SCHEME OF TEACHING AND EXAMINATION (Effective from 2020 – 2024 Batch)

B Tech (Seventh Semester, Electrical Engineering)

Sl. No.	Board of Studies (BOS)	Courses (Subjects)	Course Code	Period per Week			Scheme of Examination			Total Marks	Credit
				L	T	P	Theory/Lab				
							ESE	CT	TA		
1.	Electrical Engineering	Electrical Machines-III	**EE104701**	2	1	-	100	20	30	150	4
2.	Electrical Engineering	Electric Drives	**EE104702**	2	1	-	100	20	30	150	3
3.	Electrical Engineering	Power Apparatus System	**EE104703**	3		-	100	20	30	150	3
4.	Electrical Engineering	**Professional Elective-III**	**Refer Table-IV**	3		-	100	20	30	150	3
5.	Electrical Engineering	**Open Elective-II**	**Refer Table-V**	3	-	-	100	20	30	150	3
6.	Electrical Engineering	Electrical Machines-III Lab	**EE104791**	-		2	25	-	25	50	1
7.	Electrical Engineering	Electric Drives Lab	**EE104792**	-		2	25	-	25	50	1
8.	Electrical Engineering	Major Project Phase-I	**EE104793**	-		4	50	-	50	100	1
9.	Electrical Engineering	Internship Assessment/Industrial Training (Report Writing and Seminar)	**EE104794**	-	-	2		-	25	25	1
10.	Electrical Engineering	Innovative and Entrepreneurial Skills	**EE104795**						25	25	-
	Total			**13**	**2**	**10**	**600**	**100**	**300**	**1000**	**20**

Table-IV Professional Elective-III

S.N	Board of Studies (BOS)	Subject Code	Program Elective-I
1	**Electrical Engineering**	**EE104721**	**Flexible AC Transmission System**
2	Electrical Engineering	**EE104722**	Distributed Generation

L-Lecture **T-Tutorial** **P-Practical**
CT-Class Test **TA-Teachers Assessment** **ESE-End Semester Exam**

		July 2022	1.00	Applicable for AY 2022-23 Onwards
Chairman (AC)	Chairman (BoS)	Date of Release	Version	

Table-V Open Elective-II

S.N	Board of Studies (BOS)	Subject Code	Open Elective-II
1	**Electrical Engineering**	EE100741	**Management Concepts and Techniques for Engineers**
2	Electrical Engineering	EE100742	Hybrid Electric Vehicle

Subject Code	EE104701	L = 2	T = 1	P = 2	Credits = 4
Subject	Electrical Machines-III	CT	TA	Total	ESE Duration
Evaluation Scheme	100	20	30	150	3 Hrs

COURSE OBJECTIVES	COURSE OUTCOMES
1. To introduce the concepts of ideal synchronous machines and poly-phase induction machines. 2. The Generalized Representation and steady state analysis of Synchronous Machines 3. The generator and motor operation in steady state and transient conditions 4. Applications which will be utilized in the electrical machines with its performance and theory of operation.	**Students will be able to:-** **CO1:** Explain the theory of ideal synchronous machines and, basic machine relation **CO2:** Analyze and apply the concept of steady state analysis and electrical transients in polyphase machines **CO3:** Make use of speed control system for AC motors. **CO4:** Evaluate the basic operation and performance of special machines and can select special machines for different purpose.

UNIT I: Theory of Ideal Synchronous Machines The ideal synchronous machine, synchronous machine inductances, transformation to direct and quadrature axis variables, basic machine relation id *dq0* variables, steady state analysis using *dq0*, transient analysis, three-phase short circuit, transient power angle characteristics, effect of additional rotor circuits.	**CO1[10Hrs]**
UNIT II: Theory of Ideal Poly-Phase Induction Machines The ideal induction machine, transformation to *dq0* variables, basic machine relation in *dq0* variables, steady state analysis using *dq0*, electrical transients in induction machine, power invariance.	**CO1 ,2[10Hrs]**
UNIT III: AC Commutator Machines EMFs Induced in commutator windings, Torque, Commutation in AC Machines, Action of commutator as frequency converter, Schrage Motor- Construction, Principle of operation, Speed and power factor control, Applications.	**CO1 [10Hrs]**
UNIT IV: Two phase Motors Two-phase control motors & AC tachometer, Unbalanced operation of symmetrical two-phase machine- the symmetrical component concept, Single phasing of three-phase induction motor.	**CO3[10Hrs]**
UNIT V: Special Motors-II **Single Phase Synchronous Motors**: Construction, principle of operation and applications of Reluctance motors, Hysteresis motors, Sub-synchronous motors **Energy Efficient Machines**: Construction, Basic Concepts, losses minimization and efficiency calculations of Energy efficient AC machines	**CO4 [8Hrs]**

Text Books:

S. No.	Title	Author(s)	Publisher
1.	Generalized theory of electrical machines	P.S. Bimbhra	Khanna Pbs
2.	Electrical machines	Fitzerald and Kingseley	2nd edition, McGrawHill

Reference Books:

S. No.	Title	Author(s)	Publisher
1.	Performance and design of AC Commutator machines	Taylor, E Openshanw	AH Wheeler
2.	Power system stability	Kimbark	vol-3, Wiely
3.	General theory of electrical machines	B. Adkins	Springer Dordrecht

Subject Code	EE104702	L = 2	T = 1	P = 2	Credits = 3
Subject	Electrical Drives	CT	TA	Total	ESE Duration
Evaluation Scheme	100	20	30	150	3 Hrs

Course Objectives	Course Outcomes
1. Describe the structure of Electric Drive systems and their role in various applications. 2. Describe the operation of dc motor drives to satisfy four-quadrant operation to meet mechanical load requirements. 3. Describe the operation of induction machines in steady state. 4. Describe speed control of induction motor drives in an energy efficient manner using power electronics. 5. Describe synchronous motor drive operation. 6. Describe operation of tractions Drives.	On successful completion of the course, the student will be able to: **CO1**:- Electric drive systems for different mode of operations. **CO2**:- Performance and ratings of drive on the basis of heating and cooling. **CO3**:- Operation of tractions drive. **CO4:**- Speed control of DC and AC machines using Power Electronics devices.

UNIT – I Electric Drives Basic concept of electric drives its advantages and types, choice of electric drives, Fundamental equations, speed torque conversions and multi quadrant operation, drive parameters, component of load torque, nature and classification of load torques, calculation of time and energy loss in transient operation ,steady state stability and load equalization	**CO1 [8Hrs]**
UNIT – II Control and Rating of Electric Drives: Modes of operation of electric drives, Closed loop control of drives, closed loop control of multi-motor drives, Selection of motor power rating-Heating and Cooling of motors, Selection of motor power rating under different loading conditions, Continuous ,Short and Intermittent periodic duty.	**CO2 [8Hrs]**
UNIT – III DC Drives: Review of dc motors and their performance, Braking: Regenerative braking, Dynamic braking, Plugging. Speed control, Controlled Rectifier fed dc drives: single phase and three phase half controlled and fully controlled, Multi quadrant operation of dc drives, Chopper Controlled dc drives.	**CO3 [6Hrs]**
UNIT – IV Induction and Synchronous Motor Drives: Review of conventional method of starting, and Speed control, Braking: Regenerative braking, Dynamic braking, Plugging. Speed control by stator voltage control, supply frequency control, Voltage source inverter (VSI) and current source inverter (CSI) fed three-phase induction motor drives, Static rotor resistance control induction motor drive, Slip power recovery drives. **Synchronous motor drives**: Speed control of synchronous motor using voltage and current source inverters, Self-controlled synchronous motor drives.	**CO4 [8Hrs]**
UNIT – V Traction Drives: Electric Traction system, Nature of traction load, calculation of Traction drive rating and energy consumption, Important feature of traction drives, Motors employed in traction, Conventional method for AC and DC traction drives control, Semiconductor converter-controlled drives employing DC motors, AC motors for 25 KV AC traction.	**CO5 [6Hrs]**

Text Books:

S. No.	Title	Authors	Publisher
1.	Fundamentals of electrical drives	G K Dubey	Narosa Pb
2.	Electric Drives	Vedam Subramanyam	TMHP bs

Reference Books:

S. No.	Title	Authors	Publisher
1.	Electric Motor Drives	R. Krishnan	PHI Pb
2.	Modern Power Electronics and AC Drives	B K Bose	Pearson Education

Subject Code	EE104703	L = 2	T = 1	P = 0	Credits = 3
Subject	**Power Apparatus and Systems**	**CT**	**TA**	**Total**	**ESE Duration**
Evaluation Scheme	**100**	**20**	**30**	**150**	**3 Hours**

Course Objectives	Course Outcomes
The objective of this course is: 1. To understand the concept to mechanical design of transmission (overhead) line. 2. To provide knowledge about the different types of distribution system. 3. To provide students with the knowledge of types of grounding system 4. To provide the knowledge about the protection against over voltage. 5. To provide the knowledge about the reliability of transmission and distribution system.	After successful completion of this course, student will be able to**:** **CO1**: Acquire knowledge of mechanical design of transmission line **CO2**: Describe different types of Distribution system. **CO3**: Explain about various types of grounding system. **CO4**: Explain the protection against over voltage. **CO5:** Correlate basic concept of reliability of transmission and distribution system.

UNITI: Mechanical Design of Overhead Lines: Overhead Line Main Components, Conductor Materials, Line Supports ,Insulators, Potential Distribution over Suspension Insulator String, Sag and Tension Calculation, String Efficiency, Ways of Enhancing String Efficiency, Numerical, Overhead Line Sag, Sag and tension of the conductor, Sag Calculation , Wind and ice loading effect, Numerical.	**CO1[8Hrs]**
UNITII: Distribution System: Types of Distribution System, Various types of AC & DC Distributors, Voltage Drop Calculation, Selection of Distribution Voltage, Size of Conductor, Kelvin's Law.	**CO2[8Hrs]**
UNIT III: Power System Grounding: Different Methods of grounding : Neutral Grounding, Solid Grounding, Resistance Grounding, Reactance Grounding, Arc Suppression Coil Grounding, Zig-Zag Transformer Grounding, Effect of Grounding on System Over Voltages. Merits & Demerits of Various Grounding Systems.	**CO3[8Hrs]**
UNITIV: Protection Against Over voltages: Voltage Surge, Causes of Over voltages, Internal Causes of Overvoltages Lightning ,Mechanism of Lightning Discharge ,Types of Lightning Strokes ,Harmful Effects of Lightning , Protection Against Lightning ,The Earthing Screen ,Overhead Ground Wires ,Lightning Arresters Types of Lightning Arresters , Surge Absorber.	**CO4[6 Hrs]**
Unit V:Reliability of Transmission and distribution System: Definitions of Outage , Bath Tub Curve , Causes of Failures, Two State Model, Failure & Repair Rate, Probability Density Function, Reliability of Series / Parallel System , Reliability Planning , Preparation of Reliability Models. Numerical problems related to Reliability of Transmission and distribution system.	**CO5[6Hrs]**

Text Book:

S.No.	Title	Author	Publisher
1.	Power System Analysis &Design	B. R. Gupta	S. Chand Publications
2.	A Course in Electrical Power	Soni, Gupta and Bhatnagar	Dhanpat Rai and Sons
3.	An Introduction to Reliability and Maintainability Engineering	Ebeling	Tata McGraw Hill

Reference Book:

S. No.	Title	Author	Publisher
1.	Electrical Power Systems	C. L.Wadhwa	New Age International Publisher
2.	Transmission & Distribution	Westing house Electric Corporation	Westinghouse Electric Corporation
3.	Transmission & Distribution of Electrical Power	J. B. Gupta	S.K. Kataria & Sons

Subject Code	EE104721	L = 3	T = 0	P = 0	Credits = 3
Subject	**Flexible AC Transmission System**	**CT**	**TA**	**Total**	**ESE Duration**
Evaluation Scheme	**100**	**20**	**30**	**150**	**3 Hours**

COURSEOBJECTIVES	COURSEOUTCOMES
The objective of this course is: 1. Students will understand the basic knowledge of FACTS controller and its types. 2. Students will understand the knowledge of VSC and CSC. Students will understand the working principle of Static Shunt, Static Series and Combined Compensators.	After successful completion of this course, student will be able to**:** CO1: -Gain the basic Knowledge of FACTS controller and its types. CO2: -Explain the knowledge of VSC and CSC. CO3: -Describe the operation of Static Shunt, Static Series and Combined Compensators.

UNIT I : Introduction of FACTS Controllers: Problems of AC power transmission, Power Flow in parallel and meshed path, Overview of stability consideration, loading capabilities, Power flow control in AC transmission system, Reactive power compensation, Basic types of FACTS Controllers, Advantages of FACTS technology.	**CO1[8Hrs]**
UNIT II : Voltage Source Converters (VSCs) and Current Source Converters (CSCs): Basic concepts of VSC, single-phase full wave bridge converter operation, single phase-leg operation, three-phase full wave bridge converter and its operation, transformer connections for 12-pulse,24-pulse and 48-pulse operation. Basic concepts, three-phase CSCs, three-phase full wave rectifier, comparison of VSC and CSC.	**CO2[8Hrs]**
UNIT III: Static Shunt Compensators: Basic concepts, method of controllable VAR generation, Static VAR compensator (SVC), application of SVC in power systems, working of STATCOM, V-I and V-Q characteristics, transient stability enhancement and exchange of real power using STATCOM, comparison of SVC and STATCOM, Merits of hybrid compensators.	**CO3[8Hrs]**
UNIT IV: Static Series Compensators: Objectives of series compensation, variable impedance type series compensation, GTO thyristor controlled series capacitors (GCSC), thyristor controlled series capacitor (TCSC), basic concepts of GCSC and TCSC.	**CO4[6 Hrs]**
Unit V: Combined Compensators: UPFC: Unified Power Flow Controller (UPFC), basic operating principles, conventional transmission control capabilities, Comparison of UPFC to series compensators, Applications of UPFC. IPFC: Interline Power Flow Controller (IPFC), basic operating principles and characteristics, Applications of IPFC.	**CO5[6Hrs]**

Text Book:

S. No.	Title	Author	Publisher
1.	Understanding FACTS: Concepts and Technology of FACTS Systems	N. G. Hingorani and L. Gyugyi	Wiley-IEEE Press
2.	FACTS Controllers in Power Transmission and Distribution	K. R. Padiyar	New Age International (P) Ltd
3.	Reactive Power Control in Electric Systems	T. J. E. Miller	John Wiley and Sons

Reference Book

S.No.	Title	Author	Publisher
1.	Flexible AC Transmission Systems FACTS	Yong Hua Song, Allan T Johns	Institution of Electrical Engineers
2.	Flexible AC Transmission Systems	Xiao Ping Zhang, Christian Rehtanz, Bikash Pal	Springer
3.	Thyristor-based FACTS Controllers for Electrical Transmission Systems	R. Mohan & R. M. Mathur	John Wiley

Subject Code	EE100741	L = 3	T = 0	P = 0	Credits = 3
Subject	**Management Concepts and Techniques for Engineers**	**CT**	**TA**	**Total**	**ESE Duration**
Evaluation Scheme	**100**	**20**	**30**	**150**	**3 Hours**

Course Objectives	Course Outcomes
1. To develop skill of project planning and management among the student. 2. To understand the significance of human resource and its proper utilization for the organizational growth. 3. Students will learn to minimize the project cost by using effective management technique.	After successful completion of this course, student will be able to**:** CO1: Students can successfully design and execute project. CO2: Students will be capable of understanding the correlation between physical, market and human resources

UNIT I: Basic Management techniques: Planning, nature purpose and objectives of planning, organizing, nature and purpose of organizing, authority and responsibility, performance appraisal, controlling, process of controlling, control techniques.	**CO1,2[8 Hrs]**
UNIT II: Human resource management: Nature and scope of human resource planning, training and development, recruitment and selection, career growth, absenteeism, grievances, motivation and its types, need of motivation, reward and punishment, leaders, types of leaders, leadership styles, roles and functions of leaders, group and team working.	**CO1,2[8 Hrs]**
UNIT III: Marketing Management: Marketing environment, customer markets and buyer behavior, marketing mix, advertising and sales promotion, channels of distribution. **Financial management and accounting concepts:** book keeping, financial statements analysis, financial ratios. breakeven analysis.	**CO1,2[6Hrs]**
UNIT IV: Management Information Systems: Role of information in decision making, information system planning, design and implementation, evaluation and effectiveness of the information system, statistical quality control, total quality management and ISO certificate.	**CO1,2[6 Hrs]**
UNIT V: Social and ethical issues in management: Ethics in management, social factors, unfair and restrictive trade practices. Strategic and technology management: need, nature, scope and strategy SWOT analysis, value chain concept.	**CO1,2[8 Hrs]**

Text Books:

S. No.	Title	Authors	Edition	Publisher
1.	Principles of Management	Ankur Chhabra	1st	Sun India Publication
2.	Industrial organization and management	Ramchandran, Ramana Mutrhy	2nd	TMH

Reference Books:

S. No.	Title	Authors	Edition	Publisher
1.	Industrial management and engineering economics	K. C. Arora	1st	Khanna Publication
2.	Industrial engineering and management	O. P. Khanna	1st	DRD
3.	Management theory and practice	Chandan	1st	Vikas Pbs

Subject Code	EE104791	L = 0	T = 0	P = 2	Credits = 1
Subject	Electrical Machine-III Lab	CT	TA	Total	ESE Duration
Evaluation Scheme	25	0	25	50	50

COURSE OBJECTIVES	COURSE OUTCOMES
1. To introduce the concepts of ideal synchronous machines and poly-phase induction machines. 2. The Generalized Representation and steady state analysis of Synchronous Machines 3. The generator and motor operation in steady state and transient conditions 4. Applications which will be utilized in the electrical machines with its performance and theory of operation.	Students will be able to:- CO1: Explain the theory of ideal synchronous machines and, basic machine relation CO2: Analyze and apply the concept of steady state analysis and electrical transients in polyphase machines CO3: Make use of speed control system for AC motors. CO4: Evaluate the basic operation and performance of special machines and can select special machines for different purpose.

LIST OF EXPERIMENT:

1. Single phasing characteristics of 3-phase induction motor
2. Characteristics of 1-Phase AC commutator motor.
3. Output characteristics of Synchro Transmitter.
4. To use Synchro transmitter pair as remote control device.
5. Determination of negative sequence reactance of alternator by static test.
6. Determination of negative sequence reactance of alternator by line-to-line short circuit test.
7. Determination of negative sequence reactance of alternator by rotating test.
8. Determination of zero sequence impedance of a star-delta transformer.
9. Determination of zero sequence reactance of a three phase induction motor.
10. To perform slip test on alternator to determine X_d & X_q of three phase alternator
11. To study effect of capacitor on starting, running, and performance of induction motor.
12. Speed reversal of 1-phase induction motor.

Subject Code	EE104792	L = 0	T = 0	P = 2	Credits = 1
Subject	Electrical Drives Lab	CT	TA	Total	ESE Duration
Evaluation Scheme	25	0	25	50	50

Course Objectives	Course Outcomes
1. Describe the structure of Electric Drive systems and their role in various applications. 2. Describe the operation of dc motor drives to satisfy four-quadrant operation to meet mechanical load requirements. 3. Describe the operation of induction machines in steady state. 4. Describe speed control of induction motor drives in an energy efficient manner using power electronics. 5. Describe synchronous motor drive operation. 6. Describe operation of tractions Drives.	On successful completion of the course, the student will be able to: CO1:- Electric drive systems for different mode of operations. CO2:- Performance and ratings of drive on the basis of heating and cooling. CO3:- Operation of tractions drive. CO4:- Speed control of DC and AC machines using Power Electronics devices. CO5:- Operation of tractions drive.

List of experiments: (Minimum 10 experiments to be performed)

1. To study the heating time constant for a Continuous Duty Motor
2. To Study the heating time constant of a Short time Duty Motor
3. To Study the cooling time constant of a Short time Duty Motor
4. To Study the heating time constant of a Short Time Duty Motor
5. To Study the cooling time constant for an Intermittent Duty Motor
6. Performance and speed control of D.C drive using 3-phase full converter
7. Performance and operation of a four quadrant chopper on D.C drive
8. Study and performance of electrical Dynamic braking and Plugging of D.C shunt motor
9. Study of V/F control operation of 3-ϕ Induction motor
10. Simulation of PWM VSI/CSI fed 3-ϕ Induction motor control using MATLAB/PSPICE/PSIM software
11. Study of solid state stator voltage control of 3-ϕ Induction motor (using AC voltage regulator)
12. Performance and speed control of 3-ϕ Induction motor using 3-ϕ voltage source inverter
13. To study frequency control Synchronous motor drive
14. Study of Resistance wielding and Arc welding