TULSIRAMJI GAIKWAD-PATIL College of Engineering & Technology

Mohgaon, Wardha Road, Nagpur - 441 108

An Autonomous Institution

DEPARTMENT OF ELECTRICAL ENGINEERING

M.Tech.in Integrated Power System

Teaching Scheme

From

Academic Year 2021-22

Vision of Institute

To emerge as a learning Center of Excellence in the National Ethos in domains of Science, Technology and Management.

Mission of Institute

M1- To strive for rearing standard and stature of the students by practicing high standards of professional ethics, transparency and accountability.

M2- To provide facilities and services to meet the challenges of Industry and Society.

M3- To facilitate socially responsive research, innovation and Entrepreneurship.

M4- To ascertain holistic development of the students and staff members by inculcating knowledge and profession as work practices.

Vision of the Department

To emerge as a learning hub and centre of excellence in the domain of Electrical Engineering.

Mission of the Department

M1-To create learning environment in electrical engineering in order to enhance the standard of student by upholding professional ethics, transparency & responsibility.

M2-To provide services to meet the challenges of industries related to electrical engineering and societal concerns.

M3-To develop research culture and inculcate innovative and entrepreneurial skills.

M4-To ensure overall development of student and staff by instilling knowledge & professional ethics as a part of lifelong learning.

Program Education Objectives (PEO)

- Acquire fundamental knowledge of mathematics, science and engineering to analyze, design and implement solutions to the Electrical Engineering problems
- Understand emerging concepts and trends in Electrical Engineering.
- Apply software tools to develop innovative computational systems.
- The students are encouraged to develop the habit of lifelong learning to face the challenges.
- The students will be embedded as a responsible individual having ethical and social values to lead the society and to nurture team spirit.

Program Outcomes (PO)

PO1: An ability to independently carry out research /investigation and development work to solve practical problems.

PO2: An ability to write and present a substantial technical report/document.

PO3: Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. He should be able to inculcate research quality among himself.

Tulsiramji Gaikwad-Patil College of Engineering & Technology, Nagpur

Scheme of Instructions and Syllabus

Scheme of Instructions for First Year M. Tech. course in Integrated Power Systems

Semester–I (w. e. f.: AY2021-22)

Sr. No.	Course Category	Course Code	Course Title	L	T	P	Contact Hrs /week	Credits	Exam Scheme				
									CT- 1	CT- 2	TA	ESE	TOTAL
1.	PCC	MIP1101	Power System Modeling	4	-	-	4	4	15	15	10	60	100
2.	PCC	MIP1102	Power Quality	3	-	-	3	3	15	15	10	60	100
3.	PCC	MIP1103	Advanced Power Electronics	3	-	-	3	3	15	15	10	60	100
4.	PCC	MIP1104	Power Quality Lab	-	-	2	2	1	-	-	25	25	50
5.	PCC	MIP1105	Advanced Power Electronics Lab	-	-	2	2	1	-	-	25	25	50
6.	PEC	MIP11**06-09**	Program Elective-I	3	-	-	3	3	15	15	10	60	100
7.	PEC	MIP11**10-13**	Program Elective-II	3	-	-	3	3	15	15	10	60	100
8.	MCC	MAU1101	Pedagogy Studies	2	-	-	2	Audit	-	-	-	-	-
			Total	**17**	**1**	**4**	**22**	**18**	**75**	**75**	**100**	**350**	**600**

L- Lecture T-Tutorial P-Practical CT1-Class Test 1 CT2- Class Test 2 TA - Teacher Assessment

ESE- End Semester Examination (For Laboratory: End Semester Performance)

*-Program Elective /Audit Course/ Open Elective (list is provided at the end of structure)

Tulsiramji Gaikwad-Patil College of Engineering & Technology, Nagpur

Scheme of Instructions and Syllabus

Scheme of Instructions for First Year M. Tech. course in Integrated Power Systems

Semester– II (w. e. f.: AY 2021-22)

Sr. No.	Course Category	Course Code	Course Title	L	T	P	Contact Hrs /week	Credits	Exam Scheme				
									CT- 1	CT- 2	TA	ESE	TOTAL
1.	PCC	MIP1201	Power System Deregulation	3	-	-	3	3	15	15	10	60	100
2.	PCC	MIP1202	Advanced Power System Protection	3	-	-	3	3	15	15	10	60	100
3.	PCC	MIP1203	Advanced Power System Protection Lab	-	-	2	2	1	-	-	25	25	50
4.	PCC	MIP1204	Power System Analysis & Design Lab	-	-	2	2	1	-	-	25	25	50
5.	PCC	MIP1205	Advanced Power Simulation Lab	-	-	4	4	2	-	-	25	25	50
6.	FC	MIP1206	Research Methodology	2	-	-	2	2	-	-	25	25	50
7.	PEC	MIP12**07- 10**	Program Elective-III	3	-	-	3	3	15	15	10	60	100
8.	PEC	MIP12**11-14**	Program Elective–IV	3	-	-	3	3	15	15	10	60	100
9.	MCC	MAU1202	Research Paper Writing	2	-	-	2	Audit	-	-	-	-	-
			Total	**16**	**-**	**8**	**24**	**18**	**60**	**60**	**140**	**340**	**600**

L- Lecture T-Tutorial P-Practical CT1-Class Test 1 CT2- Class Test 2 TA - Teacher Assessment

ESE- End Semester Examination (For Laboratory: End Semester Performance)

*-Program Elective /Audit Course/ Open Elective (list is provided at the end of structure

PROGRESSIVE CREDITS=18+18=**36**

Tulsiramji Gaikwad-Patil College of Engineering & Technology, Nagpur

Scheme of Instructions and Syllabus

Scheme of Instructions for Second Year M. Tech. course in Integrated Power Systems

Semester– III (w. e. f.: AY2021-22)

Sr. No.	Course Category	Course Code	Course Title	L	T	P	Contact Hrs/week	Credits	Exam Scheme				
									CT- 1	CT- 2	TA	ESE	TOTAL
1	PROJ	MIP2301	Dissertation Phase-I	-	-	20	20	10	-	-	100	100	200
2	PEC	MIP2302	MOOC course (8-12) $	-	-	-	-	3	-	-	-	-	-
3	OEC	M**$$**XX**01-06**	Open Elective -I	3	-	-	3	3	15	15	10	60	100
			Total	**3**	**-**	**20**	**23**	**16**	**-**	**-**	**100**	**100**	**200**

*$$-CS, SE, IP, MB

Note:

1. MIP2302 will be decided by respective Guide in Consultation with Program Coordinator. Course is mandatory is for student and his dissertation phase I will be considered incomplete without this Mandatory MOOC Course.

2. In Case, the course offered online are not completely relevant with the topic of dissertation then any course suggested by NASSCOM on recent technologies can be opted by candidate.

3. $ Programme coordinator will provide list of 03 MOOC courses of minimum 08 weeks duration (as per availability). Students are expected to complete any one out of three courses in order to get the required credits.

L-Lecture T-Tutorial P-Practical
CT1- Class Test 1 TA -Teacher Assessment
CT2- Class Test 2 ESE- End Semester Examination (For Laboratory End Semester performance)

PROGRESSIVE CREDITS=36+16=**52**

Tulsiramji Gaikwad-Patil College of Engineering & Technology, Nagpur

Scheme of Instructions and Syllabus

Scheme of Instructions for Second Year M. Tech. course in Electrical Power Systems

Semester– IV (w. e. f.: AY2021-22)

Sr.	Course Category	Course Code	Course Title	L	T	P	Contact Hrs/week	Credits	Exam Scheme				
									CT- 1	CT- 2	TA	ESE	TOTAL
1.	PROJ	MIP2401	Dissertation Phase-II	-	-	32	32	16	-	-	100	200	300
			Total	**-**	**-**	**32**	**32**	**16**	**-**	**-**	**100**	**200**	**300**

TA -Teacher Assessment

ESE- End Semester Examination (For Laboratory: End Semester Performance)

TOTAL CREDITS=52+16=**68**

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Scheme of Instructions and Syllabus

Scheme of Instructions for Second Year M. Tech. course in Electrical Power Systems

List of Program Elective Courses

Semester-I			Semester - II	
Program Elective-I	**Program Elective- II**		**Program Elective- III**	**Program Elective- IV**
MIP1106:Renewable Energy Technologies	MIP1110: Electrical Power Distribution Systems		MIP1207:Facts and Custom power devices	MIP1211: Advanced Microcontroller Based Power Systems
MIP1107:Micro and Smart Grids	MIP1111: Power Apparatus Design		MIP1208:Advanced DSP	MIP1212:SCADA Systems and Applications
MIP1108:Restructured Power system	MIP1112: Control Techniques for Converters		MIP1209:Dynamicsof Electrical M/Cs	MIP1213:Power System Planning & Reliability
MIP1109:Power System Dynamics and Control	MIP1113:Electric Vehicles		MIP1210: Power System Operation and Control	MIP1214:AI Techniques

List of Audit Courses and Open Electives

Semester – I	Semester – II	Semester - III
Audit Course-I	**Audit Course-II**	**Open Electives**
MAU1101:Pedagogy Studies	MAU1201:Constitutionof India	MCSXX01:Operation Research
MAU1102:Disaster Management	MAU1202:Research Paper Writing	MSEXX02:Cost Management of Engineering Projects
MAU1103:Sanskritfor Technical Knowledge	MAU1203:Stress Management by Yoga	MSEXX03:Energy Audit & Management
MAU1104:ValueEducation	MAU1204: Personality Development through Life Enlightenment Skills	MIPXX04:Project Planning Management
		MIPXX05:Industrial Safety
		MMBXX06:Business Analytics

BoS Chairman

HOD
Department of Electrical Engineering
Tulsiramji Gaikwad Patil College of
Engineering & Technology, Nagpur

Dean Academics

Dean Academics
Tulsiramji Gaikwad-Patil
College Of Engineering
and Technology, Nagpur

Principal

Principal
Tulsiramji Gaikwad Patil College Of
Engineering and Technology Nagpur

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Syllabus

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Program: M.Tech. Integrated Power System (IPS)

Semester-II MIP1201: Power System Deregulation

Teaching Scheme		Examination Scheme	
Theory	3 Hrs/week	**CT-I**	15 Marks
Tutorial	0 Hrs/week	**CT-II**	15 Marks
Total Credits	**3**	**CA**	10 Marks
Duration of ESE: 3 Hrs		**ESE**	60 Marks
Pre-Requisites: Electrical Power System		**Total Marks**	**100 Marks**

Course Objectives:

1. To Introduce fundamental concepts of power system in Industry , its Deregulation, Market models
2. To impart knowledge Role in vertically integrated systems and introduction to congestion management
3. To analyze the concepts of revenue adequacy and Transmission pricing
4. To Illustrate about Standard market design & Developments in India

Course Contents

Unit I	**Deregulation of power industry**, Restructuring process, Issues involved in deregulation, Deregulation of various power systems, Market architecture; Fundamentals of Economics: Consumer behavior, Supplier behavior, Market equilibrium, Short and long run costs, Various costs of production–Market models: Market models based on Contractual arrangements, Comparison of various market models.
Unit II	**Congestion management:** Definition of Congestion, reasons for transfer capability limitation, Importance, Features, Classification of congestion management methods Calculation of ATC, Non – market methods –Market methods, Nodal pricing, Price area congestion management.
Unit III	**Location marginal Pricing & Financial Transmission Rights:** Introduction to Location marginal Pricing & Financial Transmission Rights, Lossless DCOPF model for LMP calculation, Loss compensated DCOPF model for LMP Calculation, Financial Transmission rights, Hedging, Risk hedging functionality, Simultaneous feasibility test and revenue adequacy
Unit IV	**Ancillary services and Transmission Pricing:** Introduction & Types of Ancillary services, Classification of Ancillary services, Load generation balancing related services, Voltage control and reactive power support devices, ancillary service-Co-optimization of energy and reserve services, Transmission pricing: Principles, Classification – Role in transmission pricing methods, Marginal transmission pricing paradigm, Composite pricing paradigm, Merits and demerits of different paradigm.
Unit V	**Power Sector Reforms**: Framework of Indian power sector, Reform initiatives, Availability based tariff, Electricity act 2003, Open access issues , Power exchange, Reforms in the near future

Text Books	
T.1	Lorrin Philipson, H. Lee Willis, "Understanding electric utilities and de-regulation", Marcel Dekker Pub., 1998.
T.2	Steven Stoft, "Power system economics: designing markets for electricity", John Wiley and Sons, 2002
T.3	Sally Hunt, "Making competition work in electricity", John Willey and Sons Inc. 2002
Reference Books	
R.1	Kankar Bhattacharya, Jaap E. Daadler, Math H.J. Boolen, "Operation of restructured power systems", Kluwer Academic Pub., 2001.
R.2	Mohammad Shahidehpour, Muwaffaq Alomoush, "Restructured electrical power systems: operation, trading and volatility", Marcel Dekker.2002
R.3	Loi Lei Lai, "Power System Restructuring & Deregulation" John Willey and Sons Ltd. 2001
Useful Links	
1	https://nptel.ac.in/courses/117/106/117106034/
2	https://nptel.ac.in/courses/108108076/

Course Code	Course Outcomes	PO/PSO	CL	Class Sessions
MIP1201.1	**Discriminate** various types of regulations & Market Models in power systems.	PO1 & PO3	4	9
MIP1201.2	**Identify** the need of regulation and deregulation and Congestion Management	PO1 & PO3	4	9
MIP1201.3	**Illustrate** the Technical and Non-technical issues in Deregulated Power Industry and Financial Transmission rights	PO1 & PO3	3	9
MIP1201.4	**Select** and give examples of existing electricity markets, Ancillary services, pricing methods	PO1 & PO3	4	9
MIP1201.5	**Compare** different market mechanisms and summarize the role of various entities in the market and reforms in the near future	PO1 & PO3	5	9

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Program: M.Tech. Integrated Power System (IPS)

Semester-II MIP1202: Advanced Power System Protection

Teaching Scheme		Examination Scheme	
Theory	3 Hrs/week	**CT-I**	15 Marks
Tutorial	0 Hrs/week	**CT-II**	15 Marks
Total Credits	**3**	**CA**	10 Marks
Duration of ESE: 3 Hrs		**ESE**	60 Marks
Pre-Requisites: Switchgear & Protection, Power System Modeling		**Total Marks**	**100 Marks**

Course Objectives:

1.	To aware students about protective relays, arc interruption theory and various faults in line.
2.	Familiarize students about protection of extra high voltage lines, electrical machines, bus bars, transformer etc.
3.	To aware students about construction, working of numerical relays and its applications.
4.	To study algorithms for numerical protection.

Course Contents

Unit I	**Review of power system Protection philosophy & Relays** Fundamental characteristics of protective relaying, types of abnormal conditions and faults, interruption of inductive and capacitive currents, pre striking voltage arc control.
Unit II	**EHV Line Protection** Protection of EHV lines against short circuit and overvoltage, Distance and carrier aided protection schemes for 3 phase lines, Stability of protection on Power Swing, Out-of-step blocking and tripping schemes, Implementation using Static relays.
Unit III	**Transformer, Machine and Bus bar Protection** Various faults occurring on transformers, alternators and large motors and complete protection against these faults, Schemes for complete protection of Bus bars
Unit IV	**Basic elements of digital protection:** Evolution of numerical relays from electromechanical relays, performance & operational characteristics of digital protection, Anti-aliasing filters, sampling, Digital filtering system-low pass, high pass, FIR and IIR Filters.
Unit V	**Algorithms** Algorithm I: Sinusoidal wave-based algorithm, first and second derivative method, two sample and three sample technique Algorithm II: Fourier analysis and Fourier transform based algorithm, Walsh function-based algorithm. Algorithm III: Incident & reflected wave, coefficient of reflection, superimposed quantities & their properties.

Text Books

T.1	Fundamentals of Power System Protection- Y. G Paithankar& S. R Bhide, 2003
T.2	Power System Protection & switchgear -Ram Badri; Vishwakarama D N , 1995

T.3	Power System Protection & switchgear -Ravindranath, B. Chander, M.; Jha, C. S.2005
T.4	Digital Protection for Power System-AT John & S.K. Salman,2004
Reference Books	
R.1	Power System Protection by Elmore (ABB)
R.2	Power System Protection by Ungradetal (Marcel Dekker Publication)
R.3	Power System Protection (Vol. I, II & III) by Warrington
Useful Links	
1	https://nptel.ac.in/courses/117/106/117106034/
2	https://nptel.ac.in/courses/108108076/
3	https://nptel.ac.in/courses/108105062/

Course Code	Course Outcomes	PO/PSO	CL	Class Sessions
MIP1202.1	**Predict** basic philosophy of power system protection.	PO1,PO2, PO3	3	9
MIP1202.2	**Evaluate** various parameters of short & long transmission line	PO1,PO2, PO3	3	9
MIP1202.3	**Apply** protective relaying for transformers, machines, bus bars and transmission lines.	PO1,PO2, PO3	4	9
MIP1202.4	**Demonstrate** the principle, construction and application of numerical relays	PO1,PO2,PO3	4	9
MIP1202.5	**Articulate** the algorithms used for fault analysis.	PO1,PO2,PO3	3	9

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Program: M. Tech. Integrated Power System (IPS)

MIP1203: Advanced Power System Protection Lab

Teaching Scheme		Examination Scheme	
Practical	2 Hrs/week	**CA**	25 Marks
Total Credit	1	**ESE**	25 Marks
		Total	50 Marks
		Duration of ESE: 02 Hrs	

Course Outcomes (CO)

Students will be able to

1	**Analyze** the characteristics of over-current & protective relay.
2	**Estimate** heat in the thermal overload relay and Buchholz relay operation.
3	**Apply** protective relaying for transformers, machines, bus bars and transmission lines.
4	**Design** protective scheme for transmission lines.
5	**Develop** mathematical approach towards protection

Sr. No.	List of Experiment	COS
1	To plot the characteristics of IMDT over current relay.	**CO1**
2	To plot the characteristics of earth fault relay.	**CO1**
3	To plot the characteristics of thermal overload relay.	**CO2**
4	To study operation of Buchholz relay	**CO2**
5	Study and testing of over frequency relay.	**CO3**
6	Study and testing of under frequency relay	**CO3**
7	To study characteristics of percentage biased differential relay. .	**CO4**
8	To study the characteristic of transmission line.	**CO4**
9	Modeling of over current relay using MATLAB	**CO5**
10	Modeling of differential/distance relay using MATLAB	**CO5**

Text Books

1	Fundamentals of Power System Protection- Y. G Paithankar& S. R Bhide, 2004
2	Power System Protection & switchgear -Ram Badri; Vishwakarama D N, 2008
3	Power System Protection & switchgear -Ravindranath, B. Chander, M.; Jha, C. S.,2007
4	Digital Protection for Power System-AT John & S.K. Salman, 2003

Reference Books

1	Power System Protection by Elmore (ABB)
2	Power System Protection by Ungradetal (Marcel Dekker Publication)
3	Power System Protection (Vol. I, II & III) by Warrington

Useful Links

1	https://nptel.ac.in/courses/108/101/108101039/
2	https://nptel.ac.in/courses/108/105/108105167/

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MIP1204: Power System Analysis & Design Lab

Teaching Scheme		Examination Scheme	
Practical	2 Hrs/week	**CA**	25 Marks
Total Credit	1	**ESE**	25 Marks
		Total	50 Marks
		Duration of ESE: 02 Hrs	

Course Outcomes (CO)

Students will be able to

1	**Evaluate** the Parameters of Transmission Lines and Bus Admittance and Impedance Matrices using ETAP
2	**Solve** power flow using Newton-Raphson & Gauss-Seidal Iterative Method.
3	**Evaluate** Single Machine & Multi Machine Infinite Bus System using MATLAB.
4	**Design** Load – Frequency Dynamics of Single Area Power Systems
5	**Implement** Two Port Network using various parameters

Sr. No.	List of Experiment	CO
1	Computation of Parameters and Modelling of Transmission Lines using ETAP	**CO1**
2	Formation of Bus Admittance and Impedance Matrices using ETAP	**CO1**
3	Solution of Power Flow Using Gauss-Seidel Method using ETAP	**CO2**
4	Solution of Power Flow Using Newton-Raphson Method using ETAP	**CO2**
5	Transient and Small Signal Stability Analysis – Single Machine Infinite Bus System using MATLAB	**CO3**
6	Transient Stability Analysis – Multi Machine Infinite Bus System using ETAP	**CO3**
7	Economic Dispatch In Power Systems using MATLAB	**CO4**
8	Load – Frequency Dynamics of Single Area Power Systems using MATLAB	**CO4**
9	Representation of Two Port Network In Z,Y,H Type using PSIM	**CO5**
10	Study of Effect of Faults (LG, LL, LLG,3 Phase) on A Single Machine Connected To Infinite Bus using PSIM	**CO5**

Text Books

1	Introduction to Matlab 7 for Engineers - William Palm Iii McGraw-Hill Education 2003
2	A Guide to MATLAB: For Beginners and Experienced Users - Brian R Hunt,Ronald L. Lipsman Et al 2006

Reference Books

1	Modeling and Simulation using MATLAB - Simulink, Shailendra Jain, Second Edition, 2015
2	MATLAB and SIMULINK for Engineers - Agam Kumar Tyagi Oxford 2011

Useful Links

1	https://in.mathworks.com/
2	https://nptel.ac.in/courses/108/102/108102044/

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MIP1205:Advanced Power Simulation Lab

Teaching Scheme			Examination Scheme	
Practical	4 Hrs/week		**CA**	25 Marks
Total Credit	2		**ESE**	25 Marks
			Total	50 Marks
			Duration of ESE: 02 Hrs	

Course Outcomes (CO)

Students will be able to

1	Evaluate two port network parameters with fundamentals of MATLAB programming
2	Implement active low pass filter and evaluate exponential Fourier series using MATLAB programming
3	Develop power converter circuits using MATLAB modeling
4	Verify different generated signals for the converters with MATLAB modeling.
5	Develop solar based systems using converters with MATLAB modeling.

Sr. No.	List of Experiment	CO
1	Study of basic commands in MATLAB and perform matrix and array operation	**CO1**
2	To implement and evaluate transmission parameter using MATLAB programming	**CO1**
3	Study and implementation of active low pass filter using MATLAB programming	**CO2**
4	Study and evaluating exponential Fourier series for a full wave rectified output using MATLAB programming	**CO2**
5	Study and implementation of fully controlled full wave rectifier with RC Filter using MATLAB modeling	**CO3**
6	Study and implementation of Buck Boost Converter using MATLAB modeling	**CO3**
7	To verify PWM signal for a fully controlled full bridge rectifier circuit using MATLAB modeling	**CO4**
8	Implementation of a fully controlled full bridge inverter circuit using MATLAB modeling	**CO4**
9	Study and implementation of solar based DC to DC converter using MATLAB modeling	**CO5**
10	Study and Implementation of Solar based AC drives using MATLAB modeling	**CO5**

Text Books

1	Electronics and circuit analysis using MATLAB, John O. Attia, CRC Press, 1999
2	A Guide to MATLAB: For Beginners and Experienced Users - Brian R Hunt, Ronald L. Lipsman, 2006

Reference Books

1	Modeling and Simulation using MATLAB - Simulink, Shailendra Jain, Second Edition, 2015
2	MATLAB and SIMULINK for Engineers - Agam Kumar Tyagi Oxford, 2011

Useful Links

1	https://in.mathworks.com/
2	archive.nptel.ac.in/courses/108/106/108106023/
3	https://onlinecourses.nptel.ac.in/noc20_me37/preview

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Semester-II MIP1206: **Research Methodology**

Teaching Scheme		Examination Scheme	
Theory	4 Hrs/week	**CT-I**	15 Marks
Tutorial	0 Hrs/week	**CT-II**	15 Marks
Total Credits	**4**	**CA**	10 Marks
Duration of ESE: 3 Hrs		**ESE**	60 Marks
Pre-Requisites: Power Plant Engineering, Power system-I, Power Quality		**Total Marks**	**100 Marks**

Course Objectives:

1.	Introduction to philosophy of research.
2.	Understand conceptual and methodological issues that will conduct successful research
3.	Understand process of planning and proposing, testing of hypothesis.
4.	Understand different statistical analysis methods.
5.	Develop research and article writing skills.

Course Contents

Unit I	**Research Foundation** What is Research, Objectives of Research, Types of Research, Scientific Research, Research and Theory, Conceptual and theoretical Models, Philosophy of research, Physical, psychological health and research.
Unit II	**Review of Literature** Need for Reviewing Literature, What to Review and for what purpose, Literature Search Procedure, Sources of Literature, Planning of Review work, Note Taking, Library and documentation
Unit III	**Planning of Research** The planning process, Selection of a Problem for Research, Formulation of the Selected Problems, Hypothesis, Research Design and Sampling, Measurement, Research Design/Plan
Unit IV	**Processing of Data and Statistical Analysis of Data** Introduction to Statistical Software, Statistical analysis of data MINITAB, SPSS, Measures of Relationship, Simple Regression Analysis, Multiple Correlation and Regression, Partial Correlation, Questioners Preparation and Presentation Skills, Application Orientation in Research.
Unit V	**Report and Thesis writing** Types of Reports, Planning of Report Writing, Research Report Format, Principles of Writing, Data and Data Analysis Reporting in a Thesis, Use of Endnote, Language Proficiency, Citations and Plagiarism, Bibliography, API , appendix, table, Observations arrangement, Preparation of type script and lay-out of thesis, Use of LATEX Indexing of Journals, Impact factor and social Media for Researchers.

Text Books

T.1	Research Methodology: Methods and Techniques by C. R. Kothari, New Age International Publishers, ISBN:81-224-1522-9

T.2	Statistical Methods for Research Workers by Fisher R. A., Cosmo Publications, New Delhi ISBN:81-307-0128-6
T.3	Research Methodology: Methods and Techniques by C. R. Kothari, New Age International Publishers, ISBN:81-224-1522-9
Reference Books	
R.1	Design and Analysis of Experiments by Montogomery D.C. (2001), John Wiley, ISBN: 0471260088
R.2	Methodology of Research in Social Sciences by O. R. Krishnaswamy and M. Rangnatham Himalaya publication House, 2005, ISBN: 8184880936
R.3	SPSS online manual
Useful Links	
1	https://nptel.ac.in/courses/121/106/121106014/
2	https://nptel.ac.in/courses/108/108/108108078/

Course Code	Course Outcomes	PO	CL	Class Sessions
MIP1206.1	**Demonstrate** the basic concepts of research and its methodologies	PO1,PO2, PO3	4	9
MIP1206.2	**Identify** the source of literature review and preparing it with proper format	PO1,PO2, PO3	5	9
MIP1206.3	**Demonstrate** research methodology with problem formulation.	PO1,PO2, PO3	3	9
MIP1206.4	**Analyze** the data required for carrying out the research work.	PO1,PO2, PO3	4	9
MIP1206.5	**Compile** the findings of the results in proper format.	PO1,PO2, PO3	6	9

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Semester-II MIP1207: FACTS & Custom Power Devices

Teaching Scheme		Examination Scheme	
Theory	3 Hrs/week	**CT-I**	15 Marks
Tutorial	0 Hrs/week	**CT-II**	15 Marks
Total Credits	**3**	**CA**	10 Marks
Duration of ESE: 3Hrs		**ESE**	60 Marks
Pre-Requisites: FACTS, Power System		**Total Marks**	**100 Marks**

Course Objectives:

1.	To understand the performance of uncompensated and compensated transmission line
2.	To understand the operation of Static VAR Compensator (SVC) and Static Synchronous Compensator (STATCOM)
3.	To understand the operation of Static Voltage and Phase angle Regulators and operation of various Series compensators
4.	To understand Sub Synchronous Resonance and how it is mitigated and the operation and control of UPFC
5.	To understand the operation of Interline power flow controller and Analyze facts controllers using simulation

Course Contents

Unit I	**Basics Of Transmission System And FACTS Controllers-** Reactive power flow control in Power Systems, Control of dynamic power un-balances in Power System. Power flow control, Constraints of maximum transmission line loading, Benefits of FACTS Transmission line compensation, Reactive power compensation.- Shunt and Series compensation.
Unit II	**SVC and STATCOM -** Static versus passive VAR compensator, Static shunt compensators: SVC and STATCOM . Operation and control of TSC, TCR and STATCOM. Comparison between SVC and STATCOM.
Unit III	**Static Series Compensation-** TSSC, SSSC, static Voltage and phase angle regulators, TCVR and TCPAR Operation, Control and Applications, Static series compensation- GCSC, TSSC, TCSC and their Control.
Unit IV	**Unified Power Flow Controller-** SSR and its damping, Unified Power Flow Controller: Circuit Arrangement, Operation and control of UPFC. Basic Principle of P and Q control, Independent real and reactive power flow control, applications.
Unit V	**Interline Power Flow Controller-** Introduction to interline power flow controller. Modelling and analysis of FACTS Controllers, Simulation of FACTS controllers, Power quality problems in distribution systems, Loads that create harmonics, series and parallel resonances, mitigation of harmonics.

Text Books	
T.1	K R Padiyar, “FACTS Controllers in Power Transmission and Distribution”, New Age International Publishers, 2007.
T.2	N.G. Hingorani, L. Gyugyi, “Understanding FACTS: Concepts and Technology of Flexible AC Transmission Systems”, IEEE Press Book, Standard Publishers and Distributors, Delhi, 2001.
Reference Books	
R.1	X P Zhang, C Rehtanz, B Pal, “Flexible AC Transmission Systems-ModellingandControl”, Springer Verlag, Berlin, 2006
R.2	K.S.Suresh Kumar, S.Ashok, “FACTS Controllers & Applications”, E-book edition, Nalanda Digital Library, NIT Calicut, 2003.
Useful Links	
1	https://nptel.ac.in/courses/108107114/
2	https://new.siemens.com/global/en/products/energy/high-voltage/facts.html
3	https://new.abb.com/facts

Course Code	Course Outcomes	PO/PSO	CL	Class Sessions
MIP1207.1	**Analyze** the performance of Transmission line with and without FACTS Devices	PO1,PO2,PO3	4	9
MIP1207.2	**Relate** Static VAR Compensator (SVC) and Static Synchronous Compensator (STATCOM)	PO1,PO2,PO3	3	9
MIP1207.3	**Correlate** the operation and control of various Static Series Compensators	PO1,PO2,PO3	4	9
MIP1207.4	**Articulate** Sub Synchronous Resonance and how it is mitigated and the operation and control of UPFC	PO1,PO2,PO3	3	9
MIP1207.5	**Illustrate** various power quality issues and how are they mitigated by various FACTS Devices	PO1,PO2,PO3	4	9

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Semester-II MIP1208: Advanced DSP

Teaching Scheme		Examination Scheme	
Theory	3 Hrs/week	**CT-I**	15 Marks
Tutorial	0 Hrs/week	**CT-II**	15 Marks
Total Credits	**3**	**CA**	10 Marks
Duration of ESE: 3Hrs		**ESE**	60 Marks
Pre-Requisites: Digital Signal Processing, Engineering Mathematics		**Total Marks**	**100 Marks**

Course Objectives:

1.	**Strengthen** the knowledge of DSP fundamentals and to familiarize with the practical aspects of DSP Algorithm development and investigation
2.	**Determine** and interpret the z domain transfer function of discrete time system.
3.	**Design** finite impulse response (FIR) and infinite impulse response (IIR)
	Discrete time filters for Low pass, high pass, band pass and band stop and arbitrary response applications
4.	**Implement** digital filter design in MATLAB and on DSP chip

Course Contents

Unit I	**Overview of DSP**- Characterization in time and frequency, FFT Algorithms, Digital filter design and structures: Basic FIR/IIR filter design &structures, design techniques of linear phase FIR filters, IIR filters by impulse invariance, bilinear transformation, FIR/IIR Cascaded lattice structures, and Parallel all pass realization of IIR.
Unit II	**Multi rate DSP-** Decimators and Interpolators, Sampling rate conversion, multistage decimator & interpolator, poly phase filters, QMF, digital filter banks, Applications in sub band coding.
Unit III	**Linear prediction** & optimum linear filters, stationary random process, forward-backward linear prediction filters, solution of normal equations, AR Lattice and ARMA Lattice Ladder Filters, Wiener Filters for Filtering and Prediction.
Unit IV	**Estimation of Spectra from Finite**-Duration Observations of Signals. Nonparametric Methods for Power Spectrum Estimation, Parametric Methods for Power Spectrum Estimation, Minimum- Variance Spectral Estimation, Eigen analysis Algorithms for Spectrum Estimation
Unit V	**Application of Multirate Signal Processing**-Introduction to Architecture of DSP processor such as TMS320C28335, piccolo series processor TMS320C28027, Application of DSP for PWM control in power converter application.

Text Books

T.1	J.G.Proakis and D.G.Manolakis "Digital signal processing: Principles, Algorithm and Applications", 4th Edition, Prentice Hall, 2007.
T.2	N. J. Fliege, "Multirate Digital Signal Processing: Multirate Systems -Filter Banks – Wavelets", 1st Edition, John Wiley and Sons Ltd, 1999.

Reference Books

R.1	Bruce W. Suter, "Multirate and Wavelet Signal Processing",1st Edition, Academic Press, 1997
R.2	M. H. Hayes, "Statistical Digital Signal Processing and Modeling", John Wiley & Sons Inc., 2002.
R.3	S.Haykin, "Adaptive Filter Theory", 4th Edition, Prentice Hall, 2001.
R.4	D.G.Manolakis, V.K. Ingle and S.M.Kogon, "Statistical and Adaptive Signal Processing", McGraw Hill, 2000.

Useful Links

1	https://nptel.ac.in/courses/117/106/117106034/
2	https://nptel.ac.in/courses/108108076/
3	https://nptel.ac.in/courses/108105062/
4	https://www.ti.com/

Course Code	Course Outcomes	PO	CL	Class Sessions
MIP1208.1	**Analysis** of Digital filter design and their structures	PO1,PO2,PO3	4	9
MIP1208.2	**Validate** the modern digital signal processing algorithms and applications.	PO1,PO2,PO3	4	9
MIP1208.3	**Predict** the use of filters in electrical power system.	PO1,PO2,PO3	3	9
MIP1208.4	**Estimate** the Spectra from Finite-Duration Observations of Signals with various algorithms.	PO1,PO2,PO3	5	9
MIP1208.5	**Comprehend** the application of DSP & Multi rate DSP.	PO1,PO2,PO3	4	9

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Semester-II MIP1209: Dynamics of Electrical Machines

Teaching Scheme		Examination Scheme	
Theory	3 Hrs/week	**CT-I**	15 Marks
Tutorial	0 Hrs/week	**CT-II**	15 Marks
Total Credits	**3**	**CA**	10 Marks
Duration of ESE: 3Hrs		**ESE**	60 Marks
Pre-Requisites: DC Machines and Transformer, AC Machine, Electrical Machine Design		**Total Marks**	**100 Marks**

Course Objectives:

1.	To learn modern techniques and analytical methods for dealing with the solving operational problems in electrical machines
2.	To develop and practice the research skill and find the solution of real time problem.
3.	The basics of electromechanical energy conversion and enables them to be acquainted with the mathematical model of various types of machines
4.	To impart student with dynamic modeling, simulation and control theory for electric machinery.

Course Contents

Unit I	Stability, Primitive 4 Winding Commutator Machine, Commutator Primitive Machine, Complete Voltage Equation of Primitive 4 Winding Commutator Machine.
Unit II	Torque Equation, Analysis of Simple DC Machines using the Primitive Machine Equations, The Three Phase Induction Motor Transformed Equations, and Different Reference Frames for Induction Motor Analysis, Transfer Function Formulation.
Unit III	Three Phase Salient Pole Synchronous Machine, Parks Transformation- Steady State Analysis.
Unit IV	Large Signal Transient, Small Oscillation Equations in State Variable form Dynamical Analysis of Interconnected Machines
Unit V	Large Signal Transient Analysis using Transformed Equations, DC Generator /DC Motor System.

Text Books

T.1	D.P. Sengupta & J.B. Lynn," Electrical Machine Dynamics", The Macmillan Press Ltd. 1980
T.2	R Krishnan "Electric Motor Drives, Modeling, Analysis, and Control", Pearson Education., 2001

Reference Books

R.1	P.C. Kraus, "Analysis of Electrical Machines", McGraw Hill Book Company, 1987
R.2	I. Boldia & S.A. Nasar,,"Electrical Machine Dynamics", The Macmillan Press Ltd. 1992.
R.3	C.V. Jones, "The Unified Theory of Electrical Machines", Butterworth, London. 1967

Useful Links	
1	https://nptel.ac.in/courses/117/106/117106034/
2	https://nptel.ac.in/courses/108108076/
3	https://nptel.ac.in/courses/108105062/

Course Code	Course Outcomes	PO	CL	Class Sessions
MIP1209.1	**Formulation** of Complete Voltage Equation of Primitive 4 Winding Commutator Machine.	PO1, PO2, PO3	6	9
MIP1209.2	**Calculate** the various equations for DC Machine and Induction Motor.	PO1, PO2, PO3	5	9
MIP1209.3	**Analyze** the Three Phase Salient Pole Synchronous Machine.	PO1, PO2, PO3	4	9
MIP1209.4	**Predict** the Large Signal Transient Dynamical Analysis of Interconnected Machines	PO1, PO2, PO3	5	9
MIP1209.5	**Implement** Large Signal Transient Analysis on DC Generator and DC Motor.	PO1, PO2, PO3	3	9

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Semester-II MIP1210: Power System Operation and Control

Teaching Scheme		Examination Scheme	
Theory	3 Hrs/week	**CT-I**	15 Marks
Tutorial	0 Hrs/week	**CT-II**	15 Marks
Total Credits	**3**	**CA**	10 Marks
Duration of ESE: 3Hrs		**ESE**	60 Marks
Pre-Requisites:	Electrical Power System, Power Electronics, Engineering Mathematics	**Total Marks**	**100 Marks**

Course Objectives:

1.	To Introduce the Load Forecasting, Estimation components & techniques for load prediction.
2.	To introduce the Unit Commitment Problem.
3.	To understand the solution methods of economic dispatch and static state estimation.
4.	To Explain the different methods of control Power Systems.

Course Contents

Unit I	**Load Forecasting**: Introduction – Estimation of Average and trend terms – Estimation of periodic components – Estimation of Stochastic components : Time series approach – Auto-Regressive Model, Auto-Regressive Moving – Average Models – Kalman Filtering Approach – On-line techniques for non stationary load prediction.
Unit II	**Unit Commitment:** Constraints in unit commitment – Spinning reserve – Thermal unit constraints – Other constraints – Solution using Priority List method, Dynamic programming method - Forward DP approach Lagrangian relaxation method – adjusting .
Unit III	**Generation Scheduling:** The Economic dispatch problem – Thermal system dispatching with network losses considered – The Lambda – iteration method – Gradient method of economic dispatch – Economic dispatch with Piecewise Linear cost functions – Transmission system effects – A two generator system – coordination equations – Incremental losses and penalty factors-Hydro Thermal Scheduling using DP
Unit IV	**Control of Power Systems** : Review of AGC and reactive power control -System operating states by security control functions – Monitoring, evaluation of system state by contingency analysis – Corrective controls (Preventive, emergency and restorative) - Energy control center – SCADA system – Functions – monitoring , Data acquisition and controls – EMS system.
Unit V	**State Estimation:** Maximum likelihood Weighted Least Squares Estimation: - Concepts - Matrix formulation - Example for Weighted Least Squares state estimation; State estimation of an AC network: development of method – Typical results of state estimation on an AC network – State Estimation by Orthogonal Decomposition algorithm.

Text Books

T.1	O. I. Elgerd, Electric Energy System Theory - an Introduction, Tata McGraw Hill, New Delhi, 2002.
T.2	L.P. Singh, Advance Power System Analysis and Dynamics, New Age International, 2006
T.3	P. Venkatesh, B.V.Manikandan, Electrical Power System, PHI Publications, 2012

Reference Books	
R.1	A. K. Mahalanabis, D.P. Kothari. and S. I. Ahson, Computer Aided Power System Analysis and Control, Tata McGraw Hill publishing Ltd., 1988
Useful Links	
1	https://www.digimat.in/nptel/courses/video/108104052/L01.html

Course Code	Course Outcomes	PO/	CL	Class Sessions
MIP1210.1	**Illustrate** in-depth understanding of Load Forecasting	PO1,PO2,PO3	3	9
MIP1210.2	**Solve** the problems related to the economic dispatch of power, plant scheduling, and unit commitment.	PO1,PO2,PO3	4	9
MIP1210.3	**Analyze** various types of methods to understand the solution of economic dispatch and static state estimation.	PO1,PO2,PO3	4	9
MIP1210.4	**Identify** and explain the different methods of control and compensation involved in the operation of power systems.	PO1,PO2,PO3	4	9
MIP1210.5	**Apply** the State Estimation to AC network by different Algorithm.	PO1,PO2,PO3	3	9

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Semester-II MIP1211: Advanced Microcontroller based Power Systems

Teaching Scheme		Examination Scheme	
Theory	3 Hrs/week	**CT-I**	15 Marks
Tutorial	0 Hrs/week	**CT-II**	15 Marks
Total Credits	**3**	**CA**	10 Marks
Duration of ESE: 3 Hrs		**ESE**	60 Marks
Pre-Requisites: Digital Electronics and Microprocessor, Power System		**Total Marks**	**100 Marks**

Course Objectives:

1.	To describe the architecture of 8051 processor and write simple assembly language program.
2.	To describe the architecture and explain the instruction set of PIC microcontrollers
3.	To describe the architecture and explain the instruction set of ARM processor
4.	To Understand Real time system
5.	To Develop applications using microcontrollers.

Course Contents

Unit I	**Fundamentals of Microcontroller**: Accumulator based Processes-Architecture, Memory Organization-I/O Organization
Unit II	**Intel 8051 Microcontroller**: Intel 8051- Registers, Memories, I/O Ports, Serial Communication, Timers,
Unit III	**Interrupts & Programming:** Interrupts, Programming, Assembly language programming, Addressing-Operations, Stack & Subroutines, Interfacing with various devices.
Unit IV	**Introduction to PIC 16F877**: Architecture Programming, Interfacing Memory/ I/O Devices, Serial I/O and data communication
Unit V	**Programming using Intel 8051 & PIC16F877**: Basic programming using Intel 8051 & PIC16F877

Text Books

T.1	John.F.Wakerly: "Microcomputer Architecture and Programming", John Wiley and Sons 1981
T.2	Ramesh S.Gaonker: "Microprocessor Architecture, Programming and Applications with the 8085"

Reference Books	
R.1	Raj Kamal: “The Concepts and Features of Microcontrollers”, Wheeler Publishing, 2005
R.2	Kenneth J. Ayala, “The 8051 microcontroller”, Cengage Learning, 2004
R.3	John Morton, “The PIC microcontroller: your personal introductory course”, Elsevier, 2005
Useful Links	
1	https://nptel.ac.in/courses/117/106/117106034/
2	https://nptel.ac.in/courses/108108076/
3	https://nptel.ac.in/courses/108105062/

Course Code	Course Outcomes	PO/PSO	CL	Class Sessions
MIP1211.1	**Articulate** the architecture of computer organization and I/O Organization	PO1,PO2,PO3,	3	9
MIP1211.2	**Describe** the architecture and functional block of 8051 microcontroller	PO1,PO2,PO3,	3	9
MIP1211.3	**Develop** an embedded C and ALP in 8051 microcontroller using the internal functional blocks for the given specification	PO1,PO2,PO3,	6	9
MIP1211.4	**Examine** the various peripherals devices such as PIC16F877, 8255, 8279, 8251, 8253,8259 and 8237	PO1,PO2,PO3,	5	9
MIP1211.5	**Directs** microcontroller application and basic architecture of DSP processors & FPGA.	PO1,PO2,PO3,	3	9

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Program: M.Tech. Integrated Power System (IPS)

Semester-II MIP1212: SCADA Systems and Applications

Teaching Scheme		Examination Scheme	
Theory	3 Hrs/week	**CT-I**	15 Marks
Tutorial	0 Hrs/week	**CT-II**	15 Marks
Total Credits	**3**	**CA**	10 Marks
Duration of ESE: 3Hrs		**ESE**	60 Marks
Pre-Requisites: Digital Electronics and Microprocessor		**Total Marks**	**100 Marks**

Course Objectives:

1.	Controlling and monitoring processes in real time from the remote location.
2.	Analyze and calculation of complex processes and maintained accordingly control signals.
3.	To understand data acquisition, historical data logging, archiving and retrieving.
4.	To understand various industrial communication technology using wired and wireless technology.

Course Contents

Unit I	**Introduction to SCADA:** Data acquisition systems, Evolution of SCADA Communication technologies
Unit II	**Monitoring and supervisory functions:** SCADA applications in Utility, Generation, Transmission and Distribution systems**,** Drive applications**,** Automation Industries. (Industrial Visits are expected)
Unit III	**SCADA System Components:** Remote Terminal Unit (RTU) , Intelligent Electronic Devices (IED), Programmable Logic Controller (PLC) Communication Network, SCADA Server, SCADA/HMI Systems
Unit IV	**SCADA Architecture:** Various SCADA architectures, advantages and disadvantages of each system single unified standard architecture -IEC 61850.
Unit V	**SCADA Communication:** Various industrial communication technologies, wired and wireless methods, communication using fiber optics, Open standard communication protocols.

Text Books

T.1	Stuart A. Boyer: "SCADA-Supervisory Control and Data Acquisition", Instrument Society of America Publications, USA
T.2	2004 Gordon Clarke, Deon Reynders: "Practical Modern SCADA Protocols: DNP3, 60870.5 and Related Systems", Newnes Publications, Oxford, UK,2004

Reference Books

R.1	William T. Shaw, "Cybersecurity for SCADA systems", PennWell Books, 2006
R.2	David Bailey, Edwin Wright, "Practical SCADA for industry", Newnes, 2003
R.3	Michael Wiebe, "A guide to utility automation: AMR, SCADA, and IT systems for electric power", PennWell 1999

Useful Links

1	https://nptel.ac.in/courses/117/106/117106034/
2	https://nptel.ac.in/courses/108108076/
3	https://nptel.ac.in/courses/108105062/

Course Code	Course Outcomes	PO/PSO	CL	Class Sessions
MIP1212.1	**Demonstrate** SCADA system used in the real time application	PO1,PO2,PO3	4	9
MIP1212.2	**Describe** building blocks of SCADA architecture as well as integration of system components.	PO1,PO2,PO3	5	9
MIP1212.3	**Implement** with practical knowledge of processes automation with the help of Hands on training.	PO1,PO2,PO3	5	9
MIP1212.4	**Examine** the work in program testing, commissioning and project execution in system automation.	PO1,PO2,PO3	3	9
MIP1212.5	**Interpret** and trouble hardware and software used in automation system.	PO1,PO2,PO3	6	9

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Semester-II MIP1213: Power System Planning and Reliability

Teaching Scheme		Examination Scheme	
Theory	3 Hrs/week	**CT-I**	15 Marks
Tutorial	0 Hrs/week	**CT-II**	15 Marks
Total Credits	**3**	**CA**	10 Marks
Duration of ESE: 3Hrs		**ESE**	60 Marks
Pre-Requisites: Advanced Electric Drive, Traction, power electronics		**Total Marks**	**100 Marks**

Course Objectives:

1.	Assess the generation adequacy yin power system using probabilistic approach
2.	Analyze the configuration of substations and power pools
3.	Evaluate the peak demand and energy requirements of system using forecasting techniques.
4.	Develop the solution methodology for optimizing the cost of power system under operation.

Course Contents

Unit I	**Load Forecasting:** Introduction, Classification of Load, Load Growth Characteristics, Peak Load Forecasting, Extrapolation and Co-Relation methods of load Forecasting, Reactive Load Forecasting, Impact of weather on load forecasting
Unit II	**Power-System Economics:** Financial Planning, Techno-Economic Viability, Private Participation, Financial Analysis, Economic Analysis, Transmission, Rural Electrification Investment, Total System Analysis, Credit-Risk Assessment. Generation Expansion: Generation Capacity and Energy, Generation Mix, Clean Coal Technologies Renovation and Modernization of Power Plants.
Unit III	**Reliability of Systems:** Concepts, Terms and Definitions, Reliability models, Markov process, Reliability function, Hazard rate function, Bathtub Curve. Serial Configuration, Parallel Configuration, Mixed Configuration of systems, Minimal Cuts and Minimal Paths, Methods to find Minimal Cut Sets, System reliability using conditional probability method, cut set method and tie set method.
Unit IV	**Generating Capacity:** Basic Probability Methods introduction, Generation system model, capacity outage probability table, recursive algorithm, Evaluation of: loss of load indices, Loss of load expectation, Loss of energy. Frequency and Duration Method basic concepts, Numerical based on Frequency and Duration method.
Unit **V**	**Composite generation and transmission system:** Data requirement, Outages, system and load point indices, Application to simple system.

Text Books

T.1	Power System Planning – R.L. Sullivan, Tata McGraw Hill Publishing Company
T.2	Electrical Power System Planning – A.S Pabla, Macmillan India Ltd.
T.3	Reliability Evaluation of Power System – Roy Billinton and Ronald N Allan, Springer Publishers

Reference Books	
R.1	Hill (2007)–McDonald, J.R., Modern Power System Planning, McGraw
R.2	Roy Billinton and Allan Ronald, “Power System Reliability.”
R.3	Modern Power System Planning. X. Wang and J.R. McDonald, McGraw Hill
Useful Links	
1	https://www.youtube.com/watch?v=zkN13OmgGOs
2	https://nptel.ac.in/courses/106/105/106105077/
3	https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-cs42/

Course Code	Course Outcomes	PO/PSO	CL	Class Sessions
MIP1213.1	**Apply** the knowledge of forecasting of future load requirements of both demand and energy by using forecasting tools.	PO1, PO2, PO3	4	9
MIP1213.2	**Analyze** the economic appraisal to allocate the resources efficiently and appreciate the investment decisions	PO1, PO2, PO3	4	9
MIP1213.3	**Design** a small Generation and Transmission system in order to achieve reliability.	PO1, PO2, PO3	6	9
MIP1213.4	**Evaluate** the operating states of transmission system & their associated contingencies for the stability of the system.	PO1, PO2, PO3	4	9
MIP1213.5	**Formulate** reliability criteria for generation, transmission, distribution and reliability evaluation and analysis, grid reliability, voltage disturbances and their remedies	PO1, PO2, PO3	6	9

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Semester-II MIP1214: Artificial Intelligence Techniques

Teaching Scheme		Examination Scheme	
Theory	3 Hrs/week	**CT-I**	15 Marks
Tutorial	0 Hrs/week	**CT-II**	15 Marks
Total Credits	**0**	**CA**	10 Marks
Duration of ESE: 3Hrs		**ESE**	60 Marks
Pre-Requisites: Basics of Artificial Intelligence		**Total Marks**	**100 Marks**

Course Objectives:

1.	Gain a historical perspective of AI and its foundations.
2.	Become familiar with basic principles of AI toward problem solving, inference, perception, knowledge representation, and learning.
3.	Investigate applications of AI techniques in intelligent agents, expert systems, artificial neural networks and other machine learning models.
4.	Experience AI development tools such as an 'AI language', expert system shell, and/or data mining tool
5.	Experiment with a machine learning model for simulation and analysis
6.	Explore the current scope, potential, limitations, and implications of intelligent systems

Course Contents

Unit I	**Introduction of AI:** Introduction: AI problems, foundation of AI and history of AI intelligent agents: Agents and Environments, the concept of rationality, the nature of environments, structure of agents, problem solving agents, problem formulation.
Unit II	**Ontology:** Introduction to ontology, Semantic network, Frame, Structural knowledge, Declarative knowledge, Procedural knowledge. **First Order Predicate Logic:** Predicate logic, Term and logic formula, Clausal form/Conjunctive, canonical form, Standardization of logic formula, Unification and resolution, Horn clause and Prolog.
Unit III	**Fuzzy Logic: Human-like decision making:** Definition of fuzzy set, Membership function, Notation of fuzzy set, Operations of fuzzy set, Fuzzy number and operations, Extension principle, Fuzzy rules, De-fuzzification, Fuzzy control Future Scope of AI.
Unit IV	**Expert Systems:** Building an expert system, application areas of expert system Knowledge Engineering, Knowledge Acquisition, Knowledge Based Systems, Automated Reasoning, Rule-Based Expert Systems Case studies: MYCIN, R1.
Unit V	**Application of AI in Power Systems:** Application of Neural Network and Expert Systems in Voltage Control, Application of ANN for security assessment, Schedule Maintenance of Electrical Power Transmission Networks using Genetic Algorithm, Intelligent Systems for Demand Forecasting.

Text Books

T.1	E. Rich and K. Knight, “Artificial intelligence”, TMH, 2nd ed., 1992.
T.2	N.J. Nilsson, “Principles of AI”, Narosa Publ. House, 1990.
T.3	D.W. Patterson, “Introduction to AI and Expert Systems”, PHI, 1992.
Reference Books	
R.1	R.J. Schalkoff, “Artificial Intelligence -an Engineering Approach”, McGraw Hill Int. Ed., Singapore, 1992.
R.2	Peter Jackson, “Introduction to Expert Systems”, AWP, M.A., 1992.
R.3	Artificial Intelligence: A Modern Approach, Stuart Russell and Peter Norvig, Prentice Hall, 3rd, 2009
Useful Links	
1	https://onlinecourses.nptel.ac.in/noc21_cs42/preview
2	https://nptel.ac.in/courses/106/105/106105077/
3	https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-cs42/

Course Code	Course Outcomes	PO	CL	Class Sessions
MIP1214.1	**Illustrate** the fundamentals of Artificial Intelligence and its characteristics	PO1, PO2, PO3	3	9
MIP1214.2	**Classification** of different aspect of Ontology and Predicate Logic	PO1 ,PO2, PO3	4	9
MIP1214.3	**Determining** the various parameter of Fuzzy logic and its control.	PO1 ,PO2, PO3	5	9
MIP1214.4	**Analyze** the different types of expert systems	PO1 ,PO2, PO3	4	9
MIP1214.5	**Design** and develop application of AI in Power Systems	PO1 ,PO2, PO3	6	9

Tulsiramji Gaikwad-Patil College of Engineering and Technology

Wardha Road, Nagpur-441 108

NAAC Accredited with A+ Grade

(An Autonomous Institute Affiliated to RTM Nagpur University, Nagpur)

Program: M.Tech. Integrated Power System (IPS)

Semester-II MAU1202: Research Paper Writing

Teaching Scheme		Examination Scheme	
Theory	2 Hrs/week	**CT-I**	-
Tutorial	0 Hrs/week	**CT-II**	-
Total Credits	**0**	**CA**	-
Duration of ESE: 3Hrs		**ESE**	-
Pre-Requisites:		**Total Marks**	-

Course Objectives:

1. Understand that how to improve your writing skills and level of readability
2. Learn about what to write in each section
3. Understand the skills needed when writing a Title

Course Contents

Unit I	Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness
Unit II	Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction
Unit III	Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.
Unit IV	Purposes of Writing a Research Paper, Structure of the Manuscript, Title Discussion, Abstract, Introduction, Methodology, Theoretical Framework, Results & Discussions,
Unit **V**	Conclusions, Acknowledgements, References, Tables and Table Captions, Figures and Captions, Authorship and Originality, Language and Editing, Essentials of A Good Research Paper, validation.

Text Books

T.1	James Lester, "Writing Research Papers: Complete Guide" , Pearson Publication, 2015
T.2	C R Kothari, "Research Methodology", New Age International Publication, 2004
T.3	Sher Singh Bhakar, "Hand Book For Writing Research Paper" , Bharati Publications, New Delhi, 2014

Reference Books

R.1	Day R How to Write and Publish a Scientific Paper, Cambridge University Press, 2006.
R.2	Goldbort R Writing for Science, Yale University Press 2006.
R.3	Adrian Wallwork, English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011

Useful Links

1	https://www.youtube.com/watch?v=cMJWtNDqGzI
2	https://www.youtube.com/watch?v=Xp2PVO3do34
3	www.digimat.in/nptel/courses/video/110105091/L07.html

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