powder structures, materials, post processing, surface deviation and accuracy, Applications. Laser Engineered Net Shaping (LENS): Processes, materials, products, advantages, limitations and applications – case Studies, Selective Laser Melting and Electron Beam Melting

**UNIT V OTHER ADDITIVE MANUFACTURING SYSTEMS 9**

Three-dimensional Printing (3DP): Principle, basic process, Physics of 3DP, types of printing, process capabilities, material system. Solid based, Liquid based and powder based 3DP systems, Demerits, Applications and case studies. Shape Deposition Manufacturing (SDM), Ballastic Particle Manufacturing (BPM), Bio Additive Manufacturing.

**Total Periods: 45**

**Text Book:**

| S.No | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Chua Chee Kai and Leong Kah Fai | Rapid Prototyping: Principles and Applications in Manufacturing | John Wiley and Sons | 1997 |

**Reference Books:**

| S.No | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Gibson, I., Rosen, D.W. and Stucker, B | Additive Manufacturing Methodologies: Rapid Prototyping to Direct Digital Manufacturing | Springer | 2010 |
| 2 | Gebhardt, A | Rapid prototyping | Hanser Gardener Publications | 2003 |
| 3 | Hilton, P.D. and Jacobs, P.F | Rapid Prototyping and Engineering applications: A tool box for prototype development | CRC press | 2005 |

**Web URL(s)**

1. **https://nptel.ac.in/courses/112/104/112104265/**
2. **https://nptel.ac.in/courses/110/106/110106146/**

| U19MET62 | Process Planning and Cost Estimation | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**Objectives:**

- To introduce the process planning concepts to make cost estimation for various products after process planning
- To calculate the machining time for various machining operations
- To select the appropriate process, equipment and tools for production of components

**Course Outcomes**:

At the end of this course, students will demonstrate the ability to

**CO1 :** Select the appropriate process, equipment and tools for production of components.

**CO2 :** Prepare process planning activity chart.

**CO3 :** Explain the concept of cost estimation and its importance.

**CO4 :** Compute the job order cost for different type of shop floor.

**CO5 :** Calculate the machining time for various machining operations.

**Unit I INTRODUCTION TO PROCESS PLANNING** 9

Introduction- methods of process planning-Drawing interpretation-Material evaluation – steps in process selection-.Production equipment and tooling selection

**Unit II PROCESS PLANNING ACTIVITIES** 9

Process parameters calculation for various production processes-Selection jigs and fixtures election of quality assurance methods - Set of documents for process planning-Economics of process planning-case studies

**Unit III INTRODUCTION TO COST ESTIMATION** **9**

Importance of costing and estimation –methods of costing-elements of cost estimation –Types of estimates – Estimating procedure- Estimation labor cost, material cost- allocation of over head charges- Calculation of depreciation cost

**Unit IV PRODUCTION COST ESTIMATION** **9**

Estimation of Different Types of Jobs - Estimation of Forging Shop, Estimation of Welding Shop, Estimation of Foundry Shop

**Unit V MACHINING TIME CALCULATION** **9**

Estimation of Machining Time - Importance of Machine Time Calculation- Calculation of Machining Time for Different Lathe Operations ,Drilling and Boring - Machining Time Calculation for Milling, Shaping and Planning -Machining Time Calculation for Grinding

**Total Periods: 45**

**Text Books:**

| S.No | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | K.C. Jain & L.N. Aggarwal | Production Planning Control and Industrial Management | Khanna Publishers, New Delhi | 1990 |
| 2 | Sinha B.P, | Mechanical Estimating and Costing | Tata-McGraw Hill, New Delhi | 1995 |

**Reference Books:**

| S.No | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Chitale A.V. and Gupta R.C., | Product Design and Manufacturing,2nd Edition | Prentice Hall India | 2002 |
| 2 | Russell R.S and Tailor B.W, | Operations Management, 4th Edition | Prentice Hall India | 2003 |
| 3 | Mikell P. Groover | Automation, Production, Systems and Computer Integrated Manufacturing | Pearson Education | 2001 |
| 4 | Ostwalal P.F. and Munez J., | Manufacturing Processes and systems, 9th Edition | John Wiley | 1998 |

**Web Url(s)**

1. https://nptel.ac.in/courses/112/107/112107238/
2. https://nptel.ac.in/courses/110/107/110107141/
3. https://onlinecourses.nptel.ac.in/noc20_me30/preview
4. https://nptel.ac.in/courses/112/107/112107142/
5. https://nptel.ac.in/courses/112/107/112107292/
6. https://nptel.ac.in/courses/112/107/112107143/

| U19MET65 | Maintenance Engineering | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**Objectives:**

- To understand the principles, objectives and importance of maintenance adopted in industry for successful progress.
- To introduce different maintenance categories, its merits and types of lubrication.
- To expose the idea of condition monitoring, methods and instruments used for allied measurements.
- To learn about failure analysis and repair methods for few mechanical elements.
- To promote computerization in maintenance and inventory management.

**Course Outcomes**:

At the end of this course, students will demonstrate the ability to

**CO1 :** Explain the principles, objectives and importance of maintenance adopted in industry

**CO2 :** Select the suitable maintenance category and lubrication type.

**CO3 :** Apply the appropriate methods and instruments for condition monitoring.

**CO4 :** Analyze the failures of mechanical systems and select suitable repair methods.

**CO5 :** Utilize computers in maintenance and inventory management.

**Unit I PRINCIPLES OF MAINTENANCE PLANNING 9**

Basic principles of maintenance planning - Objectives and principles of planned maintenance activity - Importance and benefits of sound maintenance systems - Maintenance organization - Maintenance economics.

**Unit II MAINTENANCE CATEGORIES AND LUBRICATION** 9

Maintenance categories - Comparative merits of each category - Preventive maintenance, Maintenance schedules, Repair cycle - Total Productive Maintenance - Principles and methods of lubrication.

**Unit III CONDITION MONITORING 9**

Condition based maintenance - Cost comparison with and without Condition Monitoring - Methods and instruments for condition monitoring - Noise, vibration, wear and temperature measurement.

**Unit IV FAILURE ANALYSIS AND REPAIR METHODS 9**

Failure analysis - Failures and their development - Role of Non Destructive Testing in failure analysis - Repair methods for bearings, cylinder block, fuel pump, shaft.

**Unit V COMPUTER AIDED MAINTENANCE MANAGEMENT 9**

Approach towards Computerization in maintenance - computer-aided maintenance management system (CAMMS) - Advantages of CAMMS - spare parts and inventory centre performance reporting.

**Total Periods: 45**

**Text Books:**

| S.No | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Srivastava S.K, | Maintenance Engineering | S Chand and Company | 2010 |
| 2 | Mishra R.C, and Pathak K | Maintenance Engineering and Management, 2nd Edition | Prentice Hall India Learning Pvt. Ltd. | 2013 |

**Reference Books:**

| S.No | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Keith Mobley R, Lindley R. Higgins and Darrin J. Wikoff | Maintenance Engineering Handbook, 7th Edition | McGraw-Hill Professional | 2008 |
| 2 | Davies A, | Handbook of Condition Monitoring: Techniques and Methodology | Springer | 2012 |
| 3 | Otegui Jose Luis | Failure Analysis, Fundamentals and Applications in Mechanical Components, 19th Edition | Springer | 2014 |

**Web URL(s)**

1. https://nptel.ac.in/courses/112/105/112105232/
2. https://nptel.ac.in/courses/112/105/112105048/
3. https://www.digimat.in/nptel/courses/video/112107241/L11.html

| U19MET66 | Non-Traditional Machining Processes | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**Objectives:**

- To acquire a functional understanding of non-traditional manufacturing equipment.
- To Understand the terminology used in non-traditional manufacturing industries.
- To provide knowledge on the classification of non-traditional machining process.
- To know about various process parameters and their influence on performance and their applications.
- To impart knowledge on various energy involved in non-traditional machining process.

**Course Outcomes**:

At the end of this course, students will demonstrate the ability to

**CO1 :** Understand the need of Non Traditional Machining Processes and able to classify various processes.

**CO2 :** Recognize the role of mechanical energy in non-traditional machining processes.

**CO3 :** Apply the knowledge on machining electrically conductive material through electrical energy in non-traditional machining processes.

**CO4 :** Understand the concept of machining the hard material using chemical energy and electrochemical energy.

**CO5 :** Familiarity with various thermal energy based nontraditional machining processes.

**Unit I UNCONVENTIONAL MACHINING PROCESS 9**

Introduction - Need - Classification - Energies employed in the processes - Brief overview of Abrasive jet Machining (AJM), Water jet machining (WJM), Ultrasonic machining (USM), Electric discharge machining (EBM), Electro-chemical machining (ECM), Electron beam machining (EBM), Laser beam machining (LBM), Plasma arc machining (PAM).

**Unit II MECHANICAL ENERGY BASED PROCESSES** 9

Abrasive Jet Machining, Water Jet Machining, Abrasive water jet machining and Ultrasonic Machining - Working Principles, Equipment, Process parameters, Material removal rate, Applications.

**Unit III ELECTRICAL ENERGY BASED PROCESSES 9**

Electric Discharge Machining - Working Principles, Equipment, Process Parameters, Material removal rate, Electrode / Tool, Power Circuits, Tool Wear, Dielectric, Flushing, Wire cut EDM - Applications. Micro EDM- Electric discharge grinding and drilling- Electro-stream drilling.

**Unit IV CHEMICAL AND ELECTRO-CHEMICAL ENERGY BASED PROCESSES 9**

Chemical machining - Etchants, Maskants - techniques. Electro-chemical machining – Working principle, Equipment, Process Parameters, Material removal rate, Electrical circuit. Electro-chemical grinding - Electro-chemical deburring - Electro-chemical honing - Applications.

**Unit V THERMAL ENERGY BASED PROCESSES 9**

Laser Beam machining, Plasma Arc Machining - Principles, Equipment. Electron Beam Machining - Principles, Equipment, Types, Beam control techniques, Material removal rate - Applications.

**Total Periods: 45**

**Text Books:**

| S.No | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | P. K. Mishra | Non-Conventional Machining | Narosa Publishing House, New Delhi | 2007 |
| 2 | P. C. Pandey and H.S. Shan | Modern Machining Processes | Tata McGraw Hill Publishing Company Pvt Ltd., New Delhi | 2008 |
| 3 | Joao Paulo Davim | Nontraditional Machining Processes: Research Advances | Springer, New York | 2013 |

**Reference Books:**

| S.No | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Paul De Garmo, J.T. Black, and Ronald.A. Kohser | Material and Processes in Manufacturing | Prentice Hall of India Pvt. Ltd., New Delhi | 2011 |
| 2 | Vijaya Kumar Jain | Advanced Machining Processes | Allied Publishers Pvt. Ltd., New Delhi | 2005 |
| 3 | Hassan El-Hofy | Advanced Machining Processes: Nontraditional and Hybrid Machining Processes | McGraw-Hill Professional, New Delhi | 2005 |

**Web Url(s)**

1. https://nptel.ac.in/courses/112105212/
2. https://www.me.iitb.ac.in/~ramesh/courses/ME338/non_trad.pdf
3. http://www.nitc.ac.in/dept/me/jagadeesha/mev303/OVERVIEW_OF_NTM_PROCESSES.pdf
4. https://swayam.gov.in/nd1_noc20_me41/preview

| U19MET73 | Computational Fluid Dynamics | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**Prerequisites :** Knowledge of Finite Element Analysis

**Objectives:**

- To introduce Governing Equations of viscous fluid flows.
- To introduce numerical modeling and its role in the field of fluid flow and heat transfer.
- To enable the students to understand the various discretization methods, solution procedures and turbulence modeling.
- To create confidence to solve complex problems in the field of fluid flow and heat transfer by using high speed computers.

**Course Outcomes**:

At the end of this course, students will demonstrate the ability to

**CO1 :** Derive the governing equations and boundary conditions for fluid dynamics.

**CO2 :** Analyze Finite difference and Finite volume methods for Diffusion.

**CO3 :** Analyze Finite volume method for Convective diffusion.

**CO4 :** Analyze Flow field problems.

**CO5 :** Explain and solve the Turbulence models and Mesh generation techniques.

**Unit I GOVERNING EQUATIONS AND BOUNDARY CONDITIONS 9**

Basics of computational fluid dynamics – Governing equations of fluid dynamics – Continuity, Momentum and Energy equations – Chemical species transport – Physical boundary conditions – Time-averaged equations for Turbulent Flow – Turbulent–Kinetic Energy Equations – Mathematical behaviour of PDEs on CFD - Elliptic, Parabolic and Hyperbolic equations.

**Unit II FINITE DIFFERENCE AND FINITE VOLUME METHODS FOR DIFFUSION** 9

Derivation of finite difference equations – Simple Methods – General Methods for first and second order accuracy – Finite volume formulation for steady state One, Two and Three - dimensional diffusion problems –Parabolic equations – Explicit and Implicit schemes – Example problems on elliptic and parabolic equations – Use of Finite Difference and Finite Volume methods.

**Unit III FINITE VOLUME METHOD FOR CONVECTION DIFFUSION 9**

Steady one-dimensional convection and diffusion – Central, upwind differencing schemes properties of discretization schemes – Conservativeness, Boundedness, Transportiveness, Hybrid, Power-law, QUICK Schemes.

**Unit IV FLOW FIELD ANALYSIS 9**

Finite volume methods -Representation of the pressure gradient term and continuity equation – Staggered grid – Momentum equations – Pressure and Velocity corrections – Pressure Correction equation, SIMPLE algorithm and its variants – PISO Algorithms.

**Unit V TURBULENCE MODELS AND MESH GENERATION 9**

Turbulence models, mixing length model, Two equation (k-Є) models – High and low Reynolds number models – Structured Grid generation – Unstructured Grid generation – Mesh refinement – Adaptive mesh – Software tools.

**Total Periods 45**

**Text Books**

| S.No | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Ghoshdastidar, P.S. | Computer Simulation of flow and heat transfer | Tata McGraw-Hill. | 2017 |
| 2 | Versteeg, H.K., and Malalasekera, W | An Introduction to Computational Fluid Dynamics: The finite volume Method | Pearson Education Ltd | 2007 |

**Reference Books**

| S.No | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Anil W. Date | Introduction to Computational Fluid Dynamics | Cambridge University Press | 2005 |
| 2 | Chung, T.J. | Computational Fluid Dynamics | Cambridge University Press | 2002 |
| 3 | Ghoshdastidar P.S. | Heat Transfer | Oxford University Press | 2005 |
| 4 | Muralidhar, K., and Sundararajan, T., | Computational Fluid Flow and Heat Transfer | Narosa Publishing House, New Delhi | 2014 |
| 5 | Patankar, S.V. | Numerical Heat Transfer and Fluid Flow | Hemisphere Publishing Corporation | 2004 |

**Web URL(s)**

1. **https://nptel.ac.in/courses/112/105/112105045/**

| U19MET74 | Design of Jigs, Fixture and Press Tool (Use of Approved Design Data Book permitted) | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**Objectives:**

- To impart knowledge on location and clamping principles
- To understand the functions and design principles of Jigs and fixtures
- To make known the techniques of press tool technology
- To acquire the knowledge in dies and relevant details
- To develop ability for dealing on site problems associated in shop floor

**Course Outcomes**:

At the end of this course, students will demonstrate the ability to

**CO1 :** Apply the principle of jigs and fixtures in holding work

**CO2 :** Design and develop the work holding process for any operation

**CO3 :** Exhibit the technologies available for ease of pressing operation

**CO4 :** Develop the dies for various bending, forming and drawing operations

**CO5 :** Implement the principles of Jigs and Fixtures in any on field production activities.

**Unit I LOCATING AND CLAMPING PRINCIPLES 9**

Objectives of tool design- Function and advantages of Jigs and fixtures – Basic elements – principles of location – Locating methods and devices – Redundant Location – Principles of clamping – Mechanical actuation – pneumatic and hydraulic actuation Standard parts – Drill bushes and Jig buttons – Tolerances and materials used

**Unit II JIGS AND FIXTURES** 9

Design and development of jigs and fixtures for given component- Types of Jigs – Post, Turnover, Channel, latch, box, pot, angular post jigs – Indexing jigs – General principles of milling, Lathe, boring, broaching and grinding fixtures – Assembly, Inspection and Welding fixtures – Modular fixturing systems- Quick change fixtures.

**Unit III ELEMENTS OF CUTTING DIES 9**

Press Working Terminologies – operations – Types of presses – press accessories – Computation of press capacity – Strip layout – Material Utilization – Shearing action – Clearances – Press Work Materials – Center of pressure- Design of various elements of dies – Die Block – Punch holder, Die set, guide plates – Stops – Strippers – Pilots – Selection of Standard parts – Design and preparation of four standard views of simple blanking, piercing, compound and progressive dies

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

Difference between bending, forming and drawing – Blank development for above operations – Types of Bending dies – Press capacity – Spring back – knockouts – direct and indirect – pressure pads – Ejectors – Variables affecting Metal flow in drawing operations – draw die inserts – draw beads- ironing – Design and development of bending, forming, drawing reverse re-drawing and combination dies – Blank development for axis- symmetric, rectangular and elliptic parts – Single and double action dies.

**Unit V SPECIAL DIES 9**

Bulging, Swaging, Embossing, coining, curling, hole flanging, shaving and sizing, assembly, fine Blanking dies – recent trends in tool design- computer Aids for sheet metal forming Analysis – basic introduction - tooling for numerically controlled machines- setup reduction for work holding – Single minute exchange of dies – Poka Yoke - Course should be supplemented with visits to industries.

**Total Periods 45**

**Text Books:**

| S.No | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Joshi, P.H. | Jigs and Fixture | Tata McGraw Hill, New Delhi | 2004 |
| 2 | Joshi, P.H. | Press Tools : Design and Construction | Wheels publishing Co | 1996 |

**Reference Books:**

| S.No | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Donaldson, Lecain and Goold | Tool Design | Tata McGraw Hill, New Delhi | 2000 |
| 2 | K. Venkataraman, | Design of Jigs Fixtures & Press Tools | Tata McGraw Hill, New Delhi | 2000 |

**Web URL(s)**

1. https://nptel.ac.in/content/storage2/courses/112105127/pdf/LM-33.pdf
2. https://nptel.ac.in/content/storage2/courses/112105127/pdf/LM-34.pdf
3. http://www.nitc.ac.in/dept/me/jagadeesha/mev303/CHAPT_INTRODUCTION_TO_JIGS_AND%20FIXTURES.pdf

| U19MET76 | Product Design | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**Objectives:**

- To provide the basic concepts of product design, product features and its architecture
- To impart basic knowledge in the common features a product and incorporate them suitably in product.

**Course Outcomes**:

At the end of this course, students will demonstrate the ability to

**CO1 :** Design and development some products for the given set of applications

**CO2 :** Make a prototype by utilizing the knowledge gained through prototyping technology

**CO3 :** Establish product architecture by creating detailed interface specifications

**CO4 :** Explain the design process by incorporating CAD, CAM and CAE tools

**CO5 :** Execute the product development activities in economical way.

**Unit I INTRODUCTION 9**

Need for IPPD – Strategic importance of Product development – integration of customer, designer, material supplier and process planner, Competitor and customer – Behaviour analysis. Understanding customer – prompting customer understanding – involve customer in development and managing requirements – Organization – process management and improvement – Plan and establish product specifications.

**Unit II CONCEPT GENERATION AND SELECTION** 9

Task – Structured approaches – clarification – search – externally and internally – explore systematically – reflect on the solutions and processes – concept selection – methodology – benefits.

**Unit III PRODUCT ARCHITECTURE 9**

Implications – Product change – variety – component standardization – product performance – manufacturability – product development management – establishing the architecture – creation – clustering – geometric layout development – fundamental and incidental interactions – related system level design issues – secondary systems – architecture of the chunks – creating detailed interface specifications

**Unit IV INDUSTRIAL DESIGN 9**

Integrate process design – Managing costs – Robust design – Integrating CAE, CAD, CAM tools – Simulating product performance and manufacturing processes electronically – Need for industrial design – impact – design process – investigation of for industrial design – impact – design process – investigation of customer needs – conceptualization – refinement – management of the industrial design process – technology driven products – user – driven products – assessing the quality of industrial design.

**Unit V DESIGN FOR MANUFACTURING AND PRODUCT DEVELOPMENT 9**

Definition – Estimation of Manufacturing cost – reducing the component costs and assembly costs – Minimize system complexity – Prototype basics – principles of prototyping – planning for prototypes – Economic Analysis – Understanding and representing tasks – baseline project planning – accelerating the project – project execution

**Total Periods 45**

**Text/Reference Books:**

| S.No | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Kari T.Ulrich and Steven D.Eppinger | Product Design and Development | McGraw-Hill International Editions | 1999 |
| 2 | Kemnneth Crow | Concurrent Engineering ./ Integrated Product Development | DRM Associates, 26/3,Via Olivera, Palos Verdes, CA 90274(310) 377-569, Workshop Book. | 1992 |
| 3 | Stephen Rosenthal | Effective Product Design and Development | One Orwin, Homewood, , ISBN 1-55623-603-4. | 1992 |
| 4 | Staurt Pugh | Tool Design :Integrated Methods for Successful Product Engineering | Addison Wesley Publishing, New York, | 1997 |

**Web URL(s):**

1. https://nptel.ac.in/courses/112/107/112107217/
2. https://nptel.ac.in/courses/112/104/112104230/
3. https://onlinecourses.nptel.ac.in/noc21_me66/preview

| U19MET78 | Micro Electro Mechanical Systems | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**Objectives:**

- To impart knowledge of design, fabrication and characterization of Micro Electro Mechanical systems
- To provide basic knowledge of sensors and actuators to fabricate MEMS devices.
- To educate on the rudiments of Micro fabrication techniques.

**Course Outcomes**:
At the end of this course, students will demonstrate the ability to

**CO 1:** Apply the knowledge of basic science, circuit theory and electro-magnetic field theory in fabricating electro mechanical devices.

**CO 2:** Understand and analyze linear as well as digital electronic circuits

**CO 3:** Explain the different types of sensors and actuators used in MEMS.

**CO 4:** Discuss the different materials used for MEMS applications

**CO 5:** Educate on the applications of MEMS to disciplines beyond Electrical and Mechanical engineering.

**Unit I INTRODUCTION 9**

Intrinsic Characteristics of MEMS – Energy Domains and Transducers- Sensors and Actuators – Introduction to Micro fabrication - Silicon based MEMS processes – New Materials – Review of Electrical and Mechanical concepts in MEMS – Semiconductor devices – Stress and strain analysis – Flexural beam bending- Torsional deflection.

**Unit II SENSORS AND ACTUATORS-I** 9

Electrostatic sensors – Parallel plate capacitors – Applications – Interdigitated Finger capacitor – Comb drive devices – Micro Grippers – Micro Motors - Thermal Sensing and Actuation – Thermal expansion – Thermal couples – Thermal resistors – Thermal Bimorph - Applications – Magnetic Actuators – Micromagnetic components – Case studies of MEMS in magnetic actuators- Actuation using Shape Memory Alloys

**Unit III SENSORS AND ACTUATORS-II 9**

Piezoresistive sensors – Piezoresistive sensor materials - Stress analysis of mechanical elements – Applications to Inertia, Pressure, Tactile and Flow sensors – Piezoelectric sensors and actuators – piezoelectric effects – piezoelectric materials – General Applications

**Unit IV MICROMACHINING 9**

Silicon Anisotropic Etching – Anisotrophic Wet Etching – Dry Etching of Silicon – Plasma Etching – Deep Reaction Ion Etching (DRIE) – Isotropic Wet Etching – Gas Phase Etchants – Case studies - Basic surface micro machining processes – Structural and Sacrificial Materials – LIGA Process - Assembly of 3D MEMS – Foundry process.

**Unit V POLYMER AND OPTICAL MEMS 9**

Polymers in MEMS– Polimide - SU-8 - Liquid Crystal Polymer (LCP) – PDMS – PMMA – Parylene – Fluorocarbon - Application to Acceleration, Pressure, Flow and Tactile sensors- Optical MEMS – Lenses and Mirrors – Actuators for Active Optical MEMS.

**Total Periods: 45**

**Text Books:**

| S.No | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Chang Liu | Foundations of MEMS | Pearson Education Inc | 2006 |
| 2 | Rai-Choudhury P | MEMS and MOEMS Technology and Applications | PHI Learning Private Limited | 2009 |

**Reference Books:**

| S. No | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Stephen D Senturia | Microsystem Design | Springer Publication | 2000 |
| 2 | Tai Ran Hsu | MEMS & Micro systems Design and Manufacture | Tata McGraw Hill, New Delhi | 2002 |
| 3 | Thomas M.Adams and Richard A.Layton | Introduction MEMS, Fabrication and Application | Springer Publication | 2012 |
| 4 | Julian w. Gardner, Vijay K. Varadan, Osama O. Awadelkarim | Micro Sensors MEMS and Smart Devices | John Wiley & Son LTD | 2002 |

**Web URL(s)**

1. https://nptel.ac.in/courses/117/105/117105082/
2. https://nptel.ac.in/noc/courses/noc18/SEM2/noc18-ee36/
3. http://www.nptelvideos.in/2012/12/mems-microsystems.html
4. https://onlinecourses.nptel.ac.in/noc20_ee56/preview

| U19MET09 | Automobile Engineering | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**Objectives:**

- To understand the construction and working principle of various parts of an automobile.
- To have the practice for assembling and dismantling of engine parts and transmission system

**Course Outcomes**:

At the end of this course, students will demonstrate the ability to

**CO1 :** Recognize the various parts of the automobile and their functions and materials.

**CO2 :** Discuss the engine auxiliary systems and engine emission control.

**CO3 :** Distinguish the working of different types of transmission systems.

**CO4 :** Explain the Steering, Brakes and Suspension Systems.

**CO5 :** Predict possible alternate sources of energy for IC Engines.

**Unit I VEHICLE DESIGN AND ENGINES 9**

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

**Unit II FUEL INJECTION SYSTEMS** 9

Electronically controlled gasoline injection system for SI engines - EFi, MPFi, GDi , Electronically controlled diesel injection system – CRDI, Unit injector system, Rotary distributor type , Turbo chargers (WGT, VGT), Engine emission control by three way catalytic converter system, Emission norms (Euro and BS).

**Unit III POWER TRANSMISSION SYSTEMS 9**

Clutch-types and construction, gear boxes- manual and Automatic transmission with intelligent electronic control systems - Over drive, transfer box, fluid flywheel, torque converter, propeller shaft, slip joints, universal joints, Differential and rear axle, Hotchkiss Drive and Torque Tube Drive.

**Unit IV STEERING, BRAKES AND SUSPENSION SYSTEMS 9**

Steering geometry and types of steering gear box-Power Steering, Types of Front Axle, Types of Suspension Systems, Pneumatic and Hydraulic Braking Systems, Antilock Braking System (ABS), electronic brake force distribution (EBD) and Traction Control.

**Unit V ALTERNATIVE ENERGY SOURCES 9**

Use of Natural Gas, Liquefied Petroleum Gas, Bio-diesel, Bio-ethanol, Gasohol and Hydrogen in Automobiles- Engine modifications required –Performance, Combustion and Emission Characteristics of SI and CI engines with these alternate fuels - Electric and Hybrid Vehicles, Fuel Cell

Note: Practical Training in dismantling and assembling of Engine parts and Transmission Systems should be given to the students.

**Total Periods 45**

**Text Books**

| S.No | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Jain K.K. and Asthana .R.B | Automobile Engineering | Tata McGraw Hill,New Delhi, | 2002 |
| 2 | Kirpal Singh | Automobile Engineering Vol 1&2 , 13th Edition, | Standard Publishers, New Delhi | 2014 |

**Reference Books**

| S.No | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Ganesan V | Internal Combustion engines, 3rd Edition | Tata McGraw Hill Publishers, New Delhi, | 2012 |
| 2 | Heinz Heisler | Advanced Engine Technology | SAE International Publications, USA | 1998 |
| 3 | Joseph Heitner | Automotive Mechanics, 2nd Edition, | East-West Press, New Delhi, | 1999 |
| 4 | Martin W, Stockel and Martin T Stockle | Automotive Mechanics Fundamentals | The Good heart - Will Cox Company Inc, USA | 1978 |
| 5 | Newton, Steeds and Garet | Motor Vehicles | Butterworth Publishers | 1989 |

**Web URL(s)**

1. **https://nptel.ac.in/courses/107/106/107106088/**

| U19ECE11 | EMBEDDED SYSTEMS & IoT | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 2 | 4 |

**Pre-Requisites** : NIL

**Objectives:**

- To gain knowledge of Embedded systems, categories, architecture and overview of RTOS and its concepts.
- To gain knowledge about System architecture modules and various tools for hardware/software development.
- To realize the significance and fundamentals of the Internet of Things.
- To understand the architecture, operation and business benefits of an IoT solution.
- Implement basic IoT applications on embedded platform

**Course Outcomes:**

At the end of this course students will demonstrate the ability to

**CO1** : Get a vivid understanding of embedded devices, requirements and recent system developments.

**CO2** : Understand the requirements of embedded system design concepts and grasp the details of cross platform development tools and protocols.

**CO3** : Get familiarized with the fundamentals of IoT architecture and Apply IOT to different applications. **CO4** : Analysis and evaluate protocols used in IOT and discuss the advantage of smart connected devices. **CO5** : Formulate and propose a plan for creating a solution for a research challenge.

**Unit I INTRODUCTION TO EMBEDDED CONCEPTS** 9

Introduction to embedded systems, Application Areas, Categories and specialties of embedded systems, Embedded system design process , Embedded Real time operating system concepts basic , Power optimizations for processes, Recent trends in embedded system.

**Unit II ARCHITECTURE OF EMBEDDED SYSTEMS** 9

Hardware architecture, types of hardware platforms, embedded processors - ARM architecture, Software architecture and categories, Communication software – TCP/IP protocol suite, Evaluating operating system performance, Development and testing tools.

**Unit III FUNDAMENTALS OF IoT** 9

Evolution of Internet of Things – Functional blocks of an IoT ecosystem – Sensors, Actuators, Smart Objects - Simplified IoT Architecture - Basics of Fog, Edge and Cloud computing in IoT, recent trends and applications of IoT.

**Unit IV OVERVIEW OF IoT TECHNOLOGIES** 9

Basics of sensor networking and connecting smart objects - Connectivity Technologies – RFID, zigbee, Bluetooth, IEEE
802.15.4 , ISA 100.11A , Functional components of IoT networking, Data Protocols –MQTT ,SMQTT, XMPP .

**Unit V IoT SYSTEM IMPLEMENTATION AND CASE STUDIES** 9

Interoperability in IoT, Introduction to Arduino Programming, Integration of Sensors and Actuators with Arduino - Case Study: Agriculture, Healthcare, Connected vehicles, Industrial IoT.

**Total Periods: 45**

**List of Experiments:**

1. Program to Blink LEDs with a Delay Using ARM7 LPC2148 Kit.
2. Interfacing Switches and 7 Segment Display with ARM7 LPC2148 Kit
3. Basic introduction to Arduino Programming and Compiling.
4. Basic Experiments with Arduino - LED Blink and Fade, Switches, Buzzer.
5. Interfacing Arduino to LCD and 7 Segment Display.
6. Interfacing of Relay and Servo Motor with Arduino
7. Interfacing Arduino to Temperature Sensor, Moisture Senor and PIR Sensor.
8. Measurement of BPM by Interfacing of Pulse Sensor with Arduino.
9. Interfacing of Bluetooth Module with Arduino and BYLNK App.
10. Connecting an Arduino to IoT cloud using an ESP8266 Wi-Fi module.
11. Temperature and Humidity Monitoring Using the Esp8266 and IoT cloud

**Total Periods: 30**

| U19MEE07 | Metrology and Measurements | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 1 | 2 | 4 |

**Objectives:**

- To provide knowledge on various Metrological equipments available to measure the dimension of the components.
- To provide knowledge on the correct procedure to be adopted to measure the dimension of the components.

**Course Outcomes**: Upon completing this course, the students

**CO1 :** Understand the objectives of metrology, methods of measurement, standards of measurement & various measurement parameters.

**CO2 :** Explain tolerance, limits of size, fits, geometric and position tolerances, gauges and their design. Understand the working principle of different types of comparators.

**CO3 :** Describe measurement of major & minor diameter, pitch, angle and effective diameter of screw threads.

**CO4 :** Explain measurement systems, transducers, intermediate modifying devices and terminating devices.

**CO5 :** Describe functioning of force, torque, pressure, strain and temperature measuring devices.

**Unit I INTRODUCTION TO METROLOGY 9**

Definition, objectives of metrology, Material Standards, Wavelength Standards, Classification of standards, Line and End standards, Calibration of End bars. Numerical examples. Linear measurement and angular measurements: Slip gauges-Indian standards on slip gauges, Adjustable slip gauges, Wringing of slip gauges, Measurement of angle-sine bar, Sine center, Angle gauges, Optical instruments for angular measurements. Autocollimator-Applications for measuring straightness and squareness.

**Unit II SYSTEM OF LIMITS, FITS, TOLERANCE AND GAUGING** 9

Definitions- Tolerance analysis-Inter changeability and Selective assembly. Class and grade of tolerance- Fits- Types of fits. Hole base system & shaft base system. Taylor's principle, Types of limit gauges, Numerical on limit gauge design. Comparators: Functional requirements, Classification, Mechanical- Johnson Mikrokator, Sigma comparators, Dial indicator, Electrical comparators, LVDT, Pneumatic comparators- Solex comparators, Optical comparators.

**Unit III MEASUREMENT OF SCREW THREAD AND GEAR 9**

Terminology of screw threads, Measurement of major diameter, Minor diameter, Pitch, Angle and Effective diameter of screw threads by 2- wire and 3-wire methods, Best size wire. Screw thread gauges, Toolmaker's microscope. Gear tooth Measurements: Tooth thickness measurement using constant chord method, Addendum, Comparator method and Base tangent method, Measurement of pitch, Concentricity, Run out and In volute profile. Gear roll tester for composite error.

**Unit IV BASIC CONCEPTS OF MEASUREMENT SYSTEM AND METHODS 9**

Definition, Significance of measurement, Generalized measurement system, Static characteristics- Accuracy, Precision, Calibration, Threshold, Sensitivity, Hysteresis, Repeatability, Linearity, Loading effect, Dynamic characteristics- System response, Time delay. Errors in measurement, Classification of errors. Transducers: Transfer efficiency, Primary and Secondary transducers, Electrical transducers, Mechanical, Electronic transducers, Relative comparison of each type of transducers. Intermediate Modifying and Terminating Devices: Mechanical systems, Inherent problems, Electrical intermediate modifying devices, Input circuitry, Ballast circuit, Electronic amplifiers. Terminating devices, Cathode ray oscilloscope, Oscillographs.

**Unit V APPLIED MECHANICAL MEASUREMENTS 9**

Measurement of force, Torque, Pressure, Types of Dynamometers, Absorption dynamometer, Prony brake and Rope brake dynamometer, and Power Measuring Instruments. Use of elastic members, Bridgeman gauge, McLeod gauge, Pirani gauge. Measurement of strain and temperature: Theory of strain gauges, Types, Electrical resistance strain gauge, Preparation and mounting of Strain gauges, Gauge factor, Methods of strain measurement, temperature compensation, Resistance thermometers, Thermocouple, Law of thermocouple, Pyrometer, Optical pyrometer.

**Total Periods: 45**

**List of Experiments**

1. Calibration and use of measuring instruments – Vernier caliper, micrometer- Vernier height gauge – using gauge blocks
2. Calibration and use of measuring instruments – depth micrometer, bore gauge, telescopic gauge
3. Measurement of linear dimensions using Comparators
4. Measurement of angles using bevel protractor and sine bar
5. Measurement of screw thread parameters – Screw thread Micrometers and Three wire method (Floating carriage micrometer)
6. Measurement of gear parameters – using gear tooth vernier caliper
7. Non-contact (Optical) measurement using Toolmaker's microscope / Profile projector.
8. Measurement of Surface finish in components manufactured using various processes (turning, milling, grinding, etc.,) using stylus based instruments.
9. Measurement of force
10. Measurement of torque
11. Measurement of temperature

**Total Periods: 15**

**Text Books**

| S.No | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Gupta. I.C. | Engineering Metrology | Dhanpatrai Publications | 2005 |
| 2 | Jain R.K. | Engineering Metrology | Khanna Publishers | 2009 |

**Reference Books**

| S.No | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Beckwith, Marangoni, and Lienhard. | Mechanical Measurements | Pearson Education | 2014 |
| 2 | Donald Peckman | Industrial Instrumentation | Wiley Eastern | 2004 |
| 3 | Alan S. Morris | The essence of Measurement | Prentice Hall of India | 1996 |
| 4 | Charles Reginald Shot bolt | Metrology for Engineers, 5th edition, | Cengage Learning EMEA, | 1990 |

**Web URL(s)**

1. https://nptel.ac.in/courses/112/106/112106179/
2. https://nptel.ac.in/courses/112/104/112104250/
3. https://nptel.ac.in/courses/112/106/112106139/
4. https://nptel.ac.in/noc/courses/noc19/SEM2/noc19-me70/

| U19ITE03 | OBJECT ORIENTED PROGRAMMING WITH JAVA | L | T | P | C |
|---|---|---|---|---|---|
| | (Common to CSE and IT) | 3 | 0 | 2 | 4 |

**Pre-Requisites** : NIL

**Objectives:**

- To understand Object Oriented Programming concepts and basic characteristics of Java.
- To introduce the principles of packages, inheritance and interfaces, collections.
- To introduce the concepts of I/O and Strings.
- To understand Exception handling and Multithreading.
- To design and build simple Graphical User Interfaces.

**Course Outcomes**:

At the end of this course students will demonstrate the ability to

**CO1** : Solve real world problems using OOP techniques.

**CO2** : Apply the concepts of packages, inheritance and interfaces to write simple Java applications.

**CO3** : Explore the importance of strings and stream classes.

**CO4** : Develop Java applications with Exception handling and Multithreading.

**CO5** : Design GUI based applications.

**Unit I Introduction to OOP and JAVA Fundamentals 8**

Introduction to OOP-Concepts of OOP- Java Fundamentals-An overview of Java-Characteristics, Java buzzword- Java Environment- Fundamental programming structure in Java- Defining classes – methods – constructors- Access specifiers –comments- static members-Data types - variables- operators - Control flow statements - Arrays.

**Unit II Packages, Inheritance, Interface and Collections 9**

Packages- Defining a Package, CLASSPATH, Access protection, importing packages : Inheritance – Super class, sub class- Types of inheritance- Method overriding- Polymorphism- Method overloading- Constructor overloading -Abstract class and methods - final class and methods :Interfaces– implementing and extending interfaces- Object cloning - Collections- ArrayList, Stack,

Priority Queue.

**Unit III I/O and Strings 9**

I/O basics-Byte streams and Character streams-Reading console Input and Writing Console Output-File class- Reading and writing Files-Random access file operations- The Console class- Serialization. Stringhandling – Stringoperations – String methods – Wrapper classes.

**Unit IV Exception Handling and Multithreading 10**

Fundamentals of exception handling- Exception types- Uncaught exceptions- using try and catch-multiple catch clauses- nested try statements- throw- throws and finally- built- in exceptions- creating own exception sub classes. Multithreading- Differences between thread-based multitasking and process-based multitasking- Java thread model- creating threads- thread priorities- synchronizing threads- inter thread communication**-** Generic Programming -Generic classes – generic methods – Bounded Types – Restrictions and Limitations.

**Unit V GUI Programming with Swing 9**

Introduction, limitations of AWT- MVC architecture- components- containers. Understanding Layout Managers- Flow Layout- Border Layout- Grid Layout- Card Layout- Grid Bag Layout. Event Handling-The Delegation event model- Events- Event sources- Event Listeners- Event classes- Handling mouse and keyboard events- Adapter classes- Inner classes- Anonymous Inner classes. A Simple Swing Application- Applets – Applets and HTML- Security Issues- Applets and Applications- passing parameters to applets. Creating a Swing Applet- Painting in Swing- A Paint example- Exploring Swing Controls- JLabel and Image Icon, JText Field, The Swing Buttons- JButton- JToggle Button- JCheck Box-JRadio Button- JTabbed Pane- JScroll Pane- JList- JCombo Box- Swing Menus, Dialogs.

**Total Periods: 45**

**List of Experiments:**

1. Basic Java programs.
2. Programs on Packages.
3. Programs on Inheritance.
4. Programs on Interfaces.
5. Programs on ArrayList, Stack and Priority Queue.

6. Programs on File Handling.
7. Programs on String Handling.
8. Programs on Exception Handling.
9. Programs in Multithreading.
10. Event driven Programming.

**Total Periods: 30**

**Text Books:**

| | S. No. | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|---|
| | 1. | Herbert Schildt | Java The complete reference, 11th Edition. | McGraw Hill Education (India) Pvt. Ltd. | 2019 |
| | 2. | Cay S. Horstmann, Gary cornell | Core Java Volume –I Fundamentals", 9th Edition. | PrenticeHall. | 2013 |

**Reference Books:**

| | S. No. | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|---|
| | 1. | Paul Deitel, Harvey Deitel | Java SE 8 for programmers,3rd Edition | Pearson, | 2015 |
| | 2. | Steven Holzner | Java 2 Black book | Dreamtech press | 2011 |
| | 3. | Deitel and Deitel | Java: How to Program", Ninth Edition. | Prentice Hall,10th Edition | 2014 |
| | 4. | Bruce Eckel | Thinking in Java", Fourth Edition. | Pearson Education | 2006 |

**Web URL(s)**

1. https://nptel.ac.in/courses/106/105/106105191/

2. https://onlinecourses.nptel.ac.in/noc19_cs84