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(An Autonomous Institute, affiliated to Shivaji University, Kolhapur)
Curriculum Structure and Evaluation Scheme of
M. Tech. Power Systems & Power Electronics
Department of Electrical Engineering
(2019-20)
Rev: PSPE/ Course Structure/RIT/01/2020-22

Department: Electrical Engineering **Semester:** I
Class: First Year M.Tech. Electrical- Power Systems and Power Electronics

Course Code	Course	Teaching Scheme				Evaluation Scheme					
							Theory Marks			Practical Mark	
		L	T	P	Credits	Scheme	Max	Min. % for passing		Max.	Min.% for passing
SH 515	Numerical Computational Techniques	3	-	-	3	ISE	20	40	40	----	----
						UT1	15			----	----
						UT2	15			----	---
						ESE	50	40		----	----
EPP1010	Computer Aided Power System Analysis	3	-	-	3	ISE	20	40	40	----	----
						UT1	15			----	----
						UT2	15			----	----
						ESE	50	40		----	----
EPP1020	Electric and Hybrid Electric Vehicles	3	-	-	3	ISE	20	40	40	----	----
						UT1	15			----	----
						UT2	15				
						ESE	50	40		----	----
	Program Elective-I	3			3	ISE	20	40	40	----	----
						UT1	15			----	----
						UT2	15			---	----
						ESE	50	40		----	----
	Program Elective-II	3			3	ISE	20	40	40	----	----
						UT1	15			----	----
						UT2	15				
						ESE	50	40		----	----
EPP1090	Power System Steady State Analysis Lab	-	-	4	2	ISE	----	----		50	50
						ESE	---	----		50	50
EPP1100	Renewable Energy Lab	-	-	4	2	ISE	----	----		50	50
						ESE	----	----		50	50
	TOTAL	**15**	**-**	**8**	**19**						

Total Contact Hours/week : 23
Total Credits : 19

ISE = In Semester Exam, MSE (UT1+UT2), UT-I = Unit Test-I, UT-II = Unit Test-II, ESE = End Semester Exam

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Curriculum Structure and Evaluation Scheme of
M. Tech. Power Systems & Power Electronics
Department of Electrical Engineering
(2019-20)
Rev: PSPE/ Course Structure/RIT/01/2020-22

Department: Electrical Engineering **Semester:** II
Class: First Year M.Tech. Electrical- Power Systems and Power Electronics

Course Code	Course	Teaching Scheme				Evaluation Scheme				
		L	T	P	Credits	Scheme	Theory Marks Max	Theory Marks Min. % for passing	Practical Marks Max.	Practical Marks Min.% for passing
EPP2010	Power System Dynamics and Stability	3	-	-	3	ISE	20	40	----	----
						UT1	15		----	----
						UT2	15		----	---
						ESE	50	40	----	----
EPP2020	Advanced Control of Electric Drives	3	-	-	3	ISE	20	40	----	----
						UT1	15		----	----
						UT2	15		----	----
						ESE	50	40	----	----
	Program Elective-III	3	-	-	3	ISE	20	40	----	----
						UT1	15		----	----
						UT2	15			
						ESE	50	40	----	----
	Program Elective-IV	3	-	-	3	ISE	20	40	----	----
						UT1	15		----	----
						UT2	15		---	----
						ESE	50	40	----	----
EPP2090	Research Methodology & IPR	1	1	0	2	ISE	25	40	----	----
						ESE	50	40	----	----
									----	----
EPP2100	Power System Protection Lab	-	-	4	2	ISE	----	----	50	50
						ESE	---	----	50	50
EPP2111	Advanced Electric Drives Lab	-	- -	4	2	ISE	----	----	50	50
						ESE	----	----	50	50
SHP551	Technical Communication	2	-	-	Audit	ISE	P/NP			
EPP2120	Mini Project			4	2	ISE	---	---	100	50
	TOTAL	**17**	**1**	**12**	**20**					

Total Contact Hours/week : 30
Total Credits : 20

ISE = In Semester Exam, MSE (UT1+UT2) UT-I = Unit Test-I, UT-II = Unit Test-II ESE = End Semester Exam, P=Pass, NP=Not Pass

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List of Program Elective (PE) choice-based course:

Program Elective-I

Sr. No.	Course Code	Course
1.	EPP1030	Wind and Solar Energy Technology
2.	EPP1040	Advanced Power Electronics Systems
3.	EPP1050	Distribution Automation

Program Elective-II

Sr. No.	Course Code	Course
1.	EPP1060	HVDC Transmission
2.	EPP1070	Power Electronics Application to Power System
3.	EPP1080	Smart Grid Technologies

Program Elective-III

Sr. No.	Course Code	Course
1.	EPP2030	Grid Integration of Renewable Energy Sources
2.	EPP2040	Digital Protection of Power Systems
3.	EPP2050	Power System Optimization

Program Elective-IV

Sr. No.	Course Code	Course
1	EPP2060	Restructured Power System
2	EPP2070	Power Quality and Harmonics
3	EPP2080	Energy Storage Systems

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Department of Electrical Engineering
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Department: Electrical Engineering **Semester:** III
Class: Second Year M.Tech. Electrical- Power Systems and Power Electronics

Course Code	Course	Teaching Scheme				Evaluation Scheme				
							Theory Marks		Practical Mark	
		L	T	P	Credits	Scheme	Max	Min.% for passing	Max.	Min. % for passing
EPP3010	Industry Internship	-	-	2	Audit Course	ISE	-	-	P/NP	
	Open Elective	3	-	-	3	ESE	100	40	--	--
EPP3030	Dissertation Stage I	-	-	8	4	ISE	---	---	100	50
EPP3040	Dissertation Stage II	-	-	12	6	ISE	----	----	100	50
						ESE	----	----	100	50
	TOTAL	**3**		**22**	**13**					

Total Contact Hours/week : 25
Total Credits : 13

ISE=In Semester Evaluation, ESE=End Semester Exam, P=Pass, NP=Not Pass

List of Open elective (OE): Semester-III

Sr.No.	Course Code	Course
1.	MOE2010	Artificial Intelligence - Machine Learning
2.	MOE2020	Creative Thinking: Techniques and Tools
3.	MOE2030	MOOC Course
4.	MOE2040	Condition Monitoring and Signal Processing
5.	MOE2050	Aircraft Conceptual Design

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Department: Electrical Engineering **Semester:** IV
Class: Second Year M.Tech. Electrical- Power Systems and Power Electronics

Course Code	Course	Teaching Scheme				Evaluation Scheme			
		L	T	P	Credits	Scheme	Credits	Practical Mark	
								Max	Max. Min. % for passing
EPP4010	Dissertation Stage III	-	-	12	6	ISE	6	100	50
EPP4020	Dissertation Stage IV	-	-	20	10	ISE	4	100	50
						ESE	6	100	50
	TOTAL	-	-	**32**	**16**				

Total Contact Hours/week : 32
Total Credits : 16

ISE = In Semester Exam, ESE = End Semester Exam

Class: **SY M. Tech**	Semester- **III**	**L**	**T**	**P**	**Credits**
Course Code: MOE2010	Course Name: **Artificial Intelligence - Machine Learning**	**3**		--	**3**

Course Description:

Machine learning is a part of Artificial Intelligence. It uses interdisciplinary techniques such as statistics, linear algebra, optimization, and computer science to create automated systems that can sift through large volumes of data at high speed to make predictions or decisions without human intervention. Machine learning as a field is now incredibly pervasive, with applications spanning from business intelligence to homeland security, from analyzing biochemical interactions to structural monitoring of aging bridges, and from emissions to astrophysics, etc. This class will familiarize students with a broad cross-section of models and algorithms for machine learning, and prepare students for research or industry application of machine learning techniques.

Course Learning Outcomes:

After successful completion of the course, students will be able to,

1. Describe central machine learning methods and techniques and how they relate to artificial intelligence.
2. Differentiate between supervised and unsupervised learning techniques.
3. Apply the ML algorithms to a real-world problem.
4. Optimize the models learned and report on the expected accuracy that can be achieved by applying the models.
5. Evaluate a given problem and apply appropriate machine learning technique

Prerequisite:

Statistics, linear algebra, optimization techniques, programming language

Course Content

Unit No	Description	Hrs
1.	**Introduction to Artificial Intelligence and Machine learning:** Introduction: What Is AI and ML? Examples of AI and ML, Applications, Supervised Learning, Un-Supervised Learning and Reinforcement Learning, Important Elements of Machine Learning- Data formats, Learnability, Statistical learning approaches, Elements of information theory	06
2.	**Feature Selection:** Scikit- Learn Dataset, Creating training and test sets, managing categorical data, Managing missing features, Data scaling and normalization, Feature selection and Filtering, Principle Component Analysis(PCA)- non-negative matrix factorization, Sparse PCA, Kernel PCA. Atom Extraction and Dictionary Learning.	06
3	**Regression:** Linear regression- Linear models, A bi-dimensional example, Linear Regression and higher dimensionality, Polynomial regression,	06

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	Logistic regression-Linear classification, Logistic regression, Implementation and Optimizations, Stochastic gradient descendent algorithms	
4	**Naïve Bayes and Support Vector Machine:** Bayes Theorom, Naïve Bayes Classifiers, Naïve Bayes in Scikit- learn- Bernoulli Naïve Bayes, Multinomial Naïve Bayes, and Gaussian Naïve Bayes. **Support Vector Machine(SVM)**- Linear Support Vector Machines, Scikit-learn implementation, Linear Classification, Kernel based classification, Non- linear Examples. Controlled Support Vector Machines, Support Vector Regression.	**06**
5	**Decision Trees and Ensemble Learning:** Decision Trees- Impurity measures, Feature Importance. Decision Tree Classification with Scikit learn, Ensemble Learning-Random Forest, AdaBoost, Gradient Tree Boosting, Voting Classifier. Clustering Fundamentals- Basics, K-means: Finding optimal number of clusters, DBSCAN, Spectral Clustering. Evaluation methods based on Ground Truth- Homogeneity, Completeness, Adjusted Rand Index.	**04**
6	**Clustering Techniques:** Hierarchical Clustering, Expectation maximization clustering, Agglomerative Clustering Dendrograms, Agglomerative clustering in Scikit- learn, Connectivity Constraints. Introduction to Recommendation Systems- Naïve User based systems, Content based Systems, Model free collaborative filtering-singular value decomposition, alternating least squares.	**08**

References –

Text Books:
1. Giuseppe Bonaccorso, Machine Learning Algorithms, Packt Publishing Limited.
2. Josh Patterson, Adam Gibson, Deep Learning: A Practitioners Approach, O"REILLY, SPD.

Reference Books:
1. Ethem Alpaydin, Introduction to Machine Learning, PHI .
2. Peter Flach, Machine Learning: The Art and Science of Algorithms that Make Sense of Data, Cambridge University Press.

Class: **S.Y.M. Tech.**	Semester-**III**	**L**	**T**	**P**	**Credits**
Course Code: MOE2020	Course Name: **Creative Thinking: Tools & Techniques**	**3**	**--**	**--**	**3**

Course Description:

In today's ever-growing and changing world, being able to think creatively and innovatively are essential skills. It can sometimes be challenging to step back and reflect in an environment which is fast paced or when students required to assimilate large amounts of information. Making sense of or communicating new ideas in an innovative and engaging way, approaching problems from fresh angles, and producing novel solutions are all traits which are highly sought after by employers. This course will equip with a 'tool-box', introducing to a selection of behaviours and techniques that will augment innate creativity. Some of the tools are suited to use on own and others work well for a group, enabling you to leverage the power of several minds. People can pick and choose which of these tools or techniques suit needs and interests, focusing on some or all of the selected approaches and in the order that fits best.

Course Learning Outcomes:

After successful completion of the course, students will be able to,

1. Comprehend importance in tackling global challenges as well as in everyday problem-solving scenarios
2. Apply different brainstorming techniques in group activities.
3. Be proficient in the application of the 6 thinking hats tool in different life scenarios
4. Develop a systematic approach to idea generation through the use of morphological analysis.
5. Innovate on an existing product, service or situation applying the SCAMPER method.
6. Get confident with the theory of inventive problem solving, called TRIZ.
7. Select and apply the appropriate technique based on the opportunity to seize or the problem to tackle

Prerequisite:

There are no prerequisites to this online Creative Thinking course.

Course Content

Unit No	Description	Hrs
1.	**Introduction to the Principles of Creativity:** Basic principles of creativity and highlight its importance in tackling global challenges. Creativity is explored and applied at two different levels, lower and higher-level creativity	**06**

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2.	**Creativity Tools:** Augment our creativity using different methods of Brainstorming, a creativity approach that aids the generation of ideas in solving a stated problem. Particularly focus on the application of brainstorming tools in group activities, with the aim of enabling to understand, evaluate and apply different types of brainstorming techniques in own context.	**06**
3.	**Six Thinking Hats:** Principles as well as application of the 6 Hats thinking tool both at an individual level and in a group, under various professional and personal situations, allowing students to develop competency and accelerate proficiency on the use of technique.	**06**
4.	**Clarifying the Problem:** Organizing a process, turning problems into opportunities, facts, feelings & hunches, problem as question.	**06**
5.	**Generating Ideas:** Brainstorming, scamper, forced connections, portable think tank, case studies on generating ideas.	**06**
6.	**Developing Ideas & Planning for action:** Organizing ideas, ideas to solutions, implementing solutions, case studies of development of ideas and plan of action.	**06**

References –

Text Books:

1. Thinker toys. A Handbook of Creative-Thinking Techniques, Ten Speed Press.
2. Michael Michalko. Cracking Creativity: The Secrets of Creative Genius. Ten Speed Press.
3. Edward de Bono. Lateral Thinking: A Textbook of Creativity.Penguin.
4. Edward de Bono. Six Thinking Hats. Penguin.

Reference Books:

1. Creative Thinkering: Putting Your Imagination to Work, New World Library.
2. Chris Griffiths, Kogan. The Creative Thinking Handbook: Your Step by Step Guide to Problem Solving in Business.

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Class: **S. Y. M.Tech.**	Semester-**III**	**L**	**T**	**P**	**Credits**
Course Code: MOE2030	Course Name: **MOOC Course**	--	--	--	**3**

Student can opt for online certification course and produce certificate.

1. The students who are doing course on MOOC/NPTEL course/Courses suggested by DPGC should select the course in consultation with supervisor and submit the details to head of Program.
2. The course should be minimum of 20 hours duration and should have certification facility.
3. Student should complete course and get certificate. The certificate copy should be submitted to head of program with supervisor signature.
4. If student fails to produce this certificate at the time of ESE, he or she will not be eligible to give ESE of Online/Certification course.

Course Outcomes:

After successful completion of the course, students will be able to,

1. Identify the real application and practices of the courses studied, at the industry level.
2. Recognize various modeling ,analysis and validation techniques adopted at industries.
3. Demonstrate the issue at design, manufacturing and assembly level.
4. Summarize and persent technical data in report format.

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Class: **S. Y. M. Tech**	Semester-**III**	**L**	**T**	**P**	**Credits**
Course Code: MOE2040	Course Name : **Condition Monitoring and Signal Processing**	**3**	**--**	**--**	**3**

Course Description:

The subject of condition monitoring and signal processing has been recently receiving considerable attention in India owing to concerns related to equipment reliability and safety. This increasing interest is primarily due to the significant impact of economic changes and strong competition in the global market. This course will provide students with the state of the art techniques in condition monitoring along with the recent developments in the field of signal processing, thermography, ultrasonics apart from the traditional noise and vibration monitoring. There will be demonstration of real-time machinery health monitoring by various condition monitoring aspects.

Course Learning Outcomes:

After successful completion of the course, students will be able to,

1. Identify the maintenance scheme, their scope and limitations – apply the maintenance strategies to various problems in the industrial sectors.
2. Analyze for machinery condition monitoring and explain how this compliments monitoring the condition.
3. Develop an appreciation for the need of modern technological approach for plant maintenance to reduce the maintenance expenditure.
4. Emphasizes on case studies that require gathering information using the modern testing equipment and processing it to identify the malfunction in that system.
5. Identify vibration measurement, lubrication oil analysis.

Prerequisite: Mechanical Vibration

Course Content

Unit No	Description	Hrs
1.	**Introduction:** Introduction to condition based maintenance, application and economic benefits. Typical defects in gears and rolling element bearings Vibrations of Gears and Bearings, Vibration characteristics of non-defective gears; Vibration characteristics of non-defective bearings; Vibration characteristics of defective gears; Vibration characteristics of defective bearings.	**06**

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2.	**Monitoring Methods:** Early time domain methods, spectral methods, cepstral methods, envelope methods. Vibration Analysis: Vibration- simple harmonic motion concept, vibration monitoring equipment, system monitors and vibration limit detectors, vibration monitoring examples, and critical vibration levels.	**06**
3.	**Sound Monitoring:** Sound frequencies, sound loudness measurement, acoustic power, sound measurement, sound level meters, sound analyzers, and sound signal data processing, sound monitoring.	**06**
4.	**Discrete Frequencies:** Simple vibrations, transverse vibration of bars approximate frequency calculations, more precise evaluations- overtones, torsional oscillation of flywheel-bearing shafts, belt drives, whirling of shafts, gear excitation, rolling element bearing, blade vibration, cam mechanism vibration.	**06**
5.	**Machine Condition Indicators:** RMS value, peak value and crest factor, kurtosis, defect severity index. Measurement Techniques: Instrumentation, data acquisition, signal filtering, signal analysis - online and offline techniques, normalized order analysis.	**06**
6.	**Signal Processing Tools:** Sample rate and aliasing, time and frequency domain analysis. Case Studies: Practical applications of diagnostic maintenance, condition monitoring of mechanical and electrical machines. (Rotating Machines, Bearings and Gears, Fans, Blowers, Pumps, IC Engines, Motor Current Signature Analysis, Wear Debris and Oil Analysis, NDT, Ultrasonics, Eddy Current)	**06**

References

Text Books:

1. Norton, M. P., and Karczub, D. Fundamentals of Noise and Vibration Analysis for Engineers. Cambridge University Press.
2. Collacott, R. A. Mechanical Fault Diagnosis and Condition Monitoring. Chapman and Hall.
3. Fahy, F. J., and Walker, J. G. Fundamentals of Sound and Vibration. Spon Press.
4. Mohanty, A. R. Machinery Condition Monitoring: Principles and Practices. CRC Press.
5. Isermann, R. Fault Diagnosis Applications. Springer-Verlag, Berlin.
6. Rao, J. S. Vibration Condition Monitoring. Narosa Publishing House.
7. M. Abom, M. Sound and Vibration. KTH.

Reference Books:

1. Davies,A, Handbook of Condition Monitoring- Techniques and Methodology. Springer.

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Class: **S. Y. M. Tech**	Semester-**III**	**L**	**T**	**P**	**Credits**
Course Code: MOE2050	Course Name: **Aircraft Conceptual Design**	**3**	**--**	**--**	**3**

Course Description:

This course gives students the aircraft conceptual design process. It is a combination of numerous disciplines which are combined together to give optimum configuration as per customer's requirements. Students can design their aircraft layout, choose powerplant, and decide wing area and type. Students can evaluate lift, drag and mass for aircraft design synthesis process. He can optimize the design by altering various influencing factors so that the aircraft can go for next phase of design i.e. preliminary design.

Course Learning Outcomes:

After successful completion of the course, students will be able to:

1. Understand the design process of aircraft and decide the aircraft configuration.
2. Choose type of power plant as per flight regime.
3. Decide the fuselage layout as per type of aircraft.
4. Design the wing for type of aircraft and its wing loading.
5. Accurately evaluate lift, drag and mass for design synthesis process.
6. Examine the influence of various design requirements on the configuration of an aircraft to derive an optimized design.

Prerequisite:

Students should know the design of mechanical systems and components.

Course Content

Unit No.	Description	Hrs
1.	**Design Process and Aircraft Configuration:** Aircraft design process, cost considerations, optimization, and synthesis process. Conventional configuration, alternative configurations, special considerations. Case study of Tejas aircraft.	06
2.	**Flight Regime and Power plant Consideration:** Power plant characteristics, types of power plant, typical engine parameters, flight	06

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	regimes of power plants, power plant performance representation. Case study of Kaveri Engine.	
3.	**Fuselage Layout:** Primary considerations, overall layout, local layout aspects, crew and payload, fuselage procedures. Case study of Boring 787 aircraft.	**06**
4.	**Configuration of the Wing:** Aerofoil section and high lift devices, planform shape and geometry, interaction between aerodynamic structural and wing volume considerations, wing loading.	**06**
5.	**Basic Lift, Drag and Mass Representation:** Lift: aircraft configurations, initial assumptions, moderate to high aspect ratio wing configurations, low aspect ratio wing configuration. Drag: subsonic and transonic aircraft, transonic and supersonic configurations. Mass: absolute mass contributions, variable mass contributions, total mass.	**06**
6.	**Parametric Analysis and Optimization:** Procedure for parametric analysis (first stage), power plant representation, selection of performance equations, constraints and checks, case study: short/medium haul airliner. Procedure for parametric analysis and optimization (second stage), mass calculation, wing location and control surface areas, overall layout of the aircraft, case study: short/medium haul airliner.	**06**

References –

Text Books:

1. Denis Howe, Aircraft Conceptual Design Synthesis, WILEY.

Reference Books:

1. John Cutler, Understanding Aircraft Structures, WILEY Blackwell.
2. A.C Kermode, Flight without Formulae, 10th Edition, Pearson Education.
3. A.C Kermode, Mechanics of Flight, 5th Edition, Pearson Education.
4. Ian Moir, Allan Seabridge, Aircraft Systems: Mechanical, Electrical and Avionics Subsystems Integration, WILEY India Edition.