



SARVAJANIK UNIVERSITY
Sarvajnik College of Engineering and Technology
Bachelor of Technology



B.Tech. Semester IV

Subject Name: POWER SYSTEM - 1

Subject Code: BTEL13403

Type of course: Professional core Course

Prerequisite: Fundamental knowledge of Basic Electrical Engineering

Rationale: The course is aimed to provide exposure about methods of electricity generation, various AC supply systems, transmission lines and their parameters, underground cables and their parameters, substation equipments, neutral grounding and sources of over-voltages and protection against them.

Teaching and Examination Scheme:

TEACHING SCHEME				Theory Marks			Practical Marks		Total
L	T	P	C	TEE	CA1	CA2	TEP	CA3	100
3	0	0	3	60	25	15	-	-	

CA1: Continuous Assessment (assignments/projects/open book tests/closed book tests **CA2:** Sincerity in attending classes/class tests/ timely submissions of assignments/self-learning attitude/solving advanced problems **TEE:** Term End Examination **TEP:** Term End Practical Exam (Performance and viva on practical skills learned in course) **CA3:** Regular submission of Lab work/Quality of work submitted/Active participation in lab sessions/viva on practical skills learned in course

Content:

Sr. No.	Topics	Teaching Hrs.	Module Weightage
1.	<p>Conventional & Non-conventional Generation: Introduction, Generating stations, Steam power station, Schematic arrangement of steam power station, Equipments of steam power station, Hydroelectric power station, Schematic arrangement of hydro-electric power station, Constituents of hydro-electric plants, Nuclear power station, Schematic arrangement of nuclear power station, Gas turbine power plant, Schematic arrangement of gas turbine power plant, comparison of various power plants. [1] Concentrated Solar Power (CSP) plant Operation and its working, Photovoltaic Conversion – Introduction, Description and principle of working, performance characteristics of a solar cell, Stand-alone PV system configurations, Grid-connected PV systems Wind Energy Conversion – Rotation principle, Forces on a rotor blade, Factors affecting performance of rotor, Power curve, Working Principal and operation characteristic of WRIG and SCIG based wind turbine power plant. [7,8]</p>	10	17

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2.	<p>Electrical Supply Systems : Electric supply system, Typical A.C. power supply scheme, Comparison of D.C. and A.C. Transmission, Advantages of high transmission voltage, Distribution System, Classification of Distribution Systems, Overhead v/s underground systems, Connection schemes of distribution system, Requirements of a distribution system, AC Distribution – Methods of solving AC distribution problems, Four wires star connected unbalanced load, Examples. [1,3]</p>	04	08
3.	<p>Mechanical Aspects of Overhead Transmission Lines: Main components of over head lines, conductor materials, line supports, insulators, types of insulators, potential distribution over suspension insulators, string efficiency, methods of improving string efficiency, Examples, sag in over head lines, calculation of sag. [1,3]</p>	07	15
4.	<p>Inductance and Capacitance of Overhead Transmission Lines: Introduction, Definition of Inductance, Flux Linkages of an isolated current carrying conductor, Inductance of a single phase two wire line, Conductor types, Flux Linkages of one conductor in group, Inductance of composite conductor lines, Inductance of three phase lines, Double circuit three phase lines, Bundled conductors, Resistance, Skin effect and Proximity effect, Magnetic field induction. Electric field of a long straight conductor, Potential difference between two conductors of a group of parallel conductors, Capacitance of a two wire line, Capacitance of a three phase line with equilateral spacing, Capacitance of a three phase line with unsymmetrical spacing, Effect of earth on transmission line capacitance, Method of GMD, Bundled conductors, Electrostatic induction [2,4]</p>	10	30
5.	<p>Underground Cables: Underground cables, construction of cables, classification of cables, cables for three phase services, insulation resistance of a single core cable, capacitance of a single core cable, dielectric stresses in a single core cable, most economical conductor size in a cable, grading of cables, capacitance grading and inter-sheath grading, capacitance of three core cable and measurements of capacitances. [1.3]</p>	06	15
6.	<p>Substations & Neutral Grounding : Classification of substations, Transformer substation, Pole mounted substation, Underground substation, Symbols for equipments in substations, Equipments in a transformer substation, Bus-bar arrangements in substations, Terminal and through substations, Key diagrams of 66/11 kV substation and 11/400 kV indoor substation.[1,3]</p>	08	15



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	System with ungrounded neutral, Neutral grounding, Advantages of neutral grounding, Methods of neutral grounding – Solid grounding, Resistance grounding, Reactance grounding, Resonant grounding [1,6]		
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Suggested Specification table with Marks (Theory/Practical):

% Distribution of Marks					
R Level	U Level	A Level	N Level	E Level	C Level
20	25	20	15	15	5

Legends: R: Remembrance, **U:** Understanding; **A:** Application, **N:** Analyze, **E:** Evaluate **C:** Create and above Levels (**Revised Bloom’s Taxonomy**)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Text Books:

Sr. No.	Title of book /article	Author(s)	Publisher and details like ISBN	Year of publication	Publication Edition
1	Principles of Power System	V.K.Mehta and Rohit Mehta	S. Chand ISBN: 81-219-2496-0	2009	First Multicolour
2	Modern Power System Analysis	D. P. Kothari, I. J. Nagrath	Tata McGrawHill Publication ISBN (13): 978-0-07-107775-0	2011	Fourth
3	Electric Power Transmission and Distribution	S. Sivanagaraju, S. Satyanarayana	Pearson Education ISBN: 978-81-317-0791-3	2009	First
4	Electrical Power systems	D.Das	New Age International ISBN: 81-224-1885-6	2008	First
5	Power Systems Analysis	John J. Grainger and W. D. Stevenson Jr.	Tata McGrawHill International ISBN (13): 978-0-07-058515-7	2011	First

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6	Electric Power System	C. L. Wadhwa	New Age International Ltd.ISBN: 978-1-906574-39-0	2012	First
7	Solar Energy	S. P. Sukhatme	McGraw Hill Education India Pvt. Ltd	2017	Fourth
8	Wind Power Technology	Earnest Joshua	PHI Learning Pvt. Ltd	2019	Third

Course Outcome:

Sr. No.	CO Statement After learning this subject, students will be able to	Marks % weightage
CO-1	Compare various means of electricity generation.	15
CO-2	Describe supply systems and distribution systems.	10
CO-3	Carry out mechanical design of transmission line.	15
CO-4	Compute transmission line parameters.	30
CO-5	Describe underground cables.	15
CO-6	Acquire knowledge about working of substation equipments, substation layout and methods of neutral grounding.	15

Mapping with POs:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO-1	3	-	2	-	-	2	3	3	3	3	3	3	3	2	3
CO-2	3	3	2	-	-	-	2	2	1	2	2	3	2	-	2
CO-3	3	3	3	1	2	2	2	-	1	-	-	3	3	1	1
CO-4	3	3	3	1	2	-	2	-	1	-	1	3	3	1	-
CO-5	2	3	3	2	2	2	1	-		2	1	3	2	2	-
CO-6	1	2	3	1	3	3	3	2	3	3	3	3	3	3	2
Rationale*	15	14	16	05	09	09	13	07	09	10	10	18	16	09	08

***Rationale:** Explaining why it is matching this particular program outcome

List of Open Source/learning website:

- <https://nptel.ac.in/courses/108/105/108105104/>
- https://swayam.gov.in/nd1_noc19_ee62/preview
- <https://nptel.ac.in/courses/108/104/108104051/>
- <https://nptel.ac.in/courses/108/102/108102047/>