P.K.UNIVERSITY, SHIVPURI (M.P.)

(FACULTY OF ENGINEERING & TECHNOLOGY)

EVALUATION SCHEME & SYLLABUS FOR

B. TECH.

ELECTRICAL ENGINEERING
(4^{TH} YEAR)

Effective from

Session: 2025-26

P.K.University,Vill-Thanra,Teh-Karera,Distt-Shivpuri (M.P.) 473665

EVALUATION SCHEME

B.TECH ELECTRICAL ENGINEERING

4th Year (7th & 8th Semester)

Study And Evaluation Scheme For B.Tech Electrical Engineering

Year- 4th / Semester -7th

Subject Code	Subjects Name	Study Scheme Periods/Week			Credits	Marks in Evaluation Scheme						Total Marks of Internal & External
						Internal Assessment			External Assessment			
		L	T	P		Th	Pr	Total Internal	Th	Pr	Total External	Grand Total
UENTREE701	Entrepreneurship Development	3	0	0	3	30	-	30	70	-	70	100
UELECEE702	Electric Drives	4	0	0	4	30	-	30	70	-	70	100
UPOWEEE703	Power Station Practice	3	0	0	3	30	-	30	70	-	70	100
UANALEE704	Analog & Digital Communication	3	0	0	3	30	-	30	70	-	70	100
UPOWEEE705	Power System Operation and Control	4	0	0	4	30	-	30	70	-	70	100
UELECEE706	Electric Drives Lab	0	0	2	1	-	25	25	-	25	25	50
UANALEE707	Analog & Digital Communication Lab	0	0	2	1	-	25	25	-	25	25	50
UMINIEE708	Minor project	0	0	2	1	-	25	25	-	25	25	50
UINDUEE709	Industrial Training	0	0	2	1	-	25	25	-	25	25	50
Total		19	0	8	21	150	100	250	350	100	450	700
For pass the candidate is required to obtain 40% marks in each paper and 50% marks in aggregate.												280

Study And Evaluation Scheme For B.Tech Electrical Engineering

Year- 4th /Semester -8th

Subject Code	Subjects Name	Study Scheme Periods/Week			Credits	Marks in Evaluation Scheme						Total Marks of Internal & External
						Internal Assessment			External Assessment			
		L	T	P		Th	Pr	Total Internal	Th	Pr	Total External	Grand Total
UNONCEE801	Non-Conventional Energy Resources	3	0	0	3	30	-	30	70	-	70	100
UADVAEE802	Advanced Control System	4	0	0	4	30	-	30	70	-	70	100
UUTILEE803	Utilization of Electrical Energy and Traction	4	0	0	4	30	-	30	70	-	70	100
UPOWEEE804	Power Converters Applications	3	0	0	3	30	-	30	70	-	70	100
UMAJOEE805	Major project	0	0	14	7	-	100	100	-	200	200	300
Total		14	0	14	21	120	100	220	280	200	355	700
For pass the candidate is required to obtain 40% marks in each paper and 50% marks in aggregate.												280

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4th Year / 7th Semester

UENTREE701: Entrepreneurship Development	
Credit:3	**Max Marks:100 (IA:30,ETE:70)**
3L+0T+0P	**End Term Exams: 3 hrs.**

Course Outcome: - On successful completion of this course, the students will be able:

1. The purpose of this course is to expose the student to the basic concepts of entrepreneurship, functions of entrepreneurs and problems faced by them in the real world.
2. To provide insights to students in converting an Idea to an opportunity and develop understanding of various funding sources for a startup.
3. To understand the technological, human, economic, organizational, social and other dimensions of innovation.
4. To understand the role of innovation and technical change in enterprise and global level economic performance

Unit	Contents	Hours
1	**Entrepreneurship:** Definition. Growth of small scale industries in developing countries and their positions vis- a-vis large industries; role of small scale industries in the national economy; characteristics and types of small scale industries; demand based and resources based ancillaries and sub-control types. Government policy for small scale industry; stages in starting a small scale industry.	08
2	**Project identification:** Assessment of viability, formulation, evaluation, financing, field-study and collection of information, preparation of project report, demand analysis, material balance and output methods,	08

	benefit cost analysis, discounted cash flow, internal rate of return and net present value methods.	
3	**Accountancy:** Preparation of balance sheets and assessment of economic viability, decision making, expected costs, planning and production control, quality control, marketing, industrial relations, sales and purchases, advertisement, wages and incentive, inventory control, preparation of financial reports, accounts and stores studies.	**08**
4	**Project Planning and control:** The financial functions cost of capital in project planning and control. Economic evaluation, risk analysis, capital expenditures, policies and practices in public enterprises. Profit planning and programming, planning cash flow, capital expenditure and operations. Control of financial flows, control and communication.	**08**
5	Laws concerning entrepreneur viz, partnership laws, business ownership, sales and income taxes and workman compensation act. Role of various national and state agencies which render assistance to small scale industries.	**08**

Text Books:

1. Forbat, John, ―Entrepreneurship‖ New Age International.
2. Havinal, Veerbhadrappa, ―Management and Entrepreneurship‖ New Age International
3. Joseph, L. Massod, ―Essential of Management", Prentice Hall of Indi

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UELECEE702: Electric Drives	
Credit:4	**Max Marks:100 (IA:30,ETE:70)**
4L+0T+0P	**End Term Exams: 3 hrs.**

Course Outcome: - On successful completion of this course, the students will be able:

1. Describe the operation of electric drives and its classification.
2. Explain the electric drive stability and selection of motor power rating.
3. Illustrate electric braking and its dynamics.
4. Describe the types of AC drives and its control.

Unit	Contents	Hours
1	**Fundamentals of Electric Drive:** Electric Drives and its parts, advantages of electric drives Classification of electric drives Speed-torque conventions and multi-quadrant operations Constant torque and constant power operation Types of load torque: components, nature and classification.	08
2	**Dynamics of Electric Drive:** Dynamics of motor-load combination Steady state stability of Electric Drive Transient stability of electric Drive. **Selection of Motor Power rating:** Thermal model of motor for heating and cooling, classes of motor duty, determination of motor power rating for continuous duty, short time duty and intermittent duty. Load equalization.	08
3	**Electric Braking:** Purpose and types of electric braking, braking of DC, three phase induction and synchronous motors **Dynamics during Starting and Braking:** Calculation of acceleration time and energy loss during starting of DC shunt and three phase induction motors, methods of reducing energy loss during starting. Energy relations during braking, dynamics during braking.	08

4	**Power Electronic Control of DC Drives:** Single phase and three phase controlled converter fed separately excited DC motor drives (continuous conduction only), dual converter fed separately excited DC motor drive, rectifier control of DC series motor. Supply harmonics, power factor and ripples in motor current Chopper control of separately excited DC motor and DC series motor.	**08**
5	**Power Electronic Control of AC Drives:** **Three Phase induction Motor Drive:** Static Voltage control scheme, static frequency control scheme (VSI, CSI, and cyclo – converter based) static rotor resistance and slip power recovery control schemes. Three Phase Synchronous motor: Self-controlled scheme **Special Drives:** Switched Reluctance motor, Brushless dc motor. Selection of motor for particular applications.	**08**

Text Books:

1. G.K. Dubey, ―Fundamentals of Electric Drives‖, Narosa publishing House.
2. S.K. Pillai, ―A First Course on Electric Drives‖, New Age International.
3 V. Subrahmanyam, ―Electric Drives: Concepts and Applications‖, Tata McGrawHill.

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UELECEE706: Electric Drives Lab	
Credit:1	**Max Marks:50 (IA:25,EA:25)**
0L+0T+2P	**End Term Exams: 2 hrs.**

Note: Minimum ten experiments are to be performed from the following list:

List of Experiments

1. Study of thyristor controlled DC Drives.
2. Study of Chopper fed DC Drives.
3. Study of AC Single phase motor –speed control using TRIAC.
4. PWM inverter fed 3-phase Induction motor control using PSPICE/MATLAB/PSIM Software.
5. VSI/CSI Induction motor Drive analysis using PSPICE/MATLAB/PSIM Software.
6. Study of V/F control operation of 3-phase Induction motor Drives.
7. Regenerative braking operation for DC motor-study using software.
8. Dynamic braking operation for DC motor-study using software.
9. PC/ PLC based forward/reverse motion control operation of Induction motor.
10. Dynamic braking operation for AC motor-study using software.
11. Regenerative braking operation for AC motor-study using software.

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UPOWEEE703: Power Station Practice	
Credit:4	**Max Marks:100 (IA:30,ETE:70)**
4L+0T+0P	**End Term Exams: 3 hrs.**

Course Outcome: - On successful completion of this course, the students will be able:

1. Understand the awareness of electrical energy demand, growth and electrical energy sources in India.
2. Understand the general layout and operation of thermal and hydro power plant.
3. Understand the operation of nuclear power plant, Gas turbine plant and diesel plant.
4. Draw substation layout.
5. Describe the various terms related to power plant economics and power tariffs.
6. Impart the knowledge of generation of electricity based on non-conventional energy sources

Unit	Contents	Hours
1	**Introduction:** Electric energy demand and growth in India, electric energy sources. Thermal Power Plant: Site selection, general layout and operation of plant, detailed description and use of different parts. **Hydro Electric Plants:** Classifications, location and site selection, detailed description of various components, general layout and operation of Plants, brief description of impulse, reaction, Kaplan and Francis turbines, advantages & disadvantages, hydro-potential in India.	**08**
2	**Nuclear Power Plant:** Location, site selection, general layout and operation of plant. Brief description of different types of reactors Moderator material, fissile materials, control of nuclear reactors, disposal of nuclear waste	**08**

	material, shielding. **Gas Turbine Plant:** Operational principle of gas turbine plant & its efficiency, fuels, open and closed-cycle plants, regeneration, inter-cooling and reheating, role and applications. **Diesel Plants:** Diesel plant layout, components & their functions, its performance, role and applications.	
3	**Sub-stations Layout:** Types of substations, bus-bar arrangements, and typical layout of substation. **Power Plant Economics and Tariffs:** Load curve, load duration curve, different factors related to plants and consumers, Cost of electrical energy, depreciation, generation cost, effect of Load factor on unit cost. Fixed and operating cost of different plants, role of load diversity in power system economy. Objectives and forms of Tariff; Causes and effects of low power factor, advantages of power factor improvement, different methods for power factor improvements.	**08**
4	**Economic Operation of Power Systems:** Characteristics of steam and hydro-plants, Constraints in operation, Economic load scheduling of thermal plants neglecting and considering transmission Losses, Penalty factor, loss coefficients, Incremental transmission loss. Hydrothermal Scheduling.	**08**
5	**Non-Conventional Energy Sources:** Power Crisis, future energy demand, role of Private sectors in energy management, concepts & principals of MHD generation, Solar power plant, Wind Energy, Geothermal Energy, Tidal energy, Ocean Thermal Energy.	**08**

Text Books:

1. B.R. Gupta, ―Generation of Electrical Energy‖, S. Chand Publication.

2. Soni, Gupta & Bhatnagar, ―A text book on Power System Engg.‖, Dhanpat Rai & Co.

3. P.S.R. Murthy, ―Operation and control of Power System‖ BS Publications, Hyderabad. Reference Books:

4. W. D. Stevenson, ―Elements of Power System Analysis‖, McGraw Hill.

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UANALEE704: Analog & Digital Communication	
Credit:3	**Max Marks:100 (IA:30,ETE:70)**
4L+0T+0P	**End Term Exams: 3 hrs.**

Course Outcome: - On successful completion of this course, the students will be able:

1. Understand the Amplitude Modulation in communication system.
2. Comprehend the Frequency & Phase modulation
3. Realize the Pulse Modulation Techniques.
4. Get the Digital Modulation Techniques and their use in communication system.
5. Apply the concept of Information Theory in Communication Engineering.

Unit	Contents	Hours
1	Elements of communication system and its limitations Amplitude Modulation: Amplitude modulation and detection, Generation and detection of DSB-SC, SSB and vestigial side band modulation, carrier acquisition AM transmitters and receivers, super heterodyne receiver, IF amplifiers, AGC circuits Frequency Division multiplexing	**08**
2	Angle Modulation: Basic definitions Narrow band and wideband frequency modulation, transmission bandwidth of FM signals Generation and detection of frequency modulation Noise: External noise, internal noise calculations, signal to noise ratio Noise in AM and FM systems.	**08**
3	**Pulse Modulation:** Introduction, sampling process Analog Pulse Modulation Systems-Pulse Amplitude Modulation, Pulse width modulation and Pulse Position Modulation. Waveform coding Techniques: Discretization	**08**

	in time and amplitude, Quantization process, quantization noise, Pulse code Modulation, Differential Pulse code Modulation, Delta Modulation and Adaptive Delta Modulation.	
4	**Digital Modulation Techniques:** Types of digital modulation, waveforms for amplitude, frequency and phase shift keying, methods of generation of coherent and non-coherent, ASK, FSK and PSK, comparison of above digital techniques.	**08**
5	**Time Division Multiplexing:** Fundamentals, Electronic Commutator, Bit/byte interleaving, TI carrier system, synchronization and signaling of TI, TDM and PCM hierarchy, synchronization techniques Introduction to Information Theory: Measure of information, Entropy & Information rate, channel capacity, Hartley Shannan law, Huffman coding, shannan Fano coding.	**08**

Text Books:

1. Simon Haykin,— Communication Systems‖ John Wiley & Sons 4th Edition
2. G.Kennedy and B. Davis,‖ Electronic Communication Systems‖ 4th Edition, Tata McGraw Hill
3. Simon Haykin, —Digital Communications‖ John Wiley & Sons
4. T.L. Singal, —Analog & Digital Communication‖, Tata Mc Graw Hill

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UANALEE707: Analog & Digital Communication Lab	
Credit:1	**Max Marks:50 (IA:25,EA:25)**
0L+0T+2P	**End Term Exams: 2 hrs.**

Note: The minimum 10 experiments are to be performed from the following:

1. To study amplitude modulation using a transistor and determine depth of Modulation.
2. To study generation of DSB-SC signal using balanced modulator.
3. To study generation of SSB signal
4. To study envelope detector for demodulation of AM signal and observe Diagonal peak Clipping effect.
5. To study super heterodyne AM receiver and measurement of sensitivity, Selectivity and fidelity.
6. To study frequency modulation using voltage controlled oscillator.
7. To detect FM signal using Phase Locked Loop.
8. To measure noise figure using a noise generator.
9. To study PAM, PWM and PPM.
10. To realize PCM signal using ADC and reconstruction using DAC and 4 Bit/8bit system. Observe quantization noise in each case.
11. To study Delta Modulation and Adaptive Delta Modulation.
12. To study PSK-modulation system. 13. To study FSK-modulation system.
14. To study sampling through a Sample-Hold circuit and reconstruction of the Sampled signal and observe the effect of sampling rate & the width of the Sampling pulses.
14. To study functioning of color television
15. Fabricate and test a PRBS generator
16. Realization of data in different forms, such as MRZ-L, NRZ - M&N, NRZ-S.
17. Manchester coding & decoding (Bi phase L) of NRZ-L data.

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UPOWEEE705: Power System Operation and Control	
Credit:4	**Max Marks:100 (IA:30,ETE:70)**
4L+0T+0P	**End Term Exams: 3 hrs.**

Course Outcome: - On successful completion of this course, the students will be able:

1. Analyze the various load characteristics with load curve and load duration curve.
2. Describe modeling of power-frequency dynamics and design power-frequency controller.
3. Explain the modeling of reactive power-voltage interaction and the control actions.
4. Solve economic dispatch problems and unit commitment problems in power systems.
5. Explain the need of State Estimation.

Unit	Contents	Hours
1	**Introduction:** Structure of power systems, Power system control center and real time computer control, SCADA system Level decomposition in power system Power system security various operational stages of power system Power system voltage stability.	**08**
2	**Economic Operation:** Concept and problems of unit commitment Input-output characteristics of thermal and hydro-plants System constraints Optimal operation of thermal units without and with transmission losses, Penalty factor, incremental transmission loss, transmission loss formula (without derivation) Hydrothermal scheduling long and short terms Concept of optimal power flow.	**08**

3	**Load Frequency Control:** Concept of load frequency control, Load frequency control of single area system: Turbine speed governing system and modeling, block diagram representation of single area system, steady state analysis, dynamic response, control area concept, P-I control, load frequency control and economic dispatch control. Load frequency control of two area system: Tie line power modeling, block diagram representation of two area system, static and dynamic response.	**10**
4	**Automatic Voltage Control:** Schematic diagram and block diagram representation, different types of Excitation systems & their controllers. **Voltage and Reactive Power control:** Concept of voltage control, methods of voltage control by tap changing transformer. Shunt Compensation, series compensation, phase angle compensation.	**08**
5	**State Estimation:** Detection and identification, Linear and Non-linear models. **Flexible AC Transmission Systems:** Concept and objectives FACTs controllers: Structures & Characteristics of following FACTs Controllers. TCR, FC-TCR, TSC, SVC, STATCOM, TSSC, TCSC, SSSC, TC-PAR, UPFC	**06**

Text Books:

1. D.P. Kothari & I.J. Nagrath, ―Modern Power System Analysis‖ Tata Mc Graw Hill, 3rd Edition.
2. P.S.R. Murty, ―Operation and control in Power Systems‖ B.S. Publications.
3. N. G. Hingorani & L. Gyugyi, ―Understanding FACTs‖ Concepts and Technology of Flexible AC Transmission Systems‖
4. A. J. Wood & B.F. Wollenburg, ―Power Generation, Operation and Control ― John Wiley & Sons.

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UMINIEE708: Minor Project	
Credit:1	**Max Marks:50 (IA:25,EA:25)**
0L+0T+2P	**End Term Exams: 2 hrs.**

Course Outcome: - On successful completion of this course, the students will be able:

1. Investigate the emerging problems in electrical engineering and solve them by referring standard journals.
2. Illustrate the state-of-the-art technologies in the area of electrical engineering.
3. Analyze various technological advancements in the area of machines, control system through software or hardware implementation.
4. Understand and evaluate the area for future knowledge and skill development.
5. Formulate a research paper and write the project report.

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4th Year / 7th Semester

UINDUEE709: INDUSTRIAL TRAINING	
Credit:1	**Max Marks:50**
6 WEEKS / 45 DAYS - IDUSTRY WORK EXPERIENCE WITH TRAINING REPORT & CERTIFICATE	

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UNONCEE801: Non- Conventional Energy Resources	
Credit:3	**Max Marks:100 (IA:30,ETE:70)**
3L+0T+0P	**End Term Exams: 3 hrs.**

Course Outcome: - On successful completion of this course, the students will be able

1. Identify energy demand and relate with available energy resources
2. Analyze harnessing of solar energy.
3. Analyze harnessing of wind energy.
4. Analyze harnessing of Biomass energy.
5. Analyze harnessing of Geothermal and Ocean energies.
6. Analyze Magneto hydrodynamics and Fuel cell technology.

Unit	Contents	Hours
1	**Introduction:** Various non-conventional energy resources- Introduction, availability, classification, relative merits and demerits. Solar Cells: Theory of solar cells. Solar cell materials, solar cell array, solar cell power plant, limitations.	**06**
2	**Solar Thermal Energy:** Solar radiation, flat plate collectors and their materials, applications and performance, focusing of collectors and their materials, applications and performance; solar thermal power plants, thermal energy storage for solar heating and cooling, limitations.	**06**
3	**Geothermal Energy:** Resources of geothermal energy, thermodynamics of geo-thermal energy conversion-electrical conversion, non-electrical conversion, environmental considerations. **Magneto-hydrodynamics**	**06**

	(MHD): Principle of working of MHD Power plant, performance and limitations. Fuel Cells: Principle of working of various types of fuel cells and their working, performance and limitations.	
4	**Thermo-electrical and thermionic Conversions:** Principle of working, performance and limitations. **Wind Energy:** Wind power and its sources, site selection, criterion, momentum theory, classification of rotors, concentrations and augments, wind characteristics. Performance and limitations of energy conversion systems.	**06**
5	**Bio-mass:** Availability of bio-mass and its conversion theory. **Ocean Thermal Energy Conversion (OTEC):** Availability, theory and working principle, performance and limitations. Wave and Tidal Wave: Principle of working, performance and limitations. Waste Recycling Plants.	**06**

Text/References Books:

1. Raja etal, ―Introduction to Non-Conventional Energy Resources‖ Scitech Publications.
2. John Twideu and Tony Weir, ―Renewal Energy Resources‖ BSP Publications, 2006.
3. M.V.R. Koteswara Rao, ―Energy Resources: Conventional & Non-Conventional ―BSP Publications, 2006.
4. D.S.Chauhan,‖Non-conventional Energy Resources‖ New Age International.
5. C.S. Solanki, ―Renewal Energy Technologies: A Practical Guide for Beginners‖ PHI Learning.
6. Peter Auer "Advances in Energy System and Technology". Vol. 1 & II Edited by Academic Press.

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UADVAEE802: Advanced Control System	
Credit:4	**Max Marks:100 (IA:30,ETE:70)**
4L+0T+0P	**End Term Exams: 3 hrs.**

Course Outcome: - On successful completion of this course, the students will be able

1. Do state space analysis of continuous system.
2. Describe the dynamics of a linear, time invariant and causal digital system through difference equations.
3. Determine the stability of discrete control system.
4. Analyze nonlinear system by using phase plane method.
5. Understand the concept of optimal and adaptive control system.

Unit	Contents	Hours
1	**State Space Analysis of Continuous System:** State space analysis, Solution of state equation, determination of state-transition matrix, using Laplace method, Similarity transformation method and Caley-Hamilton Method.	08
2	**Analysis of Discrete System:** Concept of state feedback design, Determination of controllability Matrix and test of controllability, State feedback controller design via pole placement method, Concept of state observer design, Determination of the observability matrix and test of observability condition, Design of the full state observer using pole placement.	08
3	**Nonlinear systems:** Nonlinear System Modeling Analysis of Nonlinear system (Inverted Pendulum) via Linearization, Describing function analysis of nonlinear system, Stability Analysis of Nonlinear system using Describing function Analysis.	08
4	**Phase Plan Analysis:** Construction of Phase portrait using Isoclines approach, Singular points, and Phase plane analysis of 2nd order linear system, Phase plane analysis of nonlinear control system.	08

5	**Liapunov Stability Analysis:** Concept of stability in the sense of Liapunov. Linear system analysis using Liapunov approach, Determination of Liapunov functions using variable gradient method, Stability analysis of nonlinear systems.	**08**

Text Books:

1. M. Gopal, ―Digital Control and State variable Methods‖, Tata Mc Graw Hill.

2. Ajit K. Madal, ―Introduction to Control Engineering: Modelling, Analysis and Design‖ New Age International.

3. K. Ogata, ―Modern Control Engineering‖, PHI.

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UUTILEE803: Utilization of Electrical Energy and Traction	
Credit:4	**Max Marks:100 (IA:30,ETE:70)**
4L+0T+0P	**End Term Exams: 3 hrs.**

Course Outcome: - On successful completion of this course, the students will be able

1. Understand basic principles of electric heating and welding.
2. Design of indoor lighting and outdoor lighting systems.
3. Understand refrigeration and air conditioning.
4. Understand starting and speed control method of electric traction.
5. Evaluate speed time curves for traction.

Unit	Contents	Hours
1	**Electric Heating:** Advantages and methods of electric heating, Resistance heating, Electric arc heating, Induction heating, Dielectric heating.	08
2	**Electric Welding:** Electric Arc Welding Electric Resistance Welding Electronic welding control Electrolyte Process: Principles of electro deposition, Laws of electrolysis, and applications of electrolysis.	08
3	**Illumination:** Various definitions, Laws of illumination, requirements of good lighting Design of indoor lighting and outdoor lighting systems Refrigeration and Air Conditioning: Refrigeration systems, domestic refrigerator, water cooler Types of air conditioning, Window air conditioner.	08
4	**Electric Traction - I** Types of electric traction, systems of track electrification Traction mechanics- types of services, speed time curve and its simplification, average and schedule speeds Tractive effort, specific energy consumption, mechanics of train movement, coefficient of adhesion and its influence.	08

5	**Electric Traction – II** Salient features of traction drives Series – parallel control of dc traction drives (bridge transition) and energy saving Power Electronic control of dc and ac traction drives Diesel electric traction.	**08**

Text Books:

1. H. Partab, ―Art and Science of Electrical Energy‖ Dhanpat Rai & Sons.
2. G.K. Dubey, ―Fundamentals of Electric Drives‖ Narosa Publishing House
3. H. Partab, ―Modern Electric Traction‖ Dhanpat Rai & Sons.
4. C.L. Wadhwa, ―Generation, Distribution and Utilization of Electrical Energy‖ New Age international Publications.

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UPOWEEE804: Power Converter Applications	
Credit:3	**Max Marks:100 (IA:30,ETE:70)**
4L+0T+0P	**End Term Exams: 3 hrs.**

Course Outcome: - On successful completion of this course, the students will be able

1. Describe the characteristics, operation of power switching devices and identify their ratings and applications.
2. Categorize different phenomena occurring in HVDC system.
3. Identify the types of faults occurring in three phase generators.
4. Define and explain the basic concepts and theory of heating.

Unit	Contents	Hours
1	**HVDC Transmission:** Schematic diagram, modes of operation, twelve pulses line commutated converters, effect of source inductance, control of HVDC converters, converter faults and protection, harmonic filters.	**08**
2	**FACT Controllers:** Principle of power transmission, principles of shunt compensation and series compensation; Shunt compensators-TCR, TSC, SVC, STATCOM Series compensators-TSSC, FCSC, TCSC, SSVC; Phase angle compensator, Unified power flow controller (UPFC), comparison of compensators.	**08**
3	**Power Supplies:** Desirable specifications of power supplies, drawbacks of linear power supply. Switch-Mode Power supply (SMPS)-schematic diagram, fly back converter, forward converter, push- pull converter, half bridge and full bridge converters; Uninterruptible power supply (UPS)- configurations of off-line and on-line UPS,	**08**

	switch mode and resonant power supplies; air- craft power supply.	
4	**Industrial Applications:** High frequency inverters for induction and dielectric heating, ac voltage controllers for resistance heating and illumination control, high frequency fluorescent lighting, electricwelding control.	**08**
5	**Interconnection of Renewable Energy Sources to the Utility Grid:** Photovoltaic array interconnection, wind and small hydro interconnection, interconnection of energy storage systems; DC circuit breaker, single phase and three phase ac switches; Excitation control of synchronous generators.	**08**

Text Books:

1. Ned Mohan, T.M.Undeland and William P.Robins, ―Power Electronics: Converters, Applications and Design‖, John Wiley & Sons.
2. M.H. Rashid, ―Power Electronics: Circuits, Devices and Applications‖ Prentice Hall of India.

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UMAJOEE805: Major Project	
Credit:7	**Max Marks:100 (IA:50,EA:50)**
0L+0T+14P	**End Term Exams: 2 hrs.**

Course Outcome: - On successful completion of this course, the students will be able:

1. Identify the particular problem in the field and demonstrate independent learning.
2. Plan, design and analyze the particular problem as project.
3. Demonstrate the usefulness of project in society and understanding of professional ethics and participate in a class or project team.