

SEMESTER S5

POWER GENERATION, TRANSMISSION AND PROTECTION

Course Code	PCEET501	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)	PCEET302	Course Type	Theory

Course Objectives:

1. To deliver fundamental concepts in power system components.
2. To deliver basic idea of power generation, transmission and protection.
3. To introduce new topics to students like energy storage systems and deregulated systems.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Generation from renewable and non-renewable sources – Hydro, thermal, nuclear- (block schematic details, environmental and ethical factors, advantages, disadvantages) Solar and wind - (block schematic details, environmental factors, regulations, advantages, disadvantages) Energy storage systems as alternative energy sources – BESS, CESS, thermal SS Load curve – Load duration curve, Load factor, diversity factor, demand factor, Plant capacity factor, plant use factor - Numerical Problems	11
2	Power Transmission System - (Electrical Model)- Line parameters – resistance - inductance and capacitance (Derivation of three phase double circuit) Transmission line modelling - classifications (concept only) – transmission line as two port network – derivation and calculation of ABCD parameters (derivation and numerical problems)	11

	<p>Skin Effect & Ferranti Effect – Corona (qualitative study only) – Surge Impedance Loading</p> <p>Insulators – string efficiency – grading (numerical problems)</p>	
3	<p>Introduction to EHVAC and HVDC: Principle, advantages/disadvantages</p> <p>Underground cables – ratings - classification - Capacitance of cables – grading – 2 types</p> <p>AC Distribution systems – connection schemes – radial and ring main systems – single phase only (numerical problems)</p> <p>Method of power factor improvement using capacitors (numerical problems)</p> <p>Tariff - different types</p> <p>Introduction to energy markets (regulated and deregulated systems)</p>	11
4	<p>Need for protection- Types of protection schemes – primary and back-up</p> <p>Protective relays –</p> <p>Basics of typical electromechanical relay – induction type only</p> <p>Static (block diagrams of o/c and instantaneous o/c relays)</p> <p>Microprocessor (block diagram and flow chart of o/c relay)</p> <p>Fundamentals of Numerical relay</p> <p>Principles of overcurrent, directional, distance and differential</p> <p>Circuit breakers – operating principle – arc phenomenon – arc extinction – principle & methods – Important terms in arc extinction</p> <p>Problems of circuit interruption – capacitive current chopping – ratings of CBs</p> <p>Circuit breaker classification based on medium of arc extinction – SF6 & VCB</p> <p>Introduction to GIS</p>	11

Note: Visit to a nearby substation, identify the components and prepare a report.

Additional topics:

- 1) Calculation of Sag and tension in transmission lines*
- 2) Introduction to Machine Learning in Power System Protection – Insulation co-ordination*
- 3) Overview of Communication: PLCC - Fibre Optic - Introduction to IEC61850*

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
<ul style="list-style-type: none"> 2 Questions from each module. Total of 8 Questions, each carrying 3 marks <p style="text-align: center;">(8x3 =24marks)</p>	<ul style="list-style-type: none"> 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. <p style="text-align: center;">(4x9 = 36 marks)</p>	60

Course Outcomes (COs)

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

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Learn different types of power generating systems and schedule generation appropriate for a given area.	K3
CO2	Evaluate the electrical performance of any transmission line.	K3
CO3	Compute various physical characteristics of overhead and underground transmission systems.	K3
CO4	Demonstrate the working of relays and switch gear for protection schemes.	K2
CO5	Design a simple ac electrical distribution system as per the standards.	K3

Note: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3			2					3
CO2	3	3	3	3								3
CO3	3	3	3	3								3
CO4	3	3	3	3								3
CO5	3	3	3	3								3

Note: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -: No Correlation

Text Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Electrical Power Systems	Wadhwa C. L.	New Age International	8 th edition 2023
2	Principles of Power System	V. K. Mehta and Rohit Mehta	S. Chand	4 th edition reprint 2020
3	Power System Protection and Switchgear	Badri Ramand D.N.Viswakarma	Tata McGraw Hill	2 nd edition, 2011
4	Non-conventional energy sources	B. H. Khan	Tata McGraw Hill	3 rd edition, 2017

Reference Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Engineering and Chemical Thermodynamics	Milo D. Koretsky	Wiley	2 nd Edn, 2012
2	Chemical and Process Thermodynamics	Kyle B.G.	Pearson	3 rd Edn, 2015

Video Links (NPTEL, SWAYAM...)

Module No.	Link ID
1	https://archive.nptel.ac.in/courses/103/103/103103144/
2	https://archive.nptel.ac.in/courses/103/103/103103144/
3	https://archive.nptel.ac.in/courses/103/103/103103144/
4	https://archive.nptel.ac.in/courses/103/103/103103144/