Sem III

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2024-25

Course Information

Programme	M. Tech. Power System Engineering
Class, Semester	Second Year M. Tech., Sem. III
Course Code	7PS691
Course Name	Dissertation Phase-I
Desired Requisites:	NIL

Teaching Scheme		**Examination Scheme (Marks)**			
Practical	24 Hrs/ Week	**LA1**	**LA2**	**Lab ESE**	**Total**
Interaction	-	30	30	40	100
		Credits: 12			

Course Objectives

1	To develop the student to apply the knowledge gained to identify problems for research and provide the solutions by self-study and interaction with stakeholders.
2	Acquire knowledge to tackle real world problems of societal concerns
3	Impart flexibility to the student to have increased control over his/ her learning
4	Enhance a students' learning through increased interaction with peers and colleagues.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Apply theoretical knowledge and technical skills to solve real-world problems in the project.	III	Applying
CO2	Analyse data, methodologies, and outcomes related to their project, identifying patterns, trends, and potential areas for improvement.	IV	Analysing
CO3	Evaluate the effectiveness of different approaches and techniques employed in their project, and propose modifications or enhancements as necessary.	V	Evaluating
CO4	Design and develop innovative solutions, products, or systems that address specific challenges or opportunities within their field of study.	VI	Creating

List of Experiments / Lab Activities/Topics

The third semester is completely devoted to dissertation work

which is defined based on the interest of the students to specialize in a particular area.

Student is expected to carry out independent research work on the chosen topic. In this semester it is expected that the student has carried out substantial research work including exhaustive literature survey, formulation of the research problem, development/fabrication of experimental set-up (if any/required) and testing, and analysis of initial results thus obtained. In fourth semester, the student continues his/her dissertation work. It is expected that the student has completed most of the experimental/computation works and analysed the results so obtained as proposed in the synopsis. The work should be completed in all respects in this semester. The student is required to submit the dissertation work in the form of report as per the institute rule.

Textbooks

1	As per the research topic

References	
1	As per the research topic
Useful Links	
1	Nil

CO-PO Mapping						
Programme Outcomes (PO)						
	1	2	3	4	5	6
CO1	3					
CO2				3		
CO3				3		
CO4			2			2
The strength of mapping is to be written as 1: Low, 2: Medium, 3: High Each CO of the course must map to at least one PO.						

Assessment				
There are three components of lab assessment, LA1, LA2 and Lab ESE. IMP: Lab ESE is a separate he ad of passing.(min 40 %), LA1+LA2 should be min 40%				
Assessment	**Based on**	**Conducted by**	**Typical Schedule**	**Marks**
LA1	Attendance, Presentation, Simulation	Project Guide	During Week 1 to Week 8 Marks Submission at the end of Week 8	30
LA2	Attendance, Presentation, Project Simulation / Hardware	Project Guide	During Week 9 to Week 16 Marks Submission at the end of Week 16	30
Lab ESE	Attendance, Presentation, Project Simulation / Hardware	Project Guide and External Examiner as applicable	During Week 18 to Week 19 Marks Submission at the end of Week 19	40
Week 1 indicates starting week of a semester. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming, and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments and related activities if any.				

Syllabus Prepared By	Mr. M.S.Mahagaonkar
Syllabus Checked By	

NPTEL/SWAYAM Course

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2024-25

Course Information

Programme	M. Tech. Power System Engineering
Class, Semester	Second Year M. Tech., Sem. III
Course Code	7PS611
Course Name	Sustainable Power Generation Systems
Desired Requisites:	Power Systems, Power Electronics

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	0	25	75	100
		Credits: 3			

Course Objectives

1	To familiarize a student with the basics of electrical engineering that are essential for better understanding on how to integrate Renewable energy sources and operate and model the power network.
2	To make students familiar with the basics of most clean and renewable energy technologies
3	To understand the concepts of solar cells, underlying physics, optoelectronic processes and techniques used for photovoltaic characterization.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Interpret thermal conversion and storage routes for solar energy	III	Applying
CO2	Interpret the photovoltaic devices and their fundamentals	III	Applying
CO3	Analyze the environmental and social impact of various generation technologies	IV	Analyzing
CO4	Analyze recent technological advancements in sustainable power generation and assess their potential to improve efficiency, reduce costs, and enhance sustainability	IV	Analyzing

Module	**Module Contents**	**Hours**
I	Introduction to power generation Global and Indian scenario, an overview of current technologies available for power generation, Concept of the renewable energy- based power plant	4
II	Solar Thermal Power Generation Fundamentals of Solar thermal energy conversion, solar thermal based power plant design and analysis (flat plate and concentrator), ORC, RC, and Stirling engine. Solar Photovoltaic Power Generation Fundamentals of Solar photovoltaic energy conversion, Solar PV power plant design, Performance analysis of standalone and grid connected PV systems.	7

III	Wind Power Generation Introduction to wind turbine, classification and analysis of different components, Theory, design and analysis of wind turbines (horizontal axis and vertical axis) and wind farms. Hydro Power Generation Introduction to hydro power plant, overview of micro, mini and small hydro power plants, hydraulic turbines, Selection and design criteria of pumps and turbines, Brief theory, design and analysis of hydro power plants	7
IV	Biomass Power Generation Fundamentals of bioenergy production technologies through different routes, design and analysis of biochemical and thermochemical reactors for clean power generation and value- added products, IGCC. Hydrogen energy and fuel cells Importance, various routes of hydrogen generation, basic principle and design of different types of fuel cells and their applications, future prospects, IGFC	7
V	Geothermal Energy Fundamentals, classification, theory, design and analysis of geothermal power plant Ocean Thermal Energy Fundamentals, classification, theory, design and analysis of ocean thermal power plant Wave and Tidal Energy Fundamentals, classification, theory, design, and analysis of wave and tidal power plant	7
VI	Energy Storage Different modes of energy storage; design and analysis of different technologies for thermal, mechanical, and electro-chemical energy storage systems Energy Economics Cost analysis, interest, Accounting rate of return, Payback, Discounted cash flow, Net present value, Internal rate of return, Inflation and life cycle analysis of energy systems.	7
Textbooks		
1	J. Twidell, T. Weir, Renewable Energy Resources, Taylor and Francis, 4th Edition, 2021	
2	G. Boyle (Editor), Renewable Energy: Power for a Sustainable Future, Oxford University press, 3rd Edition, 2012.	
3	G. N. Tiwari, Solar Energy, Fundamentals, Design, Modelling and Applications, Narosa, 2002.	
4	J. A. Duffie and W. A. Beckman, Solar Engineering of Thermal Processes, John Wiley, 4th Edition, 2013.	
References		
1	R. Gasch, J. Twele, Wind Power Plants: Fundamentals, Design, Construction and Operation, Springer, 2nd Edition, 2012.	
2	P. Breeze, Hydropower, Elsevier, 1st Edition, 2018.	
3	S. C. Bhattacharyya, Energy Economics Concepts, Issues, Markets and Governance, springer, 2nd Edition, 2019.	
4	S. P. Sukhatme and J.K. Nayak, Solar Energy: Principles of Thermal Collection and Storage, Tata Mc-Graw Hill Education Private Limited, 3rd Edition, 2010.	
Useful Links		
1	https://nptel.ac.in/courses/127103236	

CO-PO Mapping						
Programme Outcomes (PO)						
	1	2	3	4	5	6
CO1	2		1			
CO2					2	2
CO3				2		
CO4		2				
The strength of mapping is to be written as 1: Low, 2: Medium, 3: High Each CO of the course must map to at least one PO.						

Assessment
The assessment is based on MSE, ISE and ESE. MSE shall be typically on modules 1 to 3. ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO. ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6. For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

Syllabus Prepared By	Mr. V. S. Sathe
Syllabus Checked By	Mr. M. S. Mahagaonkar

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2024-25

Course Information

Programme	M. Tech. Power System Engineering
Class, Semester	Second Year M. Tech., Sem. III
Course Code	7PS612
Course Name	Power Electronics Applications in Power Systems
Desired Requisites:	NIL

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	0	25	75	100
		Credits: 3			

Course Objectives

1	To understand active and reactive power flow in transmission line.
2	To explain shunt and series static var compensator in power system.
3	To apply static var compensator in power system.
4	To understand static synchronous compensator

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Identify active and reactive power flow in transmission line.	III	Applying
CO2	Identify the use of shunt and series compensator in power system.	III	Applying
CO3	Apply static var compensator in power system to enhance system stability.	III	Applying
CO4	Analyse the modelling of static synchronous compensator in power system.	IV	Analysing

Module	**Module Contents**	**Hours**
I	**Introduction:** Introduction, Active and reactive power in electrical circuits, Reactive power compensation	4
II	**Power flow in Long transmission lines and Modelling:** Transmission line modelling: Categorization, Derivation of the relation of sending and receiving end voltages and currents, Concept of surge impedance, phase constant, and symmetrical lines Derivation of the expressions of active and reactive power, Numerical Example	7
III	**Static VAR Compensator:** Expressions of the voltage and current at the mid-point, Mid-point compensation with numerical examples – I and II, Shunt compensations Different types of SVC: Thyristor controlled Reactor (TCR) – I and II, Fixed capacitor TCR and Mechanically switched capacitor TCR, Thyristor switched capacitor (TSC), TSC-TCR, Numerical examples	8
IV	**Applications of SVC in power systems:** Application of SVC in power system voltage control and Numerical Example. Application of SVC in enhancing power system stability, Application of SVC in power system damping	7
V	**Thyristor controlled series capacitor:** Basic mathematical modelling – I and II, Application of TCSC in power systems – I and II.	7
VI	**Static Synchronous compensator:** Basic mathematical modelling of STATCOM, Applications of STATCOM in power systems, Basic mathematical modelling of SSSC, Applications of SSSC in power systems	6

Textbooks	
1	K. R. Padiyar, FACTS Controllers in Power Transmission and Distribution, New Age International (P) Limited, 2021 (reprint)
References	
1	R. M. Mathur and R. K. Varma, Thyristor-Based FACTS Controllers for Electrical Transmission Systems, Wiley-IEEE Press, 2011.
2	N. G. Hingorani, L. Gyugyi, Understaning FACTS: Concepts and Technology of Flexible AC Transmission Systems, Wiley, 2012 (reprint).
Useful Links	
1	https://onlinecourses.nptel.ac.in/noc24_ee130/preview

CO-PO Mapping						
	Programme Outcomes (PO)					
	1	2	3	4	5	6
CO1	3	2				
CO2	3	2				
CO3	3	2				
CO4	3	2				
The strength of mapping is to be written as 1: Low, 2: Medium, 3: High Each CO of the course must map to at least one PO.						

Assessment
The assessment is based on MSE, ISE and ESE. MSE shall be typically on modules 1 to 3. ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO. ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6. For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

Syllabus Prepared By	Dr. Swapnil D. Patil
Syllabus Checked By	

Walchand College of Engineering, Sangli

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AY 2024-25

Course Information

Programme	M. Tech. Power System Engineering
Class, Semester	Second Year M. Tech., Sem. III
Course Code	7PS613
Course Name	Smart Grid: Basics to Advanced Technologies
Desired Requisites:	NIL

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	0	25	75	100
		Credits: 3			

Course Objectives

1	To understand smart grid and energy storage technologies.
2	To explain detection and protection of fault in smart grid.
3	To demonstrate and apply control strategies in smart grid.
4	To understand energy management in smart grid.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Use energy storage devices and distributed generation resources in smart grid.	III	Applying
CO2	Identify the faults and protection for respective fault in smart grid.	III	Applying
CO3	Apply control strategies and phasor measurement units in smart grid.	III	Applying
CO4	Analyse the energy management in smart grid.	IV	Analysing

Module	**Module Contents**	**Hours**
I	**Introduction to Smart Grid:** Introduction to Smart Grid-I and II, Architecture of Smart Grid system, Standards for Smart Grid system, Elements and Technologies of Smart Grid System-I and II, Distributed Generation Resources-I, II, III and IV.	6
II	**Energy storage devices:** Introduction to energy storage devices, Different types of energy storage technologies, Analytical modelling of energy storage devices, Optimal sizing and siting of storages, Battery management system (BMS). **Wide area Monitoring Systems** I and II, Phasor Estimation-I and II, Digital Relays for Smart Grid Protection.	7
III	**Islanding Detection and Protection:** Techniques–I, II and III, Smart Grid Protection-I and II, Modelling of storage devices, Modelling of DC smart grid components.	6
IV	**Operation and control of Grid:** Operation and control of AC and DC Microgrid, Operation and control of AC-DC hybrid Microgrid. **Phasor measurement unit:** Phasor measurement unit placement, Cyber security and resiliency, Virtual inertia and ancillary support, Demand side management of smart grid, Demand Response Analysis of smart grid.	7

V	**Demonstration** of solar and wind power generation, Demonstration of Battery Management System and EV charging system, Hierarchical control techniques in hybrid ac-dc microgrid **Simulation and case study:** Simulation and case study of AC and DC Microgrid, Simulation and case study of AC-DC Hybrid microgrid, Demonstration of parallel inverter operation in AC microgrid, Harmonic effects and its mitigation techniques.	7
VI	**Energy management:** Design of Smart Grid and Practical Smart Grid Case Study-I and II, System Analysis of AC/DC Smart Grid, Demonstration of grid-connected DC microgrid, Demonstration of PHIL experimentation for symmetric and asymmetric fault analysis of grid-connected DFIG wind turbine, Demonstration of ancillary support from virtual synchronous generator, Demonstration on peak energy management using energy storage system.	6

Textbooks	
1	Smart power grids by A Keyhani, M Marwali.
	Computer Relaying for Power Systems by ArunPhadke
References	
1	Microgrids Architecture and control by Nikos Hatziargyriou
2	Renewable Energy Systems by Fang Lin Luo, Hong Ye
3	Voltage-sourced converters in power systems_ modeling, control, and applications by Amirnaser Yazdani, Reza Iravani"
Useful Links	
1	https://onlinecourses.nptel.ac.in/noc24_ee148/preview

CO-PO Mapping						
	Programme Outcomes (PO)					
	1	2	3	4	5	6
CO1	3	2				
CO2	3	2				
CO3	3	2				
CO4	3	2				
The strength of mapping is to be written as 1: Low, 2: Medium, 3: High Each CO of the course must map to at least one PO.						

Assessment
The assessment is based on MSE, ISE and ESE. MSE shall be typically on modules 1 to 3. ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO. ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6. For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

Syllabus Prepared By	Dr. Swapnil D. Patil
Syllabus Checked By	

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2024-25

Course Information	
Programme	M. Tech. Power System Engineering
Class, Semester	Second Year M. Tech., Sem. III
Course Code	7PS614
Course Name	Solar Energy Engineering and Technology
Desired Requisites:	NIL

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	0	25	75	100
		Credits: 3			

Course Objectives	
1	To understand fundamentals of solar PV energy.
2	To explain solar collector and grid connections of solar energy.
3	To analyse the performance of solar energy.
4	To understand thermal energy storage.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Identify the fundamentals of solar PV energy.	III	Applying
CO2	Select grid connections of solar PV system.	III	Applying
CO3	Analyse the performance of solar energy.	IV	Analysing
CO4	Analyse the thermal energy storage and emerging technologies.	IV	Analysing

Module	**Module Contents**	**Hours**
I	**Overview of solar energy:** Energy Scenario, overview of solar energy conversion devices and applications, physics of propagation of solar radiation from the sun to earth, Sun-Earth Geometry, Extra-Terrestrial and Terrestrial Radiation, Solar energy measuring instruments.	6
II	**Fundamentals of solar PV cells:** Estimation of solar radiation under different climatic conditions, Estimation of total radiation, Fundamentals of solar PV cells, principles and performance analysis, modules, arrays, theoretical maximum power generation from PV cells.	7
III	**Components of grid-connected PV system:** PV standalone system components, Standalone PV-system design, Components of grid-connected PV system, solar power plant design and performance analysis.	7
IV	**Solar collectors:** Fundamentals of solar collectors, Snails law, Bougers law, Physical significance of Transmissivity – absorptivity product, Performance anlaysis of Liquid flat plate collectors and testing.	7
V	**Performance analysis** of Solar Air heaters and testing, Solar thermal power generation (Solar concentrators).	6
VI	**Thermal Energy Storage** (sensible, latent and thermochemical) and solar pond Applications: Solar Refrigeration, Passive architecture, solar distillation, and emerging technologies.	6

Textbooks

1	G. N. Tiwari, Solar Energy, Fundamentals, Design, Modeling and Applications, Narosa, 2002.

2	C. S. Solanki, Solar Photovoltaics: Fundamentals, Technologies and Applications, Prentice Hall India, 2nd Edition, 2011.
3	T. C. Kandpal and H.P. Garg, Financial Evaluation of Renewable Energy Technologies, McMillan India Ltd., 2013
References	
1	S. P. Sukhatme and J. K. Nayak, Solar Energy: Principles of Thermal Collection and Storage, Tata McGraw Hill, 2006.
2	J. A. Duffie and W. A. Beckman, Solar Engineering of Thermal Processes, John Wiley, 20
3	K. Jager, O. Isabella, A. H. M. Smets, R.A.C.M.M. Van Swaaij, and M. Zeman, Solar Energy – fundamentals, technology and systems, Delft University of Technology, 2014
Useful Links	
1	https://onlinecourses.nptel.ac.in/noc24_ge51/preview

CO-PO Mapping

	Programme Outcomes (PO)					
	1	2	3	4	5	6
CO1	3	2				
CO2	3	2				
CO3	3	2				
CO4	3	2				

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

Syllabus Prepared By	Dr. Swapnil D. Patil
Syllabus Checked By	

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2024-25

Course Information	
Programme	M. Tech. Power System Engineering
Class, Semester	Second Year M. Tech., Sem. III
Course Code	7PS615
Course Name	Fundamentals of Artificial intelligence
Desired Requisites:	Basic programming knowledge (preferably Python) and proficiency in linear algebra, probability, and statistics.

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	0	25	75	100
		Credits: 3			

Course Objectives	
1	Provide a Comprehensive Overview of AI
2	Teach Problem-Solving and Search Techniques
3	Introduce Knowledge Representation and Reasoning
4	Cover Machine Learning and NLP Techniques

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Understand the core principles and techniques of artificial intelligence, including its history, applications, and ethical considerations.	II	Understanding
CO2	Apply search algorithms and heuristics to formulate and solve AI problems efficiently.	III	Applying
CO3	Represent knowledge using logical formalisms and perform logical reasoning and inference techniques.	IV	Analyzing
CO4	Design and implement machine learning models and natural language processing techniques using AI tools and frameworks.	VI	Creating

Module	**Module Contents**	**Hours**
I	**Introduction to Artificial Intelligence** Overview of AI: History, Evolution, and Scope, Definitions and Key Concepts, Applications of AI in Various Domains, Ethics and Challenges in AI	4
II	**Problem-Solving and Search Algorithms** Problem Formulation: State Space Representation, Uninformed Search, Techniques: BFS, DFS, Informed Search Techniques: Best-First Search, A* Algorithm, Heuristics and Optimization	7
III	**Knowledge Representation and Reasoning** Introduction to Knowledge Representation, Propositional Logic and Inference First-Order Logic: Syntax, Semantics, and Inference, Ontologies and Semantic Web Technologies	7
IV	**Reasoning Under Uncertainty** Basics of Probability Theory, Bayesian Networks: Representation, Inference, and Learning, Markov Decision Processes (MDPs), Hidden Markov Models (HMMs) and their Applications	7

V	**Machine Learning Techniques** Supervised Learning: Regression, Classification, and Neural Networks, Unsupervised Learning: Clustering, Dimensionality Reduction, Reinforcement Learning: Principles and Algorithms, Introduction to Deep Learning: Basics and Architectures	7
VI	**Natural Language Processing and AI Tools** Introduction to Natural Language Processing (NLP), Language Models and Parsing Techniques, Information Retrieval and Extraction, AI Tools and Frameworks: Python, TensorFlow, PyTorch	7

Textbooks	
1	"Artificial Intelligence: A Modern Approach" by Stuart Russell and Peter Norvig
2	"Pattern Recognition and Machine Learning" by Christopher M. Bishop
3	"Machine Learning" by Tom M. Mitchell
4	"Deep Learning" by Ian Goodfellow, Yoshua Bengio, and Aaron Courville

References	
1	"Speech and Language Processing" by Daniel Jurafsky and James H. Martin
2	"Reinforcement Learning: An Introduction" by Richard S. Sutton and Andrew G. Barto

Useful Links	
1	https://onlinecourses.nptel.ac.in/noc24_ge47/preview

CO-PO Mapping

Programme Outcomes (PO)						
	1	2	3	4	5	6
CO1	1	1	3	1	1	1
CO2	3	1	1	3	1	1
CO3	3	1	1	3	1	1
CO4	3	1	1	3	1	3

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

Syllabus Prepared By	Mr. A. N. Inamdar
Syllabus Checked By	

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2024-25

Course Information	
Programme	M. Tech. Power System Engineering
Class, Semester	Second Year M. Tech., Sem. III
Course Code	7PS616
Course Name	Economic Operations and Control of Power Systems
Desired Requisites:	Power Systems

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	0	25	75	100
		Credits: 3			

Course Objectives	
1	To understand the fundamental principles of economics as applied to power systems.
2	To learn methods for optimizing the generation schedule to minimize operational costs.
3	To study real-world case studies to understand the application of economic principles in power system operations.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Apply load forecasting techniques to predict future power demands.	III	Applying
CO2	Implement methods for economic dispatch and unit commitment in practical scenarios.	III	Applying
CO3	Analyze the economic impacts of different operational strategies in power systems.	IV	Analyzing
CO4	Assess the effectiveness of demand response strategies in reducing operational costs.	V	Evaluating

Module	**Module Contents**	**Hours**
I	Introduction- NPP, Evolution of Indian Power System- NPP, Control in Power Systems-NPP, Optimization Preliminaries-I- NPP, Optimization Preliminaries-II- NPP Dynamic Programming-GMV, Economic Dispatch of Thermal Units- GMV, Economic Dispatch using Numerical Methods-I-GMV, Economic Dispatch using Numerical Methods- II-GM, Economic Dispatch using Numerical Methods- III-GMV	6
II	Power Flow Problem on DC Network-NPP, Formulation of AC Power Flow-NPP, Decoupled Power Flow-NPP, Calculation of Transmission Losses-I-NPP, Calculation of Transmission- Losses-II-NPP Economic Dispatch using Dynamic Programming-GMV, Unit Commitment- I-GMV, Unit Commitment- II-GMV, Unit Commitment using Dynamic Programming: GMV, Unit Commitment using Lagrange Relaxation - I-GMV	7

III	Unit Commitment using Lagrange Relaxation - II-GMV, Hydrothermal Scheduling- I-GMV, Hydrothermal Scheduling- II-GMV, Hydrothermal Scheduling- III-GMV, Transmission System Effects - GMV Production Cost Model- Introduction 1-NPP, Production Cost Model- Introduction 2- NPP, Economic Scheduling with Unreserved Load Method-NPP, Expected Cost Method-NPP, Discussion of Practical Problems- NPP	6
IV	Power and Energy Interchange: Introduction; NPP, Multiple Utility Interchange Transactions; NPP, Power Pools: NPP, Transmission Effects and Issues: NPP, Discussion of Practical Problems: NPP Real-Time Case Study on Reactive Power Dispatch- I: GMV, Real-Time Case Study on Reactive Power Dispatch II: GMV, Real-Time Case Study on Reactive Power Dispatch III: GMV, Power System Security-I: GMV, Power System Security-II: GMV	7
V	Power System Security-III: GMV, Optimal Power Flow I: GMV, Optimal Power Flow II: GMV, State Estimation I: GMV, State Estimation II: GMV State Estimation III-: GMV, State Estimation IV: GMV, State Estimation V: GMV, State Estimation VI: GMV, State Estimation VII: GMV	6
VI	Control of Generation I: GMV, Control of Generation II: GMV, Short-Term Demand Forecasting - GMV, Pumped Storage & Gravity Storage: GMV, Energy Storage: GMV Advanced Distribution System Management I: GMV, Advanced Distribution System Management II: GMV, Advanced Distribution System Management III: GMV, EV Opportunities, Challenges and Impact in Indian Power Sector I:GMV, EV Opportunities, Challenges and Impact in Indian Power Sector II: GMV	7

Textbooks	
1	Power Generation Operation and Control, by Allen J. Wood, Bruce F. Wollenberg.
References	
1	Power System Stability and Control by P Kundur.
Useful Links	
1	https://onlinecourses.nptel.ac.in/noc24_ee141/preview

CO-PO Mapping						
Programme Outcomes (PO)						
	1	2	3	4	5	6
CO1				2		
CO2	2				2	
CO3	2	2				
CO4		2				2
The strength of mapping is to be written as 1: Low, 2: Medium, 3: High Each CO of the course must map to at least one PO.						

Assessment
The assessment is based on MSE, ISE and ESE. MSE shall be typically on modules 1 to 3. ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO. ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6. For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

Syllabus Prepared By	Mr. V. S. Sathe
Syllabus Checked By	

Sem IV

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2024-25

Course Information

Programme	M. Tech. Power System Engineering
Class, Semester	Second Year M. Tech., Sem. IV
Course Code	7PS692
Course Name	Dissertation Phase-II
Desired Requisites:	NIL

Teaching Scheme		**Examination Scheme (Marks)**			
Practical	34 Hrs/ Week	**LA1**	**LA2**	**Lab ESE**	**Total**
Interaction	-	30	30	40	100
		Credits: 17			

Course Objectives

1	To develop the student to apply the knowledge gained to identify problems for research and provide the solutions by self-study and interaction with stakeholders.
2	Acquire knowledge to tackle real world problems of societal concerns
3	Impart flexibility to the student to have increased control over his/ her learning
4	Enhance a students' learning through increased interaction with peers and colleagues.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Apply theoretical knowledge and technical skills to solve real-world problems in the project.	III	Applying
CO2	Analyse data, methodologies, and outcomes related to their project, identifying patterns, trends, and potential areas for improvement.	IV	Analysing
CO3	Evaluate the effectiveness of different approaches and techniques employed in their project, and propose modifications or enhancements as necessary.	V	Evaluating
CO4	Design and develop innovative solutions, products, or systems that address specific challenges or opportunities within their field of study.	VI	Creating

List of Experiments / Lab Activities/Topics

The fourth semester is completely devoted to dissertation work,

which is defined based on the interest of the students to specialize in a particular area.

Student is expected to carry out independent research work on the chosen topic. In this semester it is expected that the student has carried out substantial research work including exhaustive literature survey, formulation of the research problem, development/fabrication of experimental set-up (if any/required) and testing, and analysis of initial results thus obtained. In fourth semester, the student continues his/her dissertation work. It is expected that the student has completed most of the experimental/computation works and analysed the results so obtained as proposed in the synopsis. The work should be completed in all respects in this semester. The student is required to submit the dissertation work in the form of report as per the institute rule.

Textbooks

1	As per the research topic

References	
1	As per the research topic
Useful Links	
1	Nil

CO-PO Mapping						
	Programme Outcomes (PO)					
	1	2	3	4	5	6
CO1	3					
CO2				3		
CO3				3		
CO4			2			2
The strength of mapping is to be written as 1: Low, 2: Medium, 3: High Each CO of the course must map to at least one PO.						

Assessment				
There are three components of lab assessment, LA1, LA2 and Lab ESE. IMP: Lab ESE is a separate he ad of passing.(min 40 %), LA1+LA2 should be min 40%				
Assessment	**Based on**	**Conducted by**	**Typical Schedule**	**Marks**
LA1	Attendance, Presentation, Simulation	Project Guide	During Week 1 to Week 8 Marks Submission at the end of Week 8	30
LA2	Attendance, Presentation, Project Simulation / Hardware	Project Guide	During Week 9 to Week 16 Marks Submission at the end of Week 16	30
Lab ESE	Attendance, Presentation, Project Simulation / Hardware	Project Guide and External Examiner as applicable	During Week 18 to Week 19 Marks Submission at the end of Week 19	40
Week 1 indicates starting week of a semester. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming, and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments and related activities if any.				

Syllabus Prepared By	Mr. M.S.Mahagaonkar
Syllabus Checked By	

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2024-25

Course Information

Programme	M. Tech. Power System Engineering
Class, Semester	Second Year M. Tech., Sem. IV
Course Code	7PS645
Course Name	Internship
Desired Requisites:	-

Teaching Scheme		**Examination Scheme (Marks)**			
Practical	4 Hrs./Week	**LA1**	**LA2**	**ESE**	**Total**
Interaction	-	-	-	100	100
		Credits: 2			

Course Objectives

1	To expose the students to real life engineering problems encountered in industry/society.
2	To provide an opportunity to work in collaborative and multidisciplinary environment.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Description**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Perceive knowledge of group dynamics and contribute to multidisciplinary work.	II	Understanding
CO2	Demonstrate knowledge to solve societal problems and apply it for efficient management of projects independently and in teams.	III	Applying
CO3	Communicate with industry/society regarding engineering activities effectively and comprehend and write effective reports.	II	Understanding
CO4	Demonstrate ethical behaviour with professional code of conduct and contribute to sustainable development of society.	III	Applying

Contents

The objective of this training is to expose the students to industry environment and practices. Students are sent to leading Engineering organizations/Research laboratories/Design and Consultancy organizations to undergo a rigorous training for a minimum period of **one month** during summer term/vacation.

CO-PO Mapping

	Programme Outcomes (PO)					
	1	2	3	4	5	6
CO1					2	
CO2				2		
CO3		2				
CO4					2	

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

Assessment
• The assessment is based on ESE. The panel of minimum two members from the department shall assess the student for the internship. • The students are expected to present the work done in an internship tenure. • The students shall also submit a detailed report based on activities done in an internship and learnings through the same. • The students shall also submit the duly signed internship certificate from the organization/s where internship was done, clearly indicating the period of internship in the certificate.

Walchand College of Engineering, Sangli

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AY 2024-25

Course Information	
Programme	M. Tech. Power System Engineering
Class, Semester	Second Year M. Tech., Sem. IV
Course Code	7PS646
Course Name	Techno-Socio Activity
Desired Requisites:	-

Teaching Scheme		**Examination Scheme (Marks)**			
Practical	2 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Interaction	-	-	-	100	100
		Credits: 1			

Course Objectives

1	Develop skills like teamwork, and communication through technical contribution on socio-economic issues
2	Enhance understanding of the socio-economic impact of engineering projects and technology on society.
3	Apply engineering knowledge and problem-solving skills to address real-world challenges

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Explain professional culture/ethics and build proficiency in professional communication, working in teams, decision making and leadership.	II & III	Understanding & Applying
CO2	Apply the technical knowledge through participation in techno-socio assignments.	III	Applying
CO3	Demonstrate ethical quality and social responsibilities through the technical knowledge gained.	V	Evaluating

List of Activities

List of Activities:

1. Involvement in techno-socio activity
   a) Presentation on involvement in techno-socio activity individually/through student clubs during F.Y. & S.Y. M. Tech.
   b) Submission of summary report on these activities.
2. Techno-socio activity (Team Activity)
   a) Organization of a technical activity/event for the benefit of society in a batch.
   b) Submission of report on the organized activity.
3. Submission of certificates/documents required for student port-folio (Participation in Curricular and Extra-Curricular Activities within and outside the campus).

References

1	National Institute for Engineering Ethics (NIEE)
2	Professional ethics, National Society of Professional Engineers (NSPE).

Useful Links

1	https://www.asce.org/pdf/ethics_manual.pdf
2	https://www.aicte-india.org/atal

CO-PO Mapping						
Programme Outcomes (PO)						
	1	2	3	4	5	6
CO1		3			3	
CO2			2		3	
CO3			2		3	
The strength of mapping is to be written as 1: Low, 2: Medium, 3: High Each CO of the course must map to at least one PO.						

Assessment
• The assessment is based on ESE. The panel of minimum two members from the department shall assess the student for the techno-socio activity. • The students are expected to present the work done in an four semesters. • The students shall also submit a detailed report based on activities done and learnings through the same. • The students shall also submit the duly signed certificate from the organization/s, local bodies where activities were carried out.