

CURRICULUM & SYLLABUS

Minor in Power Engineering

Offered by: Department of Electrical and Electronics Engineering (EE)

Eligible Departments: AD, CA, CC, CE, CS, EC, ER, ME

2024 SCHEME

CURRICULUM

	Minor in Power Engineering										
SI. No	Course Code		Course Title	Credit Structure				Total Marks		G. W.	Hrs./
SI.	Sen	Course Code		L	T	P	SS	CIA	ESE	Credits	Week
1	3	24SJMNEET309	Introduction to Power Engineering*/ MOOC#	3	1	0	5	40	60	4	4
2	4	24SJMNEET409	Energy Systems*/ MOOC#	3	1	0	5	40	60	4	4
3	5	24SJMNEET509	Solar and Wind Energy Conversion Systems*/ MOOC#	3	1	0	5	40	60	4	4
4	6	24SJMNEET609	Instrumentation and Automation of Power Plants*/MOOC#	3	0	0	5	40	60	3	3
	Total									15	15

^{*}Students must register for theory courses listed in the 3rd and 4th semesters of the Minor curriculum.

^{*}Students who fail a theory course listed in the Minor curriculum are permitted to register for an alternate MOOC course.

Syllabus Semester III

SEMESTER 3

INTRODUCTION TO POWER ENGINEERING

Course Code	24SJMNEET309	CIE Marks	40
Teaching Hours/Week (L: T:P: R)	3:1:0:0	ESE Marks	60
Credits	4	Exam Hours	2 Hrs. 30 Min.
Prerequisites (if any)	24SJPCEET302 Circuits and Networks	Course Type	Minor (Theory)

Objectives

: This course introduces various conventional energy sources. This course also introduces the design of transmission system and distributions system. It also introduces the economics of power generation.

Syllabus

Module 1

Generation of power: Conventional sources: Hydroelectric Power Plants- Selection of site. General arrangement of hydel plant - components of the plant- Classification of the hydel plants.

Water turbines: Pelton wheel, Francis, Kaplan and propeller turbines- Small hydro generation.

Steam Power Plants: Working of steam plant- Power plant equipment and layout- Steam turbines.

Diesel Power Plant: Elements of diesel power plant- applications

Gas Turbine Power Plant: Introduction Merits and demerits- selection site- fuels for gas turbines- General arrangement of simple gas turbine power plant- comparison of gas power plant with steam power plants.

Nuclear Power Plants: Nuclear reaction- nuclear fission process- nuclear plant layout-Classification of reactors.

Module 2

Economics of power generation: Types of loads- Load curve- terms and factors- peak load and base load- cost of electrical energy- numerical problems. Power factor improvement - causes of low power factor- disadvantages - methods of power factor improvement-calculations of power factor correction- economics of power factor improvement.

Module 3

Transmission system: Different types of transmission system - high voltage transmission — advantages - mechanical design of overhead transmission line - main components of overhead

Syllabus Semester III

lines - types of conductors - Insulators - types -string efficiency - methods of improving string efficiency- Corona - critical disruptive voltage - visual critical voltage - corona loss - factors affecting corona- advantages and disadvantages - methods of reducing corona -sag - calculation.

Module 4

Electrical design of transmission line: Constants of transmission line -Resistance - inductance and capacitance - Inductance and capacitance of a single phase transmission line - Inductance and capacitance of a three phase transmission line with symmetrical and unsymmetrical spacing -transposition of lines

Distribution system : Types of distribution systems - types of DC distributors calculations distributor fed at one end and at both ends -types of AC distributors - calculations. **Smart Grid:** Introduction - challenges and benefits - architecture of smart grid - introduction to IEC 61850 and smart substation.

Course Assessment Method (CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination- 1 (Written)	Internal Examination- 2 (Written)	Total
5	15	10	10	40

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

PALAL						
Part A	Part B	Total				
• 2 Questions from	Each question carries 9 marks.					
each module.	Two questions will be given from each					
• Total of 8 Questions,	module, out of which 1 question should be	(0)				
each carrying 3 marks	answered.	60				
	• Each question can have a maximum of 3					
(8x3 = 24marks)	sub divisions.					
	(4x9 = 36 marks)					

Syllabus Semester III

Course Outcomes: After the completion of the course the student will be able to:

CO1	Illustrate various conventional sources of energy generation
CO2	Analyse the economics of power generation
CO3	Analyse the economics of power factor improvement
CO4	Design mechanical parameters of a transmission system.
CO5	Design electrical parameters of a transmission system.
CO6	Classify different types of ac and dc distribution systems.

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3									2
CO2	3	3									2
CO3	3	3									2
CO4	3	3			~ [/			2
CO5	3	3					10				2
CO6	3	3	-	~	- 01	- EN	IGIN	10			2

Text Books

- 1. D P Kothari and I Nagrath, "Power System Engineering," 3/e Tata McGraw Hills, 2019.
- 2. C. L. Wadhwa, "Electrical Power Systems", 8/e Wiley Eastern Ltd. 2021.

References:

- 1. A.Chakrabarti, ML.Soni, P.V.Gupta, V.S.Bhatnagar, "A text book of Power system Engineering", DhanpatRai, 2000.
- 2. D. P. Kothari & I. J. Nagrath, "Power System Engineering", 3/e, TMH Publication, 2019.
- 3. John J. Grainger & William D. Stevenson, "Power System Analysis", 2/e SI edition, 2016
- 4. A Stuart Borlase, Grids, Infrastructure, Technology and CRC Press, 2013.

Syllabus Semester IV

SEMESTER 4

ENERGY SYSTEMS

Course Code	24SJMNEET409	CIE Marks	40
Teaching Hours/Week (L: T:P: R)	3:1:0:0	ESE Marks	60
Credits	4	Exam Hours	2 Hrs. 30 Min.
Prerequisites (if any)	24SJMNEET309 Introduction to Power Engineering	Course Type	Minor (Theory)

Objectives

: This course introduces various types of renewable energy sources. It discusses various means of generating and storing energy and the importance of renewable energy. Various energy standards and means to improve efficiency of systems are also introduced

Syllabus

Module 1

Energy Scenario: Indian energy scenario - world energy scenario - Indian energy sector reforms - energy and environment - energy security - energy conservation act.

Energy Efficient Systems: Reducing pollution and improving efficiency in buildings - green building standards - types of lamps and their efficiencies.

Module 2

Renewable Energy Resources: Solar thermal system - working principle - block diagram - solar photovoltaic system - working principle - block diagram - solar cell efficiency calculation - wind energy systems - working principle - block diagram - wind power equation - energy from waves and tides - working principle - block diagram - ocean thermal energy system - working principle - block diagram - energy from biomass.

Module 3

Energy Storage: Importance of energy storage - means of storing energy - principle of operation and performance comparison - compressed air storage - fly wheel energy storage - battery storage.

Battery: Specification - Charging/Discharging rate - Primary and secondary cells - Dry cell, lead acid, lithium ion, Lithium air, Nickel Cadmium, Nickel Metal Hydride.

Fuel Cell: Working Principle – types - efficiency

Module 4

Energy Standards: International energy standards – ISO 50001 - bureau of energy efficiency - star rating.

Energy Management: Significance and general principles of energy management - energy audit - types and procedure - energy audit report - instruments for energy auditing – study of various governmental agencies related to energy conservation and management.

Economic Analysis of Energy Investments: calculation of energy efficiency and payback period - characteristics of energy projects - identification of costs and benefits - valuation of costs and benefits - indicators of cost - benefit comparison - methods without time value - net present value based indicators - role of discount rates - internal rate of return numerical problems

Course Outcomes: After the completion of the course the student will be able to:

CO1	Illustrate Indian and global energy scenario
CO2	Elaborate different conventional and non-conventional energy generation schemes
	and the economics of generation
CO3	Analyse principle of operation and performance comparison of various energy storage
	schemes
CO4	Identify major Global and Indian standards for Energy Management
CO5	Perform a preliminary Energy Audit
CO6	Appraise various aspects of energy economics

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3									2
CO ₂	3	3									2
CO3	3	3									2
CO4	3	3									2
CO5	3	3									2
CO6	3	3									2

Course Assessment Method (CIE: 40 marks, ESE: 60 marks)

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End Semester Examination Marks (ESE)

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Part A	Part B	Total	
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each module.	Two questions will be given from each		
• Total of 8 Questions,	module, out of which 1 question should be		
each carrying 3 marks	answered.	60	
	• Each question can have a maximum of 3		
(8x3 =24marks)	sub divisions.		
	(4x9 = 36 marks)		

Syllabus Semester IV

Text Books

1. A.G.Ter- Gazarian, "Energy Storage for Power Systems", 2nd edition, The Institution of Engineering and Technology (IET) Publication, UK, 2011.

- 2. Barney L. Capehart, Wayne C. Turner and William J. Kennedy, "Guide to Energy Management", eighth Edition, The Fairmont Press Inc., 2016.
- 3. A.S. Pabla, "Electric Power Systems Planning", Mac Millan India Ltd., seventh Edition, 2019

References:

- 1. K.C. Kothari, D.P.Ranjan, Rakeshsingal "Renewable Energy Sources and Emerging Technology PHI; 3rd edition, 2021.
- 2. M.V.R. Koteswara Rao, Energy Resources: Conventional & Non-Conventional BS Publications/BSP Books (2017)
- 3. Albert Thumann, Scott Dunning, "Efficient Lighting Applications & Case Studies"; The Fairmont Press, Inc. (16 April 2013)
- 4. "Energy Efficiency in Electrical Utilities"-Guide book for National Certificate Examination for Energy Managers and Energy Auditors: Bureau of Energy Efficiency
- 5. Subhes C. Bhattacharyya, "Energy Economics-Concepts, Issues, Markets and Governance," Springer, 2011
- 6. ISO 50001- Energy Management Standard (ISO 50001:2018)