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											
Sl. No	**Semester**	**Course Code**	**Course Title**	**Credit Structure**			**SS**	**Total Marks**		**Credits**	**Hrs./ Week**
				L	**T**	**P**		**CIA**	**ESE**		
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							**20**			**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 specified in the Minor curriculum.

SEMESTER 3

INTRODUCTION TO POWER ENGINEERING

Course Code	**24SJMNEET309**	**CIE Marks**	40
Teaching Hours/Week (L: T:P: R)	3:0:0:0	**ESE Marks**	60
Credits	4	**Exam Hours**	2 Hrs. 30 Min.
Prerequisites (if any)	24SJPCEET302 Circuits and Networks	**Course Type**	Honours (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 lines – types of conductors, line supports

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

Module 5

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

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

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

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									2
CO6	3	3									2

Text Books

1. D P Kothari and I Nagrath, "Power System Engineering," 2/e Tata McGraw Hills, 2008.
2. Wadhwa, “Electrical Power system”, Wiley Eastern Ltd. 2005.

References:

1. A.Chakrabarti, ML.Soni, P.V.Gupta, V .S.Bhatnagar, “A text book of Power system Engineering” DhanpatRai, 2000.
2. Grainer J.J, Stevenson W.D, “Power system Analysis”, McGraw Hill.
3. I.J.Nagarath& D.P. Kothari, “Power System Engineering”, TMH Publication.
4. A Stuart Borlase, “Smart Grids, Infrastructure, Technology and Solutions”, CRC Press, 2013.

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)	24SJPCEET301 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, efficiency

Module 4

Energy Standards – International Energy Standards-ISO50001, 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.

Module 5

Energy Economics: Traditional Types of Rates - Single-Part Rates - Two-Part Rates - Three-Part Rates – Numerical problems

Energy demand forecasting: Introduction –Forecasting using simple indicators- trend analysis- end use method - MAED Model - LEAP Model

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
CO2	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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Text Books

1. A.G.Ter-Gazarian, "Energy Storage for Power Systems", Second Edition, The Institution of Engineering and Technology (IET) Publication, UK, (ISBN - 978-1-84919-219-4), 2011.
2. Barney L. Capehart, Wayne C. Turner and William J. Kennedy, "Guide to Energy Management", Seventh Edition, The Fairmont Press Inc., 2012.
3. S. Pabla, "Electric Power Systems Planning", Mac Millan India Ltd., 1998

References:

1. K.C. Kothari, D.P.Ranjan, Rakeshsingal "Renewable Energy Sources and Emerging Technology"- PHI; 2nd Revised edition (1 December 2011)
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. ISO50001