# DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY

## CIRCULAR NO.SU/Engg./B.Tech./70/2022

It is hereby inform to all concerned that, the syllabi prepared by the Board of Studies & recommended by the Dean, Faculty of Science & Technology, **the Academic Council at its meeting held on 01 November 2021 has accepted revised following syllabus of Bachelor of Technology Third Year (Vth & VIth semester) in accordance with Choice Based Credit & Grading System as per guidelines of AICTE** as appended herewith.

| Sr.No. | Syllabi as per CBC & GS |
|---|---|
| [1] | B.Tech. [Civil Engineering], |
| [2] | B.Tech. [Mechanical Engineering], |
| [3] | B.Tech. [Plastic and Polymer Engineering], |
| [4] | B.Tech. [Electronics and Telecommunication Engineering], |
| [5] | B.Tech. [Electrical Engineering], |
| [6] | B.Tech. [Computer Science & Engineering]. |
| [7] | B.Tech.[Agricultural Engineering] |

This is effective from the Academic Year 2021-22 and onwards.

All concerned are requested to note the contents of this circular and bring the notice to the students, teachers and staff for their information and necessary action.

University Campus,
Aurangabad-431 004.
REF.NO.SU/2022/ 6330-38
Date:- 07.01.2022.

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Deputy Registrar,
Academic Section

**Copy forwarded with compliments to :-**

1] **The Principal of all concerned Colleges,**
Dr. Babasaheb Ambedkar Marathwada University,

2] **The Director, University Network & Information Centre, UNIC, with a request to upload this Circular on University Website.**

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# Dr. Babasaheb Ambedkar Marathwada University, Aurangabad-431004

# Revised Syllabus of Third Year (TY) Bachelor of Technology

## Electrical Engineering

## (V & VI Semester)

**Under Choice Based Credit System (CBCS)**

**Under Faculty of Science and Technology**

**(Effective from 2021-22 and onwards)**

**FACULTY OF SCIENCE AND TECHNOLOGY**

**Syllabus Structure w.e.f. 2021-2022 (Choice Based Credit System)**

**TY B. Tech. (Electrical Engineering)**

**Semester-V**

| Course Code | Course Name | Teaching Scheme (Hours/Week) | | | Examination Scheme and Marks | | | | | | | Credits | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Theory | Tutorial | Practical | MSE-I | MSE-II | TA | ESE | TW | PR/OR | Total | TH | TUT | TW/PR | Total |
| EED301 | Power Electronics | 3 | - | - | 15 | 15 | 10 | 60 | - | - | 100 | 3 | - | - | 3 |
| EED302 | Digital Signal Processing | 3 | - | - | 15 | 15 | 10 | 60 | - | - | 100 | 3 | - | - | 3 |
| BSH303 | Managerial Economics, Finance & Costing | 3 | - | - | 15 | 15 | 10 | 60 | - | - | 100 | 3 | - | - | 3 |
| EED341-EED343 | Professional Elective Courses-II | 3 | - | - | 15 | 15 | 10 | 60 | - | - | 100 | 3 | - | - | 3 |
| | Open Elective-I | 3 | - | - | 15 | 15 | 10 | 60 | - | - | 100 | 3 | - | - | 3 |
| EED321 | Lab: Power Electronics | - | - | 2 | - | - | - | - | - | 25 | 25 | - | - | 1 | 1 |
| EED322 | Lab: Digital Signal Processing | - | - | 2 | - | - | - | - | - | 25 | 25 | - | - | 1 | 1 |
| EED323-325 | Lab: Professional Elective Course-II | - | - | 2 | - | - | - | - | 25 | - | 25 | - | - | 1 | 1 |
| EED326 | Minor Project | - | - | 2 | - | - | - | - | 25 | - | 25 | - | - | 1 | 1 |
| EED327 | Lab: PLC for Electrical Applications | - | - | 2 | - | - | - | - | - | 25 | 25 | - | - | 1 | 1 |
| EED328 | Lab: Experiential/ Problem based learning | - | - | 2 | - | - | - | - | 25 | - | 25 | - | - | 1 | 1 |
| | | **15** | **-** | **12** | **75** | **75** | **50** | **300** | **75** | **75** | **650** | **15** | **-** | **6** | **21** |

**Semester-VI**

| Course Code | Course Name | Teaching Scheme (Hours/Week) | | | Examination Scheme and Marks | | | | | | | Credits | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Theory | Tutorial | Practical | MSE-I | MSE-II | TA | ESE | TW | PR/OR | Total | TH | TUT | TW/PR | Total |
| EED351 | Power System Analysis | 3 | - | - | 15 | 15 | 10 | 60 | - | - | 100 | 3 | - | - | 3 |
| EED352 | Control System Engineering | 3 | - | - | 15 | 15 | 10 | 60 | - | - | 100 | 3 | - | - | 3 |
| EED353 | Electrical Drives | 3 | - | - | 15 | 15 | 10 | 60 | - | - | 100 | 3 | - | - | 3 |
| EED391-393 | Professional Elective Course-III | 3 | - | - | 15 | 15 | 10 | 60 | - | - | 100 | 3 | - | - | 3 |
| | Open Elective-II | 3 | - | - | 15 | 15 | 10 | 60 | - | - | 100 | 3 | - | - | 3 |
| EED371 | Lab: Power System Analysis | - | - | 2 | - | - | - | - | - | 25 | 25 | - | - | 1 | 1 |
| EED372 | Lab: Control System Engineering | - | - | 2 | - | - | - | - | - | 25 | 25 | - | - | 1 | 1 |
| EED373 | Lab: Electrical Drives | - | - | 2 | - | - | - | - | - | 25 | 25 | - | - | 1 | 1 |
| EED 374 | Major Project-I | - | - | 4 | - | - | - | - | | 50 | 50 | - | - | 2 | 2 |
| EED 375 | Lab: Simulation & Hardware Interfacing | - | - | 2 | - | - | - | - | 25 | - | 25 | - | - | 1 | 1 |
| | Mandatory Non-Credit Course | 2 | | | | | | | | | | | | | |
| | | **17** | **-** | **12** | **75** | **75** | **50** | **300** | **25** | **125** | **650** | **15** | **-** | **6** | **21** |

**MSE- Mid Semester Exam, ESE- End Semester Examination, TH-Theory, OR- Oral, TA-Teacher Assessment, TW- Term Work, PR- Practical, Tut- Tutorial**

26/10/2021

26/10/21

Dr. V. B. Malode

**Professional Elective Courses-II (Semester-V)**

| Group A | Group B | Group C |
|---|---|---|
| EED341: Design of Electrical Machines | EED342: Power System Dynamics and Control | EED343: Line Commutated and Active Rectifiers |

**Professional Elective Courses-III (Semester-VI)**

| Group A | Group B | Group C |
|---|---|---|
| EED391: Electromagnetic Waves | EED392: High Voltage Engineering | EED393: Industrial Electrical Systems |

**List of Open Elective-I (Semester V)**

| Sr. No. | Offered by Department | Name of Course | Course Code |
|---|---|---|---|
| 1. | Agricultural Engineering | Statistical Methods in Engineering | AED331 |
| 2. | Civil Engineering | Environmental Impact Assessment | CED331 |
| 3. | Computer Science and Engineering | Artificial Intelligence and its Applications | CSE331 |
| 4. | Electrical Engineering | Special Purpose Machines | EED331 |
| 5. | Electronics and Telecommunications Engineering | Electronic Product Design | ETC331 |
| 6. | Mechanical Engineering | Operations Research | MED331 |
| 7. | Plastic and Polymer Engineering | Introduction to Nanotechnology | PPE331 |

**List of Open Elective-II (Semester VI)**

| Sr. No. | Offered by Department | Name of Course | Course Code |
|---|---|---|---|
| 1. | Agricultural Engineering | Fundamentals of Bioenergy | AED381 |
| 2. | Civil Engineering | Solid Waste Management | CED381 |
| 3. | Computer Science and Engineering | Information & Cyber Security | CSE381 |
| 4. | Electrical Engineering | Electrical Materials | EED381 |
| 5. | Electronics and Telecommunications Engineering | Internet of Things | ETC381 |
| 6. | Mechanical Engineering | Industry 4.0 | MED381 |
| 7. | Plastic and Polymer Engineering | Polymer Recycling and Waste Management | PPE381 |

**Mandatory Non-Credit Course (Audit Course) (Semester VI)**

| Sr. No. | Offered by Department | Course | Course code |
|---|---|---|---|
| 1. | First Year | German Language | BSH807 |
| 2. | First Year | Japanese Language | BSH808 |
| 3. | Civil Engineering | Professional Ethics and Constitution of India | CED801 |
| 4. | Computer Science and | Green Computing | CSE801 |

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|---|---|---|---|
| | Engineering | | |
| 5. | Electronics and Telecommunications Engineering | Smart Cities | ETC801 |
| 6. | Mechanical Engineering | Research Methodology | MED801 |
| 7. | Plastic and Polymer Engineering | Industrial Safety and Management | PPE801 |

| Dr. Babasaheb Ambedkar Marathwada University, Aurangabad<br>(Faculty of Science & Technology)<br>Syllabus of Third Year B. Tech. (Electrical Engineering) Semester-V | |
|---|---|
| Course Code: EED301<br>Course: Power Electronics<br>**Teaching Scheme:**<br>Theory: 3 Hrs/week | Credits: 3-0-0<br>Mid Semester Examination-I: 15 Marks<br>Mid Semester Examination-II: 15 Marks<br>Teacher Assessment: 10 Marks<br>End Semester Examination: 60 Marks<br>End Semester Examination (Duration):3 Hrs |
| **Prerequisite** | Concepts of Basic electrical circuits, basic differentiations, and integrations formulas |
| **Objectives** | 1. Classify different types of power semi-conductor devices and their switching characteristics.<br>2. Explain the operation and performance of controlled rectifiers.<br>3. Select PWM techniques for Inverters.<br>4. Calculate pro per capacitor and inductor values for DC-DC converters. |
| **Unit-I** | **Power Semi-conductor Devices:**<br>Study of switching devices, - Frame, Driver and snubber circuit of DIODES, SCR, TRIAC, IGBT, MOSFET, GTO. Protection circuits of switches. **(6 Hrs)** |
| **Unit-II** | **Single Phase AC to DC Converter:**<br>Single phase Fully controlled converter (rectification and inversion mode), Half controlled converter (Semi-converter), Operation of all converters with RL and RLE load, derivation of Average and RMS output voltage, power factor, THD, TUF. **(6 Hrs)** |
| **Unit-III** | **Three Phase AC to DC Converter:**<br>Three phase Fully controlled converter (rectification and inversion mode), Half controlled converter (Semi-converter), Operation of all converters with RL and RLE load, derivation of Average and RMS output voltage, power factor, THD, TUF. **(6 Hrs)** |
| **Unit-IV** | **DC to DC Converter**:<br>Principle of operation of chopper, classification of choppers based on operating quadrants. Control techniques: CLC and TRC Techniques. Analysis of Buck converter and Boost converter. **(7 Hrs)** |
| **Unit-V** | **Inverter:**<br>Single phase and three phase (both 120° mode and 180° mode) inverters, PWM techniques: Sinusoidal PWM modified sinusoidal PWM, multiple PWM, Voltage and harmonic control, Current source inverter. **(7 Hrs)** |

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| **Unit-VI** | **AC to AC Converters**:<br>Single phase AC voltage controllers, Multistage sequence control, single and three phase Cyclo-converters. **(4 Hrs)** | | | | |
| **Textbook/ Reference Books** | **Sr. No.** | **Title** | **Author** | **Publication** | **Edition** |
| | 1 | Power Electronics: Circuits, Devices and Applications | M.H. Rashid | Pearson Education, PHI | Third edition |
| | 2 | Power Electronics | P. S. Bimbra | Khanna Publishers | Third Edition 2003 |
| | 3 | Elements of Power Electronics | Philip T. Krein | Oxford University Press | 2004 Edition |
| | 4 | Power Electronics: Converters, Applications and Design | Ned Mohan, Tore. M. Undeland, William. P. Robbins, | John Wiley and sons, | Third Edition, 2003. |
| | 5 | Power Electronics for Technology | Ashfaq Ahmed, | Pearson Education | Indian Reprint, 2003. |

| Dr. Babasaheb Ambedkar Marathwada University, Aurangabad<br>(Faculty of Science & Technology)<br>Syllabus of Third Year B. Tech. (Electrical Engineering) Semester-V | |
|---|---|
| Course Code: EED302<br>Course: Digital Signal Processing<br>**Teaching Scheme:**<br>Theory: 03 Hrs/week | Credits: 3-0-0<br>Mid Semester Examination-I: 15 Marks<br>Mid Semester Examination-II: 15 Marks<br>Teacher Assessment: 10 Marks<br>End Semester Examination: 60 Marks<br>End Semester Examination (Duration): 3 Hrs |
| **Prerequisite** | The knowledge of signals and systems is essential. |
| **Objectives** | To impart knowledge about the following topics:<br>1. Signals and systems & their mathematical representation.<br>2. Discrete time systems.<br>3. Transformation techniques & their computation.<br>4. Filters and their design for digital implementation.<br>5. Programmability digital signal processor & quantization effects |
| **Unit-I** | **Introduction**<br>Classification of systems: Continuous, discrete, linear, causal, stability, dynamic, recursive, time variance; classification of signals: continuous and discrete, energy and power; mathematical representation of signals; spectral density; sampling techniques, quantization, quantization error, Nyquist rate, aliasing effect. **(6 Hrs)** |
| **Unit-II** | **Discrete Time System Analysis**<br>Z-transform and its properties, inverse z-transforms; difference equation – Solution by z-transform, application to discrete systems – Stability analysis, frequency response – Convolution – Discrete Time Fourier transform, magnitude, and phase representation. **(6 Hrs)** |
| **Unit-III** | **Discrete Fourier Transform & Computation**<br>Discrete Fourier Transform- properties, magnitude, and phase representation – Computation of DFT using FFT algorithm – DIT &DIF using radix 2 FFT – Butterfly structure. **(6 Hrs)** |
| **Unit-IV** | **Design Of Digital Filters**<br>FIR & IR filter realization – Parallel& cascade forms. FIR design: Windowing Techniques – Need and choice of windows – Linear phase characteristics. Analog filter design – Butterworth and Chebyshev approximations; IIR Filters, digital design using impulse invariant and bilinear transformation Warping, pre warping. **(7 Hrs)** |
| **Unit-V** | **Finite Word length Effects**<br>Fixed point and floating point number representations – ADC –Quantization- Truncation and Rounding errors – Quantization noise – coefficient quantization error – Product quantization error – Overflow error – Roundoff noise power – limit cycle oscillations due to product round off and overflow errors – Principle of scaling **(7 Hrs)** |

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| **Unit-VI** | **DSP Applications**<br>Multirate signal processing: Decimation, Interpolation, Sampling rate conversion by a rational factor – Adaptive Filters: Introduction, Applications of adaptive filtering to equalization. **(4 Hrs)** | | | | |
| **Textbooks** | **Sr. No.** | **Title** | **Author** | **Publication** | **Edition** |
| | 1. | Digital Signal Processing Principles, Algorithms and Applications | J.G. Proakis and D.G. Manolakis | Pearson Education, New Delhi | 2003 |
| | 2. | Digital Signal Processing – A Computer Based Approach | S.K. Mitra | Mc Graw Hill | 2001 |
| **Textbook/ Reference Books** | 3. | Multirate Digital Signal Processing: Multirate Systems - Filter Banks – Wavelets | N. J. Fliege | John Wiley and Sons Ltd | 2003 |
| | 4. | Multirate and Wavelet Signal Processing | Multirate and Wavelet Signal Processing | Bruce W. Suter | 2004 |
| | 5. | Digital Signal Processing Principles | Digital Signal Processing Principles | Tech-Max Publications, Pune, | 3rd Revised Edition. |

| Dr. Babasaheb Ambedkar Marathwada University, Aurangabad<br>(Faculty of Science & Technology)<br>Syllabus of Third Year B. Tech. (All) Semester V | |
|---|---|
| Course Code: BSH303<br>Course: Managerial Economics, Finance and Costing<br>**Teaching Scheme:**<br>Theory: 3 Hrs/week | Credits: 3-0-0<br>Mid Semester Examination-I: 15 Marks<br>Mid Semester Examination-II: 15 Marks<br>Teacher Assessment: 10 Marks<br>End Semester Examination: 60 Marks<br>End Semester Examination (Duration): 3 Hrs |
| **Prerequisite** | • Basic knowledge of concepts of economics. |
| **Objectives** | On the completion of this course, the learner will be able to<br>1. Correlate various micro and macro-economic variables and solve numerical problems<br>2. Analyse, interpret the financial statements, and decide upon the health of a firm.<br>3. Appreciate and illustrate Economic/Industrial/Trade policies and their implications and Role played by various financial institutions/banks.<br>4. Apply costing and accounting and costing practices in solving real life problems |
| **Unit I** | **Managerial Economics Part-I:**<br>Introduction- Economics, basic concepts - utility, wealth, welfare, price, markets, and opportunity cost. Micro - and macro- economics, economics of growth and development. **(4 Hrs)** |
| **Unit II** | **Managerial Economics Part-II:**<br>Demand and supply analysis: Law and elasticity of demand and supply. Demand function. Market structure - competition, monopoly, oligopoly and imperfect competition. Market imperfections and state interventions. Role of government; monetary, fiscal and trade policies, BOP, industrial policy; instruments of government policy; taxation, incentives, budget.<br>Theory of firm: Production and Cost analysis for short run and long run. Cost-Output Relationship: Cost Function, Cost-Output relationships in Short Run and Long Run. Revenue Analysis and Pricing Policies. **(8 Hrs)** |
| **Unit III** | **Finance Part-I:** Introduction, Basic business function, sources of finance and their relative importance. Long and short term finance. Fund allocation, alternative uses of finance. Time value of money. Analysis of financial statements –Ratio analysis using balance sheet, profit and loss account. Capital budgeting decisions- type, nature and evaluation criteria: NPV, IRR, Payback. **(6 Hrs)** |
| **Unit IV** | **Finance Part-II:** Working capital management. Financial markets; money markets, bill market, discount houses, call loan market, etc., Capital markets; mutual funds, stock markets, industrial banks, world bank, UTI, IDBI, ICICI, SEBI and state finance corporations. **(6 Hrs)** |
| **Unit V** | **Costing Part-I:**<br>Cost classification: Cost ascertainment; allocation, apportionment, absorption of overheads and non-production cost; overhead analysis, absorption methods, general considerations. Job costing; factory job costing, contract cost.<br>Unit costing; output and operating cost, simple process costing, normal and abnormal losses in |

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| | process, waste, scrap, bye-and joint products. Marginal costs and breakdown charges. **(6 Hrs)** |
| **Unit VI** | **Costing Part-II:**<br>Cost planning and control, standard cost and budgetary control, setting standards, variance analysis. Cost reduction; tools, techniques and productivity.<br>Depreciation; causes and significance, methods of providing for depreciation, book values, taxes and depreciation. (6 Hrs) |

**Textbook/ Reference Books**

| Sr. No. | Title | Author | Publication | Edition |
|---|---|---|---|---|
| 1 | Economics | Paul Samuelson and William Nordhaus | Tata McGraw Hill. | 2005 |
| 2 | Financial Management | Prasanna Chandra | McGraw Hill. | 10th |
| 3 | Cost Accounting | Jawaharlal | Tata McGraw Hill (TMH). | 3rd |
| 4 | Finance Sense - Text and Cases | Prasanna Chandra | Tata McGraw Hill | 4th |
| 5 | Managerial Economics | Varshney and Maheshwari | Sultan Chand and Sons, New Delhi | 22nd |
| 6 | Indian Economy | Ruddar Datt and Sundaram | S.Chand Publication | 72nd |
| 7 | Financial institutions and markets | L.M. Bhole and Jitendra Mahakud | McGraw Hill Education. | 6th |
| 8 | Managerial Economics | Paul Keat, Philip Young and Sreejata Banerjee | Pearson Publication | 7th |

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| **Web Resources:** | 1 | www.nptel.ac.in |

**Dr. Babasaheb Ambedkar Marathwada University, Aurangabad**

**(Faculty of Science & Technology)**

**Syllabus of Third Year B. Tech. (Electrical Engineering) Semester-V**

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|---|---|
| Course Code: EED341<br>Course: Design of Electrical Machines<br>**Teaching Scheme:**<br>Theory: 3 Hrs/week<br>Practical: 2 Hrs/week | Credits: 3-0-0<br>Mid Semester Examination-I: 15 Marks<br>Mid Semester Examination-II: 15 Marks<br>Term Work: 25 Marks<br>Teacher Assessment: 10 Marks<br>End Semester Examination: 60 Marks<br>End Semester Examination (Duration): 3 Hrs |

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|---|---|
| **Prerequisite** | DC Machines and Transformer, AC Machines |
| **Objectives** | 1. To study Selection proper commercial materials, their properties and selection criterions, IS standards used in electrical machine design.<br>2. To study design of commercial induction motor and transformer |
| **Unit-I** | **Major Considerations in Electrical Machine Design:**<br>Electrical Engineering Materials – Space factor – Choice of Specific Electrical and Magnetic loadings – Thermal considerations – Heat flow – Temperature rises and Insulating Materials – Rating of machines – Standard specifications. **(6 Hrs)** |
| **Unit-II** | **Design of Induction Motors-I:**<br>Constructional features, types of ac windings, Output equation of Induction motor, Main dimensions, specific electrical and magnetic loadings, ranges of specific loadings, turns per phase, number of stator slots. Length of air gap- Rules for selecting rotor slots of squirrel cage machines, Design of rotor bars & slots, Design of end rings, Harmonic field effect on the performance of three phase induction motor, Specifications of Induction motor. **(8 Hrs)** |
| **Unit-III** | **Design of Induction Motors-II:**<br>Magnetic leakage calculations – Leakage flux and leakage reactance: Slot leakage, tooth top leakage, zigzag leakage, overhang leakage, leakage reactance calculation for three phase machines. MMF Calculation for air gap, stator teeth, stator core, rotor teeth and rotor core, effect of saturation, effects of ducts on Calculations of magnetizing current, calculations of no-load current. Calculations of losses and efficiency. **(4 Hrs)** |
| **Unit-IV** | **Design of Transformers – I:**<br>Types and constructional features of core and windings used in transformer. Transformer auxiliaries such as tap changer, pressure release valve, breather, and conservator. Specifications of transformer. Output Equations, Design of Main Dimensions, KVA output for single and three phase transformers, Window space factor, Design of core and winding – Overall dimensions, Design of Tank, Methods of cooling of Transformers. **(6 Hrs)** |
| **Unit-V** | **Design of Transformers - II**<br>Estimation of resistance and leakage reactance of transformer, No load current, losses, efficiency, and regulation of transformers. Calculation of mechanical forces developed under short circuit conditions, measures to overcome this effect. Temperature rises in Transformers. **(6 Hrs)** |

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|---|---|---|---|---|---|
| **Unit-VI** | **Design of Electrical Apparatus:** Detailed design of heating coils, starters, and regulators. Design of Electrical Devices Field coils, Chokes and lifting magnets. **(6 Hrs)** | | | | |
| **Textbook/ Reference Books** | **Sr. No.** | **Title** | **Author** | **Publication** | **Edition** |
| | 1. | Theory and Performance and Design of A.C. Machines | M.G. Say | ELBS London | Edition 2 |
| | 2. | A Course in Electrical Machine Design | Sawhney A. K | Dhanpat Rai &Sons, New Delhi 1984 | Edition 3 |
| | 3. | Design and Testing of Electrical Machine Design | M.V. Deshpande | Wheeler Publications, 2010 | Edition 5 |
| | 4. | Design of Electrical Machines | K. G. Upadhyay | New age publication | Edition 3 |
| | 5. | Principles of Electrical Machine Design | R.K. Agarwal | Esskay Publications, Delhi, 2002 | Edition 2 |

| Dr. Babasaheb Ambedkar Marathwada University, Aurangabad<br>(Faculty of Science & Technology)<br>Syllabus of Third Year B. Tech. (Electrical Engineering) Semester-V | |
|---|---|
| Course Code: EED342<br>Course: Power System Dynamics and Control.<br>**Teaching Scheme:**<br>Theory: 03 Hrs/week | Credits: 3-0-0<br>Mid Semester Examination-I: 15 Marks<br>Mid Semester Examination-II: 15 Marks<br>Teacher Assessment: 10 Marks<br>End Semester Examination: 60 Marks<br>End Semester Examination (Duration): 03 Hrs |
| **Prerequisite** | Faults in Power Systems, Load flow Studies, Generation, Transmission, Distribution, basics of Power System. |
| **Objectives** | 1. Explain the basics of power system stability.<br>2. Explain different methods to determine the transient stability of power systems.<br>3. Acquaint the students with small signal stability of power systems.<br>4. Introduce the concepts of voltage stability.<br>5. Explain the methods of stability improvement. |
| **Unit-I** | **Power System stability considerations:**<br>definitions- classification of stability – rotor angle and voltage stability synchronous machine representation- classical model – load modeling- concepts- modeling of excitation systems – modeling of prime movers **(8 Hrs)** |
| **Unit-II** | **Transient stability:**<br>Swing equation-equal area criterion-solution of swing equation-Numerical methods- Euler method-Runge-Kutta method-critical clearing time and angle-effect of excitation system and governors-multi-machine stability –extended equal area criterion- transient energy function approach. **(6 Hrs)** |
| **Unit-III** | **Small signal stability:**<br>State space representation, Eigen values-modal matrices-small signal stability of single machine infinite bus system, synchronous machine classical model representation-effect of field circuit dynamics-effect of excitation system-small signal stability of multi machine system. **(4 Hrs)** |
| **Unit-IV** | **Voltage stability:**<br>Basic concepts related to voltage stability, voltage collapse, voltage stability Analysis, prevention of voltage collapse **(6 Hrs)** |
| **Unit-V** | **Methods of improving stability:**<br>Transient stability enhancement, high speed fault clearing, steam turbine fast valuing, high speed excitation systems- Fundamentals and performance of Power System Stabilizer, Multi band PSS, Three dimensional PSS, Location & dispatch of reactive power by VAR sources. **(6 Hrs)** |

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|---|---|---|---|---|---|
| **Unit-VI** | **Dynamics of synchronous machine:** Introduction, swing equation, power angle equation and curve, Concept of AGC, complete block diagram representation of load-frequency control of an isolated power system, steady state, and dynamic response. **(6 Hrs)** | | | | |
| **Textbook/ Reference Books** | **Sr. No.** | **Title** | **Author** | **Publication** | **Edition** |
| | 1. | Power Generation, Operation and Control | Allen. J. Wood and Bruce F. Wollenberg | John Wiley & Sons, Inc | Third Edition 2003 |
| | 2. | Power System Analysis: Operation and Control | P S R Murthy | Prentice Hall of India | Third Edition 2004 |
| | 3. | Modern Power System Analysis | Dr. B. R. Gupta and Vandana Singhal | S. Chand & Company Ltd | Third Edition 2003 |
| | 4. | Operations and Control in Power Systems | P S R Murthy | B S Publication | Third Edition 2003 |
| | 5. | Elements of Power System Analysis | Stevenson W. D | TMH | Third Edition 2004 |

**Dr. Babasaheb Ambedkar Marathwada University, Aurangabad**

**(Faculty of Science & Technology)**

**Syllabus of Third Year B. Tech. (Electrical Engineering) Semester-V**

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|---|---|
| Course Code: EED343<br>Course: Line Commutated and Active Rectifiers<br>**Teaching Scheme:**<br>Theory: 3 Hrs/week | Credits: 3-0-0<br>Mid Semester Examination-I: 15 Marks<br>Mid Semester Examination-II: 15 Marks<br>Teacher Assessment: 10 Marks<br>End Semester Examination: 60 Marks<br>End Semester Examination (Duration):3 Hrs |

| | |
|---|---|
| **Prerequisite** | Concepts of Basic electrical circuits, basic differentiations, and integrations formulas |
| **Objectives** | 1. Explain the operation and performance of controlled rectifiers.<br>2. Select PWM and power factor improvement techniques for rectifiers.<br>3. State space modeling techniques for power electronics circuit. |
| **Unit-I** | **Diode rectifiers with passive filtering**<br>Half-wave diode rectifier with RL and RC loads; 1-phase full-wave diode rectifier with L, C and LC filter; 3-phase diode rectifier with L, C and LC filter; continuous and discontinuous conduction, input current wave shape, effect of source inductance; commutation overlap. **(6 Hrs)** |
| **Unit-II** | **Thyristor rectifiers with passive filtering**<br>Half-wave Thyristor rectifier with RL and RC loads; 1-phase thyristor rectifier with L and LC filter; 3-phase thyristor rectifier with L and LC filter; continuous and discontinuous conduction, input current wave shape. **(6 Hrs)** |
| **Unit-III** | **Single-phase ac-dc single-switch boost converter**<br>Power circuit of single-switch ac-dc converter, steady state analysis, unity power factor operation, closed-loop control structure. **(6 Hrs)** |
| **Unit-IV** | **Switching Power Supplies**<br>Forward converters for SMPS, Resonant converters - need, concept of soft switching, switching trajectory and SOAR, load resonant converter - series loaded half bridge DC-DC converter. **(6 Hrs)** |
| **Unit-V** | **PWM Rectifiers**<br>PWM Rectifiers and Power Factor Improvement Techniques and non- isolated DC- DC converters **(6 Hrs)** |
| **Unit-VI** | **Linear and Non-linear Control**<br>Linear Control in Power Electronics, Nonlinear Control in Power Electronics, Applications and Conclusions **(6 Hrs)** |

**Textbook/ Reference Books**

| Sr. No. | Title | Author | Publication | Edition |
|---|---|---|---|---|
| 1. | Principles of Thyristorised Converters", Applications | G. De, | Oxford & IBH Publishing Co | 1988 |
| 2. | Principles of Power Electronics | J.G.Kassakian, M.F. Schlecht and G.C. Verghese, | Addison-Wesley | 1991 |

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|---|---|---|---|---|---|
| | 3 | Elements of Power Electronics | Philip T. Krein | Oxford University Press | 2004 Edition |
| | 4. | Power Electronics: Converters, Applications and Design | Ned Mohan, Tore. Undeland, William.P. Robbins, | John Wiley and sons, | third edition, 2003. |
| | 5. | Power Electronics: Essentials and Application | L. Umanand | Wiley India | 2009 |

**Dr. Babasaheb Ambedkar Marathwada University, Aurangabad**
**(Faculty of Science & Technology)**
**Syllabus of T. Y. B. Tech. (All) Semester V**

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|---|---|
| Course Code: AED 331<br>Course: Open Elective Course-I<br>(Statistical Methods in Engineering)<br>**Teaching Scheme:**<br>Theory: 03 Hrs/week | Credits: 3-0-0<br>Mid Semester Examination-I: 15 Marks<br>Mid Semester Examination-II: 15 Marks<br>Teacher Assessment: 10 Marks<br>End Semester Examination: 60 Marks<br>End Semester Examination (Duration):03 Hrs |

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|---|---|
| **Prerequisite** | Basics of Statistics and Probability Distribution |
| **Objectives** | 1. To introduce different techniques involved in statistical analysis<br>2. To learn and practice various statistical methods for data analysis |
| **Unit-I** | **Sampling Distribution**: Population and Sample, Sampling Distribution, Standard Error Sampling Distribution of Means, Sampling Distribution of Variance, Sampling Distribution of Proportions **6 Hrs** |
| **Unit-II** | **Theory of Estimation**: Estimation Theory, Point Estimation – Basic Concept & Notion, Interval Estimation – Interval Estimation for Large Samples, Confidence Limits for Mean, Proportion, Standard Deviation, Difference of Means, Difference of Proportions **6 Hrs** |
| **Unit-III** | **Testing of Hypothesis**: Statistical Hypothesis, Tests of Significance, Null Hypothesis, Alternative Hypothesis, Types of Errors in Testing of Hypothesis, Level of Significance, Critical Region, One-Tailed and Two-Tailed Tests, Critical Values and Critical Region, P-value of Test Statistic, Procedure for testing of hypothesis **6 Hrs** |
| **Unit-IV** | **Large Sample Tests**: Sampling of Attributes – Test for Single Proportion, Test of Significance for Difference of Proportions, Sampling of Variables - Test of Significance for a Single Mean **6 Hrs** |
| **Unit-V** | **Non- Parametric Tests:** Parametric Tests and Non-Parametric Tests, Sign Test, Wilcoxon Signed-Rank Test, Mann-Whitney Test **6 Hrs** |
| **Unit-VI** | **Analysis of Variance (ANOVA):** Introduction, Analysis of Variance, Assumptions for ANOVA test, One-Way Classification **6 Hrs** |

**Textbook/ Reference Books**

| Sr. No. | Title | Author | Publication | Edition |
|---|---|---|---|---|
| 1. | Statistics for Engineers and Scientists | William Navidi | McGraw | 4th Edition |
| 2. | Probability & Statistics for Engineers & Scientists | Walpole, Myers, Myers Ye | Prentice Hall | 9th Edition |
| 3. | Fundamentals of Statistics | S.C. Gupta | Himalaya Publishing House | 7th Edition |
| 4. | Statistical Methods | S. P. Gupta | Sultan Chand & Sons | 1st Edition |

**Dr. Babasaheb Ambedkar Marathwada University, Aurangabad**

**(Faculty of Science & Technology)**

**Syllabus of Syllabus of Third Year B. Tech. (All) Semester-V**

| | |
|---|---|
| Course Code: CED331<br>Course: Open Elective-I<br>(Environmental Impact Assessment)<br>**Teaching Scheme:**<br>Theory: 03 Hrs/week | Credits: 3-0-0<br>Mid Semester Examination-I: 15 Marks<br>Mid Semester Examination-II: 15 Marks<br>Teacher Assessment: 10 Marks<br>End Semester Examination: 60 Marks<br>End Semester Examination (Duration): 03 Hrs |

| | |
|---|---|
| **Prerequisite** | Environmental Engineering |
| **Objectives** | 1. Student would overview the concepts, methods, issues and various forms and stages of EIA process.<br>2. Student will be able to examine the development of EIA in India and highlight the diversity of approach and impact of the EIA process. |
| **Unit-I** | **Introduction and Evolution of EIA:** Introduction to Environmental Impact Assessment, Origin of EIA, Stages in EIA, thorough discussion of steps in EIA. Establishments of Procedure: Legislative Option, Project Screening for EIA, Public Participation in EIA process. **(6 Hrs)** |
| **Unit-II** | **Impact assessment:** Background information, IA methods, environmental impact assessment methodology, documentation and selection process, environmental indices, and indicators for describing affected environment, Life cycle assessment. **(6 Hrs)** |
| **Unit-III** | **Air and noise environment:** Prediction and assessment of impact for air and noise environment, Basic information of air quality, identification of type and quantity of air pollutant, existing air quality and air quality standards, impact prediction and assessment, mitigation. Basic information of noise, existing noise levels and standards, prediction of noise levels and assessment of impact, mitigations. **(6 Hrs)** |
| **Unit-IV** | **Water and soil environment:** Prediction and assessment of impact for water and soil environment, Basic information of water quality (Surface water and ground water), water quality standards, identification of impact, prediction of impact and assessment, mitigations. Background information of soil environment, soil and ground water standards, prediction, and assessment of impact for ground water and soil, mitigations. **(6 Hrs)** |
| **Unit-V** | **Decision Methods for Evaluation of Alternative:** Public participation in environmental decision making, Regulatory requirements, environmental impact assessment process, objectives of public participation, verbal communication in EIA studies. **(6 Hrs)** |
| **Unit-VI** | **Environmental Impact Assessment Report:** Rapid and Comprehensive EIA, general structure of EIA document, Environmental management plan; post environmental monitoring. Latest EIA notification by Ministry of Environment and Forest (Govt. of India): Provisions in the EIA notification, Procedure for public hearing, post environmental monitoring, Procedure for obtaining Environmental clearance for construction projects. **(6 Hrs)** |

| **Textbook/ Reference** | **Sr. No.** | **Title** | **Author** | **Publication** | **Edition** |
|---|---|---|---|---|---|
| | 1. | Environmental Impact Assessment | Canter R.L., | Mc Graw Hill International | Edition, 1997. |

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|---|---|---|---|---|---|
| **Books** | 2. | Environmental Impact Assessment Theory and Practice | Peter Watten (Eds.) | Unwin Hyman | London (1988) |
| | 3. | Environmental Impact Assessment | R.R. Barthwal | New Age International Publishers | I |
| | 4. | Environmental Impact Analysis Handbook | John G. Rau and David C. Wooten | McGraw Hill Book Company | I |

**Dr. Babasaheb Ambedkar Marathwada University, Aurangabad**

**(Faculty of Science & Technology)**

**Syllabus of Third Year B. Tech. (All) Semester V**

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|---|---|
| Course Code:<br>Course: **Open Elective-I**<br>(Artificial Intelligence and its Applications)<br>**Teaching Scheme:**<br>Theory: 03 Hrs/week | Credits: 3-0-0<br>Mid Semester Examination-I: 15 Marks<br>Mid Semester Examination-II: 15 Marks<br>Teacher Assessment: 10 Marks<br>End Semester Examination: 60 Marks<br>End Semester Examination (Duration):03 Hrs |

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|---|---|
| **Prerequisite** | Data Structures and Algorithms |
| **Objectives** | 3. To introduce different techniques involved defining and simulating an intelligence.<br>4. To learn and practice various Artificial Intelligence methods, algorithms, and knowledge representation schemes. |
| Unit-I | **Introduction:** Artificial Intelligence, AI Problems and AI techniques, solving problems by searching, Problem formulation. Application of AI techniques in different branches of engineering, Basic Sciences, Medical Science and equipment, Economy and Finance **(6 Hrs)** |
| Unit-II | **Searching techniques in AI:** DFS, BFS, Uniform cost search, Depth Limited Search, Iterative Deepening, Bidirectional search, Comparing Different Techniques. **(6 Hrs)** |
| Unit-III | **Heuristic functions:** Hill Climbing, Simulated Annealing, Best First Search, A*, IDA*, SMA*, Crypto-Arithmetic Problem. **(6 Hrs)** |
| Unit-IV | **Agents and Environments:** Structure of Intelligent agents, Types of Agents, Agent Environments PEAS representation for an Agent. A Knowledge Based Agent, Environment, Types of Environments WUMPUS WORLD Environment,<br>**Case Study: Automated Taxi, Vacuum Cleaner** **(6 Hrs)** |
| Unit-V | **Expert Systems:** Concept of an Expert System. Characteristics of an Expert System, Components of expert System, Concept of Knowledge Base, Components of Knowledge base, Knowledge Representation methods.<br>**Case Study : DENDRAL, MYCIN, PXDES, CaDeT** **(6 Hrs)** |
| Unit-VI | **Propositional Logic:** Introduction, First Order Predicate Logic, Forward and Backward Chaining, Resolution., Introduction to PROLOG and LISP **(6 Hrs)** |

**Textbook/ Reference Books**

| Sr. No. | Title | Author | Publication | Edition |
|---|---|---|---|---|
| 5. | Artificial Intelligence: A Modern Approach | Stuart Russell and Peter Norvig | Pearson Education | 2nd Edition |
| 6. | Artificial Intelligence | Elaine Rich, Kevin Knight, Shivshankar B Nair | McGraw Hill, | 3rd Edition |

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|---|---|---|---|---|---|
| | 7. | Artificial Intelligence | Elaine Rich, Kevin Knight | Tata McGraw Hill | 2nd Edition |

| Dr. Babasaheb Ambedkar Marathwada University, Aurangabad<br>(Faculty of Science & Technology)<br>Syllabus of Third Year B. Tech. (All) Semester-V | |
|---|---|
| Course Code: EED331<br>Course: Open Elective-I (Special Purpose Machines)<br>**Teaching Scheme:**<br>Theory: 3 Hrs/week | Credits: 3-0-0<br>Mid Semester Examination-I: 15 Marks<br>Mid Semester Examination-II: 15 Marks<br>Teacher Assessment: 10 Marks<br>End Semester Examination: 60 Marks<br>End Semester Examination (Duration): 3Hrs |

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|---|---|
| **Prerequisite** | They should have basic knowledge about all basic laws and construction / working principle of DC and AC motors and generators, |
| **Objectives** | 1. To differentiate between generalized machines and control machines.<br>2. To understand principle and working of different control machines.<br>3. To be able to identify and implement control machines. |
| **Unit-I** | **Hysteresis Motors:** Magnetic field production & nature of torque, Applications.<br>**Reluctance Motors:** F. H. P. Reluctance motors, switched reluctance motors, Principle of working & operation, Applications. **(6 Hrs)** |
| **Unit-II** | **Control Motors:**<br>D C servomotors, transfer function of Armature and field-controlled motors their applications, Construction of F. H. P. Induction two-phase servomotors, production of torque, Torque-speed curves-characteristics & features-dynamic equations, Methods of control, Applications. Numerical on DC and AC servos. **(6 Hrs)** |
| **Unit-III** | **Eddy Current Devices:**<br>Construction & operation of eddy current couplings & dynamometers, merits & limitations. **(4 Hrs)** |
| **Unit-IV** | **Tacho-Generators:**<br>Basic requirements of tacho-generators, Ideal characteristics, classification. i) D.C. Tacho Generators: Output characteristics, Deviation from no load Characteristics, Dead-zone, Tooth ripples, Temperature effect, Accuracy class. ii) Induction Tacho-generators: Operating principle, Output characteristics, Equivalent circuit, Reasons for deviation from desired characteristics, Corrective means, Advantages. iii) A. C. Tacho-generators: Construction & operation, Output characteristics, non-linearities& tooth ripples, Advantages over other tacho-generators. Dynamic characteristics of techno-generators, Applications of tacho-generators. **(8 Hrs)** |
| **Unit-V** | **Synchro & Synchro Transformers:**<br>Different types of single phase & three-phase synchro, Differential synchros, Synchro-indicators, Their constructional features, Characteristics & applications, Synchro transformers principle, Characteristics error, applications of synchro transformers. **(6 Hrs)** |

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| **Unit-VI** | **Linear Motors:**<br>Construction, Theory of operation of a linear induction motor, System with two-dimensional & three-dimensional field patterns, Performance of linear induction motors, Effect of variation in the air gap, Effect of width & thickness of the reaction plate, Thrust of linear induction motors, Applications. **(6 Hrs)** | | | | |
| **Textbook/ Reference Books** | **Sr. No.** | **Title** | **Author** | **Publication** | **Edition** |
| | 1. | 'Electrical Machine and Power Electronics' | Bhimbhra P. S | Tata McGraw Hill Publication. | Edition 2 |
| | 2. | 'Modem control Engineering' | Ogata K. | Prentice Hall. | Edition 2 |
| | 3. | Principles of Electrical Machines | V.K. Mehta | Chand Publication | Edition 2 |
| | 4. | Electrical Machines | Ashfaque Hussain | Dhanpat Rai and Co. | Edition3 |
| | 5. | Electrical Machines | Nagnath Kothari | TATA McGraw Hill. | Edition 5 |
| | 6. | Electrical Technologies | Edward Hughes Elbs | Pearson Education | Edition 2 |

**Dr. Babasaheb Ambedkar Marathwada University, Aurangabad**

**(Faculty of Science & Technology)**

**Syllabus of Third Year B. Tech. (All) Semester V**

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|---|---|
| Course Code: ETC331<br>Course: Open elective-I (Electronic Product Design)<br>**Teaching Scheme:**<br>Theory: 03 Hrs/week | Credits: 3-0-0<br>Mid Semester Examination-I: 15 Marks<br>Mid Semester Examination-II: 15 Marks<br>Teacher Assessment: 10 Marks<br>End Semester Examination: 60 Marks<br>End Semester Examination (Duration): 3 Hrs |

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|---|---|
| **Prerequisite** | Students should be familiar with Circuit design and PCB design |
| **Objectives** | 1. To understand stages of product (hardware/software) design and development.<br>2. To be acquainted with methods of PCB design and different tools used for it.<br>3. To understand the importance of testing in product design cycle. `<br>4. To understand the processes and importance of documentation. |
| **Unit-I** | **Introduction to Electronic product Design**:<br>Product development basics, Product development stages, Redundancy, Ergonomics and Aesthetic Design consideration **(6 Hrs)** |
| **Unit-II** | **Packaging, Noise and Heat management:**<br>Introduction to product packaging, Noise in electronic circuits, Grounding, Shielding, Enclosure Sizing, Thermal management **( 6 Hrs)** |
| **Unit-III** | **Fundamentals of PCB and PCB design:**<br>Important terms related to PCB, Types of PCBs, PCB Design elements, PCB design Steps, Requirements of artwork, Layout rules, Grounding, Shielding, Design issues related to supply and ground conductors **(6 Hrs)** |
| **Unit-IV** | **Software Design:** Waterfall model of software development, Phases of Software design, Goals of software design, Design of structured program, Testing and debugging of program **(6 Hrs)** |
| **Unit-V** | **Product Testing:** Environmental Testing, Temperature testing Humidity testing, Various test on enclosures, EMI and EMC related testing, Importance of standards, Classification of standards, IEC standards **(6 Hrs)** |
| **Unit-VI** | **Product Documentation:** Need of documentation, Types of documentation, Manual, Types of manuals, Study of one typical manual, Bill of Material-examples. **(6 Hrs)** |

**Textbook/ Reference Books**

| Sr. No. | Title | Author | Publication | Edition |
|---|---|---|---|---|
| 1. | Electronic Product Design | R.G.Kaduskar | Wiley-India | Second |
| 2. | Integrated Circuits | K.R.Botkar | Khanna Publisher | Tenth |
| 3. | Embedded System: A contemporary design Tool | James Peckol | Wiley | Second |

| Dr. Babasaheb Ambedkar Marathwada University, Aurangabad<br>(Faculty of Science & Technology)<br>Syllabus of Third Year B. Tech. (All) Semester V | |
|---|---|
| Course Code: MED331<br>Course: Open Elective-I (Operations Research)<br>**Teaching Scheme:**<br>Theory: 03 Hrs/week<br>Tutorial: 00 Hrs/week | Credits: 3-0-0<br>Mid Semester Examination-I: 15 Marks<br>Mid Semester Examination-II: 15 Marks<br>Teacher Assessment: 10 Marks<br>End Semester Examination: 60 Marks<br>End Semester Examination (Duration): 3 Hrs |
| **Prerequisite** | Fundamental knowledge and understanding of Engineering mathematics<br>Understanding of concepts of costing and management concepts |
| **Objectives** | 1. To familiarize the students with formal quantitative approach to problem solving<br>2. To formulate real life engineering problems<br>3. To solve engineering problems using various Operations Research Techniques |
| **Unit-I** | **Introduction to Operations Research:**<br>Basics definition, scope, objectives, phases, models, applications, and limitations of Operations Research. **(02 Hrs)** |
| **Unit-II** | **Linear Programming Problem:**<br>Formulation of LPP, Graphical solution of LPP, Simplex Method, Artificial variables, Big-M method, two-phase method, degeneracy and unbound solutions. **(08 Hrs)** |
| **Unit-III** | **Transportation Model:**<br>Transportation Problem: Formulation, solution, unbalanced Transportation problem. Finding basic feasible solutions – Northwest corner rule, least cost method, and Vogel's approximation method. Optimality test – the steppingstone method or MODI method. Degeneracy in Transportation Problem.<br>Assignment Problem: Hungarian Method to solve Assignment Problem, Travelling Salesman as an Extension of Assignment Problem. **(08 Hrs)** |
| **Unit-IV** | **Inventory Control, Replacement Analysis and Theory of Games:**<br>Inventory Models: Economic Order Quantity Models, Quantity Discount Models, Stochastic Inventory Models, Multi Product Models, Inventory Control Models in Practice.<br>Replacement Analysis: Replacement of Items that Deteriorate, Replacement of Items that Fail Suddenly.<br>Theory of Games: Introduction, Minimax and Maximin Principle, Solution of Game with |

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| | Saddle Point, Solution by Dominance. **(06 Hrs)** |
| **Unit-V** | **Queuing model and Sequencing model:** Queuing Systems and Structures, Notation Parameters, Single Server and Multi Server Models, Poisson Input, Exponential Service, Constant Rate Service, Infinite Population Sequencing Model: Introduction, n jobs through two machines, n jobs through three machines, two jobs through m machines and n jobs through m machines. **(06 Hrs)** |
| **Unit-VI** | **Network Models:** Fulkerson 's rule, concept and types of floats, float calculations, CPM and PERT, Crashing cost and crashing Network. **(06 Hrs)** |

**Text Book/ Reference Books**

| Sr. No. | Title | Author | Publication | Edition |
|---|---|---|---|---|
| 1. | Operations Research | Taha H.A. | Prentice Hall Of India. | Ninth Edition |
| 2. | Introduction to Operations Research | Frederick S. Hillier and Gerald J. Lieberman | Tata McGraw-Hill | Seventh Edition |
| 3. | Operations Research | P.K. Gupta, D.S Hira | S. Chand & Co. | Fourth Edition |
| 4. | Operations Research | Man Mohan, P. K. Gupta, Kanti Swarup | S. Chand & Co. | 12th Edition |
| 5. | Operations Research Principles and Practice | Ravindran, Phillips and Solberg | Mc. WSE Willey | Second Edition |
| 6. | Operations Research: Applications and Algorithms | Wayne L. Winston, Jeffrey B. Goldberg | Thomson Brooks | Fourth edition |
| 7. | Operations Research: Theory, Methods & Applications | S. D. Sharma, Himanshu Sharma | Kedar Nath Ram Nath | Fourth Edition |
| 8. | PERT and CPM: Principles & Applications | L. S. Srinath | East-West Press Private Limited, | Third Edition |
| 9. | Project Planning & Control with PERT & CPM | Dr. B.C. Punmia & K.K. Khandelwal | Firewall Media | Fourth Edition |

| Dr. Babasaheb Ambedkar Marathwada University, Aurangabad<br>(Faculty of Science & Technology)<br>Syllabus of Third Year B. Tech. (All) Semester V | |
|---|---|
| Course Code: PPE331<br>Course: Open Elective-I: (Introduction to Nanotechnology)<br>**Teaching Scheme:**<br>Theory: 03 Hrs/week | Credits: 3-0-0<br>Mid Semester Examination-I: 15 Marks<br>Mid Semester Examination-II: 15 Marks<br>Teacher Assessment: 10 Marks<br>End Semester Examination: 60 Marks<br>End Semester Examination (Duration): 3 Hrs |
| **Objectives** | 1. To study the introduction to nanomaterials and the factors affecting it.<br>2. To study the types and synthesis methods of nanomaterials.<br>3. To study the characterizations and properties of nanomaterials.<br>4. To study the different applications of nanomaterials. |
| **Unit-I** | **Introduction**<br>Introduction to nanotechnology, conventional micro vs. nano-material properties, role of size in properties of nanomaterials, length scale and surface to volume concept, and uniqueness of nanostructured materials; health hazards and handling of nanomaterials. **(4 Hrs)** |
| **Unit-II** | **A) Synthesis**<br>Bottom-up and top-down approach for nano materials synthesis, methods: ball milling, chemical vapor deposition, pressure vapor deposition, ultrasound assisted, minimulsion, microemulsion, nanoemulsion, hydrothermal, sol-gel, miscellaneous techniques. **(4 Hrs)**<br>**B) Types of Nanomaterials**<br>Natural and synthetic clays – Montmorillonite and layered double hydroxide (LDH); carbon nanofibers (CNFs), carbon nanotubes, graphene nanosheets, nanosilica, nanoaluminium oxide, nanotitanium oxide, nano-hybrids. **(4 Hrs)** |
| **Unit-III** | **Properties of Nan materials in terms of Structure Property Relationship**<br>Thermal properties, mechanical properties, gas barrier properties, flame retardant properties, electrical and electrochemical properties, electronic properties, optical properties, magnetic properties, biodegradable properties, antimicrobial properties, catalytic properties. **(6 Hrs)** |
| **Unit-IV** | **Preparation of Polymer Nan composites**<br>Solution intercalation, melt intercalation, roll milling, emulsion polymerization, in-situ polymerization. **(6 Hrs)** |
| **Unit-V** | **Characterization of Nanomaterials and Nano composites**<br>X-ray diffraction (XRD), dynamic light scattering (DLS), scanning electron microscopy (SEM), Transmission electron microscopy (TEM), energy dispersive X-ray spectroscopy (EDS), atomic force microscopy (AFM), small angle X-ray scattering (SAXS), differential scanning calorimetry (DSC), thermo gravimetric analysis (TGA). **(6 Hrs)** |
| **Unit-VI** | **Application of Nanomaterials and Nano composites**<br>Biomedical-drug delivery, bone replacement; sensors – gas sensor, metal adsorption and |

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| | recovery, bio-molecule detectors; energy storage and conversion - super capacitors, solar cells, energy generators; electronics; self-cleaning and self-healing paints, nano-engineering of cement-based materials, agricultural nanotechnologies. **(6 Hrs)** | | | | |
| **Textbook/ Reference Books** | **Sr. No.** | **Title** | **Author** | **Publication** | **Edition** |
| | 1. | Polymer Nanocomposites Processing, Characterization, and Applications | Joseph H. Koo | McGraw-Hill Nanoscience and Technology Series | 1st 2006 |
| | 2. | Encyclopedia of Nanoscience and Nanotechnology | Hari singh Nalwa | American Scientific publishers | - |
| | 3. | Chapter: Advanced Hybrid Nanostructures: Preparation, Properties and Applications, Book: Encyclopedia of Nanoscience and Nanotechnology | Aniruddha Chatterjee et al | American Scientific publishers | 2018 |
| | 4. | Nanoparticle Technology Handbook | M Hosokawa, K Nogi, M Naito, T Yokoyama | Elsevier | - |
| | 5. | The Science of Nanotechnology: An introductory text | Luanne Tilstra et al | Nova Science Publishers, Inc. | - |
| | 6. | Polymer-Layered Silicate and Silica Nanocomposites | Y.C. Ke, P. Stroeve | Elsevier | 2005 |
| | 7. | Nanotechnology in concrete – A review | Florence Sanchez, Konstantin Sobolev | Construction and Building Materials, Elsevier | 24 (2010) 2060–2071 |
| | 8. | Agricultural Nanotechnologies: What are the current possibilities? | Claudia Parisi et al | Nano Today, Elsevier | 2014 |

| Dr. Babasaheb Ambedkar Marathwada University, Aurangabad<br>(Faculty of Science & Technology)<br>Syllabus of Third Year B. Tech. (Electrical Engineering) Semester-V | | |
|---|---|---|
| Course Code: EED321<br>Course: Power Electronics<br>**Teaching Scheme:** Practical: 2 Hrs/week | | Credits: 0-0-1<br>Practical Mark: 25 Mark |
| **Objectives** | : | 1. Develop problem formulation, system design and solving skills.<br>2. Analyse the waveforms of Rectifier and Inverter Circuits |
| **List of Practical** | : | 1. VI Characteristics of SCR<br>2. VI Characteristics of TRIAC<br>3. VI Characteristics of MOSFET<br>4. Forced Commutation Circuits<br>5. Chopper Circuit – Step-down Chopper<br>6. Chopper Circuit – Step-Up Chopper<br>7. Single phase Fully Controlled Rectifier using R and RL Load<br>8. Single phase Series and Parallel Inverter<br>9. Simulation on Three phase Fully controlled AC to DC Bridge Converter<br>10. Simulation on Three phase Voltage source inverter using 180° and 120° Conduction Mode |

The assessment of term work shall be done based on the following.

- Continuous assessment
- Performing the experiments in the laboratory
- Oral examination conducted on the syllabus and term work mentioned above.

| Dr. Babasaheb Ambedkar Marathwada University, Aurangabad<br>(Faculty of Science & Technology)<br>Syllabus of Third Year B. Tech. (Electrical Engineering) Semester-V | | |
|---|---|---|
| Course Code: EED322<br>Course: Digital Signal Processing<br>**Teaching Scheme**: Practical: 2 Hrs/week | | Credits: 0-0-1<br>Practical: 25 Marks |
| **Objectives** | : | 1.Understanding and performing various measuring instruments through practical demonstrations. |
| **List of Practical** | : | Perform any 10 experiments<br>1. Plotting of discrete time waveforms (a) Sine, (b) Unit Step, (c) Exponential.<br>2. Verification of Z-transform properties (any two).<br>3. Find Linear convolution and correlation of signals.<br>4. Plot frequency response of given system function (Magnitude &Phase).<br>5. Find DFT & IDFT of sequence.<br>6. Find Circular convolution Using DFT IDFT method and linear convolution using Circular convolution.<br>7. DIT- FFT or DIF-FFT algorithm<br>8. Design of IIR filters (Butterworth method).<br>9. Design of FIR filters (window (any one method).<br>10. Verification of Sampling Theorem. |

The assessment of term work shall be done based on the following.

- Continuous assessment
- Performing the experiments in the laboratory
- Oral examination conducted on the syllabus and term work mentioned above.

| Dr. Babasaheb Ambedkar Marathwada University, Aurangabad<br>(Faculty of Science & Technology)<br>Syllabus of Third Year B. Tech. (Electrical Engineering) Semester-V | | |
|---|---|---|
| Course Code: EED323<br>Course: Design of Electrical Machines<br>**Teaching Scheme**: Practical: 2 Hrs/week | | Credits: 0-0-1<br>Term work: 25 Mark |
| **Objective** | : | 1.To design a system, a component to meet desired needs, differentiates and will be able to compare different options based on results, and able to analyze and interpret results for different industrial application to meet desired needs within realistic constraints and confirms manufacturability. |
| **List of Practical** | : | **Draw sheets for the following**<br>1. Layout of Lap & Wave Windings.<br>2. Details & layout of AC machine winding with detail.<br>3. Design of an Iron Cored Choke.<br>4. Details & Assembly of 3 Phase transformer<br>5. Report based on industrial Visit to the manufacturing unit. |

The assessment of term work shall be done based on the following.

- Continuous assessment
- Performing the experiments in the laboratory
- Oral examination conducted on the syllabus and term work mentioned above.

| Dr. Babasaheb Ambedkar Marathwada University, Aurangabad<br>(Faculty of Science & Technology)<br>Syllabus of Third Year B. Tech. (Electrical Engineering) Semester-V | | |
|---|---|---|
| Course Code: EED324<br>Course: Power System Dynamics and Control.<br>**Teaching Scheme**: Practical: 02 Hrs/week | | Credits: 0-0-1<br>Term work: 25 Marks |
| **Objectives** | : | 1.To understand and develop among students about power system operation and control by experiment. |
| **List of Practical** | : | **(Any 10 experiments from following list)**<br>1. To determine Steady state Stability of synchronous motor (performance).<br>2. To determine Steady state stability of medium transmission line (performance).<br>3. To plot swing curve by Point-by-Point method for transient stability analysis.<br>4. To apply equal area criteria for analysis stability under sudden rise in mechanical power input.<br>5. To apply equal area criteria for stability analysis under fault condition.<br>6. To study reactive power compensation using any device.<br>7. To study Lagrange multiplier technique for economic load dispatch.<br>8. To develop dynamic programming method for unit commitment.<br>9. To study load frequency control using approximate and exact model.<br>10. To study load frequency control with integral control.<br>11. To study the two-area load frequency control. |

The assessment of term work shall be done based on the following.

- Continuous assessment
- Performing the experiments in the laboratory
- Oral examination conducted on the syllabus and term work mentioned above.

| Dr. Babasaheb Ambedkar Marathwada University, Aurangabad<br>(Faculty of Science & Technology)<br>Syllabus of Third Year B. Tech. (Electrical Engineering) Semester-V | | |
|---|---|---|
| Course Code: EED325<br>Course: Line Commutated and Active Rectifiers<br>**Teaching Scheme**: Practical: 2 Hrs/week | | Credits: 0-0-1<br>Term work:25 Mark |
| **Objectives** | : | 1. Develop problem formulation, system design and solving skills.<br>2. Analyze the waveforms of Rectifier and Inverter Circuits |
| **List of Practical** | : | **(Any 10 experiments from the following lists)**<br>1. Simulation on Single phase diode Rectifier using R and RL Load<br>2. Simulation on Single phase Fully Controlled Rectifier using R and RL Load<br>3. Simulation on Three phase diode AC to DC Bridge Converter<br>4. Simulation on Three phase Fully controlled AC to DC Bridge Converter<br>5. Simulation on Three phase Voltage source inverter using 180° Conduction Mode<br>6. Simulation on Three phase Voltage source inverter using 120° Conduction Mode<br>7. Simulation on Dual Active Bridge DC-DC Converter by using controlled switch<br>8. Simulation on Line Commutated Inverter for grid interfacing.<br>9. Simulation on Line Commutated Inverter grid interfacing for non-linear load.<br>10. Simulation on Line Commutated Inverter grid interfacing for linear load with PI controller. |

The assessment of term work shall be done based on the following.

- Continuous assessment
- Performing the experiments in the laboratory
- Oral examination conducted on the syllabus and term work mentioned above.

**Dr. Babasaheb Ambedkar Marathwada University, Aurangabad**

**(Faculty of Science & Technology)**

**Syllabus of Third Year B. Tech. (Electrical Engineering) Semester V**

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|---|---|
| Course Code: EED326<br>**Teaching Scheme:**<br>Practical: 02 Hrs/week | Title: Minor Project<br>Teachers Assessment (Marks): 25<br>Credits:01 |

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|---|---|---|
| **Objectives** | : | 1. To plan for various activities of the project and distribute the work amongst team members.<br>2. To develop the ability to define and design the problem and lead to its accomplishment with proper planning.<br>3. To understand the importance of document design by compiling Technical Report on the Minor Project work carried out.<br>4. To develop student's abilities to transmit technical information clearly and test the same by delivery of Seminar based on the Minor Project. |
| **Guidelines** | : | 1. Students should select a problem which addresses some basic home, office, or other real-life applications.<br>2. Projects which will address the social issues will be given due weightage.<br>3. It is desirable that the systems developed by the students have some novel features.<br>4. The batch size shall not exceed TWO students per batch.<br>5. The students must select a suitable problem, design, prepare the drawings, produce the components, assemble, and commission the project.<br>6. Institute may arrange demonstration with poster presentation of all minor projects developed by the students at the end of semester.<br>7. At the end of the semester, the students must prepare and present 20-25 pages project report.<br>8. Final evaluation shall be based on continuous internal assessment followed by Viva-Voce |

| Dr. Babasaheb Ambedkar Marathwada University, Aurangabad<br>(Faculty of Science & Technology)<br>Syllabus of Third Year B. Tech. (Electrical Engineering) | | |
|---|---|---|
| Course Code: EED327<br>Course: Engineering Science Course (PLC for Electrical Application)<br>**Teaching Scheme:** 02 Hrs/week | | Credits: 0-0-1<br>Practical: 25 Mark |
| **Objectives** | : | 1. To study the Fundamentals of Programmable Logic Controllers<br>2. To study the specifications of PLC and wiring diagram.<br>3. To study the programming and applications related to process control. |
| **List of Practical** | : | 1. To understand and study the Architecture of PLC.<br>2. To study the different input and output devices.<br>3. To develop ladder logic program for logic gates.<br>4. To study the programming languages of PLC.<br>5. To study the Ladder logic and the instruction set of PLC.<br>6. To develop the ladder logic for flashing of LEDs.<br>7. To develop the ladder logic for Traffic signal Controllers.<br>8. To develop the ladder logic for water level control.<br>9. Case study of PLC of any make.<br>10. To study the different communication protocols. |

The assessment of term work shall be done based on the following.

- Continuous assessment
- Performing the experiments in the laboratory
- Oral examination conducted on the syllabus and term work mentioned above

**Dr. Babasaheb Ambedkar Marathwada University, Aurangabad**
**(Faculty of Science & Technology)**
**Syllabus of Third Year B. Tech. (Mechanical Engineering) Semester-V**

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|---|---|
| Course Code: MED328<br>Course: Experiential / Problem Based Learning<br>**Teaching Scheme:** Practical: 02 Hrs/week | Credits: 0-0-1<br>Term Work: 25 Marks |

**Course Objectives:**

On completion of the course, learner will be able to –

1. To develop positive attitude, new skills, or new ways of thinking.
2. To introduce independent and group learning by solving real world problem with the help of available resources.
3. To be able to develop systematic approach in technical documentation.
4. To select and utilize appropriate Software tools/Equipment/Problem solving tools to solve real life problems.

**Guidelines:**

The students plan, manage and complete a activity which addresses the stated problem.

1. The students must work in group to solve real life problem.

2.open ended problems from course teachers can be considered from any course related to engineering field. (it can be domain specific/ Multidisciplinary but the emphasis on Electrical Engineering.

3. A mentor to be assigned to 3-4 groups / one batch.

4. The steps to be followed for problem-based learning are as mentioned below:

**Step 1: Explore the issue.**

Gather necessary information; learn new concepts, principles, and skills about the proposed topic.

**Step 2: State what is known.**

Individual students and groups list what they already know about the scenario and list what areas they are lacking information.

**Step 3: Define the issues.**

Frame the problem in a context of what is already known and information the students expect to learn.

**Step 4: Research the knowledge.**

Find resources and information that will help create a compelling argument.

**Step 5: Investigate solutions.**

List possible actions and solutions to the problem, formulate and test potential hypotheses

**Step 6: Present and support the chosen solution.**

Clearly state and support your conclusion with relevant information and evidence.

**Step 7: Review your performance.**

Often forgotten, this is a crucial step in improving the problem-solving skills. Students must evaluate their performance and plan improvements for the next problem.

**Recommended parameters for assessment, evaluation and weightage:**

5. Identification of the Problem (20%)
6. Documentation (Gathering requirements, design & modeling, implementation/execution, use of technology and final report, other documents). (30%)
7. Demonstration (Poster Presentation/Model Exhibition etc). (20%).
8. Awareness /Consideration of - Environment/ Social /Ethics/ Safety measures/Legal aspects. (10%)
9. Outcome (Participation in technical events / publication in national international conference journal/copyright/patent/prototype). (20%)

| | Sr. No. | Title | Author |
|---|---|---|---|
| **Reference Books/ Research Articles:** | 01 | A new model of problem-based learning | Terry Barrett |
| | 02 | Research Methodology: Methods and Techniques | C. R. Kothari |
| **Web Resources:** | | 1. Problem-Based Learning:https://www.coursera.org/lecture/university-teaching/problem-based-learning-i-pbl-in-practice-SMXol<br>2. Problem-Based Learning: https://onlinecourses.swayam2.ac.in/ntr20_ed29/preview | |

**Dr. Babasaheb Ambedkar Marathwada University, Aurangabad**

**(Faculty of Science & Technology)**

**Syllabus of Third Year B. Tech. (Electrical Engineering) Semester-VI**

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|---|---|
| Course Code: EED351<br>Course: Power System Analysis<br>**Teaching Scheme:**<br>Theory: 03 Hrs/week | Credits: 3-0-0<br>Mid Semester Examination-I: 15 Marks<br>Mid Semester Examination-II: 15 Marks<br>Teacher Assessment: 10Marks<br>End Semester Examination: 60 Marks<br>End Semester Examination (Duration): 3 Hrs |

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|---|---|
| **Prerequisite** | Basics of Electrical Engineering, Power systems, Electrical Machines |
| **Objectives** | 1. To model the power system under steady state operating condition<br>2. To understand and apply iterative techniques for power flow analysis<br>3. To model and carry out short circuit studies on power system<br>4. To model and analyse stability problems in power system |
| **Unit-I** | **Power System components representation:**<br>Need for system planning and operational studies – Power scenario in India – Power System Components, Reactance Diagram, Per Unit System- P.U. Representation of Transformer, P.U. Impedance Diagram of Power system, Steady State Model of Synchronous Machines. **(8 Hrs)** |
| **Unit-II** | **Symmetrical Fault Analysis:**<br>Assumptions in short circuit analysis – Symmetrical short circuit analysis using Thevenin's theorem – Bus Impedance matrix building algorithm (without mutual coupling) – Symmetrical fault analysis through bus impedance matrix – Post fault bus voltages – Fault level – Current limiting reactors, short circuit MVA. **(6 Hrs)** |
| **Unit-III** | **Symmetrical Components:**<br>Symmetrical component transformation, Phase shift in Star-Delta Transformers, Sequence Impedances-Transmission lines, Sequence network of power system, Synchronous machines, Transformers. **(6 Hrs)** |
| **Unit-IV** | **Unsymmetrical Fault Analysis:**<br>Symmetrical components – Sequence impedances – Sequence networks – Analysis of unsymmetrical faults at generator terminals: LG, L and LG – unsymmetrical fault occurring at any point in a power system – computation of post fault currents in symmetrical component and phasor domains. **(6 Hrs)** |
| **Unit-V** | **Load Flow Analysis:**<br>Load flow problem, Gauss-Seidel Method, Newton-Raphson Method, Decoupled Load Flow studies, Fast Decoupled Load Flow studies. Comparison of Load Flow methods, Numerical treatment expected. **(6 Hrs)** |
| **Unit-VI** | **Load Dispatch:**<br>Load dispatch center function, contingency analysis, preventive, emergency, and restorative control. **(4 Hrs)** |

| **Textbook/** | **Sr. No.** | **Title** | **Author** | **Publication** | **Edition** |
|---|---|---|---|---|---|

| | | | | | |
|---|---|---|---|---|---|
| **Reference Books** | 1. | Modern Power System Analysis | I.J. Nagrath & D.P. Kothari, | Tata McGraw Hill, New Delhi. | III |
| | 2. | Power System Analysis and Design | B R Gupta | S.Chand | II |
| | 3. | Power System Analysis | Abhijit Chakraborty and Sunita Haldar | Tata McGraw Hill, New Delhi. | III |
| | 4. | Power System Analysis | P.S.R. Murthy | B.S. Publications. | III |
| | 5. | Power System Analysis | Hemalatha and Jayachrista | Scitech Publication | II |

**Dr. Babasaheb Ambedkar Marathwada University, Aurangabad**
**(Faculty of Science & Technology)**
**Syllabus of Third Year B. Tech. (Electrical Engineering)**

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|---|---|
| Course Code: EED352<br>Course: Control System Engineering<br>**Teaching Scheme:**<br>Theory: 03 Hrs/week | Credits: 3-0-0<br>Mid Semester Examination-I: 15 Marks<br>Mid Semester Examination-II:15 Marks<br>Teacher Assessment: 10 Marks<br>End Semester Examination: 60 Marks<br>End Semester Examination (Duration): 3 Hrs |

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|---|---|
| **Prerequisite** | Network and Circuits, Basic Engineering Mathematics. |
| **Objectives** | 1. To obtain a working mathematical model of a system.<br>2. To analyze behavior of system in time and frequency domain.<br>3. To design controller to meet desired specifications. |
| **Unit-I** | **Control System Modeling:**<br>Basic concepts of control system, open loop, close loop, classification of control systems. Types of control system: Feedback, tracking, regulator system, feed forward system. Transfer function, Pole and zero concept. Modeling and representation of control system-Basic concept. Mechanical, Electrical, and equivalent system. Block diagram reduction, signal flow graph, Mason's gain formula. **(8 Hrs)** |
| **Unit-II** | **Control System Components:**<br>Modeling and transfer function of control system components such as simple electrical, mechanical, electromechanical systems, Lag network, lead network, Potentiometer, Synchro's, AC and DC servo motors, Gear trains, AC-DC Tacho-Generators. **(6 Hrs)** |
| **Unit-III** | **Time Domain Analysis:**<br>Standard test signal–step, ramp, parabolic and impulse, type and order of control system, time response of 1st and 2nd order systems to unit step input, steady state errors–static and dynamic errors coefficients, generalized errors series method, Time domain specifications of 2nd order systems. Dominant closed loop poles of higher order systems. **(4 Hrs)** |
| **Unit-IV** | **Stability Analysis and Root Locus:**<br>Concept of stability-Absolute, relative, and marginal. Nature of system response for various locations of roots in S-plane of characteristics equation. Routh's criterion and Hurwithz criterion. Root Locus: Basic properties of root locus. Construction of root locus. Angle and magnitude condition for stable system. **(6 Hrs)** |
| **Unit-V** | **Frequency Domain Analysis:**<br>Steady state response of a system due to sinusoidal input. Relation between time and frequency response for second order system. Frequency domain specifications, analysis with Bode plot, Polar plot, Nyquist plot, stability analysis using Nyquist plot and Bode plot. **(6 Hrs)** |
| **Unit-VI** | **PID Controllers:**<br>Basic concept of PID controller, Design specifications in time domain and frequency domain. Time design of P, PI, PID controllers. Frequency domain design of P, PI, PID controllers, Tuning of PID controllers. Zigler-Nichol Method. **(6 Hrs)** |

| | Sr. No. | Title | Author | Publication | Edition |
|---|---|---|---|---|---|
| **Textbook/ Reference Books** | 1. | Modern control system | Richard C Dorf and Robert H Bishop | Pearson Education | 12th edition, 2011 |
| | 2. | Control Systems Engineering | Nise N. S., John Wiley & Sons, | Tata McGraw Hill | Incorporated, 2011 |
| | 3. | Control Engineering: An Introductory Course | Jacqueline Wilkie, Michael Johnson | Palgrave Publication | 2002. |
| | 4. | Modern Control Engineering | - D. Roy Choudhary | PHI Learning Pvt. Ltd | 2005 |
| | 5. | Control Systems: Theory and Application | Smarajiti Ghosh, Dorling Kindersley | Pearson Education | 2008 |

| Dr. Babasaheb Ambedkar Marathwada University, Aurangabad<br>(Faculty of Science & Technology)<br>Syllabus of Third Year B. Tech. (Electrical Engineering) Semester-VI | |
|---|---|
| Course Code: EED353<br>Course: Electrical Drives<br>**Teaching Scheme:**<br>Theory: 03 Hrs/week | Credits: 3-0-0<br>Mid Semester Examination-I: 15 Marks<br>Mid Semester Examination-II:15 Marks<br>Teacher Assessment: 10 Marks<br>End Semester Examination: 60 Marks<br>End Semester Examination (Duration): 3 Hrs |
| **Prerequisite** | Students should know the basic concepts of Basic Electrical Engineering, Power Electronics, Fundamentals of DC, and AC motors. |
| **Objectives** | 1. To understand the motor drivers and control<br>2. In-depth study on recent drives and its applications |
| **Unit-I** | **Introduction:**<br>Definition, Advantages of electrical drives, Components of Electric drive system, Selection Factors, Types of Electrical Drives (DC & AC). Motor-Load Dynamics, Speed Torque conventions and multi quadrant operation, Equivalent values of drive parameters. Load Torque Components, Nature, and classification of Load Torques, Constant Torque and Constant Power operation of a Drive. Steady state stability, Load equalization by using flywheel. **(8 Hrs)** |
| **Unit-II** | **Solid state-controlled D.C. Motors:**<br>Single phase and three phases fully controlled converter drive and performance of converter fed separately excited DC Motor for starting and speed control operations. Chopper controlled drives for separately excited and series DC Motor operations. Closed loop speed control of DC motor below and above base speed. **(5 Hrs)** |
| **Unit-III** | **Solid State Controlled Induction Motors:**<br>Thyristor stator voltage control (using ac regulators, for fixed frequency variable voltage control), Transistorized stator frequency control: v/f control, voltage source inverter (VSI) control, Steady State Analysis, current source inverter (CSI) control, relative merits, and demerits of VSI and CSI for induction motor drives. **(5 Hrs)** |
| **Unit-IV** | **Synchronous Motor Drives:**<br>Review of starting, pull in and braking of Synchronous motor, Static variable frequency control for Synchronous motors, Load commutated inverter fed Synchronous motor drive, Introduction to closed loop control of Load commutated inverter fed Synchronous motor drive. **(6 Hrs)** |

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| **Unit-V** | **Energy Saving Techniques:**<br>Calculation of time and energy loss in transient operations: Starting, Speed variation and Braking. Energy Saving in starting of Induction Motor Drive: Static rotor resistance control, Slip Power recovery schemes: Static Scherbious Drive, Static Kramer Drive Energy Saving in running of Induction Motor Driving Pump and Blower: Consideration of load torque characteristics and energy saving calculations. Power Rating: Selection criteria of motors, motor duties, inverter duty motors. Load diagram, Heating and cooling, Thermal Resistance, determination of HP rating of motor based on duty cycle, de-rating of motor, effect of harmonic current and voltage harmonics, short time rating. **(6 Hrs)** |
| **Unit-VI** | **Latest Trends in Drives and Industrial Applications:**<br>Latest trends in Drives: Rotor flux-oriented vector control for induction motor drives. Commutator less DC Motor (How Induction Motor is converted to Characteristics of DC Motor), AC Servo Drives. Industrial Applications: Drives for Rolling mills (Four Quadrant Operation), Textile mills (Synchronized operation of Drive in Tandem). **(6 Hrs)** |

**Textbook/ Reference Books**

| Sr. No. | Title | Author | Publication | Edition |
|---|---|---|---|---|
| 1. | Fundamentals of Electric Drives | G. K. Dubey | Narosa Publishing House | 2nd Edition |
| 2. | Electric Drives | N. K. De, P. K. Sen | Prentice Hall of India Eastern Economy Edition | 2nd Edition |
| 3. | Analysis of Thyristor Power Conditioned Motors | S. K. Pillai | University Press | 1st Edition |
| 4. | Modern Power Electronics and AC Drives | K. Bose | Pearson Education | 2rd Edition |
| 5. | Electric Motor Drives- Modeling Analysis and Control | PHI India | R. Krishnan | 2nd Edition |

**Dr. Babasaheb Ambedkar Marathwada University, Aurangabad**

**(Faculty of Science & Technology)**

**Syllabus of Third Year B. Tech. (Electrical Engineering) Semester-VI**

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|---|---|
| Course Code: EED391<br>Course: Electromagnetic waves (Professional Elective Courses-III)<br>**Teaching Scheme:**<br>Theory: 3 Hrs/week | Credits: 3-0-0<br>Mid Semester Examination-I: 15 Marks<br>Mid Semester Examination-II: 15 Marks<br>Teacher Assessment: 10 Marks<br>End Semester Examination: 60 Marks<br>End Semester Examination (Duration): 3 Hrs |

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|---|---|
| **Prerequisite** | Students should know the basic concepts of signal and systems. |
| **Objectives** | 1. Analyze transmission lines and estimate voltage and current at any point on Transmission line for different load conditions.<br>2. Provide solution to real life plane wave problems for various boundary conditions.<br>3. Analyze the field equations for the wave propagation in special cases such as lossy and low loss dielectric media.<br>4. Visualize TE and TM mode patterns of field distributions in a rectangular waveguide.<br>5. Understand and analyses radiation by antennas. |
| **Unit-I** | **Transmission Lines**<br>Introduction, Concept of distributed elements, Equations of voltage and current, standing waves and impedance transformation, Lossless and low-loss transmission lines, Power transfer on a transmission line, Analysis of transmission line in terms of admittances, Transmission line calculations with the help of Smith chart, Applications of transmission line, Impedance matching using transmission lines. **(6 Hrs)** |
| **Unit-II** | **Maxwell's Equations**<br>Basic quantities of Electromagnetics, Basic laws of Electromagnetics: Gauss's law, Ampere's Circuital law, Faraday's law of Electromagnetic induction. Maxwell's equations, Surface charge and surface current, Boundary conditions at media interface. **(6 Hrs)** |
| **Unit-III** | **Uniform Plane Wave**<br>Homogeneous unbound medium, Wave equation for time harmonic fields, Solution of the wave equation, Uniform plane wave, Wave polarization, Wave propagation in conducting medium, Phase velocity of a wave, Power flow and Poynting vector. **(7 Hrs)** |
| **Unit-IV** | **Plane Waves at Media Interface**<br>Plane wave in arbitrary direction, Plane wave at dielectric interface, Reflection, and refraction of waves at dielectric interface, Total internal reflection, Wave polarization at media interface, Brewster angle, Fields and power flow at media interface, Lossy media interface, Reflection from conducting boundary. **(7 Hrs)** |
| **Unit-V** | **Waveguides**<br>Parallel plane waveguide: Transverse Electric (TE) mode, transverse Magnetic (TM) mode, Cut-off frequency, Phase velocity and dispersion. Transverse Electromagnetic (TEM) mode, Analysis of waveguide-general approach, rectangular waveguides. **(5 Hrs)** |

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| **Unit-VI** | **Antennas**<br>Radiation parameters of antenna, Potential functions, Solution for potential functions, Radiations from Hertz dipole, near field, far field, Total power radiated by a dipole, Radiation resistance and radiation pattern of Hertz dipole, Hertz dipole in receiving mode.<br>**(6 Hrs)** | | | | |
| **Textbooks** | **Sr. No.** | **Title** | **Author** | **Publication** | **Edition** |
| | 1. | Electromagnetic Waves | R. K. Shevgaonkar | Tata McGraw Hill | 2005 |
| | 2. | Field and Wave Electromagnetics | D. K. Cheng | Addison-Wesley | 1989 |
| **Textbook/ Reference Books** | 1. | Elements of Electromagnetics | M. N.O. Sadiku | Oxford University Press | 2007 |
| | 2. | Advanced Engineering Electromagnetics. | C. A. Balanis | John Wiley & Sons | 2012 |
| | 3. | Antenna Theory Design and Analysis | C. A. Balanis | John Wiley & Sons | 2005 |

| Dr. Babasaheb Ambedkar Marathwada University, Aurangabad<br>(Faculty of Science & Technology)<br>Syllabus of Third Year B. Tech. (Electrical Engineering) Semester-VI | |
|---|---|
| Course Code: EED392<br>Course: High Voltage Engineering (Professional Elective Courses-III)<br>**Teaching Scheme:**<br>Theory: 3 Hrs/week | Credits: 3-0-0<br>Mid Semester Examination-I: 15 Marks<br>Mid Semester Examination-II: 15 Marks<br>Teacher Assessment: 10 Marks<br>End Semester Examination: 60 Marks<br>End Semester Examination (Duration):3 Hrs |
| **Prerequisite** | Student should know about basic concepts transmission and distribution. |
| **Objectives** | 1. To understand the various types of over voltages in power system and protection methods.<br>2. Generation of over voltages in laboratories.<br>3. Measurement of over voltages.<br>4. Nature of Breakdown mechanism in solid, liquid, and gaseous dielectrics.<br>5. Testing of power apparatus and insulation coordination |
| **Unit-I** | **Breakdown in Gases:**<br>Ionization process in gas, Townsend's Theory, current growth equation in presence of primary and secondary ionization processes, Townsend's breakdown criterion, primary and secondary ionization coefficients, Streamer mechanism of breakdown, Paschen's Law. **(6 Hrs)** |
| **Unit-II** | **Breakdown in Liquid Dielectrics:**<br>Pure and commercial liquids, Different breakdown theories: Breakdown in Pure liquid and breakdown in commercial liquids: 1. Suspended Particle theory, Cavitation's and bubble theory, Thermal mechanism of breakdown and Stressed Oil volume theory. 2. Breakdown in Solid Dielectrics: Intrinsic breakdown: electronic breakdown, avalanche or streamer breakdown, electromechanical breakdown, thermal breakdown, treeing and tracking phenomenon. **(6 Hrs)** |
| **Unit-III** | **Lightning and Switching Over Voltages:**<br>Natural Causes of over voltages, lightning phenomenon, Different types of lightening strokes and mechanisms of lightening strokes, over voltage due to switching surges and methods to minimize switching surges. **(6 Hrs)** |
| **Unit-IV** | **Generation of High Voltages and Current:**<br>a) Generation of high ac voltages-Cascading of transformers, series and parallel resonance system, Tesla coil b) Generation of impulse voltages and current-Impulse voltage definition, wave front and wave tail time, Multistage impulse generator, Marx circuit, Tripping and control of impulse generators, Generation of high impulse current c) Generation of high dc voltages: rectifier circuits, voltage multiplier. **(6 Hrs)** |
| **Unit-V** | **Measurement of High Voltage and High Currents:**<br>Measurements of high direct current voltages, electrostatic voltmeter, generating voltmeter, peak reading voltmeter, resistive, capacitive, and mixed potential divider, Measurements of high A.C and Impulse voltages, capacitance voltage transformer, measurement of dielectric |

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| | constant and loss factor, partial discharge measurements. Measurement of high-power frequency ac using current transformer with electro-optical signal converter. **(6 Hrs)** |
| **Unit-VI** | **High Voltage Testing of Electrical Apparatus and H V Laboratories:** Testing of insulators and bushings-Disruptive discharge voltage, withstand voltage, 50% & 100% flashover voltages, creepage voltages, a.c test voltages, impulse voltages, power frequency tests, impulse tests, Testing of isolators and circuit breakers-Introduction, short circuit tests, testing of cables-preparation of the cable samples, dielectric power factor tests, High voltage tests on cables, Partial discharges, Power capacitors and cables testing, testing of surge arresters and transformer Impulse testing of transformers. Radio interference measurements. **(6 Hrs)** |

**Textbook/ Reference Books**

| Sr. No. | Title | Author | Publication | Edition |
|---|---|---|---|---|
| 1. | "High Voltage Engineering" | Naidu M. S., Kamaraju V | Tata McGraw-Hill Publishing Company Ltd., New Delhi | 4th Edition, 2008. |
| 2. | "High Voltage Engineering" | Wadhwa C. L | New Age International Private Ltd | 3rd Edition, Reprint, New Delhi, 2010. |
| 3. | "High Voltage - Insulation Engineering" | Ravindra Arora and Wolfgang Mosch | New Age International Publishers Limited | 1st Edition, Reprint, New Delhi, 2008. |
| 4. | "High Voltage Engineering: Fundamentals" | Kuffel, E., Zaengl W.S., Kuffel J | Newnes Publishers, New Delhi | 2nd Edition, 2000. |
| 5. | "Extra High Voltage AC Transmission Engineering" | Rakosh Das Begamudre | New Age International Private Ltd | 3rd Edition, New Delhi, 2010. |
| 6. | "High Voltage Engineering" | Prof. D. V. Razevig Translated from Russian by Dr. M. P. Chourasia | Khanna Publishers, New Delhi | 2nd Edition |

| Dr. Babasaheb Ambedkar Marathwada University, Aurangabad<br>(Faculty of Science & Technology)<br>Syllabus of Third Year B. Tech. (Electrical Engineering) Semester-VI | |
|---|---|
| Course Code: EED393<br>Course: Industrial Electrical Systems<br>(Professional Elective Courses-III)<br>**Teaching Scheme:**<br>Theory: 03 Hrs/week | Credits: 3-0-0<br>Mid Semester Examination-I: 15 Marks<br>Mid Semester Examination-II: 15 Marks<br>Teacher Assessment: 10 Marks<br>End Semester Examination: 60 Marks<br>End Semester Examination (Duration): 3 Hrs |
| **Prerequisite** | Knowledge of AC, DC motors, generators, Transformers, and solid-state equipment's is required |
| **Objectives** | The objectives of the course are to make the students,<br>1. Introduce various methods of effectively and efficiently utilizing Electrical Energy for different and desired applications<br>2. Teach the various Electrical Lighting principles and their applications.<br>3. Impart knowledge on effective utilization of Electrical Drives, Electrical Traction and Electromechanical process |
| **Unit-I** | **Electrical Drives And Control**<br>Group drive – Individual drive – selection of motors – starting and running characteristics– Mechanical features of electric motors – Drives for different industrial applications - Choice of drives – power requirement calculation. **(6 Hrs)** |
| **Unit-II** | **Electrical Traction**<br>Traction system – Speed time characteristics – Series and parallel control of D.C motors - Open circuited, shunt and bridge transitions – Tractive effort calculation – Electric braking – Tramways and trolley bus – A.C traction and recent trend. Magnetic levitation. **(6 Hrs)** |
| **Unit-III** | **Electrical Heating**<br>Resistance, Inductance and Arc furnaces – Construction and fields of application – Losses in oven and efficiency - High frequency - Dielectric heating. **(6 Hrs)** |
| **Unit-IV** | **Electrical Welding**<br>Evolution of welding, Types of Electric welding– Resistance and arc welding, Welding Characteristics of carbon and metallic arc welding – butt welding – spot welding. **(6 Hrs)** |
| **Unit-V** | **Illumination**<br>Production of light – Determination of MHCP and MSCP – Polar curves of different types of sources – Rousseau's construction – Lighting schemes and calculations – Factory lighting – Flood lighting – Electric lamps – Gaseous discharge – High pressure and low pressure. **(6 Hrs)** |
| **Unit-VI** | **Safety Management Concepts And Techniques**<br>History of Safety movement –Evolution of modern safety concept- general concepts of management – planning for safety for optimization of productivity -productivity, quality and safety-line and staff functions for safety-budgeting for safety-safety policy. **(6 Hrs)** |

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|---|---|---|---|---|---|
| **Textbook/ Reference Books** | **Sr. No.** | **Title** | **Author** | **Publication** | **Edition** |
| | 1. | Electric Power | UPPAL S. L | KHANNA PUBLICATIONS | Edition 3 |
| | 2. | Utilization of Electrical Energy | Open Shaw Taylor | Oriented Longmans Limited | Edition 2 |
| | 3 | A textbook on Power System Engineering" | Soni A. Chakrabarti, M.L.Soni, P.V.Gupta, U.S.Bhatnagar | KHANNA PUBLICATIONS | Edition 2 |
| | 4. | Generation, Transmission and Utilization of Electric Power | A.I.Starr | ELBS, 1978. | Edition 5 |
| | 5. | Generation, Distribution and Utilization of Electrical Energy | C.L. WADHAWA | Tata McGraw Hill | Edition 3 |

**Dr. Babasaheb Ambedkar Marathwada University, Aurangabad**

**(Faculty of Science & Technology)**

**Syllabus of Third Year B. Tech. (All) Semester VI**

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| Course Code: AED381<br>Course: Open Elective-II<br>(Fundamentals of Bioenergy)<br>**Teaching Scheme:**<br>Theory: 03 Hrs/week | Credits: 3-0-0<br>Mid Semester Examination-I: 15 Marks<br>Mid Semester Examination-II: 15 Marks<br>Teacher Assessment: 10 Marks<br>End Semester Examination: 60 Marks<br>End Semester Examination (Duration): 3 Hrs |

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|---|---|
| **Prerequisite** | Biomass sources and waste to energy recovery |
| **Objectives** | 1.Understand bioenergy technologies, processes, reactions and energy conversion rates for anaerobic Digestion, gasification, pyrolysis, and combustion<br>2.Know what constitutes a suitable feedstock for bioenergy applications |
| **Unit-I** | **Introduction to bioenergy-** Introduction, Unit of Energy and Introduction of Bioenergy, How Biomass Formed on the Earth, Road Map of Bioenergy, Basic Biomass Technology (Resources and Production) Exploration of Photosynthesis Process. **(6 Hrs)** |
| **Unit-II** | **Biogas-** Basic concept in anaerobic digestion and bio gasification, mechanism of anaerobic digestion, Biochemical methane potential assay and calculations for bio gasification feasibility analysis, Biogas utilization, Biomass production System and their Categorization, Components of biogas plants. **(6 Hrs)** |
| **Unit-III** | **Bioethanol-** Basic concept of Cellulosic Bioethanol Process, Pre-treatment and Enzyme treatment of Cellulosic Bioethanol Process, Fermentation and Distillation in Cellulosic Bioethanol Production, characteristics of bioethanol. **(6 Hrs)** |
| **Unit-IV** | **Biodiesel-** Biodiesel production processes, Biodiesel characterization, Biodiesel feedstocks, biodiesel characteristics, Environmental permitting, and safety considerations for biodiesel production. **(6 Hrs)** |
| **Unit-V** | **Thermo Chemical Processes:** Basic concepts in gasification and pyrolysis, Gasification and pyrolysis systems, Gasification Types - Up Drift Gasifier, Down Draft and cross flow gasifier, operation, and performance of gasifier. **(6 Hrs)** |
| **Unit-VI** | Bioenergy distribution and end use for a sustainable future: Biological root of gasification, non-conventional energy sources, waste-to-energy recovery. **(6 Hrs)** |

**Textbook/ Reference Books**

| Sr. No. | Title | Author | Publication | Edition |
|---|---|---|---|---|
| 1. | Introduction to Bioenergy (Energy and the Environment) | Vaughn C. Nelson (Author), Kenneth L. Starcher | CRC press | - |
| 2. | Bioenergy: Biomass to Biofuels | Anju Dahiya | AP Publications | - |
| 3. | Bioenergy: Principles and Applications | Yebo Li and Samir Kumar Khanal | Wiley Publications | 1st edition |

**Dr. Babasaheb Ambedkar Marathwada University, Aurangabad**

**(Faculty of Science & Technology)**

**Syllabus of Third Year B. Tech. (All) Semester VI**

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|---|---|
| Course Code: CED381<br>Course: Open Elective-II<br>(Solid Waste Management)<br>**Teaching Scheme:**<br>Theory: 03 Hrs/week | Credits: 3-0-0<br>Mid Semester Examination-I: 15 Marks<br>Mid Semester Examination-II: 15 Marks<br>Teacher Assessment: 10 Marks<br>End Semester Examination: 60 Marks<br>End Semester Examination (Duration): 3 Hrs |

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| **Prerequisite** | Environmental Engineering |
| **Objectives** | 1. To get introduced to the generation, collection, and management of the various types of solid waste and different waste management techniques. |
| **Unit-I** | **Introduction to Solid Waste Management (SWM):** Need and Objectives, Waste Management Hierarchy, Functional elements, Environmental impact of mismanagement. Solid waste: Sources, types, Composition, Quantities, Physical, chemical, and biological properties. **(6 Hrs)** |
| **Unit-II** | **Generation of solid waste: Factors affecting.**<br>**Storage and collection:** General considerations for waste storage at source, Types of collection Systems, Transfer station: Meaning, Necessity, Transportation of solid waste: Means and Methods, Routing of vehicles. **(6 Hrs)** |
| **Unit-III** | **Segregation and Material Recovery:** Objectives, Stages of segregation, sorting operations, Guidelines for sorting for materials recovery, E waste management, Biomedical waste management. **(6 Hrs)** |
| **Unit-IV** | **Waste processing: processing technologies**: Composting, thermal conversion technologies incineration, treatment of biomedical wastes. Energy recovery from solid waste: Parameters affecting energy recovery, Bio-methanation, Fundamentals of thermal processing, Pyrolysis, Incineration, Advantages, and disadvantages of various technological options. **(6 Hrs)** |
| **Unit-V** | **Disposal:** Landfills and its introduction, Definition, Essential components, Site selection, Land filling methods, Leachate analysis and landfill gas management, treatment & disposal, Determination of capacity of landfill disposal site. **(6 Hrs)** |
| **Unit-VI** | **Hazardous waste management (HWM):** Types of hazardous waste (such as nuclear, biomedical, and industrial waste), problems and issues related to HWM, Need for HWM, Legislations on management and handling of HW, Hazardous Characteristics, reduction of wastes at source, Recycling, and reuse, labeling and handling of hazardous wastes, incineration, solidification & stabilization of hazardous waste. **(6 Hrs)** |

| **Textbook/ Reference Books** | **Sr. No.** | **Title** | **Author** | **Publication** | **Edition** |
|---|---|---|---|---|---|
| | 1. | Integrated Solid Waste Management | Hilary Theisen and Samuel A, Vigil, George Tchobanoglous | McGraw- Hill, New York | 1993 |

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| | 2. | Manual on Municipal Solid waste management | CPHEEO, Central Public Health and Environmental Engineering Organization | Government of India, New Delhi | 2000 |
| | 3. | Environmental Resources Management and Hazardous waste Management, | Michael D. LaGrega, Philip L Buckingham, Jeffrey C. E vans | Mc-Graw Hill International edition, New York | 2001 |
| | 4. | Solid waste Engineering | Vesilind P.A., Worrell W and Reinhart | Thomson Learning Inc., Singapore | 2002 |
| | 5. | Hazardous Waste Management | Charles A. Wentz | McGraw Hill International Edition,New York | 1995 Second Edition |

| Dr. Babasaheb Ambedkar Marathwada University, Aurangabad<br>(Faculty of Science & Technology)<br>Syllabus of Third Year B. Tech. (All) Semester VI | |
|---|---|
| Course Code: CSE381<br>Course: Open Elective-II<br>(Information &Cyber Security)<br>**Teaching Scheme:**<br>Theory: 3 Hrs/week | Credits: 3-0-0<br>Mid Semester Examination-I: 15 Marks<br>Mid Semester Examination-II: 15 Marks<br>Teacher Assessment: 10 Marks<br>End Semester Examination: 60Marks<br>End Semester Examination (Duration):3 Hrs |
| **Prerequisite** | Knowledge of Computer Networking is necessary to understand the concepts. |
| **Objectives** | 1. To understand the foundations of Information Security.<br>2. To learn various types of algorithms and its applications of Cyber Security<br>3. To identify insights on how to apply Cyber Security |
| **Unit-I** | **Introduction**<br>The History of Information Security, Balancing Information Security and Access, Introduction and Security Trends, General Security Concepts, and introduction to what is an "infosphere", Operational Security and People's Role in Information Security. **(6 Hrs)** |
| **Unit-II** | **Security Needs**<br>The Need for Security, Business Needs, needs to protect against Threats and Attacks, Security in Emails. Secure Software Development.<br>Essential Terminologies: CIA, Risks, Breaches, Threats, Attacks, Exploits. **(6 Hrs)** |
| **Unit-III** | **Cryptography Concepts**<br>Concepts of Data encryption, Introduction, Plaintext & Cipher text, Substitution Techniques, Transposition Techniques, Encryption & Decryption, Symmetric &Asymmetric key Cryptography. Public Key Infrastructure (PKI), Different attacks on Cryptosystems. **(6 Hrs)** |
| **Unit-IV** | **Internet Standards and Authentication**<br>Basic concepts of Internet Standards and Physical Security, Network Security and Infrastructure, Authentication Basics, Password, Authentication Token, Certificate based Authentication, Basics of authentication in Wireless Networks, Need of authentication in Wireless Communication. **(6 Hrs)** |
| **Unit-V** | **Security in Evolving Technology**<br>Biometrics, Mobile Computing and Hardening on android and iOS, IOT Security, Web server configuration and Security. Introduction, Basic security for HTTP Applications and Services, Basic Security for Web Services like SOAP, REST etc., Identity Management and Web Services, Authorization Patterns, Security Considerations, Challenges. Open Source/ Free/ Trial Tools: adb for android, xcode for ios. **(6 Hrs)** |
| **Unit-VI** | **Cyber Security Vulnerabilities& Safeguards**<br>Vulnerabilities-Overview, vulnerabilities in software, System administration, Open Access to Organizational Data, Weak Authentication, Authorization, Unprotected Broadband communications, Poor Cyber Security Awareness.<br>Cyber Security Safeguards- Overview, Access control, IT Audit, Authentication. Open |

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| | Web Application Security Project (OWASP), Web Site Audit and Vulnerabilities assessment. Open Source/ Free/ Trial Tools: Win Audit, Zap proxy (OWASP), burp suite, DVWA kit. **(6 Hrs)** | | | | |
| **Textbook/ Reference Books** | **Sr. No.** | **Title** | **Author** | **Publication** | **Edition** |
| | 1 | Cryptography and Network Security | William Stallings | Pearson Education/PHI | 2006 |
| | 2 | Cryptography and Network Security | V.K. Jain | Khanna Publishing House. | |
| | 3 | Principles of Information Security | Michael E Whitman and Herbert J Mattord | Vikas Publishing House, New Delhi. | |
| | 4 | Handbook of Information Security Management | Micki Krause, Harold F. Tipton, | CRC Press LLC | |
| | 5 | Information and Cyber Security | Gupta Sarika | Khanna Publishing House, Delhi. | |
| | 6 | Cryptography and Network Security | Atul Kahate | McGraw Hill. | |

| Dr. Babasaheb Ambedkar Marathwada University, Aurangabad<br>(Faculty of Science & Technology)<br>Syllabus of Third Year B. Tech. (All) Semester VI | |
|---|---|
| Course Code: EED381<br>Course: Open Elective-II<br>(Electrical materials)<br>**Teaching Scheme:**<br>Theory: 03 Hrs/week | Credits: 3-0-0<br>Mid Semester Examination-I: 15Marks<br>Mid Semester Examination-II: 15 Marks<br>Teacher Assessment: 10 Marks<br>End Semester Examination: 60 Marks<br>End Semester Examination (Duration): 3Hrs |
| **Prerequisite** | Basics of Electrical and Electronics Engineering, Physics, Chemistry |
| **Objectives** | 1. To understand Basic electrical and electronics engineering.<br>2. To understand Electromagnetism and its laws.<br>3. To study the conducting and superconducting materials<br>4. To study the dielectric and nano materials |
| **Unit-I** | **Crystallography**<br>Crystal directions and planes, Diatomic Crystal (CsCl, NaCl, Diamond, BaTiO3) Crystal imperfection, Point defects, Line defects, Surface and Volume defects, Structure properties relationship, structure determination by X-ray diffraction. **(8 Hrs)** |
| **Unit-II** | **Magnetic Materials**<br>Origin of magnetization using atomic theory, classification of magnetic materials and properties, Laws of magnetism, comparison of electrical and magnetic circuits<br>theory of Día, Para and ferromagnetism, Soft and Hard magnetic materials and their uses, Domain theory of ferromagnetism, Hysteresis loss, Antiferromagnetic and Ferrimagnetic materials, Ferrites and Garnets. **(5 Hrs)** |
| **Unit-III** | **Conducting and Superconducting Materials**<br>Band theory of solids, Classical free electron theory of metals, Quantum free electron theory, Density of energy states and carrier concentration, Fermi energy, Temperature and Fermi energy distribution, Superconductivity, Factor affecting Superconductivity, Meissner effect, Type-I and Type-II superconductors, BCS theory, Josephson effect, High temperature superconductors, Application of superconductors. **(5 Hrs)** |
| **Unit-IV** | **Semiconducting Materials**<br>Band structure of semiconductor, Charge carrier concentration, Fermi level and temperature, Electrical conductivity, Hall effect in semiconductors, P-N junction diode, Preparation of single crystals, LED, Photovoltaic cell. **(6 Hrs)** |
| **Unit-V** | **Dielectric Materials**<br>Dielectric constant and polarizability, types of polarization, temperature and frequency dependences of Dielectric parameter, internal fields in solids, Clausius-Mosotti equation, dielectric loss, dielectric breakdown, ferroelectric, pyroelectric and piezoelectric materials, applications of dielectric materials. **(6 Hrs)** |
| **Unit-VI** | **Nano Materials**<br>Nanomaterials: Introduction and properties, synthesis of nanomaterials, Carbon Nano Tubes, Characterization techniques of nanomaterials- SEM, TEM, EDAX, FMR, XRD. Applications of nanomaterials. **(6 Hrs)** |

| | Sr. No. | Title | Author | Publication | Edition |
|---|---|---|---|---|---|
| **Textbook/ Reference Books** | 1. | Electrical engineering materials | A.J.Dekkar | McGraw Hill Publication | Edition 2 |
| | 2. | Science of Engineering Materials and Carbon Nanotubes | C.M. Srivastava and C. Srinivasan | New Academic Science | Edition 3 |
| | 3. | Material Science and Engineering | V.Raghavan | PHI Learning | Edition 5 |
| | 4. | Solid State Physics | A.J.Dekkar | Laxmi publication | Edition 3 |

**Dr. Babasaheb Ambedkar Marathwada University, Aurangabad**

**(Faculty of Science & Technology)**

**Syllabus of Third Year B. Tech. (All) Semester VI**

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|---|---|
| Course Code: ETC381<br>Course: Open Elective-II<br>(Internet of Things)<br>**Teaching Scheme:**<br>Theory: 3 Hrs/week | Credits: 3-0-0<br>Mid Semester Examination-I: 15 Marks<br>Mid Semester Examination-II: 15 Marks<br>Teacher Assessment: 10 Marks<br>End Semester Examination: 60 Marks<br>End Semester Examination (Duration):3 Hrs |

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|---|---|
| **Prerequisite** | Python Fundamentals, basics of electronics, Networking fundamentals, WWW Terminology |
| **Objectives** | 1. To understand IoT value chain structure (device, data cloud), application areas and technologies involved<br>2. To understand IoT sensors and technological challenges faces by IoT devices.<br>3. Explore and learn about Internet of things with the help of projects |
| **Unit-I** | **Introduction to IoT:**<br>Industry 4.0., Definition of IoT- Evolution of IoT and related terms, hardware, software, network stack for IoT, SAAS Model **(6 Hrs)** |
| **Unit-II** | **Elements of IoT:**<br>Introduction to elements of IoT, Basic Architecture of an IoT application sensors, and Actuators, WPAN and LPWAN, 6LoPAN, Sigfox **(6 Hrs)** |
| **Unit-III** | **IoT Sensors:**<br>Node MCU ESP 8266- hardware specification, GPIO programming, WIFI connectivity programming, Access Point Programming, Introduction to basis looping and conditional statements, basics of HTML. **(6 Hrs)** |
| **Unit-IV** | **Communication and Connectivity Technologies:**<br>Introduction to: TCP/IP, UDP, NTP, MQTT, Network and Sockets, Cloud Computing in IoT, IoT Communication Model **(6 Hrs)** |
| **Unit-V** | **Data Analytics and IoT Platforms:**<br>Basics of statistics, Descriptive statistics, and probability distributions. Big Data Analytics, Hadoop, Data Visualization, IoT Platforms Things speak, Microsoft Azure and Amazon Web Services, IBM Watson, Google Home and Amazon's Alexa **(6 Hrs)** |
| **Unit-VI** | **Preparing IoT Projects**<br>Creating the sensor project with Node MCU ESP 8266, Sensor libraries, Internal representation of sensor values, External representation of sensor values, Exporting sensor data, Creating the actuator project **(6 Hrs)** |

| **Textbook/ Reference Books/ Web** | **Sr. No.** | **Title** | **Author** | **Publication** | **Edition** |
|---|---|---|---|---|---|
| | 1. | The Internet of Things: Applications and Protocols, | Oliver Hersent, David Boswarthick, | Wiley publications | First |

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| | | | Omar Elloumi | | |
| | 2. | Architecting the Internet of Things, | Dieter Uckelmann, Mark Harrison, Florian Michahelles | Springer publications. | First |
| | 3. | Internet of Things with Arduino | Marco Schwatrz | Cookbook, Packt Publications | First |
| | 4. | Internet of Things | Arshdeep Bagha, Vijay Madisetti | Universities Press (India) Pvt. Ltd. | First |
| | 5. | Introduction to internet of things - Course (nptel.ac.in) | | | |

**Dr. Babasaheb Ambedkar Marathwada University, Aurangabad**
**(Faculty of Science & Technology)**
**Syllabus of Third Year B. Tech. (All) Semester VI**

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|---|---|
| Course Code: MED381<br>Course: Open Elective II- (Industry 4.0)<br>**Teaching Scheme:**<br>Theory: 03 Hrs/week | Credits: 3-0-0<br>Mid Semester Examination-I: 15 Marks<br>Mid Semester Examination-II: 15 Marks<br>Teacher Assessment: 10 Marks<br>End Semester Examination: 60 Marks<br>End Semester Examination (Duration): 3Hrs |

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| **Prerequisite** | 1.Computer fundamentals and understanding of basics of information technology.<br>2.Understanding of basic concepts of production and manufacturing technology |
| **Objectives** | 1. To make students aware of the structure and role of Industry 4.0, in current evolving industrial environment.<br>2. To give learners overview of Industry 4.0 technologies and their integration. |
| **Unit-I** | **Introduction-** Four industrial revolutions, Digital transformation of Industry and the fourth industrial revolution, Scope of Industry 4.0, Automation pyramid and Industry 4.0, Principles of Industry 4.0. **(6 Hrs)** |
| **Unit-II** | **Internet of Things (IoT)–** Concept of IoT, IoT Architecture – Sensing layer, Network layer, Data processing layer, Application layer, Applications of IoT – for automobiles, homes, etc. Internet of Service (IoS), Internet of Energy (IoE). **(6 Hrs)** |
| **Unit-III** | **Technologies in Industry 4.0 (1)**-Augmented reality and Virtual Reality, 3D Printing, Collaborative robots, Smart material handling, Smart sensors, Concept of smart products. **(6 Hrs)** |
| **Unit-IV** | **Technologies in Industry 4.0 (2)-** Machine learning, Introduction to Cyber Physical Systems (CPS), Components of Cyber Physical Systems, Digital twins, Machine vision, Smart factory, Artificial intelligence. **(6 Hrs)** |
| **Unit-V** | **Data in Industry 4.0-** Big Data, Data Mining, Data Analytics, Cloud computing, Data – anew resource of organization, Data analysis for optimal decision making, Digitalization of the entire value chain. **(6 Hrs)** |
| **Unit-VI** | **Applications of Industry 4.0-** Industry 4.0 in Manufacturing – Predictive maintenance, Real-time supply-chain optimization, Digital performance management, Smart energy consumption, Challenges in implementing Industry 4.0. **(6 Hrs)** |

**Textbook/ Reference Books**

| Sr. No. | Title | Author | Publication | Edition |
|---|---|---|---|---|
| 1. | Industry 4.0_ the Industrial Internet of Things | Industry 4.0_ the Industrial Internet of Things | Industry 4.0_ the Industrial Internet of Things | |
| 2. | Industry 4.0_ Managing The Digital Transformation | Alp Ustundag, Emre Cevikcan | Springer | |
| 3. | Automated Manufacturing System | Hugh Jack | - | |
| 4. | Industry 4.0_Opportunities Behind The Challenge | Dr. Mirjana Stankovic, Ravi Gupta and Dr. Juan | UNIDO General Conference | |

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| | | | E. Figueroa | 2017 | |
| | 5. | Handbook of Ind. Automation | Richard L. Shell<br>Ernest L. Hall | Marcel Dekker | |

| Dr. Babasaheb Ambedkar Marathwada University, Aurangabad<br>(Faculty of Science & Technology)<br>Syllabus of Third Year B. Tech. (All) Semester VI | |
|---|---|
| Course Code: PPE381<br>Course: Open Elective-II: (Polymer Recycling and Waste Management)<br>**Teaching Scheme:**<br>Theory: 03 Hrs/week | Credits: 3-0-0<br>Mid Semester Examination-I: 15 Marks<br>Mid Semester Examination-II: 15 Marks<br>Teacher Assessment: 10 Marks<br>End Semester Examination: 60 Marks<br>End Semester Examination (Duration): 3Hrs |
| **Prerequisite** | Basic knowledge of polymeric materials, additives, and their properties.<br>Basic knowledge of polymer rheology and processing. |
| **Objectives** | 1. To learn the basic concepts used in the recycling of polymers along with learning about solid waste management. |
| **Unit-I** | **Significance of Recycling**<br>Introduction and classification of waste. Global polymer production and consumption, Global polymer waste composition, quantities and disposal, Identification of polymer for recycling.<br>Recycling Process: collection, sorting and segregation of waste, Use of advanced technologies such as artificial intelligence in sorting, Recycling methods: primary, secondary, tertiary, and quaternary recycling, land filling. **(6 Hrs)** |
| **Unit-II** | **Recycling Equipment/Machinery**<br>Equipment for primary and secondary recycling: shredder, granulator, pulverized, shredder, cutter, Classification, and types of reactors for tertiary recycling, Case study on waste to energy conversion plant. **(5 Hrs)** |
| **Unit-III** | **Recycling of Plastics from Urban Waste**<br>Physiochemical, mechanical, and rheological characteristics of recycled plastics, hydrolytic treatment of plastics waste containing paper, mixed plastic waste and its processing, recycling extrusion and additives used in polymer recycling, wood plastic composites, use of x-ray photoelectron spectroscopy (XPS) in recycling, international standards in recycling. **(7 Hrs)** |
| **Unit-IV** | **Recycling Techniques**<br>PE/PP packaging films and woven sacks, PET bottles and films, PVC products, fiber reinforced plastics (FRP), and rubber products. **(6 Hrs)** |
| **Unit-V** | **Municipal Solid Waste Management and Treatment Techniques**<br>Collection, storage, transportation, and disposal of municipal solid waste, sorting of MSW, vehicles and equipment for primary collection, secondary collection, and transport.<br>a) Sanitary land filling: Requirements, layout, leach ate management, waste placement and inspection.<br>b) Composting: windrow, aerated static pile, in vessel, decentralized, bin, box and vermicomposting.<br>c) Bio methanation and refuse derived fuel. **(7 Hrs)** |

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| **Unit-VI** | **Tools for Combating Polymer Waste**<br>Combating tools for waste management: Case studies on extended producer responsibility, product stewardship, usage of green products and usage of biodegradable or environmentally degradable polymers, plastic roads. **(5 Hrs)** | | | | |
| **Textbook/ Reference Books** | **Sr. No.** | **Title** | **Author** | **Publication** | **Edition** |
| | 1. | Plastics Fabrication and Recycling | Manas Chanda and Salil K. Roy | CRC Press | 4th (2007) |
| | 2. | Introduction to Plastics Recycling | Vannessa Goodship | Smithers Rapra | 2nd (2006) |
| | 3. | Recycling of Polymers | Raju Francis | Wiley-VCH | 1st (2016) |
| | 4. | Recycling of Plastic Materials | Francesco Paolo La Mantia | Chemtec Publishing | 2nd (1993) |
| | 5. | Feedstock Recycling and pyrolysis of waste plastics | John Schiers & W. Kaminsky | John Wiley and Sons | 1st (2006) |
| | 6. | Mixed Plastic Recycling Technology | B. Hegberg, G. Brenniman | Noyes Data Corporation | 1st (1992) |
| | 7. | Plastics Waste: Recovery of Economic value | Jacob Leidner | Marcel Decker Inc. | 2nd (2001) |
| | 8. | Management of municipal solid waste | T. V. Ramchandra | TERI Press | 1st (2009) |
| | 9. | Waste Management | Martin F. Lehmann | I. A. Publishers | 1st (2008) |
| | 10. | Environmental Waste Management | Ram Chandra | CRC Press | 1st (2015) |
| | 11. | Plastic Waste | Jacob Leidner | Marcel Decker Inc. | 1st (1981) |

| Dr. Babasaheb Ambedkar Marathwada University, Aurangabad<br>(Faculty of Science & Technology)<br>Syllabus of Third Year B. Tech. (Electrical Engineering) Semester-VI | |
|---|---|
| Course Code: EED371<br>Course: Laboratory of Power System Analysis<br>**Teaching Scheme**: Practical: 2 Hrs/week | Credits: 0-0-1<br>Practical: 25 Marks |
| **Objectives:** | 1. To measure parameters of transmission lines.<br>2. To analyze various types of faults in power systems.<br>3. To perform load flow analysis. |
| **List of Practical:** | 1. Determine the ABCD, H, Z & Image parameters of short transmission line<br>2. Determine the ABCD, H, Z & Image parameters of medium transmission line. For T and pi network<br>3. Determine the ABCD, H, Z & Image parameters of long transmission line<br>4. Measure the receiving end voltage of each line under no load or lightly load condition to understand Ferranti effect.<br>5. Understand the performance of transmission line under different loads with varying resistive, inductive, and capacitive load in different steps.<br>6. Line to Ground (L-G) fault analysis of a single-phase transmission line<br>7. Line to Ground (L-G) fault analysis of a three-phase transmission line<br>8. Line to Line (L-L) fault analysis of a three-phase transmission line<br>9. Double Line to Ground (L-L-G) fault analysis of a three-phase transmission line<br>10. Symmetrical L-L-L fault analysis of a three-phase transmission line<br>11. Symmetrical L-L-L-G fault analysis of a three-phase transmission line |

The assessment of term work shall be done based on the following.

- Continuous assessment
- Performing the experiments in the laboratory
- Oral examination conducted on the syllabus and term work mentioned above.

| Dr. Babasaheb Ambedkar Marathwada University, Aurangabad<br>(Faculty of Science & Technology)<br>Syllabus of Third Year B. Tech. (Electrical Engineering) Semester-VI | | |
|---|---|---|
| Course Code: EED372<br>Course: Control System Engineering<br>**Teaching Scheme**: Practical: 2 Hrs/week | | Credits: 0-0-1<br>Practical: 25 Mark |
| **Objectives** | : | 1. To develop ability among students for problem formulation, system design and solving skills. |
| **List of Practical** | : | **A) Minimum SEVEN experiments should be conducted**<br>1 Experimental analysis of D.C. Position Control System.<br>2 Experimental determinations of DC servo motor parameters for mathematical modeling, transfer function and characteristics.<br>3 Experimental determinations of AC servo motor parameters for mathematical modeling, transfer function and characteristics.<br>4 Syncro Transmitter & receiver: Modeling, characteristics, and transfer function.<br>5 Experimental study of time response characteristics of R-L-C second order system: Validation using simulation.<br>6. Experimental frequency response determination of Lag and Lead compensator.<br>7. Experimental determination of transfer functions of two tank system.<br>8. PID control of level/Pressure/Temperature control system.<br>**B) Minimum THREE experiments should be conducted**.<br>1. Stability analysis using a) Bode plot b) Root locus c) Nyquist plot using software. 2. Time response of second order system effect of P, PI, PID on it.<br>3. Analysis of closed loop DC position control system using PID controller.<br>4. Effect of addition of pole-zero on root locus of second order system. |

The assessment of term work shall be done based on the following.

- Continuous assessment
- Performing the experiments in the laboratory
- Oral examination conducted on the syllabus and term work mentioned above.

| Dr. Babasaheb Ambedkar Marathwada University, Aurangabad<br>(Faculty of Science & Technology)<br>Syllabus of Third Year B. Tech. (Electrical Engineering) Semester-VI | | |
|---|---|---|
| Course Code: EED373<br>Course: Electrical Drives<br>**Teaching Scheme**: Practical: 2 Hrs/week | | Credits: 0-0-1<br>Practical: 25 Mark |
| **Objectives** | : | 1. To understand the motor drivers and control<br>2. In-depth study on recent drives and its applications |
| **List of Practical** | : | 1. Study of Electrical braking of D.C. Shunt motor (Rheostatic, Plugging).<br>2. Study of Electrical braking of 3-phase Induction Motor (DC Dynamic Braking, Plugging).<br>3. Study of Single-phase converter fed separately excited D.C. motor speed control characteristics (Fully controlled /Semi controlled).<br>4. Study of Three phase (Fully controlled/Semi controlled) converter fed / Dual converter fed/ separately excited D.C. motor (Open Loop Control).<br>5. Study of Chopper fed D.C. series motor speed control characteristics.<br>6. Study of VSI fed 3-phase Induction motor (using V/f control PWM inverter) speed control characteristics.<br>7. Study of Solid-state stator voltage control of 3-phase Induction motor (Using AC voltage Regulator).<br>8. Study of Closed loop speed control of separately excited D.C. motor/ Induction Motor.<br>9. Simulation of starting characteristics of D.C. / 3-phase Induction motor.<br>10.Simulation of an electric drive system for steady state and transient analysis.<br>11.Energy saving Experiment for determining percentage energy saving with damper (Conventional) Control and AC Drive Control.<br>12.Study of parameterization of drives (AC/DC) using manufacturer's drive manual. |

The assessment of term work shall be done based on the following.

- Continuous assessment
- Performing the experiments in the laboratory
- Oral examination conducted on the syllabus and term work mentioned above.

**Dr. Babasaheb Ambedkar Marathwada University, Aurangabad**

**(Faculty of Science & Technology)**

**Syllabus of Third Year B. Tech. (Electrical Engineering) Semester VI**

| Course Code.: EED374 | Title: Major Project I |
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| **Teaching Scheme:** | Practical Examination (Marks): 50 |
| Practical: 04 Hrs/week | Credits:02 |

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| **Objectives** | : | 1. The Projects in the undergraduate study of engineering aims at developing in the student, knowledge, and skills to match the current and projected needs of industry, society, or user systems and to create social awareness and professional attitudes. Apart from monitoring the engineering processes and maintenance of engineering work, machines and equipment, an engineer must do investigate survey, collect data, refer handbooks/datasheets, prepare estimates, and design the systems. |
| **Contents** | : | • The completion of project is to be carried out in two semesters i.e., in Third Year Sem. VI and Final Year B. Tech Sem. VII.<br>• The students shall form project group of maximum 3 students for within department projects and maximum of 6 students in case of interdisciplinary projects of their choice.<br>• The students' groups shall collect the information on the topic/area of interest and submit brief synopsis to Project Coordinator.<br>• The Project Coordinator shall allot the Project Guide depending upon the area or specialization of eligible faculty members from the department.<br>• The individual student from the project group shall maintain the project diary and update weekly by taking remark of respective guide.<br>• The industry sponsored projects and inter departmental projects shall be encouraged and in case of inter departmental projects, students of maximum 3 different departments/disciplines shall work together by forming the group. The guide allotment and internal/external assessment of such groups shall be done by the respective departments.<br>• The projects addressing issues related to environmental, rural development and societal issues shall be preferred.<br>• The selected project shall help to promote participation in government approved schemes like Unnat Maharashtra Abhiyaan (UMA) and Unnat Bharat Abhiyaan |

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| | | (UBA).<br>• The students shall aim to promote their project work in project exhibitions/competitions, paper presentation/publication in reputed journals and conferences.<br>• The relevance of project and implementation including details of attainment of POs and PSOs addressed through the projects with justification must be clearly stated.<br>**Phases of Major Project - I:**<br>**Phase I:** Problem Identification, Literature survey, data collection, deciding scope of topic and objectives and Methodology of the project.<br>**Phase II:** Confirmation of block diagram or layout of the proposed project.<br>**Phase III:** Submission of report of project work. |

| Dr. Babasaheb Ambedkar Marathwada University, Aurangabad<br>(Faculty of Science & Technology)<br>Syllabus of Third Year B. Tech. (Electrical Engineering) Semester-VI | | |
|---|---|---|
| Course Code: EED375<br>Course: Engineering Science Course (Simulation and Hardware Interfacing)<br>**Teaching Scheme:** 02 Hrs/week | | Credits:0-0-1<br>Term Work: 25 Mark |
| **Objectives** | : | 1. To understand and develop among students about simulation software interfacing with hardware and develop electrical engineering problem using simulation software like MATLAB, PSIM, PSCAD, PROTEUS etc. |
| **List of Practical** | : | 1.Speed control of dc motor.<br>2. Generation of various types of PWM.<br>3. A simple battery monitoring and charging system.<br>4. Designing and frequency calculation of RC phase shift oscillator.<br>5. LCD interfacing with Microcontroller.<br>6. Speed control of stepper motor using Microcontroller.<br>7.Simulation of Single phase full controlled rectifier using R and RL load Scilab.<br>8. Simulation of Single-phase inverter using R and RL load.<br>9. Interfacing Arduino with Scilab.<br>10. Interfacing Arduino with Scilab for blinking LED.<br>11. Interfacing Arduino with Scilab to control DC motor.<br>12. Interfacing Arduino with Scilab to control servo motor.<br>13. Developing Raspberry Pi 3 into a Portable PC.<br>14. IoT using Raspberry pi 3 (controlling LED) |

The assessment of term work shall be done based on the following.

- Continuous assessment
- Performing the experiments in the laboratory
- Oral examination conducted on the syllabus and term work mentioned above.

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**Syllabus of Third B. Tech. (All) Semester-VI**

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|---|---|
| Code No.: BSH807<br>Course: Mandatory Non-Credit Course:<br>(German Language)<br>**Teaching Scheme**: Theory: 02 Hours per week | Credit- 0-0-0<br>Total Marks: 50 (Continuous Assessment) |

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|---|---|---|
| **Objectives** | | 1. Students will be able to apply communicative German Grammar in communication.<br>2. Students will be able to enhance the level of German vocabulary.<br>3. Students will be able to pronounce and articulate words as well as sentences accurately.<br>4. Students will be able to understand and apply German language eventually.<br>5. Students will be able to develop German language skills.<br>6. Students will be able to manage situational communication in German. |
| **Unit-I** | : | **Introduction**<br>- Self –Introduction<br>- Nos. up to 10,000<br>- Weekdays, Months<br>- Date and Time<br>- Greetings **(6 Hrs)** |
| **Unit-II** | : | **Vocabulary**<br>- My house<br>- My family<br>- Daily routine<br>- Hobbies<br>- Food **(6 Hrs)** |
| **Unit-III** | : | **Grammar**<br>- Verb forms (Present Tense)<br>- Articles<br>- Possessive pronouns<br>- Auxiliary verbs<br>- Wh-Questions / Yes-No Questions<br>- Past-Tense of haben and sein **(12 Hrs)** |

| **List of Reference** | **Sr. No.** | **Title** | **Author** | **Publication** |
|---|---|---|---|---|
| **Books** | 1 | German Made Simple: Learn to speak and understand German quickly and easily | Arnold Leitner PhD | Namrata's Amazon.in |
| | 2 | The Everything Learning German Book: Speak, | Edward Swick | Adams Media |

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|---|---|---|---|---|
| | | write, and understand basic German in no time | | |
| | 3 | Langenscheidt German in 30 Days | Von Angelika G. Beck | Langenscheidt |
| | 4 | Complete German Beginner to Intermediate Book and Audio Course: Learn to read, write, speak and understand a new language with Teach Yourself | Heiner Schenke | The McGraw Hill |
| | 5 | German: How to Speak and Write It (Beginners' Guides) | Joseph Rosenberg | Repro Books |
| | 6 | Collins Easy Learning – Collins Easy Learning German Grammar and Practice | Collins | Collins |

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**Syllabus of Third Year B. Tech. (All) Semester-VI**

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|---|---|
| Course Code.: BSH808<br>Course: Mandatory Non-Credit Course:<br>(Japanese Language)<br>**Teaching Scheme:**<br>Theory: 02 Hours per week | Credit- 0-0-0<br>Total Marks: 50 (Continuous Assessment) |

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| **Objectives** | | 1. Students will be able to apply communicative Japanese Grammar in communication.<br>2. Students will be able to enhance the level of Japanese vocabulary.<br>3. Students will be able to pronounce and articulate words as well as sentences accurately.<br>4. Students will be able to understand and apply Japanese language eventually.<br>5. Students will be able to develop Japanese language skills.<br>6. Students will be able to manage situational communication in Japanese. |
| **Unit-I** | : | **Introduction**<br>- Introduction<br>- Numbers<br>- Days, Months, Dates **(8Hrs)** |
| **Unit-II** | : | **Grammar**<br>- Verb and verb forms<br>- Present and Past Tense **(8 Hrs)** |
| **Unit-III** | : | **Communication**<br>- Introduction of Japanese script<br>- Dialogues (Shopping, in the restaurant)<br>- Themes: Family, my city, my country, my friend **(8 Hrs)** |

| **List of Reference Books** | **Sr. No.** | **Title** | **Author** | **Publication** |
|---|---|---|---|---|
| | 1 | Japanese Kanji for Beginners | Timothy G. Stout and Kaori Hakone | Tuttle Publishing |
| | 2 | Essential Japanese Grammar: A Comprehensive Guide to Contemporary Usage | Masahiro Tanimori and Eriko Sato Ph.D. | Tuttle Publishing |
| | 3 | 15-Minute Japanese: Learn in Just 12 Weeks | D.K. Goel and Rajesh Goel | Amazon.in |
| | 4 | Oxford Japanese Grammar | Bunt Jonathan | Oxford Publication |

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| | | and Verbs (Dictionary) | | |
| | 5 | Read and write Japanese scripts: Teach yourself | Helen Gilhooly | Teach Yourself |
| | 6 | Complete Japanese Beginner to Intermediate Book and Audio Course: Learn to read, write, speak and understand a new language with Teach Yourself | Helen Gilhooly | Teach Yourself |

| Dr. Babasaheb Ambedkar Marathwada University, Aurangabad<br>(Faculty of Science and Technology)<br>Syllabus of Third Year B. Tech. (All) Semester-VI | |
|---|---|
| Course Code: CED801<br>Course: Mandatory Non-Credit Course:<br>(Professional Ethics and Constitution of India)<br>**Teaching Scheme:**<br>Theory: 02 Hrs/week | Credit- 0-0-0<br>Total Marks: 50 (Continuous Assessment) |
| **Prerequisite** | Knowledge of the basic structure of constitution of India. |
| **Objectives** | 1. To create awareness of Engineering Ethics and human values, instill moral social values, loyalty, and ethical issues. It will allow the students to assimilate with basic information about Indian Constitution, know its salient features and thus functioning of Democracy in India. |
| **Unit-I** | **Professional Ethics:** Definition of Ethics, Professional Ethics, Business Ethics, Corporate Ethics, Engineering Ethics, Personal Ethics; Profession, Professionalism, Professional Responsibility, Professional Ethics; Conflict of Interest, Gift v/s Bribery, Environmental breaches, Negligence, Deficiencies in state of-the-art; Vigil Mechanism, Whistle blowing, protected disclosures. **(4 Hrs)** |
| **Unit-II** | **Engineering and Professionalism:** Positive and Negative Faces of Engineering Ethics, Code of Ethics as defined in the website of Institution of Engineers (India): Profession, Professionalism, and Professional Responsibility. Clash of Ethics, Conflicts of Interest. **(4 Hrs)** |
| **Unit-III** | **Responsibility and reliability in Engineering:** Responsibilities in Engineering and Engineering Standards, the impediments to Responsibility. Trust and Reliability in Engineering, IPRs (Intellectual Property Rights), Risks, Safety, and liability in Engineering. **(4 Hrs)** |
| **Unit-IV** | **Introduction to Indian Constitution:** The Necessity of the Constitution, The Societies before and after the Constitution adoption. Introduction to the Indian constitution, The Making of the Constitution, The Role of the Constituent Assembly - Preamble and Salient features of the Constitution of India. Fundamental Rights and its Restriction and limitations in different Complex Situations. Directive Principles of State Policy (DPSP) and its present relevance in our society with examples. Fundamental Duties and its Scope and significance in Nation building. **(4 Hrs)** |
| **Unit-V** | **Union Executive and State Executive:** Parliamentary System, Federal System, Centre-State Relations. Union Executive – President, Prime Minister, Union Cabinet, Parliament - LS and RS, Parliamentary Committees, Important Parliamentary Terminologies. Supreme Court of India, Judicial Reviews and Judicial Activism. State Executives – Governor, Chief Minister, State Cabinet, State Legislature, High Court and Subordinate Courts, Special Provisions (Articles 370.371,371J) for some States. **(4 Hrs)** |
| **Unit-VI** | **Elections, Amendments and Emergency Provisions:** Elections, Electoral Process, and Election Commission of India, Election Laws. Amendments - Methods in Constitutional |

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| | Amendments (How and Why) and Important Constitutional Amendments. Amendments – 7,9,10,12,42,44, 61, 73,74, ,75, 86, and 91,94,95,100,101,118 and some important Case Studies. Emergency Provisions, types of Emergencies and its consequences. **(4 Hrs)** | | | | |
| **Textbook/ Reference Books** | **Sr. No.** | **Title** | **Author** | **Publication** | **Edition** |
| | 1. | "Engineering Ethics (Including Human Values) | Govindrajan. M, Natrajan S, Senthilkumar V. S | PHI publication | |
| | 2. | Ethics, Integrity and Aptitude | Reddy.N H, Ajmera, Santosh, | Tata McGraw Hill | Latest |
| | 3. | Introduction to the Constitution on India | Durga Das Basu | Prentice –Hall EEE, 19th / 20th Ed. | 2008 and latest |
| | 4. | "Constitution of India and Professional Ethics | Shubham Singles, Charles E. Haries, and Et al | Cengage Learning India Private Limited | Edition – 2018 |
| | 5. | An Introduction to Constitution of India | M.V.Pylee | Vikas Publishing | 2002 |

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**Syllabus of Third Year B. Tech. (All) Semester-VI**

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|---|---|
| Course Code: CSE801<br>Audit Course: Mandatory non-credit course:<br>(Green Computing)<br>**Teaching Scheme:**<br>Theory: 2 Hrs /week | Credit- 0-0-0<br>Total Marks: 50 (Continuous Assessment) |

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| **Prerequisite** | Nil |
| **Objectives** | 1. To learn the fundamentals of Green Computing.<br>2. To understand the concepts related to Green IT, Green devices, and hardware along with software methods, green enterprise activities.<br>3. To study the various laws, standards, protocols for regulating green IT<br>4. To study various case studies related to the application of Green IT strategies. |
| **Unit-I** | **Green IT: An Overview**<br>Introduction, Environmental Concerns and Sustainable Development, Environmental Impacts of IT, Green IT, Holistic Approach to Greening IT, Applying IT for enhancing Environmental sustainability, Green IT Standards and Eco-Libeling of IT. **(4 Hrs)** |
| **Unit-II** | **Green Devices and Hardware with Green Software**<br>Green Devices and Hardware: Introduction, Life Cycle of a device or hardware, Reuse, Recycle and Dispose. Green Software: Introduction, Energy-saving software techniques. **(4 Hrs)** |
| **Unit-III** | **Green Enterprises and the Role of IT**<br>Introduction, Organization and Enterprise Greening, Information systems in Greening Enterprises, Greening Enterprise: IT Usage and Hardware, Inter-Organizational Enterprise activities and Green Issues. **(4 Hrs)** |
| **Unit-IV** | **Managing Green IT:**<br>Introduction, Strategizing Green Initiatives, Implementation of Green IT, Information Assurance, Communication, and social media. **(4 Hrs)** |
| **Unit-V** | **Regulating the Green IT: Laws, Standards and Protocols**<br>Introduction, The regulatory environment and IT manufacturers, non-regulatory government initiatives, Industry associations and standards bodies, green building standards, green data centers, social movements, and Greenpeace. **(4 Hrs)** |
| **Unit-VI** | **Case Studies**<br>The Environmentally Responsible Business Strategies (ERBS) – Case Study Scenarios for Trial Runs – Case Studies – Applying Green IT Strategies and Applications to a Home, Hospital. **(4 Hrs)** |

| **Textbook/ Reference Books** | **Sr. No.** | **Title** | **Author** | **Publication** | **Edition** |
|---|---|---|---|---|---|
| | 1. | Harnessing Green IT Principles and Practices | San Murugesan, G.R. Gangadharan | Wiley Publication | |
| | 2. | Green IT Strategies and Applications-Using | Bhuvan Unhelkar | CRC Press | June 2014 |

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| | | Environmental Intelligence | | | |
| | 3. | The Greening of IT | John Lamb | Pearson Education | 2009 |
| | 4. | Green Home computing for dummies | Woody Leonhard, Katherine Murray | | 2012 |

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**Syllabus of Third Year B. Tech. (All) Semester-VI**

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|---|---|
| Course Code: ETC801<br>Course: Mandatory non-credit course:<br>(Smart Cities)<br>**Teaching Scheme:**<br>Theory: 02 Hrs/week | Credit- 0-0-0<br>Total Marks: 50 (Continuous Assessment) |

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| **Prerequisite** | Nil |
| **Objectives** | 1. To identify urban problems.<br>2. To study Effective and feasible ways to coordinate urban technologies.<br>3. To study models and methods for effective implementation of Smart Cities. |
| **Unit-I** | Smart cities: Ideal Smart City loop, Socio-economic and environmental issues, Implications of Urbanization, Urbanization models and global trends, Urbanization in India. **(4 Hrs)** |
| **Unit-II** | Criteria for smart cities: Smartness - Citizens, Living, Environment, Mobility, Economy, Governance Pillars of Smart cities, Buildings, Utilities, Transportation and road Infrastructure, Health Care, Sustainability issues. **(4 Hrs)** |
| **Unit-III** | Fundamental Technologies: Ubiquitous computing, Big Data, Networking, Internet of Things, Cloud computing, Cyber security architectures. **(4 Hrs)** |
| **Unit-IV** | ICT for Smart Cities: Complex Urban systems ICT Infrastructure modelling, Typical Edge Environment, Smart Cities as Systems of Systems, IoT Centric approach, IoT technologies: WiFi, 6LowPAN, Cellular, NFC, LoRa, Bluetooth, RFID, Zigbee. **(4 Hrs)** |
| **Unit-V** | Smart City: Smart Street lighting, Smart Parking, Environmental pollution monitoring, Vehicular tracking, Smart Traffic Control, Waste Management, Smart Grid, Amenity availability, Heritage Information portal, Mobile application design, development, and Visualization. **(4 Hrs)** |
| **Unit-VI** | Case Studies of Smart Cities: National and International smart cities, their model, Clusters and Urbanization, Environmental Issues: The Role of Local and Global Climate Change **(4 Hrs)** |

| | **Sr. No.** | **Title** | **Author** | **Publication** | **Edition** |
|---|---|---|---|---|---|
| **Textbook/ Reference Books** | 1. | The City of Tomorrow: Sensors, Networks, Hackers, and the Future of Urban Life (The Future Series) | Carlo Ratti and Matthew Claudel | Yale University Press | |
| | 2. | The Responsive City: | Stephen | Jossey Bass – | ll, 1st |

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| | | Engaging Communities Through Data-Smart Governance | Goldsmith, Susan Crawford | Wiley | Edition. |

| Dr. Babasaheb Ambedkar Marathwada University, Aurangabad<br>(Faculty of Science & Technology)<br>Syllabus of T. Y. B. Tech. (All) Semester VI | |
|---|---|
| Course Code: MED801<br>Course: Mandatory noncredit course:<br>(Research Methodology)<br>**Teaching Scheme:**<br>Theory: 02 Hrs/week | Credits: 0-0-0<br>Total Marks: 50 (Continuous Assessment) |

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|---|---|
| **Prerequisite** | Nil |
| **Objectives** | 1. To introduce students to quantitative and qualitative methods for conducting meaningful inquiry and research.<br>2. Prepare a preliminary research design for projects in their subject matter areas<br>3. Accurately collect, analyse, and report data<br>4. Present complex data or situations clearly |
| **Unit-I** | **Research Problems and Research Design:** -Meaning of research, objectives of research, motivation in research, types of research, steps in involved in research process, criteria of good research, significance of research, research methods versus methodology, selection of research problem, steps involved in defining research problem, research process, need for research design, types of research designs, basic principles of experimental design, formal and informal experimental design. **(4 Hrs)** |
| **Unit-II** | **Sampling Design:** -Need for sampling, steps in sampling design, different types of sampling designs, sampling distributions, concept of central limit and standard error, sources of errors, population mean and proportion, sample size calculations, tests of measurements for validity, reliability, and practicality **(4 Hrs)** |
| **Unit-III** | **Data collection, Processing and Analysis:** -Methods for collection of data, selection of data collection method, data processing operations, statistics in research, confidence level, measures of central tendency, dispersion, asymmetry and relationship. Spearman's and Pearson's coefficient of correlation, simple & multiple regression analysis, analysis of variance (ANOVA), factor analysis methods. **(4 Hrs)** |
| **Unit-IV** | **Hypothesis Test:**-Concept of research hypothesis, concept of testing of hypothesis, Procedure for hypothesis testing, Flow diagram for hypothesis testing, Measuring the power of a hypothesis test, Parametric tests (z, t, F and chi-square tests), Hypothesis testing of means and correlation coefficient, Limitations of the tests of hypotheses. **(4 Hrs)** |
| **Unit-V** | **Report Writing**<br>**Interpretation:** Meaning of Interpretation, Why Interpretation? Technique of Interpretation, Precaution in Interpretation.<br>**Report Writing:** Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report, Types of Reports, Oral Presentation, Mechanics of Writing |

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| | a Research Report, Precautions for Writing Research Reports, Conclusions. **(4 Hrs)** | | | | |
| **Unit-VI** | **Ethics:** - Ethical Issues, Ethical Committees, Commercialization, copy right, royalty, Intellectual Property rights and patent law, Reproduction of published material, Plagiarism, Citation and Acknowledgement, Reproducibility, and accountability. **(4 Hrs)** | | | | |
| **Text Book/ Reference Books** | **Sr. No.** | **Title** | **Author** | **Publication** | **Edition** |
| | 1. | Research Methodology: Methods & Techniques | C. R. Kothari and G. Garg | New Age International | 4th |
| | 2. | Research Methodology | R. Pannerselvam | PHI Learning, | 2nd |
| | 3. | Research Methods and Statistics | Bernard C. Beins & Maureen A. McCarthy | Pearson Education Inc. | 2012 |
| | 4. | Research Methods Handbook | Stuart MacDonald & Nicola Headlam | CLES | - |
| | 5. | Intellectual Property Rights--Unleashing the Knowledge Economy, | Ganguli Prabuddha. | Tata McGraw-Hill, | 2001 |
| | 6. | Intellectual Property Rights | Neeraj Pandey and Khushdeep Dharni. | PHI Learning | 1st |
| | 7. | Fundamentals of Intellectual Property Rights, | Ramakrishna B. | Notion Press | 1st |
| | 8. | The Indian Patents Act 1970 (as amended in 2005) | - | - | - |

**Dr. Babasaheb Ambedkar Marathwada University, Aurangabad**

**(Faculty of Science and Technology)**

**Syllabus of Third Year B. Tech. (All) Semester-VI**

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|---|---|
| Course Code: PPE801<br>Course: Mandatory non-credit audit course: (Industrial Safety and Management)<br>**Teaching Scheme:**<br>Theory: 02 Hrs/week | Credit- 0-0-0<br>Total Marks: 50 (Continuous Assessment) |

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| **Objectives** | 1. To understand the fundamental concepts, and methods in Industrial Safety.<br>2. To understand the impact of safe industrial operations, its benefits and safety management. |
| **Unit-I** | **Introduction to Industrial Safety**<br>Introduction, key concepts, terminologies, Need for safety, Safety information system. **(4 Hrs)** |
| **Unit-II** | **Safety Management**<br>Safety inspection, procedure, checklist, safety sampling, safety audit, safety survey, accident prevention, training for safety. **(4 Hrs)** |
| **Unit-III** | **Safety in Process**<br>Safety in material handling and equipment's used, design for safety in process. **(4 Hrs)** |
| **Unit-IV** | **Fire Safety**<br>Classification of fires. Common causes of industrial fires. Fire protection systems. **(4 Hrs)** |
| **Unit-V** | **Hazards**<br>Occupational health hazards, physical and chemical hazards. **(4 Hrs)** |
| **Unit-VI** | **Hazard Analysis**<br>Fault tree and event tree analysis, hazard identification techniques (e.g., HAZOP, HAZAN, OSHAS 18001). **(4 Hrs)** |

**Textbook/ Reference Books**

| Sr. No. | Title | Author | Publication | Edition |
|---|---|---|---|---|
| 1. | Industrial Safety, Health and Environment Management Systems | R. K. Jain and Sunil S. Rao | Khanna Publishers, New Delhi | 2006 |
| 2. | Industrial Safety Management | Deshmukh L M | Tata McGraw-Hill | |
| 3. | Handbook of Occupational Safety and Health | Slote. L | John Willey and Sons, New York | |
| 4. | Safety at Work | Ridley J and Channing J | Butterworth-Heinemann UK | |
| 5. | Loss of prevention in Process Industries, Vol. 1 and 2 | Frank P. Lees | Butterworth-Heinemann Ltd., London | 1991 |
| 6. | Safety Management | Grimaldi and Simonds | AITBS Publishers, New Delhi | 2001 |

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| **Website** | https://nptel.ac.in/courses/110/105/110105094/ |



26/10/21
Dr. V. B. Malode.