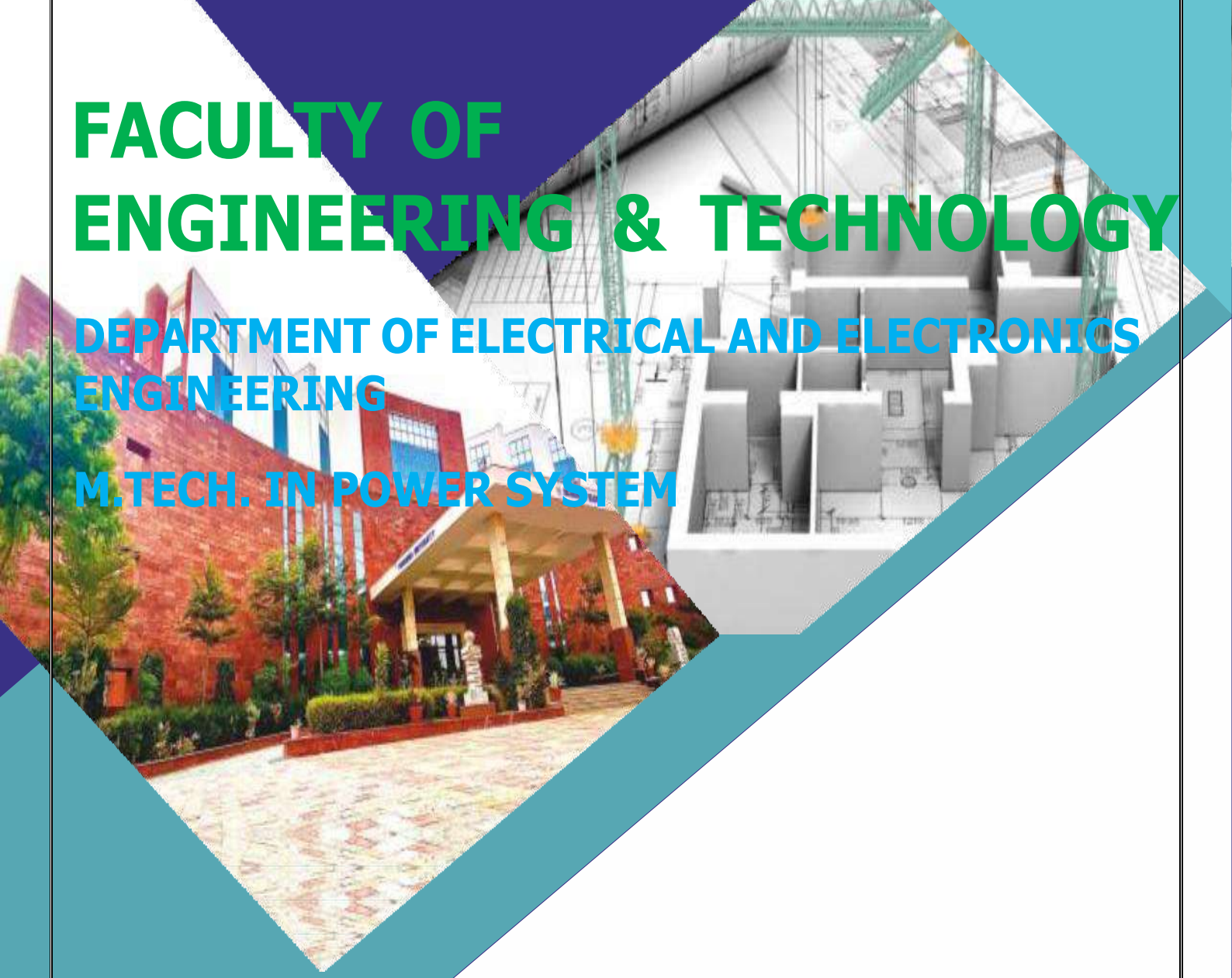
Your Dreams Our Goal

POORNIMA UNIVERSITY

Member of Association of Indian Universities & Approved by UGC (Govt. of India) under 2(f) & 12(B)



FACULTY OF ENGINEERING & TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

M.TECH. IN POWER SYSTEM

SCHEME & SYLLABUS BOOKLET

BATCH 2023-2025

SCHEME & SYLLABUS

BATCH: 2023-25

INDEX

Disclaimer: The scheme, syllabus and other materials published in this booklet may be changed or modified as per the requirement after approval of competent authority. The decision taken by the management of Poornima University will be final and abiding to all.

Student Details

Name of Student:

Name of Program:

Semester:

VISION

To create knowledge based society with scientific temper, team spirit and dignity of labor to face global competitive challenges.

Mission

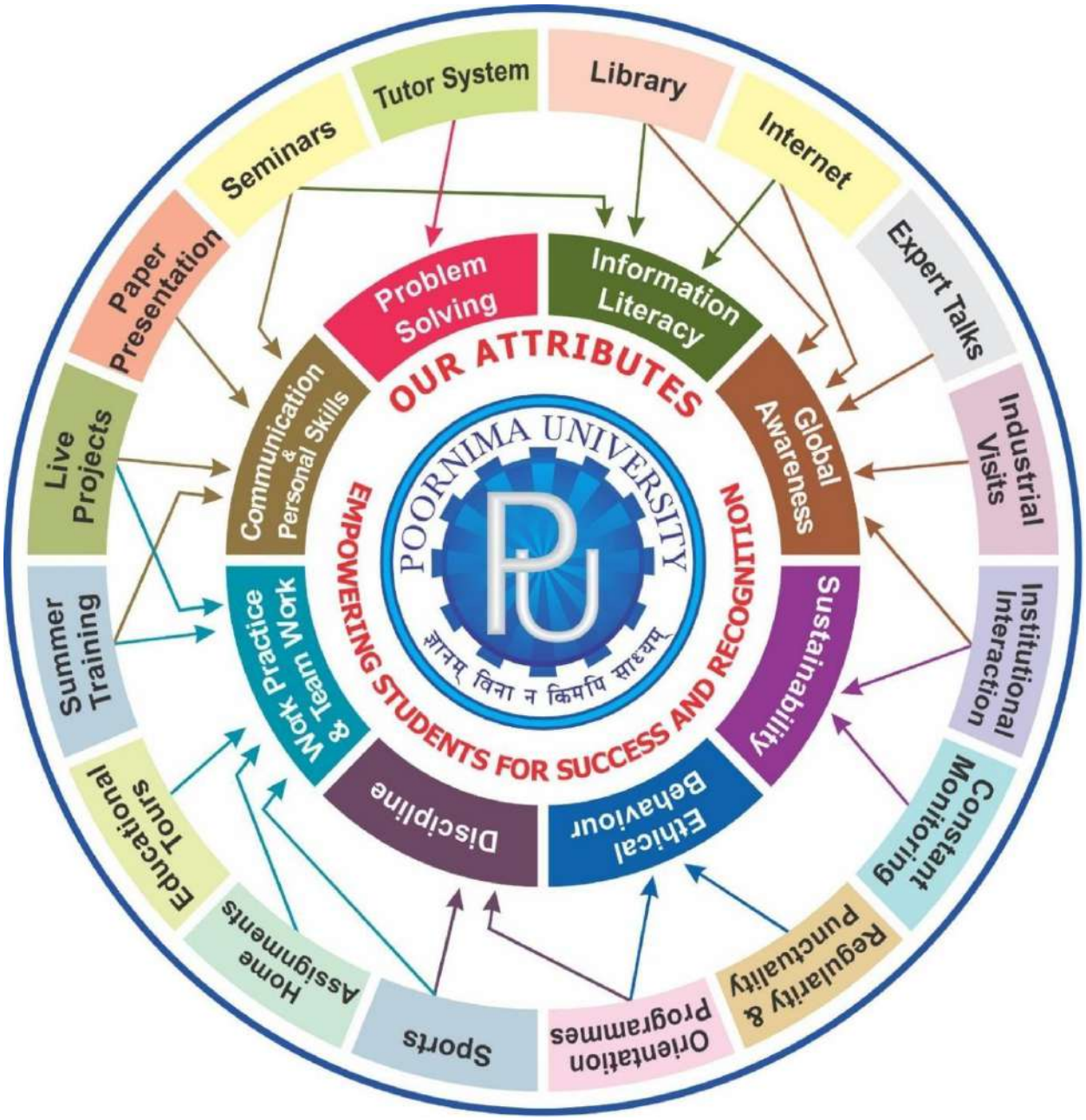
To evolve and develop skill based systems for effective delivery of knowledge so as to equip young professionals with dedication and commitment to excellence in all spheres of life.

Quality Policy

To provide Quality Education through Faculty development, updating of facilities and continual improvement meeting University norms and keeping stake holders satisfied

Knowledge Wheel

At Poornima, the academic atmosphere is a rare blend of modern technical aswell as soft skills and traditional systems of learning processes.



About Program and Program Outcomes (PO):

Title of the Programme: Bachelor of Technology (B. Tech.)

Nature of the Programme: B. Tech. is four year full-time programme.

Program Outcomes (PO) :

Engineering Graduates will be able to:

A. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

B. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

C. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

D. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

E. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

F. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

G. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

H. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

I. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

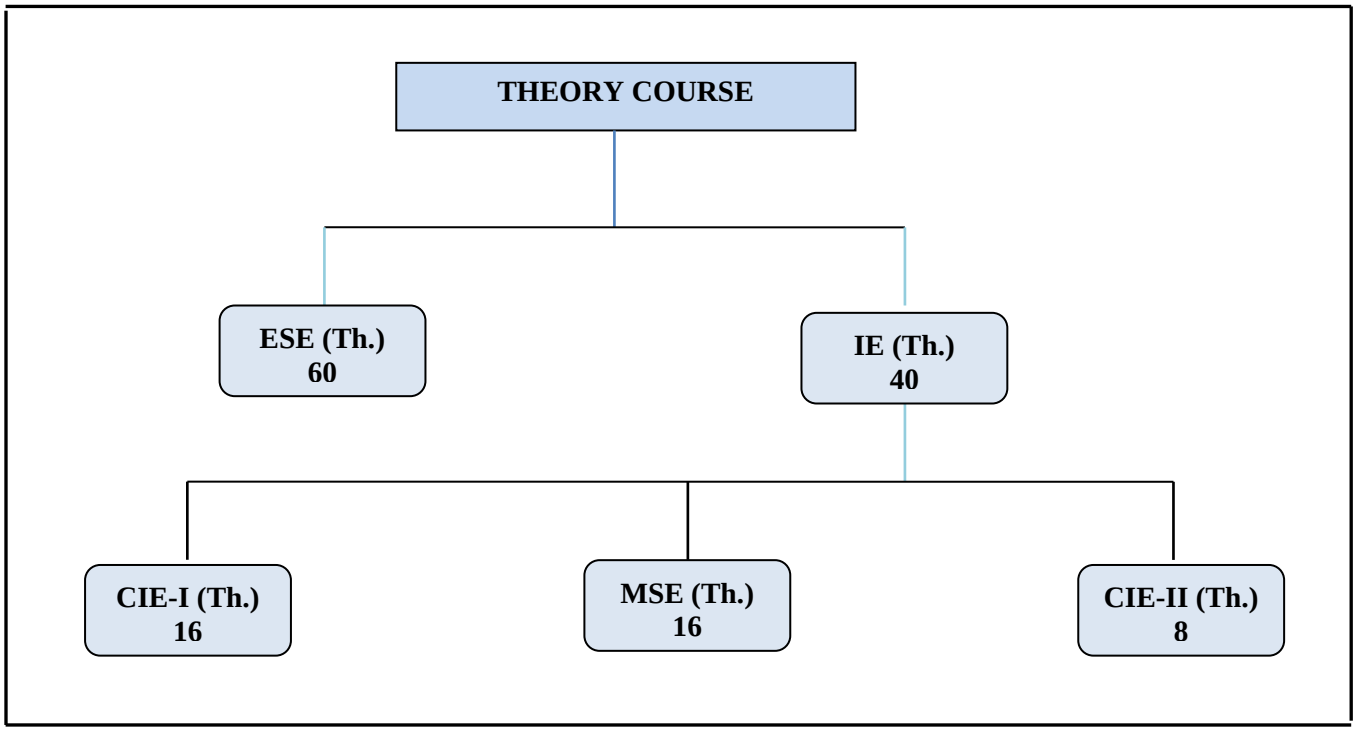
J. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

K. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

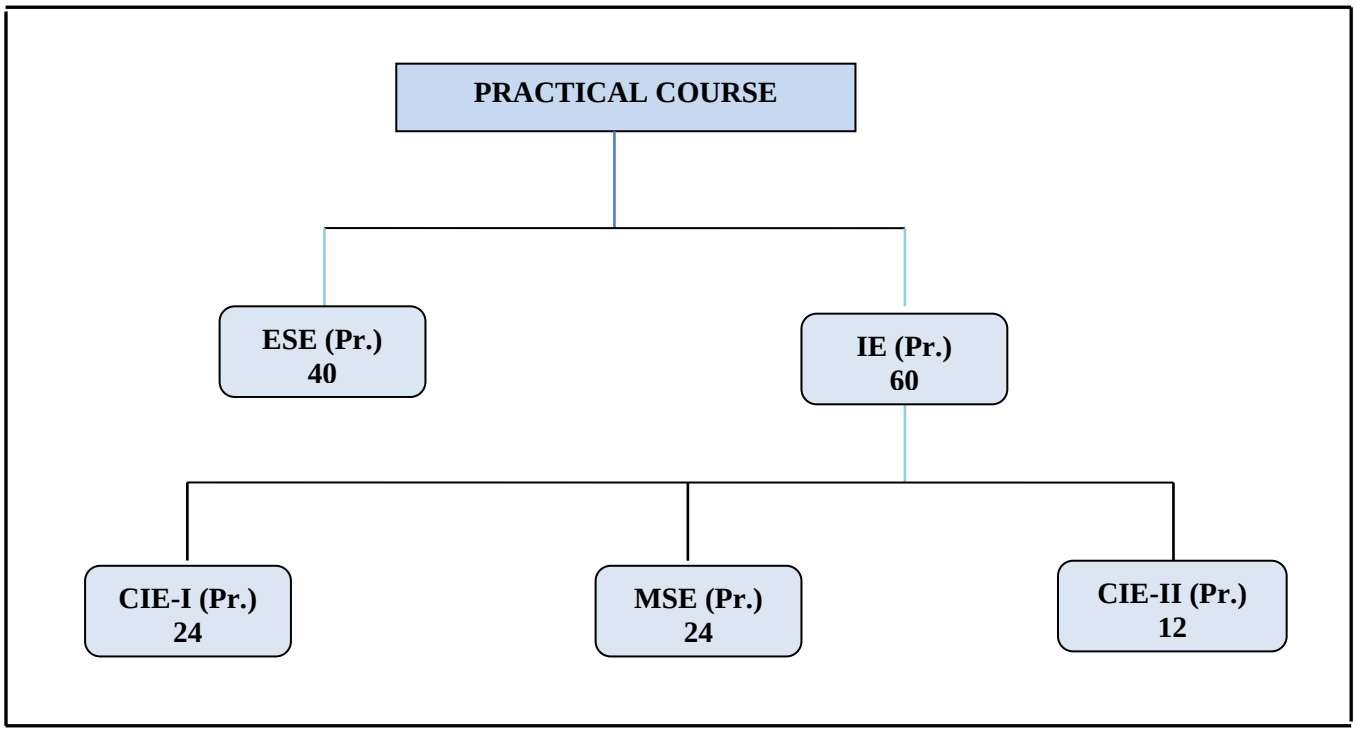
L. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Examination System :

A. Marks Distribution of Theory Course:



B. Marks Distribution of Practical Course :



Th.: Theory, Pr**.**: Practical, **ESE:** End Semester Examination, **MSE:** Mid Semester Examination, **CIE:** Continuous Internal Evaluation.

CO Wise Marks Distribution:

Exam Entity	Theory Subject		Practical/ Studio Subject	
	Maximum Marks	CO to be Covered	CO to be Covered	Maximum Marks
CIE-I	16 (8 + 8)	1 & 2	1 & 2	24 (12 + 12)
MSE	16 (8 + 8)	3 & 4	3 & 4	24 (12 + 12)
CIE-II (Activity/ Assignment)	8 (8)	5	5	12 (12)
ESE	60	-	-	40
TOTAL	100	-	-	100

Minimum Passing Percentage in All Exams:

S No.	Program Name	Minimum Passing Percentage in		
		IE Component	ESE Component	Total Component
1	Course Work for PhD Registration	-	-	50%
2	B. Arch.	-	45%	50%
3	MBA, MCA, M.Des., M.Tech., M.Plan, MHA, MPH	-	40%	40%
4	MBA, MCA, M.Des., M.Tech., M.Plan, MHA, MPH	-	35%	35%

SGPA Calculation

$$SGPA = \frac{C_1G_1 + C_2G_2 + \ldots\ldots\ldots + C_nG_n}{C_1 + C_2 + \ldots\ldots + C_n}$$

$$SGPA = \frac{\sum_i C_i \times G_i}{\sum_i C_i}$$

where (as per teaching scheme & syllabus):

C_i is the number of credits of subject i,

G_i is the Grade Point for the subject I and i = 1 to n,

n = number of subjects in a course in the semester

CGPA Calculation

$$CGPA = \frac{C_1G_1 + C_2G_2 + \ldots\ldots\ldots + C_nG_n}{C_1 + C_2 + \ldots\ldots + C_n}$$

$$CGPA = \frac{\sum_i C_i \times G_i}{\sum_i C_i}$$

where (as per teaching scheme & syllabus):

C_i is the number of credits of subject i,

G_i is the Grade Point for the subject I and i = 1 to n,

n = number of subjects in a course of all the semesters up to which CGPA is computed

Grading Table:

Applicable for B.Arch. & Ph.D. Courses

Academic Performance	Grade	Grade Point	Marks Range (in %)
Outstanding	O	10	90≤ x ≤100
Excellent	A+	9	80≤ x <90
Very Good	A	8	70≤ x <80
Good	B+	7	60≤ x <70
Above Average	B	6	50≤ x <60
Fail	F	0	x <50
Absent	Ab	0	Absent

Applicable for All Courses except B.Arch. & Ph.D.

Academic Performance	Grade	Grade Point	Marks Range (in %)
Outstanding	O	10	90≤ x ≤100
Excellent	A+	9	80≤ x <90
Very Good	A	8	70≤ x <80
Good	B+	7	60≤ x <70
Above Average	B	6	50≤ x <60
Average	C	5	40≤ x <50
Pass	P	4	35≤ x <40
Fail	F	0	x <35
Absent	Ab	0	Absent

CGPA to percentage conversion rule:

Equivalent % of Marks in the Program = *CGPA* *10

Award of Class

CGPA	Percentage	Equivalent Division
7.50 ≤ CGPA	75% or more	First Division with Distinction
6.00 ≤ CGPA < 7.50	60% ≤ x <75%	First Division
5.00 ≤ CGPA < 6.00	50% ≤ x <60%	Second Division
4.00 ≤ CGPA < 5.00	40% ≤ x < 50%	Pass Class

Guidelines for Massive Open Online Courses (MOOCs)

(Session 2023-24)

Poornima University, in its never ending endeavor to equip students with best-of-class learning and knowledge, has undertaken to include MOOC courses as part of its credit scheme from session 2023-24 onwards. The objective behind this is to enable students to study courses designed by the best teachers in the country and to scale their knowledge base with the rest of learners from the nation. The MOOCs which are included under this scheme is can be chosen from SWAYAM and NPTEL.

1. Introduction of MOOCs: SWAYAM and NPTEL

About SWAYAM:

SWAYAM is a programme initiated by Government of India and designed to achieve the three cardinal principles of Education Policy viz., access, equity and quality. The objective of this effort is to take the best teaching learning resources to all, including the most disadvantaged. SWAYAM seeks to bridge the digital divide for students who have hitherto remained untouched by the digital revolution and have not been able to join the mainstream of the knowledge economy.

This is done through a platform that facilitates hosting of all the courses, taught in classrooms to be accessed by anyone, anywhere at any time. All the courses are interactive, prepared by the best teachers in the country and are available, free of cost to any learner. However learners wanting a SWAYAM certificate should register for the final proctored exams that come at a fee and attend in-person at designated centers on specified dates. Eligibility for the certificate will be announced on the course page and learners will get certificates only if this criteria is matched.

The courses hosted on SWAYAM are in 4 quadrants – (1) video lecture, (2) specially prepared reading material that can be downloaded/printed (3) self-assessment tests through tests and quizzes and (4) an online discussion forum for clearing the doubts. Steps have been taken to enrich the learning experience by using audio-video and multi-media and state of the art pedagogy / technology.

In order to ensure that best quality content is produced and delivered, nine National Coordinators have been appointed. They are:

1. AICTE (All India Council for Technical Education) for self-paced and international courses
2. NPTEL (National Programme on Technology Enhanced Learning) for Engineering
3. UGC (University Grants Commission) for non-technical post-graduation education
4. CEC (Consortium for Educational Communication) for under-graduate education
5. NCERT (National Council of Educational Research and Training) for school education
6. NIOS (National Institute of Open Schooling) for school education
7. IGNOU (Indira Gandhi National Open University) for out-of-school students
8. IIMB (Indian Institute of Management, Bangalore) for management studies
9. NITTTR (National Institute of Technical Teachers Training and Research) for Teacher Training programme

Two types of courses are offered on SWAYAM platform: Credit Courses and Non- Credit Courses. Credit courses are offered for each semester in January and July every year. The list is available on SWAYAM official website: https://onlinecourses.swayam2.ac.in/

About NPTEL:

NPTEL (National Programme on Technology Enhanced Learning), is a joint venture of the IITs and IISc, funded by the Ministry of Education (MoE) Government of India, and was launched in 2003. Initially started as a project to take quality education to all corners of the country, NPTEL now offers close to 600+ courses for certification every semester in about 22 disciplines.

Some highlights:

- Largest online repository in the world of courses in engineering, basic sciences and selected humanities and management subjects
- YouTube channel for NPTEL – most subscribed educational channel, 1.3 billion views and 40+ lakhs subscribers

- More than 56000 hours of video content, transcribed and subtitled
- Most accessed library of peer-reviewed educational content in the world
- Translation of more than 12000 hrs of English transcripts in regional Indian languages

NPTEL Online Certification:

The objective of enabling students obtain certificates for courses is to make students employable in the industry or pursue a suitable higher education programme. Through an online portal, 4, 8, or 12-week online courses, typically on topics relevant to students in all years of higher education along with basic core courses in sciences and humanities with exposure to relevant tools and technologies, are being offered. Enrolment to and learning from these courses is free. Following these online courses, an in-person, proctored certification exam is conducted and a certificate is provided through the participating institutions and industry, as applicable.
Some statistics regarding the open online courses since March 2014 till Dec 2021
Completed courses: 3496;
Enrollments across courses: 1.58 CRORE +
Number of exam registrations: 15.1 LAKH +
All the statistics pertaining to completed courses are available at https://beta.nptel.ac.in/courses. All courses are completely free to enroll and learn from. The certification exam is optional and comes at a fee of Rs 1000/course exam.

2. MOOCs at Poornima University:

MOOCs envelops best in class teaching - learning processes along with meeting the requirements of various courses in terms of quality of teaching and evaluation system. To promote the MOOCs among students of Poornima University, it is decided to consider the credits earned through MOOCs.

(a) Options for MOOCs at Poornima University

(For this document, only those MOOCs will be considered which are available on SWAYAM & NPTEL platforms)

- Credit and Non-credit SWAYAM MOOCs can be opted by anyone, anytime, anywhere and in any language. However, prior-permission of the University Authorities is mandatory if the credits are to be transferred to regular degree.
- In case of credit courses, there are two ways to opt these courses for the purpose of credit transfer to PU system as given below:

OPTION–I: As Open Elective (for batches entered till 2022) / Multidisciplinary Courses (for batches admitted from 2023-24 onwards):

Open Elective (for batches entered till 2022) / Multidisciplinary Courses (for batches admitted from 2023-24 onwards) are available at University level in offline mode for which relevant booklets are already published. **These courses carries 02 credits.** These category/type of courses (similar/different) are also available as MOOC courses. The respective Deans / HODs shall provide both the options to all the students to either select offline courses or MOOCs as per details given below:

- Deans / HODs shall prepare a list of upto 05 appropriate MOOC courses of 02/03 credits each, well in advance (at-least 15 days prior to commencement of semester) and take approval from the Office of Dean, Academics / Pro-President, PU.
- After approval, the respective Deans / HODs shall circulate a notice to all their respective students so that they can select any one course from the list, the credits **(only 02)** of which will be counted against Open Elective/ Multidisciplinary courses pertaining to that particular semester.
- If the students are not willing to opt for MOOC Open Elective/ Multidisciplinary course, they can proceed with the current offline practice of opting for Multidisciplinary courses.
- The tutor of the class shall monitor the progress (assignments, feedback, any problem etc.) on weekly basis and report to Head/Dean.

OR

OPTION–II: As Major / Minor Courses:

- Deans / HODs shall identify a course of **03 credits** for each semester, well in advance (at-least 15 days prior to commencement of semester) and take approval from the Office of Dean, Academics / Pro-President, PU.
- After approval, the respective Deans / HODs shall circulate a notice to all their respective students citing that the particular course will be conducted through MOOCs only and is compulsory for all respective students. The credits of this course will be counted against Major/Minor courses pertaining to that particular semester.
- The tutor of the class shall monitor the progress (assignments, feedback, any problem etc.) on weekly basis and report to Head/Dean.
- This is to be noted that if Deans / HODs decide to conduct any major/minor course in any semester through MOOCs, no offline course will be conducted against that.

(b) Important points related to MOOCs at Poornima University

- Only one MOOC shall be allowed in a particular semester for the purpose of credit transfer in the beginning.
- No attendance will be taken for MOOC courses.
- Last period of T/T/S shall be taken for MOOC courses which shall be in self-study mode.
- The method of assessments of MOOC such as assignments and examination are completely associated with that particular MOOC and no exam will be conducted by the department as well as by the Examination Cell.
- The respective Dean / HOD must submit the detail of course i.e., code, name and credit of MOOC opted against that particular course in particular semester attached with highlighting in the related examination scheme of syllabus of that semester signed by BOS Convener / HoD and Dean of Faculty to the office of Pro-President before commencement of the classes.
- SWAYAM will award a certificate to all the students passing the examination along with the credit earned. The center of examination for SWAYAM MOOCs will be finalized by SWAYAM. All the responsibility related to registration for MOOCs, timely submission of assignments, examinations etc. will be borne by the students only.
- The list of registered students in MOOC along with name of course will be submitted to the Examination Cell by the Deans / HoDs before commencement of the classes.
- Any student who would not be able to register/present/clear/pass the MOOC in the stipulated time, it is the choice of the student that he or she may register in next semester (odd or even) with MOOC again or appear as a back exam candidate of the University as per PU norms.
- There will be no provision of re-evaluation of MOOC.
- The scorecard and related certificate of MOOC along with a consolidated list of students with marks of assignment and final exam will be submitted to the examination cell by the concerned Dean / HOD for further process. It is also recommended that alteration/changes/scaling in marks obtained by the students in any MOOC will not be considered.
- The exam registration fee of MOOC up to Max. INR 1000/- will be reimbursed to the student only after successful completion of the course in first attempt and submission of the fee receipt, score-card and certificate of the MOOC to the concerned department within stipulated time after declaration of the results.

NOTE: This is to be noted that the procedure for getting approval from BOS, Faculty Board, Academic Council and BoM is to be followed as per regular process.

Attached Items:

Open Elective Booklet	Annexure-1
Soft Skills Booklet	Annexure-2
Value Added Course Booklet	Annexure-3

Required credits for Honors:

S.No	Program Duration	Required credits for Honors
1.	2- Year	10- Credits
2.	3- Year	15- Credits
3.	4-Year	20- Credits

S. No	NPTEL/ SWAYAM Course duration (in weeks)	Equivalent Credits
1	4	2
2	8	3
3	12	4

Attached Items:

Open Elective Booklet	Annexure-1
Soft Skills Booklet	Annexure-2
Value Added Course Booklet	Annexure-3

	POORNIMA UNIVERSITY, JAIPUR								
	Faculty of Engineering and Technology								
Name of Program:	**M.Tech. in Power System** **Duration: 2 Years** **Total Credits: 80**								
	Teaching Scheme for Batch 2023-25								
	Semester-I								
Course Code	**Name of Course**	**Teaching Scheme**				**Marks Distribution**			**Credits**
		Lecture (L)	**Tutorial (T)**	**Practical**	**SH**	**IE**	**ESE**	**Total**	
A.		**Major (Core Courses)**							
A.1	**Theory**								
MPSCEE1101	Power System Stability	3	1	-	-	40	60	100	4
MPSCEE 1102	Advanced Power System Analysis	3	1	-	-	40	60	100	4
A.2	**Practical**								
MPSCEE 1201	PS Lab I	-	-	2		60	40	100	1
B.		**Minor Stream Courses/ Department Electives I and II**							
B.1	**Theory**								
MPSEEE1101	Power Quality	3	1	-	-	40	60	100	4
MPSEEE1102	Numerical Methods & Computer Programming			-	-	40	60	100	
MPSEEE1103	Industrial Control Electronics			-	-	40	60	100	
MPSEEE1104	Economics & Planning of Energy System			-	-	40	60	100	
MPSEEE1105	Renewable Power Generation Sources	3	1	-	-	40	60	100	4
MPSEEE1106	System Theory			-	-	40	60	100	
MPSEEE1107	Digital Signal Processing & Applications			-	-	40	60	100	
MPSEEE1108	Power System Planning & Reliability			-	-	40	60	100	
B.2	**Practical**								
	-	-	-	-	-	-	-	-	-
C		**Multidisciplinary Courses**							
		-	-	-	-	-	-	-	-
D		**Ability Enhancement Courses (AEC)**							
MULCHM1101	Soft Skills - I	-	-	2		60	40	100	1
E		**Skill Enhancement Courses (SEC)**							
BULCPS3201	Skill Enhancement Technical Course			2		60	40	100	1
F		**Value Added Courses (VAC)**							
	-	-	-	-	-	-	-	-	-
G		**Summer Internship / Research Project / Dissertation**							
MPSCEE1401	Seminar-I	-	-	4		60	40	100	2
Total		12	4	10					**21**
Total Teaching Hours		**26**							

	POORNIMA UNIVERSITY, JAIPUR								
	Faculty of Engineering and Technology								
Name of Program:	**M.Tech. in Power System** **Duration: 2 Years** **Total Credits: 80**								
	Teaching Scheme for Batch 2023-25								
	Semester-II								
Course Code	**Name of Course**	**Teaching Scheme**				**Marks Distribution**			**Credits**
		Lecture (L)	**Tutorial (T)**	**Practical**	**SH**	**IE**	**ESE**	**Total**	
A.		**Major (Core Courses)**							
A.1	**Theory**								
MPSCEE2101	Power System Optimization and Control	3	1	-		40	60	100	4
MPSCEE 2102	EHV AC/DC Transmission & FACTS	3	1	-		40	60	100	4
A.2	**Practical**								
MPSCEE2201	PS Lab II	-	-	2		60	40	100	1
B.		**Minor Stream Courses/ Department Electives I and II**							
B.1	**Theory**								
MPSEEE2101	AI Applications to Power Systems	3	1			40	60	100	4
MPSEEE2102	Advanced Power Electronics					40	60	100	
MPSEEE2103	Power System Deregulation					40	60	100	
MPSEEE2104	Digital Controllers in Power Electronics Applications					40	60	100	
MPSEEE2105	Transient over Voltages in Power	3	0			40	60	100	3
MPSEEE2106	Advanced Solar Thermal & PV					40	60	100	
MPSEEE2107	Modeling & Analysis of Electrical Machines					40	60	100	
MPSEEE2108	Computer Networking					40	60	100	
B.2	**Practical**								
	-	-	-	-	-	-	-	-	-
C		**Multidisciplinary Courses**							
MULEBX2109	Engineering Economics	3	-	-	-				3
D		**Ability Enhancement Courses (AEC)**							
MULCHM2201	Soft Skills - II	-	-	2		60	40	100	1
E		**Skill Enhancement Courses (SEC)**							
BULCPS4201	Skill Enhancement Technical Course-II			2		60	40	100	1
F		**Value Added Courses (VAC)**							
	-	-	-	-	-	-	-	-	-
G		**Summer Internship / Research Project / Dissertation**							
MPSCEE 2401	Seminar-II	-	-	2		60	40	100	1
Total		15	3	8					**22**
Total Teaching Hours		**26**							

	POORNIMA UNIVERSITY, JAIPUR								
	Faculty of Engineering and Technology								
Name of Program:	**M.Tech. in Power System** **Duration: 2 Years** **Total Credits: 80**								
	<u>Teaching Scheme for Batch 2023-25</u>								
	Semester-III								
Course Code	**Name of Course**	**Teaching Scheme**				**Marks Distribution**			**Credits**
		Lecture (L)	**Tutorial (T)**	**Practical**	**SH**	**IE**	**ESE**	**Total**	
A.		**Major (Core Courses)**							
A.1	**Theory**								
MPSCEE3101	Smart Grid	3	1	-		40	60	100	4
MPSCEE3102	Advanced Power System Protection	3	1	-		40	60	100	4
A.2	**Practical**								
MPSCEE3201	PS Lab III	-	-	2		60	40	100	1
MPSCEE 3401	Review/Research Paper	-	-	2		60	40	100	1
B.		**Minor Stream Courses/ Department Electives/*<u>Open Elective</u>***							
B.1	**Theory**								
MULEEE3107	E-Commerce and Knowledge Management	3	0	-		40	60	100	3
MULEEE3108	Water and Environmental Pollution			-		40	60	100	
MULEEE3109	IPR & Patents			-		40	60	100	
MULEEE3110	Robotics			-		40	60	100	
MULEEE3111	Digital India Implementation			-		40	60	100	
MULEEE3112	Smart City Design			-		40	60	100	
MULEEE3113	Renewable Energy			-		40	60	100	
B.2	**Practical**								
C		**Multidisciplinary Courses**							
MPSEMC3121	MOOC Course - I	3	-	-	-	-	-	-	3
D		**Ability Enhancement Courses (AEC)**							
E		**Skill Enhancement Courses (SEC)**							
-	-	-	-	-	-	-	-	-	-
F		**Value Added Courses (VAC)**							
G		**Summer Internship / Research Project / Dissertation**							
MPSCEE33402	Dissertation Part - I	-	-	12		60	40	100	6
Total		12	3	16					**22**
Total Teaching Hours		**31**							

	POORNIMA UNIVERSITY, JAIPUR								
	Faculty of Engineering and Technology								
Name of Program:	**M.Tech. in Power System** **Duration: 2 Years** **Total Credits: 80**								
	Teaching Scheme for Batch 2023-25								
	Semester-IV								
Course Code	**Name of Course**	**Teaching Scheme**				**Marks Distribution**			**Credits**
		Lecture (L)	**Tutorial (T)**	**Practical**	**SH**	**IE**	**ESE**	**Total**	
A.		**Major (Core Courses)**							
A.1	**Theory**								
-	-	-	-	-	-	-	-	-	-
A.2	**Practical**								
-	-	-	-	-	-	-	-	-	-
B.		**Minor Stream Courses/ Department Electives/*Core Elective***							
B.1	**Theory**								
-	-	-	-	-	-	-	-	-	-
B.2	**Practical**								
-	-	-	-	-	-	-	-	-	-
C		**Multidisciplinary Courses**							
-	-	-	-	-	-	-	-	-	-
D		**Ability Enhancement Courses (AEC)**							
-	-	-							
E		**Skill Enhancement Courses (SEC)**							
-	-	-	-	-	-	-	-	-	-
F		**Value Added Courses (VAC)**							
	-	-	-	-	-	-	-	-	-
G		**Summer Internship / Research Project / Dissertation**							
MPSCEE34401	Dissertation Part - II	-	-	30		250	250	500	15
Total		0	0	30					**15**
Total Teaching Hours		**30**							

M.Tech.

Batch 2023-25

DEPARTMENT OF EEE

POORNIMA UNIVERSITY

SCHOOL OF ENGINEERING & TECHNOLOGY

Detailed Syllabus

M. Tech. POWER SYSTEM
Syllabus – First Semester

Code: MPSCEE1101

POWER SYSTEM STABILITY **4 Credits [LTP: 3-1-0]**

COURSE OUTCOMES: After Successful completion of the course students will be able to-

- To understand about the Overloading - under voltage - over voltage.
- To learn about Sags and swells.
- To learn about Static Sources of over voltages.
- To understand the concepts - monitoring and diagnostic of power system static and dynamic stability.

A. DETAILED SYLLABUS

Unit	Contents
Unit 1	**Synchronous Machines:** Modeling of cylindrical rotor synchronous machine, flux linkage equations, voltage equations and equivalent circuit, real and reactive power control. Modeling of salient pole synchronous machine (Two – axis model), flux linkage equations, Park's transformation, current and voltage equations. Transient and sub-transient effects, reactance and time constants of synchronous machines. Equivalent circuits, vector diagrams, power angle equations and characteristics under steady state and transient conditions.
Unit 2	**Steady State and Dynamic Stabilities:** Development of swing equation, linearisation of swing equation. Steady state stability of single machine connected to an infinite bus system and two machine systems. Coherent and non-coherent machines. Swing equation including damping effect. Introduction to dynamic stability of power system. Introduction to classical model of multi machine system.
Unit 3	**Transient Stability:** Equal area criterion and its application to transient stability studies under common disturbances including short circuits. Critical clearing angle and critical clearing time. Numerical solution of swing equation by step-by-step method.
Unit 4	**Multi machine Transient Stability (i):** Numerical methods for solution of differential equations: Modified Euler Method, Runge – Kutta fourth order method. Multi machine transient stability studies using modified Euler method and Range – kutta fourth order method.
Unit 5	**Multi machine Transient Stability (ii)** Factors affecting steady state and transient stabilities. Methods of improving steady state, dynamic and transient stabilities, series capacitor compensation of lines, excitation control, power stabilizing signals, High speed circuit breaker, and auto – reclosing circuit's breaker, single pole and selective pole operation, by pass valving and dynamic braking.

B. RECOMMENDED STUDY MATERIAL:

S. No	Title of the Book	Author
1.	Power System Stability, TMH	P. Kundur
2.	Power System Stability, Vol. 1-3, wiley india	Edward Wilson Kimbark

Websites
• https://nptel.ac.in/courses/108106025/ • https://nptel.ac.in/courses/108107157/

D. CO-PO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	**2**	**2**	**1**	**1**	–	–	–	–	–	–	–	–
CO 2	**3**	**2**	**1**	**1**	–	–	–	–	–	–	–	–
CO 3	**3**	**2**	**1**	**1**	–	–	–	–	–	–	–	–
CO 4	**2**	**2**	**2**	**1**	–	–	–	–	–	–	–	–

E.CO-PSO Mapping

	PSO 1	PSO 2	PO 3
CO 1	—	—	2
CO 2	—	—	2
CO 3	—	—	2
CO 4	—	—	2

Code: MPSCEE 1102 ADVANCED POWER SYSTEM ANALYSIS 4 Credits [LTP: 3-1-0]

COURSE OUTCOMES: After Successful completion of the course students will be able-

- To understand the basic principles of Percent and per unit quantities & Admittance
- To apply characteristics and learning the concepts by Symmetrical Components & Fault Analysis.
- To understand and apply concepts of Unsymmetrical Fault Analysis
- To understand theory and applications of Load flow Analysis.

A. DETAILED SYLLABUS

Unit	Contents
Unit 1	**Load Flow** - Network modeling – Conditioning of Y Matrix – Load flow-Newton Raphson method-Decoupled – Fast decoupled Load flow -three-phase load flow.
Unit 2	**DC power flow** –Single phase and three phase -AC-DC load flow - DC system model – Sequential Solution Techniques
Unit 3	**Multiple and Multi-terminal DC systems** – DC convergence tolerance – Test System and results. Fault Studies -Analysis of balanced and unbalanced three phase faults – fault calculations – Short circuit faults – open circuit faults.
Unit 4	**System optimization** -strategy for two generator systems – generalized strategies – effect of transmission losses - Sensitivity of the objective function- Formulation of optimal power flow-solution by Gradient method-Newton's method.
Unit 5	**State Estimation** – method of least squares – statistics – errors – estimates – test for bad data – structure and formation of Hessian matrix – power system state estimation.

B. RECOMMENDED STUDY MATERIAL:

S. No	Title of the Book	Author
1.	Power System Analysis, Tata McGraw hill, New Delhi	Grainger, J.J. and Stevenson, W.D.
2.	Computer analysis of power systems, John Wiley	Arrillaga, J and Arnold, C.P.
3.	Computer Techniques in Power System Analysis, Tata McGraw hill	Pai, M.A.

Websites

- https://nptel.ac.in/courses/108101039/
- https://nptel.ac.in/content/storage2/courses/108101039/download/Lecture-1.pdf
- https://nptel.ac.in/courses/117105140/

E. CO-PO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	**2**	**2**	**1**	**1**	–	–	–	–	–	–	–	–
CO 2	**3**	**2**	**1**	**1**	–	–	–	–	–	–	–	–
CO 3	**3**	**2**	**1**	**1**	–	–	–	–	–	–	–	–
CO 4	**2**	**2**	**2**	**1**	–	–	–	–	–	–	–	–

E.CO-PSO Mapping

	PSO 1	PSO 2	PO 3
CO 1	—	—	2
CO 2	—	—	2
CO 3	—	—	2
CO 4	—	—	2

DEPARTMENT ELECTIVE

Code: MPSEEE1101 POWER QUALITY 4 Credits [LTP: 3-1-0]

COURSE OUTCOMES: After Successful completion of the course students will be able to-

- To understand about the Power Quality issues.
- To learn about Sags and swells and several drawbacks of poor power quality.
- To learn about Static Sources of over voltages.
- To understand the concepts - monitoring and diagnostic of power quality by various mechanisms.d

A. DETAILED SYLLABUS

Unit	Contents
Unit 1	**Electric power quality** - IEC and IEEE definitions - power quality disturbances-voltage fluctuations-transients-unbalance-waveform distortion-power frequency variations. Voltage variations.
Unit 2	**Voltage sags and short interruptions** – flicker-longer duration variations - sources – range and impact on sensitive circuits-standards – solutions and mitigations – equipment and techniques.
Unit 3	**Transients –** origin and classifications – capacitor switching transient – lightning-load switching – impact on users – protection – mitigation. Harmonics – sources – definitions & standards – impacts -
Unit 4	**Calculation and simulation** – harmonic power flow - mitigation and control techniques – filtering – passive and active.
Unit 5	**Power Quality conditioners –** shunt and series compensators, D-Statcom, Dynamic voltage restorer, unified power quality conditioners, case studies.

B. RECOMMENDED STUDY MATERIAL:

S. No	Title of the Book	Author
1.	Electric Power Quality, Stars in a Circle Publications	Heydt, G.T.
2.	Understanding Power Quality Problems: Voltage sags and interruptions	Bollen, M.H.J
3.	Power System Quality Assessment, Wiley, New York,	Arrillaga, J, Watson, N.R., Chen, S.

Websites

- https://nptel.ac.in/courses/108101039/
- https://nptel.ac.in/content/storage2/courses/108101039/download/Lecture-1.pdf
- https://nptel.ac.in/courses/117105140/
- https://nptel.ac.in/courses/108106025/
- https://nptel.ac.in/courses/108107157/

F. CO-PO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	**1**	**2**	**1**	**1**	–	–	–	–	–	–	–	–
CO 2	**3**	**2**	**1**	**1**	–	–	–	–	–	–	–	–
CO 3	**3**	**2**	**1**	**1**	–	–	–	–	–	–	–	–
CO 4	**1**	**2**	**2**	**1**	–	–	–	–	–	–	–	–

E.CO-PSO Mapping

	PSO 1	PSO 2	PO 3
CO 1	—	—	2
CO 2	—	—	1
CO 3	—	—	2
CO 4	—	—	2

Code: MPSEEE1102 NUMERICAL METHODS & COMPUTER PROGRAMMING 4 Credits [LTP: 3-1-0]

COURSE OUTCOMES: After Successful completion of the course students will be able to understand-

• The fundamental data structures used in computer science
• How several fundamental algorithms work, particularly those concerned with sorting, searching and graph manipulation
• The space and time efficiency of most algorithms
• Design of new algorithms or modify existing ones for new applications and graph algorithms

A. DETAILED SYLLABUS

Unit	Contents
Unit 1	**Matrix Algebra: (a)** Matrix Computation**:** Algebra of matrices, Inverse of a matrix, Rank of a matrix. Matrix inversion by Gauss elimination method, Computer programs for matrix computation using MATLAB.
Unit 2	**Eigen values and Eigen Vectors:** Characteristic equation of a matrix, Determination of eigen values and eigen vectors, Cayley Hamilton theorem, Largest and smallest eigen values, Computation of eigen values and Eigen vectors using MATLAB. **Solution of Linear and Non Linear Equations: (a)** Solution of linear equations: Crammer's rule, consistency of linear simultaneous equations, Gauss elimination method, Gauss Jordan elimination method. Gauss-seidal iterative method. Computer program for the solution of linear equations using MATLAB.
Unit 3	**Solution of Non-Linear Equations:** Interval bisection method, Secant method, Regular falsi method, Newton-Raphson method. Solution of non-linear equations using MATLAB. **Numerical Differentiation and Integration: (a)** Numerical differentiation using Newton's forward, backward and Stirling's interpolation formulae.

Unit 4	**Numerical Integration:** General quadrature formula, Trapezoidal rule, Simson's rule, Simpson's three eight rule, Romberg integration. Numerical integration program using MATLAB. **Solution for Differential Equations:** Euler's method, Improved Euler's method, Runga-Kutta method of second order. Runga-Kutta method of fourth order. Solution of differential equations using MATLAB.
Unit 5	**Programming in MATLAB:** Basics of MATLAB, Matrices and vectors, Matrix and array operations, Saving and loading data, Plotting simple graphs, Scripts and functions, Script files, Function files, Global variables, Loops, Branches, Control flow, Advanced data objects, Multi-dimensional matrices, Structures, Applications in linear algebra, Curve fitting and interpolation, Numerical integration, Ordinary differential equations, Non-linear algebraic equations.

B. RECOMMENDED STUDY MATERIAL:

S. No	Title of the Book	Author
1.	Numerical Analysis and Computer Programming	Pradip Narain and Tajender Si ngh Saluj
2.	Computer Oriented Numerical Methods	V. Rajaraman, PHI

Web sites

- www.**electronicsdevices**.com/; www.pearsonhighered.com; **www.khanacademics.com**
- www.mindtools.com
- www.tryscience.com
- www.khaki.com
- www.Raifoundation.org
- www.tryingineering.com
- https://nptel.ac.in/courses/106102064/

G. CO-PO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	**2**	**2**	**1**	**1**	–	–	–	–	–	–	–	–
CO 2	**3**	**2**	**1**	**1**	**2**	–	–	–	–	–	–	–
CO 3	**3**	**2**	**1**	**1**	–	–	–	–	–	–	–	–
CO 4	**2**	**2**	**2**	**1**	–	–	–	**2**	–	–	–	–

E.CO-PSO Mapping

	PSO 1	PSO 2	PO 3
CO 1	—	—	2
CO 2	—	—	2
CO 3	—	—	1
CO 4	—	—	2

Code: MPSEEE1103 INDUSTRIAL CONTROL ELECTRONICS 4 Credits [LTP: 3-1-0]

COURSE OUTCOMES: After Successful completion of the course students will be able to understand-

- The fundamental switching regulators and switch mode power supply.
- Concept of analog controllers
- Mechanism of signal conditioners
- Design of opto electronic devices, stepper motor and servo motors.

A. DETAILED SYLLABUS

Unit	Contents
Unit 1	**Review of switching regulators and switch mode power supplies**-Uninterrupted power supplies-solid state circuit breakers – programmable logic controllers
Unit 2	**Analog Controllers** -Proportional controllers, Proportional – Integral controllers, PID controllers, Feed forward control
Unit 3	**Signal conditioners**-Instrumentation amplifiers – voltage to current, current to voltage, voltage to frequency, frequency to voltage converters; Isolation circuits – cabling; magnetic and electro static shielding and grounding
Unit 4	**Opto-Electronic devices and control** , Applications of opto isolation, interrupter modules and photo sensors – Fibre optics – Bar code equipment, application of barcode in industry.
Unit 5	**Stepper motors and servo motors-** control and applications. Servo motors – servo motor controllers – servo amplifiers – selection of servo motor – applications of servo motors.

B. RECOMMENDED STUDY MATERIAL:

S. No	Title of the Book	Author
1.	Industrial Control Electronics – Applications and Design, Prentice Hall	Michael Jacob
2.	Industrial Electronics, PHI	Thomas, E. Kissel

Websites

- https://nptel.ac.in/courses/108101039/
- https://nptel.ac.in/content/storage2/courses/108101039/download/Lecture-5.pdf
-

H. CO-PO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	**2**	**2**	**1**	**1**	–	–	–	–	–	–	–	–
CO 2	**3**	**2**	**1**	**1**	–	–	–	–	–	–	–	–
CO 3	**3**	**2**	**1**	**1**	–	–	–	–	–	–	–	–
CO 4	**2**	**2**	**2**	**1**	–	–	–	–	–	–	–	–

E.CO-PSO Mapping

	PSO 1	PSO 2	PO 3
CO 1	—	—	2
CO 2	—	—	2
CO 3	—	—	2
CO 4	—	—	2

Code: MPSEEE1104 ECONOMICS & PLANNING OF ENERGY SYSTEMS 4 Credits [LTP: 3-1-0]

COURSE OUTCOMES: After Successful completion of the course students will be able-

- To understand the concept of system economics and economic models..
- To analyze dynamic model of economy and its relation with energy efficiency.
- To understand the concept and applications of energy efficiency and system design.

A. DETAILED SYLLABUS

Unit	Contents
Unit 1	**System Economics**: Basic concepts, National accounting framework. Criteria for economic growth. Model types and philosophy. Production functions. Input output economics, macroeconomic growth models
Unit 2	**Econometric models-** Policy options and budgetary Implication, some illustrations of economic research for identifying demand functions, supply functions, cost functions, production functions, utility functions and Engel curves.
Unit 3	**Dynamic models of the economy** –"Simple" theory of business fluctuations. Multiple linear and nonlinear regression analysis, energy per unit monetary value of consumer needs and services.
Unit 4	**Energy efficiency-**Cost benefit risk analysis. Environmental repercussions and the economic structure. Conflict between energy consumption and pollution.
Unit 5	**Systems Design -** Quantitative economic policy with particular references to energy. Econometric in the context of multiple objectives, conflicting goals and decisions under uncertainty.

B. RECOMMENDED STUDY MATERIAL:

S. No	Title of the Book	Author
1.	Electric Power System Planning, Springer	Seifi, Hossein, Sepasian, Mohammad Sadegh
2.	Economic Market Design and Planning for Electric Power Systems, Wiley india	James Momoh, Lamine Mili
3.	Economic Problems in Electric Power System Planning	Joel Bergsman
Websites		
• https://nptel.ac.in/courses/108/106/108106160/ • https://nptel.ac.in/courses/108/105/108105104/ • https://nptel.ac.in/courses/108/101/108101004/		

I. CO-PO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	**2**	**2**	**1**	**1**	–	–	–	–	–	–	–	–
CO 2	**3**	**2**	**1**	**1**	–	–	–	–	–	–	–	–
CO 3	**3**	**2**	**1**	**1**	–	–	–	–	–	–	–	–

E.CO-PSO Mapping

	PSO 1	PSO 2	PO 3
CO 1	—	—	2
CO 2	—	—	2
CO 3	—	—	2

Code: MPSEEE1105 RENEWABLE POWER GENERATION SOURCES 4 Credits [LTP: 3-1-0]

COURSE OUTCOMES: After Successful completion of the course students will be able -

- To Understand the Need, importance and scope of non-conventional and alternate energy resources.
- To understand role significance of solar energy.
- To provide importance of Wind Energy.
- To understand the role of ocean energy in the Energy Generation.
- To get the utilization of Biogas plants and geothermal energy
- To understand the concept of energy Conservation.

A. DETAILED SYLLABUS

Unit	Contents
Unit 1	**Basic characteristics of sunlight** – solar energy resource – photovoltaic cell-characteristics – equivalent circuit – photo voltaic for battery charging.
Unit 2	**Wind source** – wind statistics - energy in the wind – aerodynamics - rotor types – forces developed by blades-Aerodynamic models – braking systems – tower - control and monitoring system – power performance
Unit 3	**Wind driven induction generators** -power circle diagram -steady state performance – modeling-integration issues –impact on central generation- transmission and distribution systems – wind farm electrical design.
Unit 4	**Wind-diesel systems**-fuel savings-permanent magnet alternators – modeling – steady state equivalent circuit-self-excited induction generators – integrated wind-solar systems.
Unit 5	**Micro-hydel electric systems** – power potential – scheme layout – generation efficiency and turbine part flow-isolated and parallel operation of generators – geothermal-tidal and OTEC systems.

B. RECOMMENDED STUDY MATERIAL:

S. No	Title of the Book	Author
1.	Wind energy Technology , John Wiley and sons	John F.Walker & Jenkins. N
2.	Physics, Technology and use of Photovoltaic	Van Overstraeton and Mertens R.P
3.	Wind Energy Conversion Systems, Prentice Hall	Freries LL

Web sites

- www.**electronicsdevices**.com/; www.pearsonhighered.com; **www.khanacademics.com**
- www.mindtools.com
- www.tryscience.com
- www.khaki.com
- www.Raifoundation.org
- www.tryingineering.com
- https://nptel.ac.in/courses/103107157/

CO- PO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	2	2	2	–	–	–	–	–	–	–	–
CO2	3	2	1	1	–	–	–	–	–	–	–	–
CO3	3	2	2	2	–	–	–	–	–	–	–	–
CO4	3	1	1	1	–	–	–	–	–	–	–	–
CO5	3	2	2	2	–	–	–	–	–	–	–	–

CO-PSO Mapping

	PSO 1	PSO 2	PO 3
CO1	2	–	–
CO2	1	–	–
CO3	2	–	–
CO4	2	–	–
CO5	2	–	–

Code: MPSEEE1106	SYSTEM THEORY	4 Credits [LTP: 3-1-0]

COURSE OUTCOMES: After Successful completion of the course students will be able-

- To understand the basic principles of control system.
- To apply characteristics and learning the concepts of time response analysis.
- To understand and apply concepts of frequency response analysis.

A. DETAILED SYLLABUS

Unit	Contents
Unit 1	**State space modeling of physical systems –**determining of STM – controllability and observability of time invariant linear system
Unit 2	**Different techniques of linearising non-linear systems** – Describing functions for various types of non- linearity – describing function analysis of non linear control systems
Unit 3	**Method of constructing phase –** trajectories- phase plane analysis of linear and non-linear systems – Bang-bang system
Unit 4	**Liapunov functions** -Different methods of constructing Liapunov functions for linear and non-linear continuous systems – stability analysis
Unit 5	**Pole placement technique** -Pole placement technique by state feedback for linear SISO time, invariant system – Theory of high-gain feedback-advantages – Pole placement technique along with high-gain feedback control.

B. RECOMMENDED STUDY MATERIAL:

S. No	Title of the Book	Author
1.	Modern Control Systems Theory, Wiley Eastern Ltd	Gopal, M.
2.	Modern Control Engineering, Prentice Hall of India	Ogata, K.
3.	Automatic Control Systems, Prentice Hall of India	Kuo, B.C.

Websites

- www.electronicsdevices.com/
- www.pearsonhighered.com
- www.khanacademic
- www.mindtools.com
- www.tryscience.com
- www.khaki.com
- www.Raifoundation.org
- www.tryingineering.com
- https://nptel.ac.in/courses/108/106/108106098/

CO- PO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	2	2	2	–	–	–	–	–	–	–	–
CO2	3	2	1	1	–	–	–	–	–	–	–	–
CO3	3	2	2	2	–	–	–	–	–	–	–	–

CO-PSO Mapping

	PSO 1	PSO 2	PO 3
CO1	2	–	–
CO2	1	–	–
CO3	2	–	–

Code: MPSEEE1107 DIGITAL SIGNAL PROCESSING & APPLICATIONS 4 Credits [LTP: 3-1-0]

A. DETAILED SYLLABUS

Unit	Contents
Unit 1	**Z-Transform-**Review of Discrete – Time Signal & System representation in Z – Transform domain – Inverse Z – Transform – Properties – System characterization in Z – domain -- Equivalence between Fourier Transform and the Z-Transform of a Discrete signal.
Unit 2	**Sampling in Fourier domain** - Discrete Fourier Transform and its properties – Linear filtering using DFT – Resolution of DFT - FFT Algorithm – Radix-2 FFT Algorithm - DIT & DIF Structures – Higher Radix schemes.
Unit 3	**Classification of filter design** - Design of IIR filters – Bilinear transformation technique – Impulse invariance method – Step invariance method.
Unit 4	**FIR filter design** – Fourier series method - Window function technique - Finite Word Length Effects.
Unit 5	**Introduction to Multi-rate Signal Processing** - Decimation - Interpolation - Case Studies on Speech Coding, Transform Coding – DSP based measurement system.

B. RECOMMENDED STUDY MATERIAL:

S. No	Title of the Book	Author
1.	Fundamentals of Digital Signal Processing	Ludemann L. C., Harper and Row publications
2.	Digital Filters – Analysis and Design, Tata Mc-Graw Hill	Oppenheim and Schaffer

3.	Discrete time Signal processing, PHI	Oppenheim and Schaffer
4.	Multirate systems and filter banks, PHI	P.P. Vaidhyanathan

Code: MPSEEE1108 POWER SYSTEM PLANNING & RELIABILITY 4 Credits [LTP: 3-1-0]

COURSE OUTCOMES: After Successful completion of the course students will be able to-

- Understand the concept of Conventional Energy Generation Methods
- Solve the operations of Load and Load Curves.
- Understand the study Power System Economics
- Apply Economic Operation of Power Systems.

A. DETAILED SYLLABUS

Unit	Contents
Unit 1	**Load Forecasting:** Classification and characteristics of loads, Approaches to load forecasting, Forecasting methodology, Energy forecasting.
Unit 2	**Basic Probability Theory:** Review of probability concepts, Probability distribution, Application of binomial distribution to engineering problem, Probability distribution in reliability evaluation, Network modeling and evaluation of simple and complex systems, System reliability evaluation using probability distribution, Frequency and duration methods.
Unit 3	**Generation System Reliability Evaluation:** Concept of LOLP, Evaluation of indices for isolated system, Generation system, Reliability analysis using the frequency and duration methods.
Unit 4	**Transmission System Reliability Evaluation:** Evaluation of LOLP and indices for an isolated transmission system using frequency and duration method.
Unit 5	**Distribution System Reliability Evaluation:** Reliability analysis of radial system with perfect and imperfect switching.

B. RECOMMENDED STUDY MATERIAL:

S. No	Title of the Book	Author
1.	Reliability Evaluation of Power Systems	R.N. Allan, Billinton
2.	Power System Planning and Reliability	J. Peschon
3.	Power Distribution System Reliability: Practical Methods and Applications, Wiley india	Ali Chowdhury, Don Koval

Websites

- https://nptel.ac.in/courses/108/106/108106160/
- https://nptel.ac.in/courses/108/105/108105104/
- https://nptel.ac.in/courses/108/101/108101004/

CO- PO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	2	2	2	–	–	–	–	–	–	–	–
CO2	3	2	1	1	–	–	–	–	–	–	–	–
CO3	3	1	1	1	–	–	–	–	–	–	–	–
CO4	3	2	2	2	–	–	–	–	–	–	–	–

CO-PSO Mapping

	PSO 1	PSO 2	PO 3
CO1	2	–	–
CO2	1	–	–
CO3	2	–	–
CO4	2	–	–

Code: MPSCEE1201	Power System Lab-I	2 Credits [LTP: 0-0-2]

A. DETAILED SYLLABUS

Unit	Contents
	Minimum 3-4 four experiments to be performed in each subject compulsory as well as Electives.

Code: MULCHM1101	Soft Skills-I	2 Credits [LTP: 2-0-0]

Course Objectives:

- Understand what constitutes a professional environment.
- Develop positive group strategies & team spirit.
- Set specific measurable goals for themselves in their personal and/or professional life.
- Understand the skills and the intricacies involved in starting an entrepreneurial venture
- Understand the use of English, specifically in industry situations.

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	**Personality Enrichment**	
2.	**Effective Management**	
3.	**Art of Communication**	
4.	**Interpersonal Skills**	
5.	**Written & Oral Communication**	

B. DETALED SYLLABUS

Unit	Unit Details
1.	**Personality Enhancement**
	• Self-Awareness, Self Esteem & Confidence , Attitude • Branding Yourself: Assertiveness and Confidence • The Corporate Fit-Dressing and Grooming, Corporate Dressing – Dress for Success • Etiquette: Social etiquette, business etiquette – civic sense – social norms
2.	**Effective Management Skills**
	• Time & Stress Management: Act in time on commitment • Planning & Prioritizing

	• Emotional Intelligence: Managing Emotions
3.	**Art of Communication**
	• Interview Skills: Fluency & Expression • Group Discussions: Structured & Unstructured • Presentations: Voice, Body Language, Content and Visual Aids, Audience Management
4.	**Interpersonal Skills**
	• The Team Concept & Elements of Teamwork, • Stages of Team Formation, & an Effective Team • Essential Building Blocks of Effective Teams • Leadership Skills: style and traits
5.	**Written & Oral Communication**
	Writing Skills: Picture perception & Story Making , Storytelling , Extempore & Paper Presentations.

CO- PO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	2	2	2	–	–	–	–	–	–	–	–
CO2	3	2	1	1	–	–	–	–	–	–	–	–
CO3	3	2	2	2	–	–	–	–	–	–	–	–
CO4	3	1	1	1	–	–	–	–	–	–	–	–
CO5	3	2	2	2	–	–	–	–	–	–	–	–

CO-PSO Mapping

	PSO 1	PSO 2	PO 3
CO1	2	–	–
CO2	1	–	–
CO3	2	–	–
CO4	2	–	–
CO5	2	–	–

Code: MPSCEE1401	SEMINAR-I	2 Credits [LTP: 2-0-0]

A. DETAILED SYLLABUS

Unit	Contents
	Students will be grouped in two to three, will have to decide final thesis area, download research papers from IEEE, ACM, Elsevier, Springer etc. Summarizing paper – Reading abstracts and finding ideas, conclusion, Advantages of Their approach, the drawbacks of the papers. Generalize results from a research paper to related research problems. Comparing the approach - Identify weaknesses and strengths in recent research articles in the subject. Practice sessions on how to read, analyze and summarize research papers. Students in group will have to deliver seminar, prepare a report and a review paper based on analysis.

M. Tech. POWER SYSTEM

Syllabus– Second Semester

Code: MPSCEE2101 Power System Optimization & Control 4 Credits [LTP: 3-1-0]

COURSE OUTCOMES: After Successful completion of the course students will be able to-

- To Have An Overview Of Power System Operation And Control.
- To Model Power-Frequency Dynamics And To Design Power-Frequency Controller.
- To Model Reactive Power-Voltage Interaction And The Control Actions To Be Implemented For Maintaining The Voltage Profile Against Varying System Load.
- To Study The Economic Operation Of Power System.
- To Teach About SCADA And Its Application For Real Time Operation And Control Of Power Systems

A. DETAILED SYLLABUS

Unit	Contents
Unit 1	**Optimal Power System Operation:** System constraints. Generator operating cost. Input-Output and incremental fuel characteristics of a generating unit. Optimal operation of generators on a bus bar, algorithm and flow chart. Optimal unit commitment, constraints in unit commitment, spinning reserve, thermal and hydro constraints.
Unit 2	**Unit Commitment Solution Methods:** Priority list method and dynamic programming method. Reliability consideration, Patton's security function, security constrained optional unit commitment, start- up considerations. **Optimal Generation Scheduling:** Development of transmission loss and incremental loss equations. Optimal generation scheduling including transmission losses, algorithm and flow chart. Optimal load flow solution. Hydrothermal coordination.
Unit 3	**Load Frequency Control:** Control of real and reactive power of generator. Turbine speed governing system, Modelling of speed governing system. Methods of frequency control: flat frequency, flat tie line and tie line load bias control. Block diagram representation of load frequency control of an isolated system, steady state analysis, dynamic response. Introduction to Two – area load frequency control.
Unit 4	**Power System Security**: Introduction to power system security & SCADA, System monitoring, contingency analysis, System state classification, security control.
Unit 5	**Automatic Generation Control:** Speed governing characteristic of a generating unit. Load sharing between parallel operating generators. Introduction to automatic generation control of an area by computer (description of block diagram).

B. RECOMMENDED STUDY MATERIAL:

S.No	Title of the Book	Author
1.	Power System Operation and control	S. Sivanagaraju, Pearson Education India
2.	Modern power system analysis	D. P. Kothari & I. J. Nagrath, TMH
3.	Power Generation, Operation, and Control	A.J. Wood & W.F. Wollenberg, John Wiley & Sons

Websites

- https://nptel.ac.in/courses/108101040/
- https://nptel.ac.in/content/syllabus_pdf/108104052.pdf

CO- PO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	2	2	2	–	–	–	–	–	–	–	–
CO2	3	2	1	1	–	–	–	–	–	–	–	–
CO3	3	2	2	2	–	–	–	–	–	–	–	–
CO4	3	1	1	1	–	–	–	–	–	–	–	–
CO5	3	2	2	2	–	–	–	–	–	–	–	–

CO-PSO Mapping

	PSO 1	PSO 2	PO 3
CO1	2	–	–
CO2	1	–	–
CO3	2	–	–
CO4	2	–	–
CO5	2	–	–

Code: MPSCEE 2102 EHV AC/DC TRANSMISSION& FACTS 4 Credits [LTP: 3-1-0]

COURSE OUTCOMES: After Successful completion of the course students will be able-

- To make students understand the basic knowledge about EHV AC Transmission.
- To make students understand the basic knowledge about HVDC Transmission
- To understand the concept of Load Frequency Control, Voltage Control & their applications.
- To learn about FACTS devices.

A. DETAILED SYLLABUS

Unit	Contents
1.	**EHV AC Transmission**
	Bulk power transmission over long distance, need for EHV transmission problems of EHV transmission, Power Handling capacity and surge impedance loading. Current carrying capacity of conductor. Choice of economic voltage, standard transmission voltages. Bundled Conductors: Properties of bundled conductors, geometric mean radius of bundle, inductance and capacitance, Voltage gradients of conductors, maximum surface voltage gradients of bundled conductors, maximum surface electric fields for bundled and single conductor lines. Electrostatic fields of EHV lines. Effect of E.S. field on Humans, Animals and Plants
2.	**HVDC Transmission-1**
	Rectification: The 3-phase Bridge rectifier or Graetz circuit, Inversion, Kinds of D.C links, Major components of a converter station-converter unit, filters, reactive power source.
3.	**FACTS**
	Principle of FACTS, FACTS controllers: shunt, series and shunt-series combined, SVC
4.	**Design and Analysis of FACTS**
	STATCOM, TCSC, TSC, PAR, SSSC, UPFC, System operation performance improvement through FACTS controllers, Advance new generation FACTS devices.
5.	**HVDC Transmission-2**
	Ground return and ground electrode. Introduction to Multi-terminal HVDC Systems and HVDC Circuit Breakers. Application of HVDC transmission.

RECOMMENDED STUDY MATERIAL:

S.No	Title of the Book	Author
1.	EHV Transmission New Age Publishers	R.D.Bagmudre
2.	HVDC Transmission New Age Publishers	K.R.Padiar

Websites

- https://nptel.ac.in/courses/108104013/

CO- PO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	2	2	2	–	–	–	–	–	–	–	–
CO2	3	2	1	1	–	–	–	–	–	–	–	–
CO3	3	2	2	2	–	–	–	–	–	–	–	–
CO4	3	2	2	2	–	–	–	–	–	–	–	–

CO-PSO Mapping

	PSO 1	PSO 2	PO 3
CO1	2	–	–
CO2	1	–	–
CO3	2	–	–
CO4	2	–	–

DEPARTMENT ELECTIVE

Code: MPSEEE2101 AI APPLICATIONS TO POWER SYSTEMS 4 Credits [LTP: 3-1-0]

COURSE OUTCOMES: After Successful completion of the course students will be able to -

- Understand non-traditional technologies or approaches for solving hard real-world problems.
- Understand tolerance of imprecision and uncertainty as the main attributes of soft computing theories.
- Understand Neural networks. Fuzzy logic. Genetic algorithms. Probabilistic reasoning. Rough sets. Chaos.

Understand Hybrid approaches (combinations

A. DETAILED SYLLABUS

Unit	Contents
Unit 1	**Introduction to AI:** Definition, Applications, Components of an AI program; production system, Problem characteristics, Overview of searching techniques.
Unit 2	**Knowledge representation:** Turning test AI agents and architecture, Predicate and propositional logic, Procedural versus declarative knowledge, forward versus backward reasoning.
Unit 3	**Statistical Reasoning:** Probability and Baye's theorem, Certainty factor and rule based systems, Baysian Networks, Dampster Shafer theorem, Examples of knowledge based systems
Unit 4	**Artificial Neural Networks:** Biological Neuron, Neural Net, Use of neural nets, Applications, Perceptron Model, Idea of single layer and multiplayer neural nets, Back propagation, Hopfield nets, Supervised and unsupervised learning.Expert Systems: Introduction, Study of some popular expert systems, Expert system building tools and shells, Components of expert systems, Applications to power systems.
Unit 5	**Fuzzy Logic:** Fuzzy logic concepts, Fuzzy relation and membership functions, Defuzzufication, Fuzzy controllers Genetic algorithm: concepts, coding, reproduction, crossover, mutation, scaling and fitness.

B. RECOMMENDED STUDY MATERIAL:

S.No	Title of the Book	Author
3.	Artificial intelligence techniques in power systems IET	K. Warwick, Arthur. Ekwue, Raj Aggarwa
4.	Artificial Intelligence in Power System Optimization CRC press	WeerakornOngsakul; Vo Ngoc Dieu

Websites

- www.slideshare.net/ankush281290/introduction-to-**soft-computing**
- www..4shared.com/q/CCAD/1/soft%20computing?suggested
- https://nptel.ac.in/courses/106/105/106105173/
- https://nptel.ac.in/content/storage2/nptel_data3/html/mhrd/ict/text/106105173/lec1.pdf

CO- PO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	2	2	2	–	–	–	–	–	–	–	–
CO2	3	2	1	1	–	–	–	–	–	–	–	–
CO3	3	2	2	2	–	–	–	–	–	–	–	–

CO-PSO Mapping

	PSO 1	PSO 2	PO 3
CO1	2	–	–
CO2	1	–	–
CO3	2	–	–

Code: MPSEEE2102 Advanced Power Electronics 4 Credits [LTP: 3-1-0]

COURSE OUTCOMES: After Successful completion of the course students will be able-

- To understand the concept of power semiconductor devices.
- To analyze concept and applications of SCR, Convertor.
- To understand the concept and applications of DC-DC convertor

A. DETAILED SYLLABUS

Unit	Contents
Unit 1	**Phase Controlled Converters:** Performance measures of single and three-phase converters with discontinuous load current for R, RL and RLE loads. Effect of source inductance for single and three-phase converters.
Unit 2	**Chopper-**Review of choppers configurations, Steady state analysis of type A Chopper-Minimum and Maximum Currents, Ripple and average load current. Commutation in Chopper Circuits.
Unit 3	**Inverters:** Performance parameters, voltage control of three phase inverters-Sinusoidal PWM, Third Harmonic PWM, 60 degree PWM and Space Vector Modulation. Harmonic reductions
Unit 4	**AC Voltage Controllers:** Single and Three Phase AC Controllers. AC Voltage Controller with PWM Control.
Unit 5	**Cyclo-converters:** Single phase and three phase Cyclo-converters. Reduction in Output Harmonics. Matrix Converter

B. RECOMMENDED STUDY MATERIAL:

S.No	Title of the Book	Author
1.	Power Electronics, TMH	P.C.Sen
2.	Power Electronics, Khanna Publishers	P.S.Bhimbra
3.	Power Electronics converters and applications, TMH	Ned Mohan

Websites

- https://nptel.ac.in/courses/108/105/108105066/
- https://nptel.ac.in/courses/108101038/

CO- PO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	2	2	2	–	–	–	–	–	–	–	–
CO2	3	2	1	1	–	–	–	–	–	–	–	–
CO3	3	2	2	2	–	–	–	–	–	–	–	–

CO-PSO Mapping

	PSO 1	PSO 2	PO 3
CO1	2	–	–
CO2	1	–	–
CO3	2	–	–

Code: MPSEEE2103 Power System Deregulation 4 Credits [LTP: 3-1-0]

COURSE OUTCOMES: After Successful completion of the course students will be able-

- To understand knowledge in the deregulation and independent system operator .
- To apply General description of some ancillary services.
- To understand working and applicarions of Operational planning

A. DETAILED SYLLABUS

Unit	Contents
Unit 1	**Deregulation** -Reconfiguring Power systems, unbundling of electric utilities, Background to deregulation and the current situation around the world, benefits from a competitive electricity market after effects of deregulation.
Unit 2	**Role of the independent system operator**, Operational planning activities of ISO: ISO in Pool markets,ISO in Bilateral markets
Unit 3	**Operational planning**-Activities of a GENCO: Genco in Pool and Bilateral markets, market participation issues, competitive bidding. Power wheeling
Unit 4	**Transmission open access,** pricing of power transactions, security management in deregulated environment, and congestion management in deregulation.
Unit 5	**General description of some ancillary services**, ancillary services management in various countries, reactive power management in some deregulated electricity markets.

B. RECOMMENDED STUDY MATERIAL:

S.No	Title of the Book	Author
1.	Operation of Restructured Power Systems, KluwerAcademic Publishers, USA, 2001.	K. Bhattacharya, MHT Bollen and J.C Doolder
2.	Power System restructuring and deregulation, John Wiley and Sons, UK. 2001	Lei Lee Lai
3.	Power System Operations and Electricity Markets", CRC Press, LLC,2002.	Fred I Denny and David E. Dismukes

Websites

- https://nptel.ac.in/courses/108101039/
- https://nptel.ac.in/content/storage2/courses/108101039/download/Lecture-1.pdf

CO- PO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	2	2	2	–	–	–	–	–	–	–	–
CO2	1	2	1	1	–	–	–	–	–	–	–	–
CO3	3	2	2	1	–	–	–	–	–	–	–	–

CO-PSO Mapping

	PSO 1	PSO 2	PO 3
CO1	2	–	–
CO2	2	–	–
CO3	2	–	–

Code: MPSEEE2104 Digital Controllers in Power Electronics Applications 4 Credits [LTP: 3-1-0]

COURSE OUTCOMES: After Successful completion of the course students will be able-

- To understand the basic principles of C2xx DSP core and code generation
- To apply External devices to the C2xx core.
- To understand and apply concepts of Multiplexing and General Purpose I/O Control Registers
- To understand theory and applications of HDL programming.

A. DETAILED SYLLABUS

Unit	Contents
Unit 1	**Introduction**-Introduction to the C2xx DSP core and code generation, The components of the C2xx DSP core.
Unit 2	**Mapping** -External devices to the C2xx core , peripherals and Peripheral Interface , System configuration registers , Memory , Types of Physical Memory , memory Addressing Modes , Assembly Programming using C2xx DSP, Instruction Set, Software Tools. Pin Multiplexing (MUX) and General
Unit 3	**Purpose I/O Overview**, Multiplexing and General Purpose I/O Control Registers .Introduction to Interrupts, Interrupt Hierarchy, Interrupt Control Registers, Initializing and Servicing Interrupts in Software. ADC Overview , Operation of the ADC in the DSP , Overview of the Event manager (EV) , Event Manager Interrupts , General Purpose (GP) Timers , Compare Units, Capture Units and
Unit 4	**Quadrature Enclosed Pulse** (QEP) Circuitry , General Event Manager Information Introduction to Field Programmable Gate Arrays – CPLD Vs FPGA – Types of FPGA , Xilinx XC3000 series , Configurable logic Blocks (CLB), Input / Output Block (IOB) – Programmable Interconnect Point (PIP) – Xilinx,4000 series
Unit 5	**HDL programming** – overview of Spartan 3E and Virtex II pro FPGA boards- case study. Controlled Rectifier , Switched Mode Power Converters , PWM Inverters , DC motor control , Induction Motor Control

B. RECOMMENDED STUDY MATERIAL:

S.No	Title of the Book	Author
3.	DSP Based Electro Mechanical Motion Control , CRC Press New York	Hamid. A. Toliyat and Steven G. Campbell
4.	FPGA based system design , Prentice hall	Wayne Wolf
5.	XC 3000 series datasheets (version 3.1)	Xilinx,Inc.,USA

Websites
• https://nptel.ac.in/courses/108101039/ • https://nptel.ac.in/content/storage2/courses/108101039/download/Lecture-1.pdf • https://nptel.ac.in/courses/117105140/

CO- PO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	2	2	2	–	–	–	–	–	–	–	–
CO2	3	2	1	1	–	–	–	–	–	–	–	–
CO3	3	2	2	2	–	–	–	–	–	–	–	–
CO4	3	2	2	2	–	–	–	–	–	–	–	–

CO-PSO Mapping

	PSO 1	PSO 2	PO 3
CO1	2	–	–
CO2	1	–	–
CO3	2	–	–
CO4	2	–	–

Code: MPSEEE2105 Transient over Voltages in Power System 3 Credits [LTP: 3-0-0]

COURSE OUTCOMES: After Successful completion of the course students will be able-

- To understand knowledge in the field of Smart Grid.
- To apply Sensing, Measurement, Control and Automation in smart grid.
- To understand working and applicarions of Micro Grids .

A. DETAILED SYLLABUS

Unit	Contents
Unit 1	**Transients in electric power systems** – Internal and external causes of over voltages-– Lightning strokes – Mathematical model to represent lightning. Travelling waves in transmission lines – Circuits with
Unit 2	**Distributed constants** – Wave equations – Reflection and refraction of travelling waves – Travelling waves at different line terminations. Switching transients –double frequency transients – abnormal switching transients –
Unit 3	**Transients in switching a three phase reactor**- three phase capacitor. Voltage distribution in transformer winding – voltage surges-transformers –generators and motors,
Unit 4	**Transient parameter** values for transformers, reactors, generators and transmission lines. Basic ideas about protection –surge diverters-surge absorbers-protection of lines and stations Modern lighting arrestors, Insulation coordination,
Unit 5	**Protection of alternators and industrial drive systems.** Generation of high AC and DC-impulse voltages, currents-measurement using sphere gaps-peak voltmeters-potential dividers and CRO.

B. RECOMMENDED STUDY MATERIAL:

S.No	Title of the Book	Author
1.	Electrical transients in power systems, Wiley	Allen Greenwood
2.	Travelling waves and transmission systems, Dover publications, New York	Bewley, L.W
3.	High voltage measurement, Testing and Design, John Wiley and sons	Gallaghar, P.J. and Pearmain, A.J.

Websites

- https://nptel.ac.in/courses/108107113/
- https://nptel.ac.in/content/storage2/nptel_data3/html/mhrd/ict/text/108107113/lec2.pdf

CO- PO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	2	2	2	–	–	–	–	–	–	–	–
CO2	3	2	1	1	–	–	–	–	–	–	–	–
CO3	2	2	1	2	–	–	–	–	–	–	–	–

CO-PSO Mapping

	PSO 1	PSO 2	PO 3
CO1	2	–	–
CO2	1	–	–
CO3	2	–	–

Code -MPSEEE2106 Advanced Solar Thermal & PV 3 Credits [LTP: 3-0-0]

COURSE OUTCOMES:After Successful completion of the course students will be able to-

- Understand the concept for Renewable Energy
- Understand the concept of Solar energy and solar Thermal .
- To understand the concept of Charging Controllers .
- Explain the concepts of PV System design (Calculation) and its applications & Business Tips .

A. DETAILED SYLLABUS

Unit	Contents
Unit 1	**Solar Radiation** Nature of Solar Radiation, Global, Beam and Diffuse Radiation, Hourly, Daily and Seasonal variation of solar Radiation, Estimation of Solar Radiation, Measurement of Solar Radiation. Global, National and State scenario of solar radiation and its potential.
Unit 2	**Photo thermal Systems** Flat Plate Collector, Hot Air Collector, Evacuated Tube Collector, Parabolic , Compound Parabolic and Fresnel Solar Concentrators, Central Receiver System, Thermal Analysis of Solar Collectors Performance of Solar Collectors, Solar Water Heating Systems(Active & Passive), Solar Space Heating & Cooling Systems, Solar Industrial Process Heating Systems, Solar Dryers & Desalination Systems, Solar Thermal Power Systems.
Unit 3	**Photovoltaic systems** Solar cells & panels, performance of solar cell, estimation of power obtain from solar power, solar panels PV systems, components of PV systems, performance of PV systems, design of PV systems, applications of PV systems, concentrating PV systems, PV power plants, power plant with fuel cells
Unit 4	**Design & modeling of solar energy systems** F Chart method, φ– F Chart method, Utilizability modeling & simulation of Solar Energy Systems,
Unit 5	**Economic analysis of Solar energy Systems** Life cycle analysis of Solar Energy Systems, Time Value of Money, Evaluation of Carbon Credit of Solar Energy Systems,

B. RECOMMENDED STUDY MATERIAL:

S.No	Title of the Book	Author
1.	Solar Engineering of Thermal Process	J.A.Duffie& W.A. Beckman
2.	Solar Energy Engineering	S.A.Kalogirou

Websites

- https://nptel.ac.in/courses/103107157/
- https://nptel.ac.in/courses/112105051/

CO- PO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	2	2	2	2	–	–	–	–	–	–	–	–
CO2	3	2	1	1	–	–	–	–	–	–	–	–
CO3	2	2	2	2	–	–	–	–	–	–	–	–
CO4	3	2	2	2	–	–	–	–	–	–	–	–

CO-PSO Mapping

	PSO 1	PSO 2	PO 3
CO1	2	–	–
CO2	2	–	–
CO3	2	–	–
CO4	2	–	–

Code: MPSEEE2107 Modeling & Analysis of Electrical Machines 3 Credits [LTP: 3-0-0]

COURSE OUTCOMES: After Successful completion of the course students will be able to understand-

- The principles of operations of DC machines as motor and generator
- The principles of operations of Transformers
- The principles of operations of Induction machines
- The principles of operations of Synchronous machines and special machines.

A. DETAILED SYLLABUS

Unit	Contents
Unit 1	**Principles of Electromagnetic** Energy Conversion, General expression of stored magnetic energy, co-energy and force/torque, example using single and doubly excited system.
Unit 2	**Basic Concepts of Rotating Machines**-Calculation of air gap mmf and per phase machine inductance using physical machine data; Voltage and torque equation of dc machine.
Unit 3	**Three phase symmetrical induction machine** , salient pole synchronous machines in phase variable form; Application of reference frame theory to three phase symmetrical
Unit 4	**Induction and synchronous machines**, dynamic direct and quadrature axis model in arbitrarily rotating reference frames Determination of Synchronous Machine Dynamic Equivalent Circuit Parameters, Analysis and dynamic modeling of two phase asymmetrical induction machine and single phase induction machine.
Unit 5	**Special Machines -** Permanent magnet synchronous machine: Surface permanent magnet (square and sinusoidal back emf type) and interior permanent magnet machines. Construction and operating principle, dynamic modeling and self controlled operation; Analysis of Switch Reluctance Motors**.**

B. RECOMMENDED STUDY MATERIAL:

S.No	Title of the Book	Author
1.	Electric Machinery, Tata Mcgraw Hill	Charles Kingsley,Jr., A.E. Fitzgerald, Stephen D.Umans
2.	Electric Motor & Drives: Modeling, Analysis and Control, PHI	R. Krishnan
3.	Brushless permanent magnet and reluctance motor drives, Clarendon Press, Oxford	Miller, T.J.E

Websites

- khanacademy.com
- https://nptel.ac.in/courses/108/102/10810 2146/

CO- PO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	2	2	2	–	–	–	–	–	–	–	–
CO2	3	3	1	1	–	–	–	–	–	–	–	–
CO3	3	2	2	2	–	–	–	–	–	–	–	–
CO4	2	2	2	2	–	–	–	–	–	–	–	–

CO-PSO Mapping

	PSO 1	PSO 2	PO 3
CO1	2	–	–
CO2	2	–	–
CO3	2	–	–
CO4	2	–	–

Code: MPSEEE2108 Computer Networking 3 Credits [LTP: 3-0-0]

COURSE OUTCOMES: After Successful completion of the course students will be able-

- To understand the concept of Internet of Things.
- To analyze concept and applications of demystifying the IoT Paradigm.
- To understand the Emerging IoT Flavors and Popular M2M Applications
- To learns IoT Ecosystem Using Wireless Technologies

A. DETAILED SYLLABUS

Unit	Contents
Unit 1	**Computer Network** – Hardware and Software, OSI and TCP reference Model, Transmission media, Wireless transmission,
Unit 2	**Public switched telephone network -** Structure, multiplexing and switching. Data link layer - design issues,
Unit 3	**Data link protocols. Medium access sub layer -** channel allocations, Multiple Access protocols and IEEE protocols. Network layer
Unit 4	**Design issues**, routing algorithms, congestion control algorithms, QoS, Transport layer- Design issues, Connection management.
Unit 5	**Application layer** – DNs, Electronic mail, World Wide Web, multimedia, Cryptography, Internet transport protocols - TCP and UDP

B. RECOMMENDED STUDY MATERIAL:

S.No	Title of the Book	Author
1.	Computer Networking, 2nd Edition, Pearson	James F. Kurose and Keith W. Ross
2.	Computer Networks, 4th Edition, Prentice Hall of India	Tanenbaum, A.S.
3.	Data and Computer Communication,PHI	Stallings, W.

Websites

- https://nptel.ac.in/courses/106/105/106105166/
- https://www.iotworldtoday.com/
- https://www.postscapes.com/
- https://connectedworld.com/
- https://www.ibm.com/internet-of-things
- https://azure.microsoft.com/en-in/overview/iot/
- https://www.ibm.com/watson

CO- PO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	2	2	2	–	–	–	–	–	–	–	–
CO2	3	2	1	1	–	–	–	–	–	–	–	–
CO3	3	2	2	2	–	–	–	–	–	–	–	–

CO-PSO Mapping

	PSO 1	PSO 2	PO 3
CO1	2	–	–
CO2	1	–	–
CO3	2	–	–

Code: MPSCEE2201	Power System Lab-II	2 Credits [LTP: 0-0-2]

A. DETAILED SYLLABUS

Unit	Contents
	Minimum 3-4 four experiments to be performed in each subject compulsory as well as Electives.

Code: MPSCHM2201	Soft Skills-II	2 Credits [LTP: 2-0-0]

COURSE OUTCOMES

Students will be able:

- CO206.1: To present themselves in an effective manner and know about their short-term and long-term goals.
- CO206.1To works in a team by managing time properly and focus on personal grooming, etiquettes and body language.
- CO206.1 to demonstrate their abilities by improving skills of LSRW (Listening /Speaking/Reading/Writing).
- CO206.1 To present different viewpoints or ways of thinking about a situation , expand their abilities to resolve situations and get experience within the given context
- CO206.1 to enhance their employability skills by working on the presentation of Résumé and giving impactful performance during Group Discussion.

Unit	Unit Details
1	Self-Awareness, Self Esteem & Confidence
2	The Corporate Fit-Dressing and Grooming, Etiquette: Social etiquette, business etiquette – civic sense – social norms
3	Effective Management Skills Time & Stress Management: Act in time on commitment
4	Personal Grooming and Body language
5	Time Management & Conflict Management
6	Planning & Prioritizing, Emotional Intelligence: Managing Emotions
7	Oral Communication &Writing Skills: Extempore & Paper Presentations.
8	Selling Self/Job Hunting Writing resume / Curriculum vitae
9	Mock GD – Goal setting - Career planning
10	Mock interview or Interview skills

Code: MPSCEE2401	SEMINAR II	2 Credits [LTP: 2-0-0]

A. DETAILED SYLLABUS

Unit	Contents
	Students grouped in two to three during Semester I, will now continue to download further the research papers in the area, analyze, allocate individually, the set of papers, **Literature survey** Overview – What is literature survey, Functions of literature survey, maintaining a notebook, developing a Bibliography Methods of data collection – Observation, survey, contact methods, experimental, determining sample design Searching for publications – Publication databases, search engines and patent data bases, Find some/all of the references for a given paper, including those that are not on the web Online tools – google, CiteSeer, ACM Digital Library, IEEE, The on-line Computer Science bibliography, Survey papers, Finding material not on the web, Searching patents **Publishing a paper** How to write scientific paper Structure of a conference and journal paper, how (and How Not) to write a Good Systems Paper: Abstract writing, chapter writing, discussion, conclusion, references, bibliography, and In-class discussion of technical writing examples, Poster papers, review papers, how to organize thesis Project report, How to write a research proposal? How research is funded? Research ethics – Legal issues, copyright, and plagiarism General advice about writing technical papers in English Tips for writing correct English Practice sessions on above will be conducted. Students will have to deliver seminar, prepare a report and a review paper based on analysis individually.

M. Tech. POWER SYSTEM

Syllabus– Third Semester

Code: MPSCEE3101 SMART GRID 4 Credits [LTP: 3-1-0]

COURSE OUTCOMES: After Successful completion of the course students will be able-

CO1- To understand the concepts of Smart grid Technologies.
CO2- To examine the Sensing, Measurement, Control and Automation in smart grid.
CO3- To discriminate between Micro Grids And Distributed Energy Resources.
CO4- To investigate Power Quality Management In Smart Grid
CO5- To design Information And Communication Technology For Smart Grid.

A. DETAILED SYLLABUS

Unit	Contents
Unit 1	• Introduction of Unit • Evolution of Electric Grid, Concept of Smart Grid, Definitions • Need of Smart Grid, Functions of Smart Grid, Opportunities & Barriers of Smart Grid, Difference between conventional & smart grid • Concept of Resilient & Self-Healing Grid, Present development & International policies in Smart Grid. Case study of Smart Grid, CDM opportunities in Smart Grid, What is a Smart Grid?, The Smart Grid Enables the Electric Net SM, Local Energy Networks • Electric Transportation, Low-Carbon Central Generation, What Should Be the Attributes of the Smart Grid?, Why Do We Need a Smart Grid?, Is the Smart Grid a "Green Grid"?, Smart Grid Initiative for Power Distribution Utility in India Conclusion and Summary of Unit
Unit 2	• Introduction of Unit • Smart metering and demand-side integration, Introduction, Smart metering, Evolution of electricity metering, Key components of smart metering, Smart meters: An overview of the hard ware used Signal acquisition, Signal conditioning, Analogue to digital conversion, Computation, Input/output • Communication, Communications infrastructure and protocols for smart metering, Home-area network, Neighborhood area network, Data concentrator, Meter data management system, Protocols for communications, • Demand-side integration, Services provided by DSI , Implementations of DSI, Hardware support to DS I implementations, Flexibility delivered by prosumers from the demand side, System support from DSI. Conclusion and Summary of Unit
Unit 3	Introduction of Unit Concept of micro grid, need & applications of micro grid, formation of micro grid, issues of interconnection, protection & control of micro grid. Islanding, need and benefits, different methods of is landing detection. Distributed Energy Resources: Small scale distributed generation, Distributed Generation Technology, Internal Combustion Engines, Gas Turbines, Combined Cycle Gas Turbines, Micro

	turbines, Fuel Cells, Solar Photovoltaic, Solar thermal, Wind power, Geo thermal, -all sources as a DG. Advantages and disadvantages of DG. Conclusion of Unit
Unit 4	Introduction of Unit Power Quality & EMC in Smart Grid, Power Quality issues of Grid connected Renewable Energy Sources, Power Quality Conditioners for Smart Grid, Web based Power Quality monitoring, Power Quality Audit. Conclusion of Unit including real life application.
Unit 5	• Introduction of Unit • Information And Communication Technology For Smart Grid: Advanced Metering Infrastructure (AMI),Home Area Network (HAN), Neighborhood Area Network(NAN) • Wide Area Network(WAN).Bluetooth, Zig-Bee, GPS, Wi-Fi, Wi-Max based communication, Wireless Mesh Network, Broadband over Power line(BPL). Conclusion of Unit

B. RECOMMENDED STUDY MATERIAL:

Sr. No	Reference Book	Author	Publication
1.	"Integration of Green and Renewable	Ali K., M.N. Marwali, MinDai	Wiley
2.	The Smart Grid: Enabling Energy	Clark W.Gellings	CRC press
3.	Smart Grid: Technology and Applications	Janak aEkana yake, N. Jenkins,	Wiley
4.	Smart Grids	Jean Claude Sabon nadiere	Wiley Black well
Websites			
▫ https://nptel.ac.in/courses/108107113/			

Code: MPSCEE3102 ADVANCED POWER SYSTEM PROTECTION 4 Credits [LTP: 4-0-0]

COURSE OUTCOMES: After Successful completion of the course students will be able-

- To understand knowledge in the Static Relays ,Comparators & Static over Current .
- To apply Carrier Current Protection & Distance Protection.

To understand working and applicarions of Circuit Breakers II & Digital Protection

C. DETAILED SYLLABUS

Unit	Contents
Unit 1	**(i) Static Relays:** Introduction, merits and demerits of static relays. **Comparators:** amplitudeand phase comparator, duality between amplitude and phase comparators. Circulating current type phase-splitting type and sampling type amplitude comparators. Vector product type andcoincidence type phase Comparators. **ii) CTs & PTs:** Current transformer (CT) Construction, measurement CT and protective CT. Type of potential transformers. Steady state ratio and phase angle errors in CTs and PTs. Transient errors in CT and CVT.
Unit 2	**i) Static Over Current Relays:** Instantaneous over current relay, definite time over current relay, inverse-time over current relay, directional over current relay. **(ii) Static Differential Relays:** Differential relay scheme, single-phase static comparator, poly-phase differential protection. Differential protection for generator and transformer.
Unit 3	**(i) Static Distance Relays:** Impedance relay, reactance relay and mho relay using amplitudeand phase comparators. Polarized and offset mho relays. **(ii) Carrier Current Protection:** Phase Comparison scheme, carrier aided distance protection.
Unit 4	**i) Distance Protection:** Effect of arc resistance, power swings, line length and source impedance on the performance of distance protection. Out of step tripping and blocking relays. Mho relay with blinders. Quadrilateral and elliptical relays. Selection of distance relays. **(ii) Induction Motor Protection:** Various faults and abnormal operating conditions. Protection against faults, unbalance supply voltage, single phasing, over load and mechanical rotor faults, HRC fuses, over-current, percentage differential and earth fault protection. Negative sequence voltage relays and resistance temperature detector relay.

Unit 5	**Digital Protection:** Introduction to digital protection, block diagram of digital relay, sampling theorem, correlation with a reference wave, Fourier analysis of analogue and discrete signals, least error squared technique, digital filtering – low pass, high pass, finite impulse response and infinite impulse response fillers. Introduction to digital over-current, transformerdifferential and transmission line distance protection.

B. RECOMMENDED STUDY MATERIAL:

S.No	Title of the Book	Author
1.	Power System Protection And Switchgear, New Age Publishers	Ravindranath, M.chander
2.	Switchgear & Protection, TMH	Badri ram

Websites

- https://nptel.ac.in/courses/108101039/
- https://nptel.ac.in/content/storage2/courses/108101039/download/Lecture-1.pdf

Code: MPSCEE3201	Power System Lab III	2 Credits [LTP: 0-0-2]

B. DETAILED SYLLABUS

Unit	Contents
	• 3-4 Experiments based on each theory subject will have to be carried out.

OPEN ELECTIVE

Code: MULEEE3107	E- Commerce & Knowledge Management	3 Credits [LTP:3-0-0]

COURSE OVERVIEW AND OBJECTIVES

This course provides an introduction to information systems for business and management. It is designed to familiarize students with organizational and managerial foundations of systems, the technical foundation for understanding information systems

COURSE OUTCOME

The student would be able to

CO03115.1 Understand the basic concepts and technologies used in the field of management information systems;

CO03115.2To impart the knowledge of the different types of management information systems;

CO03115.3 To Understand the processes of developing and implementing information systems;

CO03115.4 To aware of the ethical, social, and security issues of information systems;

CO03115.5 To familiarize students with organizational and managerial foundations of systems

A. OUTLINE OF COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1	**INTRODUCTION TO ELECTRONIC COMMERCE**	9
2.	**BUILDING OWN WEBSITE**	8
3.	**INTERNET AND EXTRANET**	9
4.	**ELECTRONIC DATA INTERCHANGE**	9
5.	**PLANNING FOR ELECTRONIC COMMERCE**	9

B. Detailed Syllabus

Unit	Unit Details

Unit 1	**INTRODUCTION TO ELECTRONIC COMMERCE** Introduction of Unit, what is E-Commerce (Introduction and Definition), Main activities E- Commerce, Goals of E-Commerce, Technical Components of E-commerce, Functions of E- commerce, Advantages and Disadvantages of E-commerce, Scope of E-commerce, Electronic commerce Applications, Electronic commerce and Electronic Business, Conclusion of Unit.
Unit 2	**BUILDING OWN WEBSITE** Introduction of Unit, Reasons for building own website, Benefits of website, Bandwidth requirements, Cost, Time, Reach, Registering a Domain Name, Web promotion, Target email, Banner Exchange, Shopping Bots, Conclusion of Unit
Unit 3	**INTERNET AND EXTRANET** Introduction of Unit, Definition of Internet, Advantages and Disadvantages of the Internet, Component of an Intranet Information technology structure, Development of a Intranet, Extranet and Intranet Difference, Role of Intranet in B2B Application, Conclusion of Unit.
Unit 4	**ELECTRONIC DATA INTERCHANGE** Introduction of Unit, Concepts of EDI and Limitation, Application of EDI, Disadvantages of EDI, EDI model, Conclusion of Unit.
Unit 5	**PLANNING FOR ELECTRONIC COMMERCE** Introduction of Unit, planning electronic commerce initiatives, linking objectives to business strategies, measuring cost objectives, comparing benefits to costs, strategies for developing electronic commerce web sites, Conclusion of Unit.

C. RECOMMENDED STUDY MATERIAL:

S. No	Title of the Book	Author
1.	E-Commerce	Greenstein & Feinman, Tata McGrew Hill
2.	Frontiers of Electronic Commerce	Kalakota Winston ,Pearson Education

Important Web Links:

1. https://www.kmslh.com/3-reasons-why-ecommerce-must-have-knowledge-management/
2. https://link.springer.com/chapter/10.1007/978-3-642-23993-9_31
3. https://ieeexplore.ieee.org/document/5279962
4. https://www.sciencedirect.com/science/article/pii/S0268401207001120
5. https://www.slideshare.net/monoaziz/knowledge-management-1852596

Code: MULEEE3108	Water and Environmental Pollution	3 Credits [LTP:3-0-0]

COURSE OVERVIEW AND OBJECTIVES

The aim of this course is to teach students about current environmental problems. From an environmental perspective, the student will learn how to develop an activity using various strategies to control, reduce and monitor all environmental problems that might arise as a result.

COURSE OUTCOME

The student would be able to

CO03114.1 To be able to identify and value the effect of the pollutants on the environment: atmosphere, water and soil.

CO03114.2 To be able to analyse an industrial activity and identify the environmental problems.

CO03114.3 TO be able to plan strategies to control, reduce and monitor pollution.

CO03114.4 To be able to select the most appropriate technique to purify and/or control the emission of pollutants.

CO03114.5 To be able to apply the basis of an Environmental Management System (EMS) to an industrial activity.

A.OUTLINE OF COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1	**WATER AND WATER ANALYSIS**	9
2.	**WASTEWATER AND THEIR TREATMENT**	8
3.	**GLOBAL ATMOSPHERIC CHANGE**	9
4.	**AIR POLLUTION & METEOROLOGY**	9
5.	**SOLID WASTE MANAGEMENT**	9

A. DETAILEDSYLLABUS

Unit 1	**WATER AND WATER ANALYSIS** Water resources, Sources of water, characteristics of water, water pollutants, oxygen demanding wastes, surface water quality, ground water quality. Municipal water supply: Requisites of drinking water, Steps involved in treatment of water
Unit 2	**WASTEWATER AND THEIR TREATMENT** Wastewater Characteristics: Quality parameters: BOD, COD, TOC, Solids, DO, Nitrogen, Phosphorus, Standards of disposal into natural watercourses and on land, Indian standards. wastewater treatment systems, disposal scope
Unit 3	**GLOBAL ATMOSPHERIC CHANGE** The atmosphere of earth, greenhouse effect, radiative forcing of climate change, global warming potential, carbon cycle, carbon emissions from fossil fuels, regional impacts of temperature change, global initiatives.
Unit 4	**AIR POLLUTION & METEOROLOGY** Atmospheric motion, Lapse rate, atmospheric stability, inversion, atmospheric dispersion, maximum mixing depth, Air quality standards, plume rise, emission controls. Air pollution control methods in industries. **NOISE POLLUTION:** Effect of noise on people, rating systems, community noise sources and criteria, traffic noise prediction, noise control

Unit 5	**SOLID WASTE MANAGEMENT** Integrated solid waste management, hazardous waste management, biomedical waste treatment technologies and disposal options, e-waste management, waste minimization for sustainability, waste management – Indian scenario.

B. RECOMMENDED STUDYMATERIAL:

S.No	Title of the Book	Author
1.	Environmental Engineering	Howard S Peavy, Donald RRowe, George Tchobanoglous
2.	Engineering: Treatment, and Reuse, 4th edition, Tata McGraw Hill, 2007.	Metcalf and Eddy Inc
3.	Manual for Water Treatment.	Ministry of Urban development, Govt of India
4.	Manual for Sewage Treatment	Ministry of Urban development, Govt of India
5.	Air Pollution	M N Rao
6.	Air Pollution Control Engineering	De Nevers
7	Solid Wastes: Engineering principles and Management issues	Tchobanoglous G.

Important Web Links:

1. https://www.google.co.in/search?biw=1366&bih=608&ei=Y4HLXvytHffYz7sPn9eB4AY&q=water+and+enviroment+polluation+nptel&oq=water+and+enviroment+polluation+nptel&gs_lcp=CgZwc3ktYWIQAzIKCCEQFhAKEB0QHjIKCCEQFhAKEB0QHjIKCCEQFhAKEB0QHjoECAAQRzoGCAAQFhAeOgcIIRAKEKABUIsYWP4mYMItaABwAXgAgAG8AogBuw2SAQcwLjEuNS4xmAEAoAEBqgEHZ3dzLXdpeg&sclient=psy-ab&ved=0ahUKEwi868D4y87pAhV37HMBHZ9rAGwQ4dUDCAw&uact=5\
2. https://www.nrdc.org/stories/water-pollution-everything-you-need-know
3. https://www.environmentalpollutioncenters.org/water/
4. https://www.explainthatstuff.com/waterpollution.html
5. https://wwf.panda.org/knowledge_hub/teacher_resources/webfieldtrips/water_pollution/

Code: MULEEE3108	IR& Patents	3 Credits [LTP:3-0-0]

COURSE OVERVIEW AND OBJECTIVES: The main objective of the IPR is to make the students aware of their rights for the protection of their invention done in their project work.Further teacher will have to demonstrate with products and ask the student to identify the different types of IPR's

COURSE OUTCOME:

CO03116.1 To introduce fundamental aspects of Intellectual property Rights to students who are going to play a major role in development and management of innovative projects in industries.

CO03116.2 To disseminate knowledge on patents, patent regime in India and abroad and registration aspects

CO03116.3 To acquire knowledge on copyrights and its related rights and registration aspects

CO03116.4 To understand knowledge on trademarks and registration• aspects

CO03116.5 To disseminate knowledge on Design, Geographical Indication (GI), Plant Variety and Layout Design Protection and their registration aspects

A. OUTLINE OF COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1	**INTRODUCTION TO IPR**	9
2.	**TYPES OF IPR AND WIPO**	8
3.	**LEGAL AND COMMERCIAL ASPECTS OF IPR**	9
4.	**INTRODUCTIONS TO PATENTS**	9
5.	**PATENT PROCEDURES**	9

B. DETAILED SYLLABUS

Unit	Unit details
Unit 1	**INTRODUCTION TO IPR** General Regime of Intellectual Property Rights, Concept of Property vis-à-vis Intellectual Property, Concept of Property and Theories of Property - An Overview. Theories of Intellectual Property Rights, Intellectual Property as an Instrument of Development, Need for Protecting. Intellectual Property- Policy Consideration- National Perspectives and International demands.
Unit 2	**TYPES OF IPR AND WIPO** Types of Intellectual Property- Origin and Development- An Overview, Intellectual Property Rights as Human Right, Role of International Institutions, World Intellectual Property Organization (WIPO), Function of WIPO, Membership of WIPO, Agreement between the WIPO and the WTO.
Unit 3	**LEGAL AND COMMERCIAL ASPECTS OF IPR** Dispute Settlement- New Treaties, Commercialization of Intellectual Property Rights by Licensing, Determining Financial Value of Intellectual Property Rights, Negotiating Payments Terms in Intellectual Property Transaction, Intellectual Property Rights in the Cyber World.

Unit 4	**INTRODUCTIONS TO PATENTS** Introduction to Patent Law, Paris Convention, Patent Cooperation Treaty, WTO- TRIPS, Harmonization of CBD and TRIPs, Indian Patent Law, The Patents Act, 1970, Amendments to the Patents Act, Patentable Subject Matter, Patentability Criteria.
Unit 5	**PATENT PROCEDURES** Procedure for Filing Patent Applications, Patent Granting Procedure, Revocation, Patent Infringement and Remedies, Relevant Provisions of the Biological Diversity Act, 2002, Access and Benefit SharingIssues.

C. RECOMMENDED STUDY MATERIAL:

S. No	Title of the Book	Author
1.	Intellectual Property Rights in India	VK Ahuja (Lexis Nexis butter worths Publications)
Important Web Link:		
1. https://www.cencenelec.eu/ipr/Pages/default.aspx		
2. http://www.ipindia.nic.in/		
3. https://en.wikipedia.org/wiki/Intellectual_property		
4. https://en.wikipedia.org/wiki/Intellectual_propert		
5. https://www.itu.int/en/ITU-T/ipr/Pages/default.aspx		

Code:MOE03110	Robotics	3 Credits [LTP:3-0-0]

COURSE OVERVIEW AND OBJECTIVES: To understand the basic concepts associated with the design and Functioning and applications of Robots To study about the drives and sensors used in Robots To learn about analyzing robot kinematics and robot programming.

COURSE OUTCOME:

The student would be able to:

CO03117.1 To be able to introduce basics of robotics.
CO03117.2 To understand robot kinematics and robot programming
CO03117.3 To understand the application of Robots
CO03117.4 To learn about force and torque sensing
CO03117.5 To acquire knowledge of robotics programming.

A. OUTLINE OF COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1	FUNDAMENTALS	9
2.	ROBOT KINEMATICS	9
3.	ROBOT DYNAMIC ANALYSIS AND FORCES	8
4.	ACTUATORS AND SENSORS	9
5.	ROBOT PROGRAMMING, SYSTEMS AND APPLICATIONS	9

B. Detailed Syllabus

Unit	Unit details
Unit 1	**FUNDAMENTALS** Historical information, robot components, Robot characteristics, Robot anatomy, Basic structure of robots, Resolution, Accuracy and repeatability, Position Analysis forward and inverse kinematics of robots, Including frame representations.
Unit 2	**ROBOT KINEMATICS** Transformations, position and orientation analysis and the Denavit-Hartenberg representation of robot kinematics, The manipulators, The wrist motion and grippers. Differential motions, Inverse Manipulator Kinematics: Differential motions and velocity analysis of robots and frames.
Unit 3	**ROBOT DYNAMIC ANALYSIS AND FORCES** Analysis of robot dynamics and forces, Lagrangian mechanics is used as the primary method of analysis and development. Trajectory Planning: Methods of path and trajectory planning, Both in joint-space and in Cartesian-space.
Unit 4	**ACTUATORS AND SENSORS** Actuators, including hydraulic devices, Electric motors such as DC servomotorsand stepper motors, Pneumatic devices, as well as many other novel actuators, It also covers microprocessor control of these actuators, Mechatronics, Tactile sensors, Proximity and range sensors, Force and torque sensors, Uses of sensors in robotics.

Unit 5	**ROBOT PROGRAMMING, SYSTEMS AND APPLICATIONS** Robot languages, Method of robots programming, Lead through programming methods, A robot programs as a path in space, Motion interpolation, WAIT, SIGNAL and DELAY commands, Branching capabilities and limitation of lead through methods and robotic applications. Basic principles of fuzzy logic and its applications in microprocessor control and robotics.

C. RECOMMENDED STUDYMATERIAL:

S.No	Title of the Book	Author
1.	Robotics Control Sensing, Vision and Intelligence	McGraw Hill Gonzalez, R. C., Fu, K. S. and Lee, C.S.G.
2.	Robotics for Engineers	McGraw Hill Koren,Y
3.	Introduction to Robotics, Analysis, Systems, Applications,	Dorling Kingsley, Dorling Kingsley Niku, S.B
4.	Programming robot controllers	McGraw Hill Predko, M

Important Web Links:

1. https://nptel.ac.in/courses/112/105/112105249/
2. https://nptel.ac.in/courses/112/101/112101099/
3. https://nptel.ac.in/courses/112/101/112101098/
4. https://swayam.gov.in/nd1_noc20_me03
5. https://www.youtube.com/watch?v=DaWMvEY3Qgc

Code: MULEEE3111	Digital India Implementation	[LTP:3-0-0]

COURSE OVERVIEW AND OBJECTIVES: The Digital India programme aims to provide broadband highways, universal access to mobile connectivity, public internet access programme, e-governance: Reforming government through technology, eKranti - Electronic delivery of services, Information for all, Electronics manufacturing: Target net zero imports, IT for jobs and early harvest programmes

COURSE OUTCOME:

At the end of the course students will be able to:
CO03111.1. Understand concepts and objectives digital India and digital infrastructure.
CO03111.2 Understand the pillars of the digital India.
CO03111.3 Understand the concept of new digital services and platforms for implementations purpose.
CO03111.4 Understand the various digital facilities to empower citizen.
CO03111.5 Apply the digital India initiative for training objective.

A. OUTLINE OF THE COURSE

Unit No.	Title of the Unit	Time required for the Unit (Hours)
1.	Digital India Initiative	8
2.	Focus Area	8
3.	Implementation	9
4.	Facilities To Digitally Empower Citizen	7
5.	Training	8

B. DETAILEDSYLLABUS

Unit	Unit Details
1.	**Digital India Initiative**
	Concept, aims and objectives, opportunities, inclusive growth in areas of electronic services, products, manufacturing and job opportunities, centered on three keyareas – Digital Infrastructure as a Utility to Every Citizen, Governance & Services on Demand and Digital Empowerment of Citizens.
2.	**Focus Area**
	The Government of India specifically targets nine 'Pillars of the Digital India' as follows: Broadband Highway, Universal Access to Mobile connectivity, Public Internet Access Programme, E-Governance, reforming Government through Technology, E- Kranti, electronic delivery of services, Information for All, Electronics Manufacturing, IT for Jobs
3.	**Implementation**
	New digital services, MyGov.in is a platform to share inputs and ideas on matters of policy and governance, UMANG (Unified Mobile Application for New-age Governance) ,AADHAR,Digi-Locker,Bharat Bill Payment System, PAN, EPFO services, PMKVY services, Indian railway tickets bookings, birth certificates, e-District, e-Panchayat, e-Sign framework, Swachh Bharat Mission(SBM) Mobile app, e-Hospital application, Digital attendance.
4.	**Facilities To Digitally Empower Citizen**
	Digital locker facility, eliminating the use of physical documents and enables the sharing of verified electronic documents across government agencies, three key stakeholders of citizen, issuer and requester. BPO and job growth, government is planning to create 28,000 seats of bpos in various states

	and set up at least one common service centre in each of the gram panchayats in the state. Easy access to a common services center (CSC), Shareable private space on a public cloud, Safe and secure cyberspace, Universally accessible digital resources, Collaborative digital platforms for intergovernmental operations. E- Samparkvernacular email service: connect rural India with the digital India, the government of India impelled email services provider giants including Gmail, office and rediff to provide the email address in regional languages, anIndian-based company, data Xgen technologies pvt.ltd, has launched world‟s first free linguistic email address under the name „Data mail‟ which allows creating email ids in 8 Indian languages, English; and 3 foreign languages – Arabic, Russian and Chinese. Overthe period of time the email service in 22 languages will be offered by Data Xgen technologies.
5.	**Training**
	PradhanMantriGramin, Digital SakshartaAbhiyan, PMG Disha, Ongoing awareness campaign, reception within country and the outside world, criticism and impact.

C. RECOMMENDED STUDY MATERIAL:

S.No	Book	Author	Publication
a. Reference Books			
1.	Digital India: Understanding Information,Communication and Social Change	PradipNinan Thomas	SAGE
2.	Book on Digital India (Special Edition) by National e-governance mission, Government of India		
Important Web Links:			
1.	https://economictimes.indiatimes.com/tech/internet/digital-india-15-salient-things-to-know-about-pm-narendra-modis-project/articleshow/47893380.cms		
2.	https://en.wikipedia.org/wiki/Digital_India		
3.	https://www.researchgate.net/publication/303643369_Digital_India_Objectives_Initiatives_and_Inherent_Challenges		
4.	https://digitalindia.gov.in/content/programme-pillars		
5.	https://www.civilserviceindia.com/subject/Essay/digital-india-or-green-india-discuss3.html		

Code: MULEEE3112	SMART CITY DESIGN	3 Credits [LTP:3-0-0]

COURSE OVERVIEW AND OBJECTIVES:

The objective of the Smart Cities **Mission** is to promote cities that provide core infrastructure and give a decent quality of life to its citizens, a clean and sustainable environment and **application** of 'Smart' Solutions.

COURSE OUTCOME:

At the end of the course students will be able to:

C03112.1 Understand the concept of smart city and smart energy business concepts.
CO03112.2 Apply governance of smart city by various techniques like Augmented Reality for City Planning.
CO03112.3. Understand the concept and characteristics of Smart City Intelligent Buildings and Urban Spaces.
CO03112.4 Understand the environmental and economic impacts on buildings by Multi-objective optimization.
CO03112.5 Apply the energy management and Smart City Distributed Energy.

A. OUTLINE OF THE COURSE

Unit No.	Title of the Unit	Time required for the Unit (Hours)
1.	Smart City Introduction And Concept	7
2.	Smart City Governance	8

3.	Smart City Intelligent Buildings And Urban Spaces	7
4.	Multi Objective Optimization- Smart City	7
5.	Smart City Distributed Energy	8

B. DETAILED SYLLABUS

Unit	Unit Details
1.	**Smart City Introduction And Concept**
	Smart City: local but networked, distributed but integrated Smart City, City monitoringandoperationsystemsVisionofanopensmartcityinteroperability environment Road maps for research and innovation policy Smart energybusiness concepts for Energy Hub districts Identifying development trends in smart city technologies – VTT Trend generator Public procurement of innovation for smart city solutions.
2.	**Smart City Governance**
	Real-time decision support systems for city management, Boosting collaborative planning with visualisation technology, Virtual Model Facilitating Citizen Interaction, Mobile Augmented Reality for City Planning, Co-creating future smart cities - Visual and participative urban planning services Citizen-driven co- design for a smarter city Social media for citizen participation Gamification as an enabler of mutual learning in complex health care systems Decision-making support: A smart city perspective
3.	**Smart City Intelligent Buildings And Urban Spaces**
	Intelligent buildings and urban spaces in smart cities Intelligent urban spaces– automatic real-time responses to people behavior Occupancy in smart buildings of smart cities – case hospital smart lighting Mobile augmented reality for building maintenance Autonomous management system for buildings and districts
4.	**Multi Objective Optimization- Smart City**
	Multi-objective optimization for the minimization of environmental and economic impacts on buildings at district level Intelligent Street lights adapt to conditions City mills leading the positive change in recycling.
5.	**Smart City Distributed Energy**
	Distributed renewable energy and energy management Highlights from the Smart Grids and Energy Systems programme. Active distribution networks with full integration of demand and distributed resources Integration of variable power generation into urban energy systems Future district heating solutions for residential districts Smart metering cyber security ICT for neighborhoods‟ energy management Energy-Hub for residential and commercial districts and transport ICT-supported business in energy positive neighborhood‟s Renewable energy and energy efficiency in new districts – how to accelerate systemic change towards smart cities Internet of Energy: Electric Mobility with Smart Grids.

C. RECOMMENDED STUDY MATERIAL:

S.No	Book	Author	Publication
a. Reference Books			
1.	Building smart cities-Analytics, design building and thinking	Carol l. Stimmel	Auerbach Publications
2.	Smart City- Foundation, principles and application	Houbing Song	JOHN WILEY
3.	Smart city and urban development of India	N. Mani	New Century Publications
b. Important Web Links:			
1.	https://nptel.ac.in/courses/105/105/105105160/		
2.	https://nptel.ac.in/courses/124/107/124107007/		
3.	https://swayam.gov.in/nd1_noc20_ce43/preview		
4.	https://www.youtube.com/watch?v=8G8ewFxE_V8		
5.	http://www.digimat.in/nptel/courses/video/105105160/L41.html		

Code: MULEEE3113	Renewable Energy	3 Credits [LTP:3-0-0]

COURSE OVERVIEW AND OBJECTIVES

The course should enable the students to : 1. Understand the various forms of conventional energy resources. 2. Learn the present energy scenario and the need for energy conservation 3. Explain the concept of various forms of renewable energy 4. Outline division aspects and utilization of renewable energy sources for both domestics and industrial application 5. Analyse the environmental aspects of renewable energy resources.

COURSE OUTCOME

The student would be able to

CO03113.1 Describe the environmental aspects of non-conventional energy resources. In Comparison with various conventional energy systems, their prospects and limitations

CO03113.2 Know the need of renewable energy resources, historical and latest developments.

CO03113.3 Describe the use of solar energy and the various components used in the energy production with respect to applications like - heating, cooling, desalination, power generation, drying, cooking etc

CO03113.4 Appreciate the need of Wind Energy and the various components used in energy generation and know the classifications.

CO03113.5 Understand the concept of Biomass energy resources and their classification, types of biogas Plants-applications

A. OUTLINE OF COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1	CLASSIFICATION OF ENERGY	**9**
2	APPLICATIONS OF SOLAR ENERGY	**10**
3	BIO ENERGY SOURCES	**8**
4	WIND ENERGY & SMALL HYDRO POWER SYSTEMS	**10**
5	OCEAN & GEOTHERMAL ENERGY	**7**

B. Detailed Syllabus

Unit No.	Description
UNIT 1	**CLASSIFICATION OF ENERGY** Energy chain and common forms of usable energy- Present energy scenario-World energy status-Energy scenario in India - Introduction to renewable energy resources Introduction to Solar Energy-Energy from sun-Spectral distribution of Solar radiation- Instruments for measurement of solar radiation-Solar radiation data analysis
UNIT 2	**APPLICATIONS OF SOLAR ENERGY** Thermal applications -Introduction to Solar thermal collectors- Types - Principle of operation of different collectors - Flat plate- Evacuated tube collectors-Compound parabolic collectors- Solar air heaters - Solar dryers-solar cookers- solar stills - Solar ponds - concentrating collectors- line type - point type - Methods of Solar power generation - Power towers. Physics of solar cells - Cell and module Characteristics of cells and module - Performance parameters -BoS- PV System applications - Stand- alone- Grid connected systems
UNIT 3	**BIO ENERGY SOURCES** Energy through various processes - Energy through fermentation - Gasification - various types of gasifiers -Pyrolysis - Fixed bed and fast Pyrolysis - Bio energy through digestion - Types of Digesters-Factors affecting the yield of products
UNIT 4	**WIND ENERGY & SMALL HYDRO POWER SYSTEMS**

	Resource assessment - types of wind turbines - selection of components - blade materials - power regulation - various methods of control - wind farms - site selection - off shore wind farms - Solar Wind Hybrid energy systems. Introduction - types - system components, discharge curve and estimation of power potential- Turbines for SHP
UNIT 5	**OCEAN & GEOTHERMAL ENERGY** Power generation through OTEC systems - various types - Energy through waves and tides - Energy generation through geothermal systems - types