



- **Department Name: Electrical Engineering**
- **PG Program Name: Power system and Power Electronics**

### Course Outcome CO's-

Sr. No.	Sem ester	Course Code	Course Name	Course Outcome
1.	I	SHP5151	Numerical Computational Technique	<ol style="list-style-type: none"> <li>1. Estimate the error.</li> <li>2. Apply the relevant numerical method for interpolating the polynomial</li> <li>3. Develop the equation to be fitted and fit the curve for given data</li> <li>4. Estimate numerically the solution of given algebraic equation.</li> <li>5. Use the relevant method for solving the simultaneous linear equations and compute the Eigen values.</li> <li>6. Construct the fuzzy set for given linguistic variable and apply fuzzy logic.</li> </ol>
2.	I	EPP1011	Computer aided PowerSystem Analysis	<ol style="list-style-type: none"> <li>1. Model different components of power system</li> <li>2. Carry out contingency analysis of power system</li> <li>3. Analyze power network by conducting power flow studies</li> <li>4. Model and simulate generator excitation system</li> <li>5. Estimate state of power system using state estimation theory</li> </ol>
3.	I	EPP1021	Electric and Hybrid Electric Vehicles	<ol style="list-style-type: none"> <li>1. Discuss the trends and philosophy of electric vehicles</li> <li>2. Analyze Conventional Vehicles and Powertrains</li> <li>3. Discuss the electric drive mechanism.</li> <li>4. Classify hybrid electric vehicles</li> <li>5. Differentiate Electric and range-extended electric vehicles</li> <li>6. Describe plug-in hybrid electric vehicles and electrical infrastructure</li> </ol>
4.	I	EPP1031	Wind andSolar energy Technology	<ol style="list-style-type: none"> <li>1. Describe the principle of energy generation from wind and solar PV systems</li> <li>2. Formulate wind and solar energy systems by mathematical equations</li> <li>3. Assess energy produced from wind and solar energy systems.</li> <li>4. Compare the different methods of energy generation from wind and energy systems</li> <li>5. Develop economic analysis of a wind turbine and solar PV systems</li> </ol>
5.	I	EPP1041	Advanced Power Electronics systems	<ol style="list-style-type: none"> <li>1. Classify different type's converters with respect to power output, configuration and application.</li> <li>2. Compare different types of power converters</li> <li>3. Describe the working principle of different types of power converters</li> <li>4. Model different types of power converters mathematically.</li> </ol>



				5. Design pore converter for specific application.
6.	I	EPP1051	Distribution Automation	<ol style="list-style-type: none"> <li>1. Prepare layout of the substations and feeders considering load and desired voltage</li> <li>2. Design distribution system and associated equipment and devices.</li> <li>3. Identify an appropriate method of communication for any particular distribution system with a view of automation and SCADA</li> <li>4. Analysis distribution feeder components.</li> <li>5. Model the different distribution feeder components.</li> </ol>
7.	I	EPP1061	HVDC Transmission	<ol style="list-style-type: none"> <li>1. Justify the need of HVDC Transmission system for power transmission</li> <li>2. Analyze different working modes of converters used for HVDC transmission</li> <li>3. Compare different control schemes employed for controlling HVDC system</li> <li>4. Compute the filter parameters for elimination of voltage and current harmonics inHVDC system</li> <li>5. Draw and compare different configuration multi-terminal HVDC system</li> </ol>
8.	I	EPP1071	Power Electronics Applicationto Power Systems	<ol style="list-style-type: none"> <li>1. Justify need of reactive power compensation schemes</li> <li>2. Classify different power electronics based reactive power compensation systems</li> <li>3. Identify suitable reactive power compensation system for specific power systemproblems.</li> <li>4. Compare performance of different power electronics based reactive powercompensation systems</li> <li>5. Design suitable power electronic based reactive power compensation system forspecific power system problem</li> </ol>
9.	I	EPP1081	Smart Grid Technologies	<ol style="list-style-type: none"> <li>1. Discuss the smart grid in Indian perspective</li> <li>2. Explain various smart grid technologies.</li> <li>3. Describe smart meters and advance metering infrastructure.</li> <li>4. Compare Smart grid and microgrid</li> <li>5. Apply power quality management in smart grid Identify communication technologies for smart grid</li> </ol>
10.	I	EPP1091	Power System Steady StateAnalysis Lab	<ol style="list-style-type: none"> <li>1. Develop script to analyze symmetrical components using power system software.</li> <li>2. Analyze load flow and fault studies of given power system network using power systemsoftware.</li> <li>3. Develop programme for power system optimization problem</li> </ol>



				<ol style="list-style-type: none"> <li>4. Develop estimation algorithm using least square methods.</li> <li>5. Use various power system software packages to analyze power system networks</li> </ol>
11		EPP1101	Renewable Energy Lab	<ol style="list-style-type: none"> <li>1. Prepare report on wind resource assessment</li> <li>2. Operate and maintain squirrel cage and DFIG based systems.</li> <li>3. Compute reactive power requirement for standalone wind turbine system</li> <li>4. Demonstrate the effects of shadowing on PV modules</li> <li>5. List the installation materials for off grid PV systems</li> </ol>
12		SH551	Technical Communication	<ol style="list-style-type: none"> <li>1. Acquire skills required for good oral and written communication</li> <li>2. Demonstrate improved writing and reading skills</li> <li>3. Ensure the good quality of oral and written communication</li> </ol>
13	II	EPP2011	Power System Dynamics and Stability	<ol style="list-style-type: none"> <li>1. Describe power system operating states and control</li> <li>2. Analyze synchronous machine models</li> <li>3. Model excitation and prime mover system</li> <li>4. Explain the power system stability</li> <li>5. Discuss scenario of voltage collapse</li> </ol>
14	II	EPP2021	Advanced Control of Electrical Drives	<ol style="list-style-type: none"> <li>1. Justify the need of closed loop drive system for industrial applications.</li> <li>2. Explain the working principle of different types of drive system.</li> <li>3. Compare different types of electric drives.</li> <li>4. Develop mathematical models of electric drive system for specific application.</li> <li>5. Design controllers for closed-loop operation of different types of electrical motors.</li> </ol>
15		EPP2031	Grid Integration of Renewable Energy Sources	<ol style="list-style-type: none"> <li>1. Summarize the grid codes for integration of renewable energy sources</li> <li>2. Explain the working principle of different power electronic topologies and controllers.</li> <li>3. Model mathematically renewable energy sources and associated control system</li> <li>4. Design systems to reduce impact of renewable energy fluctuations on grid</li> <li>5. Develop simulation systems using MATLAB</li> </ol>
16	II	EPP2041	Digital Protection of Power System	<ol style="list-style-type: none"> <li>1. Discuss the importance of power electronics devices in power system protection.</li> <li>2. Distinguish between conventional relays and modern relays</li> <li>3. Apply mathematical approach towards</li> </ol>



				<p>protection</p> <ol style="list-style-type: none"> <li>4. Develop algorithms for numerical protection</li> <li>5. Explore recent advances in digital protection of power systems</li> </ol>
17	II	EPP2051	Power System Optimizati on	<ol style="list-style-type: none"> <li>1. Explain the need of power system optimization</li> <li>2. Formulate power system optimization problem</li> <li>3. Apply numerical and heuristic technique to solve power system optimizationproblem.</li> <li>4. Solve power system optimization problem</li> <li>5. Assess the impact of parameters on defined optimization problem.</li> </ol>
18	II	EPP2061	Power System Restructuring	<ol style="list-style-type: none"> <li>1. Describe the new dimensions associated with the power systems.</li> <li>2. Determine transmission congestion management</li> <li>3. Discuss pricing of transmission network</li> <li>4. Explain ancillary service management in electrical market</li> <li>5. Justify the role and functions of PX, IEX and various organization in Indian restructuredpower market</li> </ol>
19	II	EPP2071	Power Quality and Harmonics	<ol style="list-style-type: none"> <li>1. Discuss various power quality problems and their analysis.</li> <li>2. Classify various voltage quality issues and solutions.</li> <li>3. Describe Power Quality Standards and Monitoring.</li> <li>4. Asses sources of harmonic in power system</li> <li>5. Analyze effects of Harmonics on Power system</li> <li>6. Design of harmonic filters.</li> </ol>
20	II	EPP2081	Energy Storage Systems	<ol style="list-style-type: none"> <li>1. Discuss the energy storage as a structural unit of a power system.</li> <li>2. Compare various energy storage technologies for power systems.</li> <li>3. Apply battery energy storage and management for power system.</li> <li>4. Describe hydrogen energy storage for power system.</li> <li>5. Discuss short-term, mid-term and long-term applications of power system.</li> <li>6. Analyze economics and reliability of energy storage Systems</li> </ol>
21	II	EPP2091	Research Methodology & IPR	<ol style="list-style-type: none"> <li>1. Formulate a research problem.</li> <li>2. Analyze research related information</li> <li>3. Prepare and present research proposal/paper by following research ethics</li> <li>4. Make effective use of computers and computing tools to search information, analyzeinformation and prepare report.</li> </ol>



				5. Describe nature and processes involved in development of intellectual property rights
22	II	EPP2101	Advanced Power System Protection Lab	<ol style="list-style-type: none"> <li>1. Analyze characteristics of digital relays</li> <li>2. Demonstrate fault simulation on different protection panels</li> <li>3. Develop an algorithm for different protection schemes</li> <li>4. Simulate protection models</li> </ol> <p>Interpret the simulation results</p>
23	II	EPP2111	Advanced Electric Drives Lab	<ol style="list-style-type: none"> <li>1. Demonstrate control of Induction motor drive.</li> <li>2. Experiment with chopper fed DC drive system.</li> <li>3. Experiment with three phase half and full converter fed DC motor drive.</li> <li>4. Demonstrate control of BLDC, servo and stepper motor drive system.</li> </ol> <p>Demonstrate control of AC and DC drives using MATLAB/SIMULINK</p>
24	II	EPP2121	MiniProject	<ol style="list-style-type: none"> <li>1. Formulate a real world problem.</li> <li>2. Design solution for a set of requirements.</li> <li>3. Use software packages available to analyze the proposed theory.</li> <li>4. Explain technical ideas, strategies and methodologies in written form and oral presentations</li> </ol>
25	III	EPP3011	Industry Internship	<ol style="list-style-type: none"> <li>1. Apply engineering knowledge learned during the program.</li> <li>2. Apply his/her technical skills to solve industrial problem.</li> <li>3. Work in multi-disciplinary environment.</li> </ol>
26	III	MOE2010	Artificial Intelligence - Machine Learning	<ol style="list-style-type: none"> <li>1. Describe central machine learning methods and techniques and how they relate to artificial intelligence</li> <li>2. Differentiate between supervised and unsupervised learning techniques</li> <li>3. Apply the ML algorithms to a real-world problem,</li> <li>4. Optimize the models learned and report on the expected accuracy that can be achieved by applying the models.</li> <li>5. Evaluate a given problem and apply appropriate machine learning technique</li> </ol>
27	III	MOE2020	Creative Thinking: Techniques & Tools	<ol style="list-style-type: none"> <li>1. Comprehend importance in tackling global challenges as well as in everyday problem-solving scenarios</li> <li>2. Apply different brainstorming techniques in group activities</li> <li>3. Be proficient in the application of the 6 thinking hats tool in different life scenarios</li> <li>4. Develop a systematic approach to idea generation through the use of morphological</li> </ol>



				<p>analysis</p> <ol style="list-style-type: none"> <li>Innovate on an existing product, service or situation applying the SCAMPER method</li> <li>Get confident with the theory of inventive problem solving, called TRIZ Select and apply the appropriate technique based on the opportunity to seize the problem to tackle</li> </ol>
28	III	MOE2030	MOOC Course	<ol style="list-style-type: none"> <li>Identify the real applications and practices of courses studied, at industry level</li> <li>Recognize various modeling, analysis and validation techniques adopted in industries.</li> <li>Demonstrate the issues at design, manufacturing and assembly levels.</li> <li>Summarize and present technical data in report format.</li> </ol>
29	III	MOE2040	Condition Monitoring and Signal Processing	<ol style="list-style-type: none"> <li>Identify the maintenance scheme, their scope and limitations – apply the maintenance strategies to various problems in the industrial sectors.</li> <li>Analyze for machinery condition monitoring and explain how this complements monitoring the condition.</li> <li>Develop an appreciation for the need of modern technological approach for plant maintenance to reduce the maintenance expenditure.</li> <li>Emphasizes on case studies that require gathering information using the modern testing equipment and processing it to identify the malfunction in that system.</li> <li>Identify vibration measurement, lubrication oil analysis.</li> </ol>
30		MOE2050	Aircraft Conceptual Design	<ol style="list-style-type: none"> <li>Understand the design process of aircraft and decide the aircraft configuration.</li> <li>Choose type of power plant as per flight regime.</li> <li>Decide the fuselage layout as per type of aircraft.</li> <li>Design the wing for type of aircraft and its wing loading.</li> <li>Accurately evaluate lift, drag and mass for design synthesis process.</li> </ol>



31	III	EPP3021	Dissertation Stage I	<ol style="list-style-type: none"> <li>1. Identify research opportunities in his/her domain or multidisciplinary domains</li> <li>2. Formulate the problem statement and its objectives correctly</li> <li>3. Apply the principles of project management during development of the project</li> <li>4. Present synopsis in logical order</li> <li>5. Write synopsis of the proposed system</li> </ol>
32	III	EPP3031	Dissertation Stage II	<ol style="list-style-type: none"> <li>1. Identify research opportunities in his/her domain or multidisciplinary domains.</li> <li>2. Formulate the problem statement and its objectives correctly</li> <li>3. Develop, simulate and implement the system by complying with desired technical specifications</li> <li>4. Analyze and synthesize obtained results in theoretical and practical context</li> <li>5. Present report in logical order</li> <li>6. Write report of the system implementation</li> </ol>
33	IV	EPP4011	Dissertation Stage III	<ol style="list-style-type: none"> <li>1. Formulate the problem statement and its objectives correctly</li> <li>2. Develop, simulate and implement the system by complying with desired technical specifications</li> <li>3. Analyze and synthesize obtained results in theoretical and practical context</li> <li>4. Present report in logical order</li> <li>5. Write report of the system implementation</li> <li>6. Apply the principles of project management during development of the project</li> </ol>
34	IV	EPP4021	Dissertation Stage IV	<ol style="list-style-type: none"> <li>1. Formulate the problem statement and its objectives correctly</li> <li>2. Develop, simulate and implement the system by complying with desired technical specifications</li> <li>3. Analyze and synthesize obtained results in</li> </ol>



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				<p>theoretical and practical context</p> <ol style="list-style-type: none"><li>4. Present report in logical order</li><li>5. Write report of the system implementation</li><li>6. Apply the principles of project management during development of the project</li></ol>
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