Dr. Babasaheb Ambedkar Technological University, Lonere.

B.Tech (Electrical Engineering / Electrical Engineering (Electronics and Power)/ Electrical & Electronics Engg / Electrical & Power Engineering)

Curriculum for Semester VII

Course Category	Course Code	Course Title	Teaching Scheme			Evaluation Scheme				Credit
			L	T	P	CA	MSE	ESE	Total	
PCC10	BTEEC701	High Voltage Engineering	3	1	-	20	20	60	100	4
PCC11	BTEEC702	Power System Operation & Control	3	1	-	20	20	60	100	4
PEC4	BTEEPE703	Group F	3	-	-	20	20	60	100	3
OEC3	BTEEOE704	Group G	3	-	-	20	20	60	100	3
OEC4	BTEEOE705	Group H	3	-	-	20	20	60	100	3
HSSMC	BTHM706	Engineering Operations and Project Management	-	-	-	-	-	-	-	Audit
LC	BTEEL707	High Voltage Engineering Lab	-	-	2	60	-	40	100	1
Project	BTEEM708	Inhouse Project Part-I /Miniproject-III	-	-	4	60	-	40	100	2
Internship	BTEEP609	Internship-III Evaluation	-	-	-	-	-	50	50	1
		Total	**15**	**2**	**10**	**340**	**100**	**510**	**950**	**21**

Semester VIII

Course Category	Course Code	Course Title	Teaching Scheme			Evaluation Scheme				Credit
			L	T	P	CA	MSE	ESE	Total	
PEC5	BTEEPE801	NPTEL online courses	3	-	-	20	20	60	100	3
Project/Internship	BTEEP802	Inhouse Project Part-II /Internship in Industry.	-	-	26	60	-	40	100	12
		Total								15

BSC= Basic Science Course, ESC= Engineering Science Course, PCC= Professional Core Course, PEC= Professional Elective Course, OEC= Open Elective Course, LC= Laboratory Course, HSSMC= Humanities and Social Science including Management Course

Important Note: Minimum Eight Experiment to perform based on the syllabus for the laboratory subject.

Semester VII

BTEEPE703 Professional Elective (Group F)	BTEEOE704 Open Elective (Group G)	BTEEOE705 Open Elective (Group H)
(A) Energy Audit and Conservation	(A) Process Control Instrumentation	(A) Testing, Maintenance and Commissioning of Electrical Equipment
(B) Electrical System Design for Building	(B) Biomedical Instrumentation	(B) Electric and Hybrid Electric Vehicles
(C) Applications of Power Electronics in Power System	(C) Mechatronics	(C) Internet of Things (IoT)
(D) Electrical Utilization		

Mapping of Courses with MOOCs Platform SWYAM / NPTEL

S.N.	Course Name	Duration	Name of Professor	Institute offering Course
1	Power Management Integrated Circuits	12 Weeks	Prof. Qadeer Ahmad Khan	IITM
2	DC Power Transmission Systems	12 Weeks	Prof. Krishna S	IITM
3	High Power Multilevel Converters	12 Weeks	Prof. Anandarup Das	IITD
4	Fuzzy Sets, Logic and Systems & Applications	12 Weeks	Prof. Nishchal Kumar Verma	IITK
5	The Joy of Computing using Python	12 Weeks	Prof. Sudarshan Iyengar Prof. Yayati Gupta	IIT Ropar
6	Introduction to Industry 4.0 and Industrial Internet of Things	12 Weeks	Prof. Sudip Misra	IIT KGP
7	Entrepreneurship Essentials	12 Weeks	Prof. Manoj Kumar Mondal	IIT KGP

BTEEC701 HIGH VOLTAGE ENGINEERING 04 credits

UNIT 1: Introduction to High Voltage Engineering (02 hours)

Electric Field Stresses,Poisson's equation, Estimation and Control of Electric Stress, Surge Voltages, their distribution and control.

UNIT 2: Conduction & breakdown in gases (06 hours)

Gases as insulation media, ionization processes, Townsend's current growth equation, current growth in presence of secondary processes, Townsend's criterion for breakdown in electronegative gases, time lags for breakdown, Streamers theory, Paschen's law, breakdown in non-uniform fields and corona discharge, corona under positive & negative polarities, glow & arc discharge, considerations in using gases for insulation purpose.

UNIT 3: Breakdown in Dielectric Materials (08 hours)

Conduction & breakdown in liquid dielectrics: Pure and commercial liquids, breakdown in pure and commercial liquids, theories of breakdown in liquids. Breakdown in solid dielectrics: Intrinsic, electromechanical& thermal breakdown, chemical, electrochemical deterioration, treeing, tracking, internal discharges, breakdown in composite insulation, properties of solid insulators & other materials used in practice. Insulating materials: In power transformers, rotating machines, circuit breakers, cables, power capacitors & other equipment.

UNIT 4: Over voltage due to lightening phenomenon: (08 hours)

Natural causes for over voltages – Lightning phenomenon, Overvoltage due to switching surges, system faults and other abnormal conditions, propagation of lightning voltage & current waves on transmission lines, reflection & transmission of traveling wave at junction, system control of over voltage due to switching protection of transmission lines against over voltage. Insulation co-ordination, surge diverters, equipment insulation level & co-ordination of substations.

UNIT 5: Generation& Measurement of high voltages & currents: (10 hours)

Generation of a) high d. c voltage b) power frequency high alternating voltage c) high frequency a. c. d) impulse voltages Standard impulse waves shapes and it's equation, multistage impulse generator, marx circuit, generation of switching surges, tripping & control of impulse generators, generation of impulse currents.

Measurement of High Direct Current voltages, Abraham Voltmeter Measurement of High Voltages alternating and impulse, Measurement of High Currents-direct, alternating and Impulse, Oscilloscope for impulse voltage and current measurements

UNIT 6: Non Destructive Testing **(06 hours)**

I. E. C. & IS codes for high voltage tests on electrical appliances & power apparatus &electrical motors, non- destructive testing, testing of insulators, bushings, isolators, circuit breakers, cables, transformers, surge diverter, layout of high voltage laboratories & test facilities.

Reference Books:

1. High Voltage Engineering: Fundamentals by E.Kuffel, W.S.Zaengl, J.Kuffel by Elsevier, 2nd Edition
2. High Voltage Insulation Engineering by Ravindra Arora, Wolfgang Mosch, New Age International (P) Limited, 1995.
3. High Voltage Engineering, Theory and Practice by Mazen Abdel Salam, Hussein Anis, Ahdan El-Morshedy, RoshdyRadwan, Marcel Dekker

Text Books:

1. Kamaraju V. & Naidu M. S., 'High Voltage Engineering', Tata-McGraw Hill
2. C. L. Wadhwa, "High Voltage Engineering", New Age International Pvt. Ltd

BTEEC702 POWER SYSTEM OPERATION AND CONTROL 4 Credits

Unit 1: Reactive Power Management **6 Hours**

Necessity of reactive power control, production and absorption of reactive power, methods of voltage control, shunt reactors, series capacitors, shunt capacitors, synchronous condensers, Static VAR Systems

Unit 2: Power System Stability **6 Hours**

The stability problem-Steady state stability, transient stability and Dynamic stability, Swing equation. Equal area criterion of stability-Applications of Equal area criterion, Step by step solution of swing equation-Factors affecting transient stability, Methods to improve steady state and Transient stability

Unit 3: Excitation Systems **6 Hours**

Excitation Systems: Excitation System requirements, Elements of an excitation system Types of excitation systems. Control and protective functions of Excitation systems

Unit 4: Load Frequency Control **7 Hours**

Introduction, LFC control of a single-area system, Two-Area Load Frequency Control,Automatic voltage Control, Speed governing mechanism and modelling, Speed Governor Dead band and its effect on Automatic Generation Control

Unit 5: Economic Operation of Power System **10 Hours**

Distribution of load between units within a plant, Economic division of load between units in a plant, transmission loss as function of plant generation, calculation of loss-coefficient, numerical Unit Commitment, Constraints on Economic operation of power system, optimum scheduling of hydro-thermal system, long term hydro scheduling in a hydro-thermal system, short term hydro-thermal scheduling, computer approach to solve the short-term hydro-thermal scheduling problem

Text/References Books:

1. P. Kundur, “Power System Stability and Control”, McGraw-Hill, 1993.
2. I. J. Nagrath and D. P. Kothari, Modern Power System Analysis, TMH, 2003
3. A Chakrabarti and S. Halder, Power System Analysis: Operation and Control, PHI, 2006.
4. W. D. Stevenson, Elements of Power system analysis, Mcgraw Hill, Digitized on Dec., 2007.
5. C.L.Wadhwa, Electrical Power Systems, 3rd Edn, New Age International Publishing Co., 2001
6. T. K. Nagsarkar and M. S. Sukhija, Power System Analysis, Oxford University Press, 2007

BTEEPE703A Energy Conservation and Audit **03 Credits**

Unit 1: Sources of Energy and International Agreements **7 Hours**

Energy resources, Stored & running resources, Non-conventional energy sources, Necessity of conserving resources. United Nation Framework Convention on Climate Change. International Agreements – History and Current Agreements – Paris Agreement.

UNIT 2 Energy In Industries **7 Hours**

Energy inputs in industry, Comparison of various energy inputs, Use of electric energy in industries for motive power, Heating (Space, Furnace, Water), Lighting, Air conditioning, Welding, Energy efficiency of the apparatus in above energy conversion processes, Energy efficient design of above processes.

UNIT 3 Energy in Non-industrial Sector **7 Hours**

Different forms of energy used in agricultural, commercial, domestic & municipal sectors.

UNIT 4 Energy Audit **7 Hours**

Audit, A prerequisite for energy conservation, Principles of energy audit, Measurement & measuring devices, Analysis of data, Audit Case Studies.

UNIT 5 Energy Conservation in Utilities and Energy Investment **8 Hours**

Energy conservation in generation, transmission, distribution & utilization, Demand side energy management, Energy efficient lighting system, Energy efficient drives-Critical study & analysis of certain case studies.Planning, Implementation & monitoring of energy conservation project, Time Value of money, Financial Investment.All calculations and numerical interpretation.

Texts/References Books:

1. Charles M Gottschalk , “Industrial Energy Conservation” , John Willey and Sons
2. Keth & Fecher, “Energy Efficiency Handbook”, CRC Publication
3. Paul O Callagham,“Energy Management”, Tata Mc Grawhill
4. S Rao and B Parulekar ,“Energy Technology”, Khanna Publisher

BTEEC703B ELECTRICAL SYSTEM DESIGN FOR BUILDING 3 Credits

Unit 1 System planning **7 Hours**

Preparation of estimate of quantity of material required for wiring of a house (typical plan of house including electric layout is to be given). Drawing of electrical circuit for such electrification. Conductor size, calculations for internal domestic wiring, Permissible voltage drops for lighting and industrial load, Numerical, Conductor size calculation for underground cables: General considerations, Numerical, Basic design considerations.

Unit 2: Study of different types of components in electrical distribution system **8 Hours**

Review of Insulated Wires: Types: Rubber covered taped and compounded or VIR, Lead alloy sheathed, Tough rubber sheathed, Weather proof, Flexible wire splicing, Termination (Twist splicing, Married joint, Tap joint, Pig tail joint) Different Types of Switches: Tumbler, flush, pull, grid, architrave, rotary snap, Push button, Iron clad water proof, Quick break knife switch. Ceiling roses, Mounting blocks, Socket outlets plugs, Main switches, Distribution fuse boards, MCB (Miniature Circuit Breakers)

Unit 3 Cable size selection and Substation **7 Hours**

Load Details Calculation, Cable type and Construction features, Site Installation Conditions, Cable Selection Based on Current Rating of feeder, Introduction, Design consideration of Electrical installation. Introduction, Types of substation, Equipment and Accessories, Outdoor substation- pole mounting type and their SLD & estimation, Indoor substation- floor mounting type and their SLD & estimation.

Unit 4 Protection **7 Hours**

Protection devices such as fuse, Earthing and requirements such as Soil Resistivity, Electrode, Types of earthing, Single phase and three phase installation for residential load, Busbar and Busbar chambers, Mounting of CTs and PTs.

Light Source: Incandescent lamp, Quartz lamps, Fluorescent lamps- General characteristics, Fluorescent lamps types, HID Lamps, Mercury vapour lamps, Metal halide lamps, high pressure sodium lamps, induction lamps.

Unit 5 Electrical Planning **7 Hours**

Procedure in wiring planning, computer used in Electrical Design, the architecture-Electrical plan, Residential Electrical criteria.

Texts/References Books:

1. Electrical Wiring - Estimating & Costing By S.L. Uppal, Khanna Publishers.
2. Electrical Installation Estimating & Costing By J.B. Gupta, S.K. Kataria & Sons Publishers.
3. Electrical Design Estimating And Costing by K.B. Raina, S.K. Bhattacharya, New Age international LTD Publishers.
4. Residential, Commercial and Industrial Electrical Systems by Hemant Joshi, Tata Mcgraw-Hill Publishers.

Reference: Manual of Auto CAD.

BTEEC703CAPPLICATION OF POWER ELECTRONICS IN POWER SYSTEM 3 Credits

Unit 1: Introduction **5 Hours**

Basics of Power Transmission Networks, Introduction to power electronics applications to power system:power generation, power transmission, power quality, active power filter.

Unit 2: Flexible AC transmission systems (FACTS) **9 Hours**

Basic realities & roles, Types of facts controller, Principles of series and shunt compensation Description of static var compensators (SVC), Thyristor Controlled series compensators (TCSC), Static phase shifters (SPS), Static condenser (STATCON), Static synchronous series compensator (SSSC) and Unified power flow controller (UPFC).

Unit 3: Modelling and Analysis of FACTS controllers **7 Hours**

Modelling and analysis of various FACTS controllers (SVC,TCSC,SPS,STATCON and UPFC),Control strategies to improve system stability. Power Quality problems in distribution systems.

Unit 4: Harmonics **7 Hours**

Generation of Harmonics, Harmonics creating loads, modelling, Series and parallel resonances, harmonic power flow, Mitigation of harmonics, active filters, and passive filters.

Unit 5: Active filters **7 Hours**

Shunt, series hybrid filters, voltage sags & swells, voltage flicker. Mitigation of power quality problems using power electronic conditioners. IEEE standards

Text/References Books:

1. R.M. Mathur and R. K. Varma, ―Thyristor-Based FACTS Controllers for Electrical Power Systems‖, IEEE Press and John Wiley, 2002

2. Understanding of FACTs., Hingorani, N. G.; IEEE Press 1996.

3. Power Quality;Heydt G.T.; Stars in a Circle Publications , Indiana, 1991.

4. Static Reactive Power Compensation.; Miller T.J.E.; John Wiley & Sons, New York, 1982

5. Flexible AC Transmission System. (FACTs).; Yong Hua Song.; IEE 1999

6. Recent Publications on IEEE Journals

BTEEC703D ELECTRICAL UTILIZATION 3 Credits

Unit 1: Electrical Heating **7 Hours**

Advantages of electrical heating, Resistance heating, Design of heating element in resistance oven, Control of temperature in resistance oven, Electric arc furnaces, Induction furnaces, Dielectric heating. Electric Welding: Electric arc welding & Resistance welding, Modern welding techniques like Ultrasonic & Laser welding.

Unit 2: Electrolytic Processes **6 Hours**

Faradays laws of electrolysis, Application of electrolysis, Like Electroplating, Anodizing electrical polishing & electroextraction, Accumulators & cell, Types & construction, Charging & discharging, recent trends in manufacturing of batteries.

Unit 3: Illumination **7 Hours**

Requirement of good lighting, Classification of light fitting & luminaries, Factor to be considered for design of indoor & outdoor lighting scheme, Design procedure for factory lighting, flood lighting & street lighting. Design of illumination scheme-Factors to be considered for design of illumination scheme, Calculation of illumination at different points, considerations involved in simple design problems for indoor installation, illumination schemes, standard illumination level.

Unit 4: Electric Traction System: **8 Hours**

Electrical transmission: Electrical transmission system employing D.C. generator D.C. series motor, Electrical transmission system employing 3 phase alternator supplying D.C. traction motors, electrical transmission employing 3 phase alternator supplying induction motors, Choice of traction system-battery drive, hybrid drive, flywheel drive, tramways, trolley bus. Traction Motors: Characteristics of traction motors, straight D.C. series motor, suitability of series motor for traction duty, constructional details of D.C. Traction Motors.

Unit 5: Train Movement and Braking: **7 Hours**

Speed time curve, its analysis and construction, schedule speed and factors affecting it, train resistance and its components. Tractive effort calculations, average acceleration and speed, energy output and consumption.

Braking: Mechanical versus electric breaking, rheostatic braking, Regenerative braking, method and energy saved in the process, Magnetic track brakes.

REFERENCE BOOKS:

1) Utilization of Electrical Power and Electic Traction by J.B. Gupta. (Katson Book publisher)
2) H. Partab: Modern Electric Traction, Dhanpat Rai & sons.
3) Upadhayay J. & Mahindra S.N., Electric Traction, Allied Publishers Ltd., 1st Ed.
4) Rao P.S., Principle of 25 KV Overhead Equipments. R. (Nasik) Printpack Pvt Ltd,, 1st Ed.
5) Electric Traction for Railway Trains, by Edward P. Burch. McGraw Hill Book Co. Inc.
6) Electrical Wiring - Estimating & Costing By S.L. Uppal, Khanna Publishers.

BTEEOE704A PROCESS CONTROL INSTRUMENTATION 3 Credits

Unit 1: Introduction to Process Control **7 Hours**

Mathematical Modeling, Development of mathematical models. Modeling considerations for control purposes

Unit 2: Dynamic Behavior of Chemical Processes **7 Hours**

Computer simulation and the linearization of nonlinear systems, Brief of Laplace transforms, Transfer functions and the input-output models, Dynamics and analysis of first, second and higher order systems.

Unit 3: Feedback Control Schemes **7 Hours**

Concept of feedback control, Dynamics and analysis of feedback-controlled processes, Stability analysis, Controller design, Frequency response analysis and its applications

Unit 4: Advanced Control Schemes **7 Hours**

Feedback control of systems with dead time or inverse response, Control systems with multiple loops, Feed forward and ratio control.

Unit 5: Instrumentation **7 Hours**

Final control elements, measuring devices for flow, temperature, pressure and level Mathematical modeling: Development of mathematical models, modeling consideration for control purpose.

Text /Reference Book:

1. Stephanopoulos, G. (1984). "Chemical process control: an introduction to theory and practice," Prentice-Hall, New Delhi.

2. Seborg, D.E., Edgar, T.F. and Mellichamp, D.A. (2003). "Process dynamics and control," Wiley, New York.

3. Smith, C.A. and Corripio, A.B. (1997). "Principles and practice of automatic process control," Wiley, New York.

4. Johnson, C.D. (2006). "Process control instrumentation technology," Prentice-Hall, New Delhi.

BTEEOE704B BIOMEDICAL INSTRUMENTATION 03 Credits

Unit 1: Fundamentals of Biomedical Engineering 7 Hours

Cell and its structure – Resting and Action Potential – Nervous system and its fundamentals - Basic components of a biomedical system- Cardiovascular systems- Respiratory systems -Kidney and blood flow – Biomechanics of bone - Biomechanics of soft tissues - Basic mechanics of spinal column and limbs -Physiological signals and transducers - Transducers – selection criteria – Piezo electric, ultrasonic transducers - Temperature measurements - Fiber optic temperature sensors.

Unit 2: Non-Electrical Parameters Measurement and Diagnostic Procedures 7 Hours

Measurement of blood pressure - Cardiac output - Heart rate - Heart sound - Pulmonary function measurements – spirometer – Photo Plethysmography, Body Plethysmography – Blood Gas analysers, pH of blood –measurement of blood pCO2, pO2, finger-tip oxymeter - ESR, GSR measurements.

Unit 3: Electrical Parameters Acquisition and Analysis 7 Hours

Electrodes – Limb electrodes –floating electrodes – Pregelled disposable electrodes - Micro, needle and surface electrodes – Amplifiers, Preamplifiers, differential amplifiers, chopper amplifiers – Isolation amplifier - ECG – EEG – EMG – ERG – Lead systems and recording methods – Typical waveforms - Electrical safety in medical environment, shock hazards – leakage current-Instruments for checking safety parameters of biomedical equipment‘s.

Unit 4: Imaging Modalities and Analysis 7 Hours

Radio graphic and fluoroscopic techniques – Computer tomography – MRI – Ultrasonography – Endoscopy – Thermography –Different types of biotelemetry systems - Retinal Imaging - Imaging application in Biometric systems - Analysis of digital images.

Unit 5: Life Assisting, Therapeutic and Robotic Devices 7 Hours

Pacemakers – Defibrillators – Ventilators – Nerve and muscle stimulators – Diathermy – Heart – Lung machine – Audio meters – Dialysers – Lithotripsy - ICCU patient monitoring system: Nano Robots - Robotic surgery – Advanced 3D surgical techniques- Orthopedic prostheses fixation.

Text /Reference Books:

1. Biomedical Instrumentation by R. S. Khandpur, Tata McGraw Hill.
2. Introduction to Biomedical Technology by J. J. Karr & J. M. Brown, Pearson Publication.
3. Medical Instrumentation Application and Design by J. G. Webster, Wiley Publication.

BTEEOE704C MECHATRONICS **03 Credits**

Unit 1: Introduction to Mechatronics and its Systems **4 Hours**

Evolution, Scope, Measurement Systems, Control Systems, Open and Close Loop Systems, Sequential Controllers, Microprocessor based Controllers, Mechatronics approach.

Unit 2: Sensors and Transducers **8 Hours**

Introduction to Sensors and measurement systems, Displacement and Position Sensors, Proximity Sensors (Capacitive and Inductive Sensor), Ultrasonic Sensors, Temperature and Light Sensors, Velocity and Motion Sensors, Force and Pressure Sensors, Level and Flow Sensors, Magnetic Sensors (Reed Switch), pH Sensor, Humidity Sensors, Selection of Sensors, Signal Conditioning Devices.

Unit 3: Mechanical Actuation Systems **8 Hours**

Mechanical systems, Types of motion, Kinematics Chains, Cams, Gear Trains, Ratchet and Pawl, Belt and Chain drives, Bearings, Mechanical aspectsof motor selection.

Pneumatic and Hydraulic Actuation Systems: Actuation systems, Pneumatic and Hydraulic systems, Components and Symbols, Directional Control Valves, Pressure Control Valves, Cylinders, Rotary Actuators, Application.

Unit 4: Microprocessors **7 Hours**

Digital logic: Basics of Digital Technology Number System, Boolean algebra, Logic Functions, Karnaugh Maps, Timing Diagrams, Flip-Flops. Microprocessors: Introduction, Architecture, Pin Configuration, Instruction set, Programming of Microprocessors using 8085 instructions, Interfacing input and output devices-Interfacing D/A converters and A/D converters, Applications, Temperature control, Stepper motor control, Traffic light controller.

Unit 5: Programmable Logic Controller **8 Hours**

Introduction, Basic structure, Input/ Output Processing, Programming, Mnemonics, Timers, Internal relays and counters, Data handling, Analog and Digital Input/Output, Selection of a PLC, Applications.

Robotics: Introduction, Types of Robots, Robotic Control, Robot Drive Systems Robot End Effectors, Selection Parameters of a Robot, Applications.

Text Books/Reference Books:

1. Bolton W., “Mechatronics”, Pearson, Sixth Edition, 2015.
2. Robert H. Bishop, “Mechatronic Systems, Sensors, And Actuators”, CRC Press.

3. David G. Alciatore & Michael B. Histand, “Introduction to Mechatronics & Measurement Systems”, McGraw Hill, 2003.
4. Nitaigour P. Mahalik, “Mechatronics: Principles, Concepts and Applications”, McGraw Hill, 2003.
5. HMT Limited, “Mechatronics”, Tata McGraw-Hill Publishing Co Ltd, 2002.
6. K.P. Ramachandran, G.K. Vijayaraghavan & M.S. Balasundaram, “Mechatronics: Integrated Mechanical Electronic Systems”, Wiley India, 2008.
7. Gordon M. Mair, “Industrial Robotics”, Prentice Hall, 1998.
8. C. D. Johnson, “Process Control Instrumentation Technology”, PHI.
9. W. Bolton, “Programmable Logic Controllers”, Elsevier.
10. John W. Webb & Ronald A. Reis, “Programmable Logic Controllers”, PHI.

BTEEOE 705A TESTING, MAINTENANC AND COMMISSIONING OF ELECTRICAL EQUIPMENT **3 Credits**

Unit 1: Maintenance and Condition Monitoring **7 Hours**

Importance and necessity of maintenance, different maintenance strategies like Breakdown maintenance, planned maintenance and condition based maintenance. Planned and preventive maintenance of transformer, induction motor and alternators. Insulation stressing factors, insulation deterioration, polarization index, dielectric absorption ratio. Concept of condition monitoring of electrical equipments. Advanced tools and techniques of condition monitoring (Only theory)

Unit 2: Condition Monitoring of Transformers **7 Hours**

Testing and condition monitoring of oil as per the IS/IEC standards. Filtration/reconditioning of insulating oil. Failure modes of transformer. Condition monitoring of transformer bushings, On load tap changer, dissolved gas analysis, degree of polymerization. IS/Specifications for testing of transformer bushing and oil.

Unit 3: Condition Monitoring of Induction Motors **7 Hours**

Parameters of induction motors, Induction motor fault diagnostic methods, the induction motor fault monitoring method and Remedies

Unit 4: Testing of Electrical Equipments **7 Hours**

Testing of Power cables – Causes of cable failure, fault location methods and Remedial actions, Testing of Transformer - Type tests, Routine tests and Special tests. Various abnormal conditions, trouble shooting, faults, causes and remedies, Testing of Induction motor – Various abnormal conditions, trouble shooting, faults, causes and remedies, Testing of Capacitor banks

Unit 5: Special Tests for Faults Finding and Earthing **7 Hours**

Industrial Sonography (ultra sonic tests) to detect internal mechanical faults, Industrial X ray /Radiography, Megger, Heat Run Test, High voltage withstand Tests.

Substation earthing system i) Types of earthing (Equipment and Neutral), Maintenance free earthing system. ii) Different electrode configuration (Plate and Pipe Electrode) iii) Tolerable step and Touch Voltages. Methods of testing earth resistance.

Text Books/Reference Books:

1. Rao, Testing Commissioning Operation and Maintenance of Electrical Equipment, Khanna publishers.

2. Hand book of condition monitoring by B.K.N.Rao, Elsevier Advance Tech.,Oxford(UK)

3. S.L.Uppal - Electrical Power - Khanna Publishers Delhi

4. S. K. Shastri – Preventive Maintenance of Electrical Apparatus – Katson Publication House

5. B. V. S. Rao – Operation and Maintenance of Electrical Equipment – Asia Publication

BTEEOE 705B ELECTRIC AND HYBRID ELECTRIC VEHICLES 3 credits

Unit 1: Introduction to Hybrid Electric Vehicles **7 Hours**

History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies. Conventional Vehicles: Basics of vehicle performance, vehicle power source characterization, transmission characteristics, and mathematical models to describe vehicle performance.

Unit 2: Hybrid Electric Drive-trains **7 Hours**

Basic concept of hybrid traction, introduction to various hybrid drive-train topologies, power flow control in hybrid drive-train topologies, fuel efficiency analysis. Electric Drive-trains: Basic concept of electric traction, introduction to various electric drive-train topologies, power flow control in electric drive-train topologies, fuel efficiency analysis.

Unit 3: Electric Propulsion unit **7 Hours**

Introduction to electric components used in hybrid and electric vehicles, Configuration and control of-DC Motor drives, Induction Motor drives, Permanent Magnet Motor drives, Switch Reluctance Motor drives, drive system efficiency. Power converters in EV.

Unit 4: Energy Storage **7 Hours**

Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Super Capacitor and Flywheel used for energy storage, Hybridization of different energy storage devices

Unit 5: Sizing the drive system **7 Hours**

Matching the electric machine and the internal combustion engine (ICE), Sizing the propulsion motor, sizing the power electronics, selecting the energy storage technology Communications, supporting subsystems: In vehicle networks- CAN, Energy Management Strategies: Introduction to energy management strategies used in hybrid and electric vehicles, classification of different energy management strategies, comparison of different energy management strategies

Text/Reference Books:

1. Iqbal Hussein, “Electric and Hybrid Vehicles: Design Fundamentals”, CRC Press, 2003
2. James Larminie, John Lowry, “Electric Vehicle Technology Explained”, Wiley, 2003.
3. Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay, Ali Emadi, “Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design”,

BTEEOE705C - INTERNET OF THINGS **03 Credits**

Unit 1: Internet in general and internet of things **7 Hours**

Layers, protocols, packets, services, performance parameters of a packet network as well as applications such as web, Peer-to-peer, sensor networks, and multimedia

Unit 2: Transport services **7 Hours**

TCP, UDP, socket programming, Network layer: forwarding & routing algorithms (Link, DV), IP-addresses, DNS, NAT, and routers

Unit 3: Local area network **7 Hours**

MAC level, link protocols such as: point-to-point protocols, Ethernet, WiFi 802.11, cellular Internet access, and Machine-to-machine. Mobile networking: Roaming and handoffs, mobile IP, and ad hoc and infrastructure less networks.

Unit 4: Real time networking **7 Hours**

Soft and real time, quality of service/information, resource reservation and scheduling, and performance measurements

Unit 5: IOT definitions **7 Hours**

Overview, applications, potential & challenges, and architecture, IoT examples; case studies e.g sensor body area network and control of smart home

Text Books/Reference Books:

1. Kurose, James F.; Ross, Keith W. Computer networking: a top-down approach, 5th ed., international ed.:Boston, Mass.:Pearson,cop.2010

BTHM706 ENGINEERING OPERATIONS AND PROJECT MANAGEMENT AUDIT COURSE

Unit 1: Operations Planning Concepts **7 Hours**

Introduction, Operations Functions in Organizations, Historical development, Framework for managing operations, The trend: Information and Non-manufacturing systems, Operations management, Factors affecting productivity, International dimensions of productivity, The environment of operations, Production systems decisions- a look ahead.

Unit 2: Operations Decision Making **7 Hours**

Introduction, Management as a science, Characteristics of decisions, Framework for decision making, Decision methodology. (Problems on decision trees)

Unit 3: System Design and Capacity **7 Hours**

Introduction, Manufacturing and service systems, Design and systems capacity, Capacity planning. Forecasting Demand: Forecasting objectives and uses, forecasting variables, Opinion and Judgmental methods, Time series methods, Moving Average methods, Exponential smoothing, Trend adjusted Exponential Smoothing, Regression and correlation methods, Application and control of forecasts-Mean Absolute Deviation, BIAS, and Tracking Signal.

Unit 4: Aggregate Planning and Master Scheduling **7 Hours**

Introduction- planning and scheduling, Objectives of aggregate planning, Three Pure Strategies, Aggregate planning methods, Master scheduling objectives, Master scheduling methods. Material and Capacity Requirements Planning: Overview: MRP and CRP, MRP: Underlying concepts, System parameters, MRP logic, System refinements, Capacity management, and CRP activities.

Unit 5: Scheduling and Controlling Production Activities **7 Hours**

Introduction, PAC, Objectives and Data requirements, Loading –Finite and Infinite Scheduling methodology, priority sequencing, capacity control. Single Machine Scheduling: Concept, measures of performance, SPT rule, Weighted SPT rule, EDD rule. Flow –Shop Scheduling: Introduction, Johnson‘s rule for ‗n‘ jobs on 2 and 3 machines, CDS heuristic. Job-Shop Scheduling: Types of schedules, Heuristic procedure, scheduling 2 jobs on ‗m‘ machines.

Lean Systems: Seven Wastes in Lean, Characteristics of Just-in-Time operations, Pull method of materials flow, consistently high quality, small lot sizes, Uniform workstation loads, Standardized components and work methods, close supplier Ties, Flexible workforce, Line flows, Automated production, preventive maintenance, continuous improvement, The Kanban system, General operating rules, Determining the number of containers, Other Kanban Signals, JIT II, Lean Systems in Services, Strategic Implications of Lean systems, Competitive Priorities, Flows, Operational Benefits Implementation Issues, Organizational Consideration, Process considerations, Inventory and scheduling, Lean system across the organization.

Text /Reference Books:

2. Monks, J.G., Operations Management, McGraw-Hill International Editions, 1987.

3. Pannerselvam. R., Production and Operations Management, PHI, 2012. (Unit-IV scheduling-single machine, flow shop and job shop scheduling)

4. Lee J Karjewski and Larry P Ritzman, Operations Management – strategy and Analysis, 6th Edn, Pearson Education Asia ,2009(Unit-V)

5. Buffa, Modern Production/Operations Management, Wiely Eastern Ltd, 8e, 2003.

6. Chary, S.N., Production and Operations Management, Tata-McGraw Hill, 5th edition, 2012.

7. Chase Jacobs Aquilano, Operations Management for Competitive Advantages, 10th Edition, 2012, TMH

BTEEL707 HIGH VOLTAGE ENGINEERING LAB **1 credit**

List of Experiments: Perform minimum eight experiments from given list

1) Study of Faraday Cage for HV labs.
2) Study of Standard HV Laboratory layouts.
3) One min. (1-min.) DC high voltage withstand test on Equipment. (Max. up to 10 KV).
4) Effect of gap length on liquid insulating material.
5) Breakdown Strength of composite dielectric material.
6) Study of impulse generator.
7) High voltage withstand test on cables/safety gloves/shoes, as per IS. (Max. 2.25 KV DC)
8) Horn gap arrangement as surge diverter.
9) Measurement audible and visible corona inception and extinction voltage.
10) Development of tracks and trees on polymeric insulation.
11) Study of Effect of EHV field on Human, Animals & Plants.

BTEEM708 INHOUSE PROJECT PART-I /MINIPROJECT-III 2 credits

Inhouse Project Part-I

It is the phase –I of in house project, for the students those are not doing Internship in the Industry, such students can do project work in the dept. It is expected that students should finalize objective of the work, tools and techniques, and literature survey of the work. Assessment will be based on the work carried out by the student, report submitted and presentation.

Miniproject-III

Student, who wanted to opt for internship in industry in VIII semester, should do the miniproject, preferably based on hardware. Assessment will be based on the work carried out by the student, report submitted and presentation.

BTEEP802 INHOUSE PROJECT PART-II /INTERNSHIP IN INDUSTRY .

In House Project Part-II

In phase-II of In-house project, work should consist of detailed report for chosen topic and output of work proposed in VIIth semester, in addition to the contents specified in semester VII. Assessment will be based on the work carried out by the student, report submitted and presentation.

Internship in Industry

In this course, students should go to industry for internship for one semester and do assigned work. After, completion of the Internship student should submit the report to the department. Assessment will be based on the work carried out by the student, report submitted and presentation, in consultation with the Industry guide.