POWER SYSTEM-I

Subject Code : EE405PC
Regulations : R18 - JNTUH
Class : II Year B.Tech EEE II Semester

Department of Electrical and Electronics and Engineering

BHARAT INSTITUTE OF ENGINEERING AND TECHNOLOGY

Ibrahimpatnam - 501 510, Hyderabad

POWER SYSTEM-1(EE405PC)

COURSE CONTENT

I. COURSE OVERVIEW:

The main objective of this course is to understand the basic concepts of power generation, transmission and distribution systems

a) To understand the different types of power generatingstations.
b) To examine A.C. and D.C. distributionsystems.
c) To understand and compare overhead line insulators and Insulatedcables.
d) To illustrate the economic aspects of power generation and tariffmethods.
e) To evaluate the transmission line parameterscalculations
f) To understand the concept ofcorona

II. PREREQUISITE(S):

Level	Credits	Periods/ Week	Prerequisites
UG	3	4	1. Basic Electrical Engineering 2. Electrical Machines-I 3. Electrical Machines-II

III. COURSE OBJECTIVE:

The main objective of this course is to understand the basic concepts of power generation, transmission and distribution systems

1	To understand the different types of power generatingstations
2	To examine A.C. and D.C. distributionsystems
3	To understand and compare overhead line insulators and Insulatedcables
4	To illustrate the economic aspects of power generation and tariffmethods
5	To evaluate the transmission line parameterscalculations
6	To understand the concept ofcorona

IV. COURSE OUTCOMES:

At the end of the course the student will be in a position to

S.No	Description	Bloom's Taxonomy Level
1	Understand the operation of conventional generating stations and renewable sources of electricalpower	Knowledge, Understand (Level 1, Level 2)
2	Understand Economics of power generation Concepts and Evaluate the power tariffmethods	Understand, Analyze (Level 2, Level 4)
3	Understand underground cables andoverhead line insulators	Understand, Analyze (Level 2, Level 4)
4	Determine the electrical circuit parameters of transmissionlines and understand corona	Understand, Analyze (Level 2, Level 4)
5	Understand power distribution systems	Understand, Analyze (Level 2, Level 4)

V. HOW PROGRAM OUTCOMES ARE ASSESSED

Program Outcomes		Level	Proficiency assed by
PO1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	3	Assignments, Mock tests
PO2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	1	Assignments, Mock tests
PO3	**Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	1	Mini projects
PO4	**Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	-	Assignments, Mock tests, Mini projects
PO5	**Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an Understand of the limitations.	1	Assignments, Mock tests
PO6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.	1	Insdustrial visit
PO7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.	-	-
PO8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.	-	-
PO9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	1	Mini projects
PO10	**Communication:**Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	1	Seminars

PO11	**Project management and finance:** Demonstrate knowledge and Understand of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.	1	seminars
PO12	**Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	2	Industrial visits

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) - : None

VI. HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED

Program Specific Outcomes		Level	Proficiency assed by
PSO 1	Talented to analyze, design and implement electrical & electronics systems and deal with the rapid pace of industrial innovations and developments	1	Industrial visits, projects
PSO 2	Skillful to use application and control techniques for research and advanced studies in Electrical and Electronics engineering domain	1	Guest lecturers projects

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) - : None

VII. COURSE CONTENT:

JNTUH SYLLABUS

UNIT - I

Generation of Electric Power

Conventional Sources (Qualitative): Hydro station, Steam Power Plant, Nuclear Power Plant and Gas Turbine Plant. Non-Conventional Sources (Qualitative): Ocean Energy, Tidal Energy, Wave Energy, wind Energy, Fuel Cells, and Solar Energy, Cogeneration and energy conservation and storage.

UNIT -II

Economics of Generation: Introduction, definitions of connected load, maximum demand, demand factor, load factor, diversity factor, Load duration curve, number and size of generator units. Base load and peak load plants. Cost of electrical energy-fixed cost, running cost, Tariff on charge to customer.

UNIT - III

Overhead Line Insulators & Insulated Cables: Introduction, types of insulators, Potential distribution over a string of suspension insulators, Methods of equalizing the potential, testing of insulators. Introduction, insulation, insulating materials, Extra high voltage cables, grading of cables, insulation resistance of a cable, Capacitance of a single core and three core cables, Overhead lines versus underground cables, types ofcables.

UNIT - IV

Inductance & Capacitance Calculations of Transmission Lines: Line conductors, inductance and capacitance of single phase and three phase lines with symmetrical and unsymmetrical spacing, Composite conductors-transposition, bundled conductors, and effect of earth on capacitance.

Corona: Introduction, disruptive critical voltage, corona loss, Factors affecting corona loss and methods of reducing corona loss, Disadvantages of corona, interference between power and Communication lines.

UNIT-V

A.C. Distribution: Introduction, AC distribution, Single phase, 3-phase, 3 phase 4 wire system, bus bar arrangement, Selection of site for substation. Voltage Drop Calculations (Numerical Problems) in A.C.

Distributors for the following cases: Power Factors referred to receiving end voltage and with respect to respective load voltages.

DC Distribution: Classification of Distribution Systems.- Comparison of DC vs. AC and Under- Ground vs. Over- Head Distribution Systems.- Requirements and Design features of Distribution Systems.-Voltage Drop Calculations (Numerical Problems) in D.C Distributors for the following cases: Radial D.C Distributor fed one end and at the both the ends (equal/unequal Voltages) and Ring Main Distributor.

GATE SYLLABUS:

1. Power generation concepts, AC and DC transmission concepts, Models and performance of transmission lines, Cables, Insulators, Distribution systems

IES SYLLABUS:

Basic power generation concepts, Steam, gas and water turbines, transmission line models and performance, cable performance, insulation, corona and radio interference, power factor correction , radial and ring-main distribution systems and fundamentals of power economics.

TEXT BOOKS:

1. W.D. Stevenson – Elements of Power System Analysis, Fourth Edition, McGraw Hill,1984.
2. C.L. Wadhwa – Generation, Distribution and Utilization of Electrical Energy, Second Edition, New Age International,2009.
3. "V.K Mehta and Rohit Mehta", "Principles of Power Systems", Third Edison, S. Chand & Company Ltd, New Delhi,2004.

REFERENCE BOOKS:

1. C.L. Wadhwa – Electrical Power Systems, Fifth Edition, New Age International,2009
2. M.V. Deshpande –Elements of Electrical Power Station Design, Third Edition, Wheeler Pub. 1998
3. H. Cotton &H. Barber-The Transmission and Distribution of Electrical Energy,

NPTEL COURSES:

1. https://swayam.gov.in/nd1_noc20_ee39/preview
2. https://swayam.gov.in/nd1_noc20_me33/preview

VIII. COURSE PLAN:

LESSON PLAN ACADEMIC YEAR 2020-2021 II SEM									
Course Instructor : Dr.Sukanth.T **Class: II EEE A**									
Subject: POWER SYSTEM-I **WEF : 26/03/2021**									
Lecture No.	**Unit No.**	**Topics to be covered**	**Link for PPT**	**Link for PDF**	**Link for Small Projects/ Numericals(if any)**	**Course learning outcomes**	**Bloom's Taxonomy**	**Teaching Methodology**	**Reference**

1		**UNIT-1 Generation of Electric Power:**	https://drive.google.com/drive/folders/1QYuZWhJ2FOGqvD1CRnii16Xk4Jki8eeC?usp=sharing	https://drive.google.com/drive/folders/1QYuZWhJ2FOGqvD1CRnii16Xk4Jki8eeC?usp=sharing	**NA**	CO-1	Understand	chalk & talk	
2		Classification of Energy Sources (Conventional and Non-conventional)	https://drive.google.com/drive/folders/1QYuZWhJ2FOGqvD1CRnii16Xk4Jki8eeC?usp=sharing	https://drive.google.com/drive/folders/1QYuZWhJ2FOGqvD1CRnii16Xk4Jki8eeC?usp=sharing	**NA**	CO-1	Understand	Ppt.	
3		Hydro station	https://drive.google.com/drive/folders/1QYuZWhJ2FOGqvD1CRnii16Xk4Jki8eeC?usp=sharing	https://drive.google.com/drive/folders/1QYuZWhJ2FOGqvD1CRnii16Xk4Jki8eeC?usp=sharing	**DESIGN OF HYDRO STATION**	CO-1	Understand	Ppt.	
4		Steam Power Plant	https://drive.google.com/drive/folders/1QYuZWhJ2FOGqvD1CRnii16Xk4Jki8eeC?usp=sharing	https://drive.google.com/drive/folders/1QYuZWhJ2FOGqvD1CRnii16Xk4Jki8eeC?usp=sharing	**DESIGN OF THERMAL STATION**	CO-1	Understand	Ppt.	
5		Nuclear Power Plant and Gas Turbine Plant	https://drive.google.com/drive/folders/1QYuZWhJ2FOGqvD1CRnii16Xk4Jki8eeC?usp=sharing	https://drive.google.com/drive/folders/1QYuZWhJ2FOGqvD1CRnii16Xk4Jki8eeC?usp=sharing	**NA**	CO-1	Understand	Ppt.	
6	**I**	Non-Conventional Sources (Qualitative), Solar Energy & Ocean Energy	https://drive.google.com/drive/folders/1QYuZWhJ2FOGqvD1CRnii16Xk4Jki8eeC?usp=sharing	https://drive.google.com/drive/folders/1QYuZWhJ2FOGqvD1CRnii16Xk4Jki8eeC?usp=sharing	**SOLAR ENERGY PRODUCTION**	CO-1	Understand	Ppt.	T3 &R1
7		Tidal Energy and Wave Energy	https://drive.google.com/drive/folders/1QYuZWhJ2FOGqvD1CRnii16Xk4Jki8eeC?usp=sharing	https://drive.google.com/drive/folders/1QYuZWhJ2FOGqvD1CRnii16Xk4Jki8eeC?usp=sharing	**NA**	CO-1	Understand	Ppt.	
8		wind Energy and Fuel Cells	https://drive.google.com/drive/folders/1QYuZWhJ2FOGqvD1CRnii16Xk4Jki8eeC?usp=sharing	https://drive.google.com/drive/folders/1QYuZWhJ2FOGqvD1CRnii16Xk4Jki8eeC?usp=sharing	**NA**	CO-1	Understand	Ppt.	
9		Co-generation and energy conservation, Energy storage.	https://drive.google.com/drive/folders/1QYuZWhJ2FOGqvD1CRnii16Xk4Jki8eeC?usp=sharing	https://drive.google.com/drive/folders/1QYuZWhJ2FOGqvD1CRnii16Xk4Jki8eeC?usp=sharing	**NA**	CO-1	Understand	Ppt.	
10		MOCK TEST-1	https://drive.google.com/drive/folders/1QYuZWhJ2FOGqvD1CRnii16Xk4Jki8eeC?usp=sharing	https://drive.google.com/drive/folders/1QYuZWhJ2FOGqvD1CRnii16Xk4Jki8eeC?usp=sharing	**NA**	CO-1	Understand	Ppt.	

11		**UNIT-II Economics of Generation: IntroductionDefinitions of connected load, maximum demand, demand factor, load factor, diversity factor.**	https://drive.google.com/drive/folders/15emt9P6t29zZsjAXWNKV56pcJwfeYVeE?usp=sharing	https://drive.google.com/drive/folders/15emt9P6t29zZsjAXWNKV56pcJwfeYVeE?usp=sharing	**NA**	CO-2	Understand	chalk & talk	
12	**II**	Additional problems	https://drive.google.com/drive/folders/15emt9P6t29zZsjAXWNKV56pcJwfeYVeE?usp=sharing	https://drive.google.com/drive/folders/15emt9P6t29zZsjAXWNKV56pcJwfeYVeE?usp=sharing	**NA**	CO-2	Understand	chalk & talk	
13		Load duration curve, number and size of generator units.	https://drive.google.com/drive/folders/15emt9P6t29zZsjAXWNKV56pcJwfeYVeE?usp=sharing	https://drive.google.com/drive/folders/15emt9P6t29zZsjAXWNKV56pcJwfeYVeE?usp=sharing	**NA**	CO-2	Apply	Hands on practice	
14		Additional problems	https://drive.google.com/drive/folders/15emt9P6t29zZsjAXWNKV56pcJwfeYVeE?usp=sharing	https://drive.google.com/drive/folders/15emt9P6t29zZsjAXWNKV56pcJwfeYVeE?usp=sharing	**NA**	CO-2	Apply	Hands on practice	
15		Base load and peak load plants-Cost of electrical energy-fixed cost, running cost,	https://drive.google.com/drive/folders/15emt9P6t29zZsjAXWNKV56pcJwfeYVeE?usp=sharing	https://drive.google.com/drive/folders/15emt9P6t29zZsjAXWNKV56pcJwfeYVeE?usp=sharing	**NA**	CO-2	Understand	chalk & talk	
16		Tariff on charge to customer-problems	https://drive.google.com/drive/folders/15emt9P6t29zZsjAXWNKV56pcJwfeYVeE?usp=sharing	https://drive.google.com/drive/folders/15emt9P6t29zZsjAXWNKV56pcJwfeYVeE?usp=sharing	**NA**	CO-2	Apply	Hands on practice	
17	**III**	**UNIT-III Overhead Line Insulators & Insulated Cables: Introduction-types of insulators-Potential distribution over a string of suspension insulators**	https://drive.google.com/drive/folders/1fdXzRoBhBIwu7HjG9-UsVByS7QfoQPmp?usp=sharing	https://drive.google.com/drive/folders/1fdXzRoBhBIwu7HjG9-UsVByS7QfoQPmp?usp=sharing	**NA**	CO-3	Understand	chalk & talk	T3 &R1

18		Methods of equalizing the potential over a string	https://drive.google.com/drive/folders/15emt9P6t29zZsjAXWNKV56pcJwfeYVeE?usp=sharing	https://drive.google.com/drive/folders/15emt9P6t29zZsjAXWNKV56pcJwfeYVeE?usp=sharing	**NA**	CO-3	Understand	chalk & talk	
19		PROBLEMS			**NA**	CO-3	Understand and Apply	chalk & talk	
20		Testing of insulators-Introduction, insulation, insulating materials, Overhead lines versus underground cables	https://drive.google.com/drive/folders/1fdXzRoBhBIwu7HjG9-UsVByS7QfoQPmp?usp=sharing	https://drive.google.com/drive/folders/1fdXzRoBhBIwu7HjG9-UsVByS7QfoQPmp?usp=sharing	**NA**	CO-3	Analyze and Apply	Hands on practice	
21		Types of cables Extra high voltage cables-insulation resistance of a cable	https://drive.google.com/drive/folders/1fdXzRoBhBIwu7HjG9-UsVByS7QfoQPmp?usp=sharing	https://drive.google.com/drive/folders/1fdXzRoBhBIwu7HjG9-UsVByS7QfoQPmp?usp=sharing	**NA**	CO-3	Analyze and Apply	Hands on practice	
22		Capacitance of a single core cable, Capacitance of a three core cable	https://drive.google.com/drive/folders/1fdXzRoBhBIwu7HjG9-UsVByS7QfoQPmp?usp=sharing	https://drive.google.com/drive/folders/1fdXzRoBhBIwu7HjG9-UsVByS7QfoQPmp?usp=sharing	**NA**	CO-3	Understand, Analyze	chalk & talk	
23		Grading of cables-PROBLEMS	https://drive.google.com/drive/folders/1fdXzRoBhBIwu7HjG9-UsVByS7QfoQPmp?usp=sharing	https://drive.google.com/drive/folders/1fdXzRoBhBIwu7HjG9-UsVByS7QfoQPmp?usp=sharing	**NA**	CO-3	Understand, Analyze	chalk & talk	
24	**IV**	**UNIT-IV-Inductance & Capacitance Calculations of Transmission Lines: Line conductors-Calculation of Inductance of single phase line**	https://drive.google.com/drive/folders/1PSVJRt_QhUKrg3sF1-SJigeHzd1XH_PK?usp=sharing	https://drive.google.com/drive/folders/1PSVJRt_QhUKrg3sF1-SJigeHzd1XH_PK?usp=sharing	**NA**	CO-4	Knowledge	PPT	
25		Calculation of Inductance three phase line with symmetrical spacing and unsymmetrical	https://drive.google.com/drive/folders/1fdXzRoBhBIwu7HjG9-UsVByS7QfoQPmp?usp=sharing	https://drive.google.com/drive/folders/1fdXzRoBhBIwu7HjG9-UsVByS7QfoQPmp?usp=sharing	**NA**	CO-4	Apply and Understand	chalk & talk	T3 &R1

		spacing							
26		Composite conductors- transposition, bundled conductors- Calculation of Capacitance of single phase line	https://drive.google.com/drive/folders/1fdXzRoBhBIwu7HjG9-UsVByS7QfoQPmp?usp=sharing	https://drive.google.com/drive/folders/1fdXzRoBhBIwu7HjG9-UsVByS7QfoQPmp?usp=sharing	**NA**	CO-4	Apply and Understand	chalk & talk	
27		Calculation of Capacitance of three phase line with symmetrical spacing & unsymmetrical spacing	https://drive.google.com/drive/folders/1fdXzRoBhBIwu7HjG9-UsVByS7QfoQPmp?usp=sharing	https://drive.google.com/drive/folders/1fdXzRoBhBIwu7HjG9-UsVByS7QfoQPmp?usp=sharing	**NA**	CO-4	Understand	chalk & talk	
			https://drive.google.com/drive/folders/1fdXzRoBhBIwu7HjG9-UsVByS7QfoQPmp?usp=sharing	https://drive.google.com/drive/folders/1fdXzRoBhBIwu7HjG9-UsVByS7QfoQPmp?usp=sharing	**NA**	CO-4	Apply and Understand	chalk & talk	
28		Effect of earth on the calculation of capacitance	https://drive.google.com/drive/folders/1fdXzRoBhBIwu7HjG9-UsVByS7QfoQPmp?usp=sharing	https://drive.google.com/drive/folders/1fdXzRoBhBIwu7HjG9-UsVByS7QfoQPmp?usp=sharing	**NA**	CO-4	Apply and Understand	chalk & talk	
29		Corona: Introduction, disruptive critical voltage, corona loss, Factors affecting corona loss	https://drive.google.com/drive/folders/1fdXzRoBhBIwu7HjG9-UsVByS7QfoQPmp?usp=sharing	https://drive.google.com/drive/folders/1fdXzRoBhBIwu7HjG9-UsVByS7QfoQPmp?usp=sharing	**NA**	CO-4	Apply and Understand	chalk & talk	
30		methods of reducing corona loss, Disadvantages of corona, interference between power and Communication lines.	https://drive.google.com/drive/folders/1fdXzRoBhBIwu7HjG9-UsVByS7QfoQPmp?usp=sharing	https://drive.google.com/drive/folders/1fdXzRoBhBIwu7HjG9-UsVByS7QfoQPmp?usp=sharing	**NA**	CO-4	Analyze and Apply	chalk & talk	**T3 &R1**
31		***Mock Test – II***							
32	**V**	**UNIT-V DC Distribution: Classification of Distribution Systems.-**	https://drive.google.com/drive/folders/1h5uvqa89ouzkvWjo8K4tmZRCrHT19Wt5?usp=sharing	https://drive.google.com/drive/folders/1h5uvqa89ouzkvWjo8K4tmZRCrHT19Wt5?usp=sharing	**NA**	CO-5	Knowledge and Understand	PPT	

		Comparison of DC vs. AC and Under-Ground vs. Over- Head Distribution Systems- Requirements and Design features of Distribution Systems							
33		Voltage Drop in D.C Distributors for Radial D.C Distributor fed one end	https://drive.google.com/drive/folders/1h5uvqa89ouzkvWjo8K4tmZRCrHT19Wt5?usp=sharing	**https://drive.google.com/drive/folders/1h5uvqa89ouzkvWjo8K4tmZRCrHT19Wt5?usp=sharing**	**NA**	CO-5	Knowledge and Understand	chalk & talk	
34		Voltage Drop in D.C Distributors for Radial D.C Distributor fed at the both the ends with unequal Voltages	**https://drive.google.com/drive/folders/1h5uvqa89ouzkvWjo8K4tmZRCrHT19Wt5?usp=sharing**	**https://drive.google.com/drive/folders/1h5uvqa89ouzkvWjo8K4tmZRCrHT19Wt5?usp=sharing**	**NA**	CO-5	Understand and Apply	chalk & talk	
35		Ring Main Distributor	**https://drive.google.com/drive/folders/1h5uvqa89ouzkvWjo8K4tmZRCrHT19Wt5?usp=sharing**	**https://drive.google.com/drive/folders/1h5uvqa89ouzkvWjo8K4tmZRCrHT19Wt5?usp=sharing**	**NA**	CO-5	Understand and Apply	chalk & talk	
36		A.C. Distribution: Introduction, Single phase, 3-phase, 3 phase 4 wire system	**https://drive.google.com/drive/folders/1h5uvqa89ouzkvWjo8K4tmZRCrHT19Wt5?usp=sharing**	**https://drive.google.com/drive/folders/1h5uvqa89ouzkvWjo8K4tmZRCrHT19Wt5?usp=sharing**	**NA**	CO-5	Understand and Apply	chalk & talk	
37		bus bar arrangement, Selection of site for substation.	**https://drive.google.com/drive/folders/1h5uvqa89ouzkvWjo8K4tmZRCrHT19Wt5?usp=sharing**	**https://drive.google.com/drive/folders/1h5uvqa89ouzkvWjo8K4tmZRCrHT19Wt5?usp=sharing**	**NA**	CO-5	Understand and Apply	chalk & talk	
38		Voltage Drop Calculations in A.C. Distributors for the Power	**https://drive.google.com/drive/folders/1h5uvqa89ouzkvWjo8K4tmZRCrHT19Wt5?usp=shari**	**https://drive.google.com/drive/folders/1h5uvqa89ouzkvWjo8K4tmZRCrHT19Wt5?usp=shar**	**NA**	CO-5	Understand	chalk & talk	

		Factors referred to receiving end voltage	**ng**	**ing**				
39		Voltage Drop Calculations in A.C. Distributors for the Power Factors referred to respective load voltages.	**https://drive.google.com/drive/folders/1h5uvqa89ouzkvWjo8K4tmZRCrHT19Wt5?usp=sharing**	**https://drive.google.com/drive/folders/1h5uvqa89ouzkvWjo8K4tmZRCrHT19Wt5?usp=sharing**	**NA**	CO-5	Understand	chalk & talk
40		PROBLEMS			**NA**	CO-5	Understand and Apply	chalk & talk
41		REVISION			**NA**	CO-5	Understand and Apply	chalk & talk
42		***Topics beyond the syllabus#11**			**NA**		Knowledge	chalk & talk
43		**REVISION**						
II Mid Examinations								

*** Topics beyond Syllabus**

TEXT BOOKS:

1 W.D. Stevenson – Elements of Power System Analysis, Fourth Edition, McGraw Hill, 1984.
C.L. Wadhwa – Generation, Distribution and Utilization of Electrical Energy, Second Edition,
2 New Age International, 2009.
"V.K Mehta and Rohit Mehta", "Principles of Power Systems", Third Edison, S. Chand & Company Ltd, New Delhi, 2004.
3

REFERENCE BOOKS

1 C.L. Wadhwa – Electrical Power Systems, Fifth Edition, New Age International, 2009
M.V. Deshpande –Elements of Electrical Power Station Design, Third Edition, Wheeler Pub.
2 1998
3 H. Cotton & H. Barber-The Transmission and Distribution of Electrical Energy.

IX. MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcomes	Program Outcomes (PO)												Program Specific Outcomes (PSO)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO 7	PO8	PO 9	PO 10	PO 11	PO1 2	PSO1	PSO2
CO1	3	1	1	1	1	1	-	-	1	-	-	-	2	1
CO2	2	2	1	1	1	1	-	-	1	1	-	-	2	2
CO3	2	1	1	1	1	1	-	-	1	-	1	1	2	2
CO4	2	1	1	1	1	1	-	-	-	1	-	-	1	2
CO5	2	2	1	1	1	1	-	-	1	1	1	-	1	2
Avg	2.2	1.4	1	1	1	1	-	-	0.8	0.6	0.4	0.2	1.6	1.8

1: Slight (Low) 2:Moderate (Medium) 3: Substantial (High) - : None

X. QUESTION BANK: (As Per JNTU, Hyderabad)

UNIT-I

LONG ANSWER QUESTIONS

S.No	Question	Blooms Taxanomy Level	Course Outcome
1	Explain the function of the following in thermal power plant and explain the principle of operation of each: i. Economizer ii. Electrostatic precipitator iii. Condenser iv. Super heater v. Cooling tower	Knowledge	1
2	Draw a general layout of a modern thermal power plant and explain the working of different circuits	Knowledge	1
3	Classify the hydro power plants?	Knowledge	1
4	Give the classification of nuclear reactors and explain about BWR, PWR andFBR with a neat sketch	Knowledge	1
5	Explain in detail the constructional aspects of a gas turbine plant.	Knowledge	1
6	Give the comparison of steam power plant, nuclear power plant and gas power plant on the basis of different factors	Knowledge	1
7	Enumerate & explain essential components of a nuclear reactor	Knowledge	1
8	Discuss and compare the performance of different types of boilers used inthermal power plants	Knowledge	1
9	Draw a general layout of a modern nuclear power plant and explain each component in detail?	Knowledge	1
10	Define Non conventional energy source? Give the examples for Non conventional energy sources and explain them in detail	Knowledge	1

SHORT ANSWER QUESTIONS

S.No	Question	Blooms Taxanomy Level	Course Outcome
1	Why pulverized fuel is preferred	knowledge	1
2	What are the functions of Economizer Super Heater	knowledge	1
3	Discuss about nuclear fission process?	knowledge	1
4	What are the different merits and demerits of nuclear power plant?	knowledge	1

5	Discuss about nuclear fusion process?	knowledge	1
6	What are the different merits and demerits of thermal power plant?	knowledge	1
7	What are the different merits and demerits of hydel power plant?	knowledge	1
8	What are the points to be considered for the selection of site for thermal power plant?	knowledge	1
9	What are the points to be considered for the selection of site for hydel power plant?	knowledge	1
10	What are the points to be considered for the selection of site for nuclear power plant?	knowledge	1

UNIT-II

LONGANSWER QUESTIONS

S.No	Questions	Blooms Taxanomy Level	Course Outcome
1	What do you understand by the load curve? What information is conveyed by a load curve	Apply	2
2	Write short notes on the following: a) Two - part tariff b) Power factor tariff. c) Three - part tariff	Apply	2
3	A generating station has a connected load of 43MW and a maximum demand of 20 MW; the units generated being 60 x 106 per annum. Calculate (a) the demand factor and (b) load factor	Apply	2
4	From a load duration curve, the following data are available: the maximum demand on the system is 25 MW. The load supplied by two units is 15 MW and 12.5 MW. Unit no.1 acts as a base load unit and No.2 as a peak load unit. The base load unit works for 100% of the time and peak load unit for only 40% of time. The energy generated by unit No.1 is 1×10 8 units and that by No.2 is 1×10 7 units. Determine the load factor, plant capacity factor and plant use factor of each unit and load factor of the total plant.	Understand and Apply	2
5	Give the basis for expressing the cost of electrical energy as (a + b kW + c kWh) and explain the factors on which a, b, and c depend	Apply	2
6	A hydro electric plant costs Rs. 3000 Per KW of installed capacity the total annual charges consists of 5% as interest, depreciation at 2%, operation and maintenance at 2% and insurance, rent etc.1.5%. Determine the suitable two parts tariff if the losses in transmission and distribution are 12.5% and diversity of load is 1.25. Assume that maximum demand on the station is 80% of the capacity and annual load factor is 40%. What is the overall cost of generation per KWh.	Understand	2

SHORT ANSWER QUESTIONS

S.No	Questions	Blooms Taxanomy Level	Course Outcome
1	Define connected load.	knowledge	2
2	Define maximum demand.	knowledge	2
3	Define demand factor.	Understand	2

4	Define average load.	knowledge	2
5	Define load factor.	knowledge	2
6	Define Diversity factor.	knowledge	2
7	Define Load curve, Load duration curve	knowledge	2
8	What is tariff? Classify tariff?	knowledge	2
9	What are the factors affecting tariff?	knowledge	2
10	Define the base load and peak load plants?	knowledge	2

UNIT-III

LONGANSWER QUESTIONS:

S.No	Questions	Blooms Taxanomy Level	Course Outcome
1	Derive an expression for capacitance of a single core cable.	Understand	3
2	Give a brief note of Capacitance grading mathematically.	Understand	3
3	Calculate the capacitance & charging current of a single core cable used on a 3-ph, 66 KV system. The cable is 1 km long having a core diameter of 10cm & an insulation thickness of 7cm. Relative permittivity of insulation is 4 at 50Hz.	Apply	3
4	What is an Underground cable & explain its construction with a neat diagram	Understand	3
5	Explain about the types of cables based on operating voltage	Understand	3
6	What is String efficiency and what are the methods to improve it	Understand	3
7	Each line of a 3-Phase system is suspended by a string of 3 similar insulators. If the voltage across the line unit is 17.5 KV, calculate the line to neutral voltage. Assume that the shunt capacitance between each insulator and earth is 1/5 of the capacitance of the insulator itself. Also find the string efficiency	Apply	3
8	Explain about Pin type & Suspension type insulators with neat diagrams?	Understand	3
9	Give a brief note of strain & shackle insulators with neat diagrams?	Understand	3
10	Derive a mathematical expression for string efficiency of 4 suspension type insulators	Understand	3

SHORT ANSWER QUESTIONS

S.No	Questions	Blooms Taxanomy Level	Course Outcome
1	What are the different types of insulators?	Knowledge	3
2	What are the different methods to improve string efficiency?	Knowledge	3
3	Explain about capacitance grading in overhead insulators?	Understand	3
4	Explain the different types of cables?	knowledge	3
5	Derive the expression for resistance of a Single core cable?	knowledge	3
6	Compare overhead lines and underground cables?	knowledge	3
7	What are the different types of Insulating materials?	Understand	3
8	Explain about Inter-sheath grading?	Understand	3
9	Explain about Inter-sheath grading?	Understand	3
10	Derive the expression for capacitance of a Single core cable?	Understand	3

UNIT IV

LONG ANSWER QUESTIONS

S.No	Questions	Blooms Taxanomy Level	Course Outcome
1	A 3-Phase, 50 Hz, 66 KV, 100 Km overhead line conductors are placed in a horizontal plane with diameter of 1.25 cm. Calculate the capacitance & charging current per phase assuming complete transposition of the line.	Apply	4
2	Explain the effect of earth on capacitance calculations mathematically	Apply	4
3	Derive an expression for 3 phase capacitance in symmetrical& asymmetrical configuration	Apply	4
4	Derive an expression for 3 phase inductance in asymmetrical configuration	Apply	4
5	Derive an expression for inductance of a single phase two wire line.	Apply	4
6	Derive an expression for capacitance of a single phase two wire line.	Apply	4
7	Derive an expression for 3 phase inductance in symmetrical configuration	Apply	4

SHORT ANSWER QUESTIONS

S.No	Questions	Blooms Taxanomy Level	Course Outcome
1	Define GMD and GMR?	Apply	4
2	Explain about skin effect?	Apply	4
3	Explain about proximity effect?	knowledge	4
4	What are different types of transmission conductors?	knowledge	4
5	Why we prefer double circuit lines in transmission?	knowledge	4
6	Explain the concept of corona?	knowledge	4
7	Explain the concept Radio Interference?	knowledge	4
8	What are the different factors affecting the corona?	knowledge	4
9	Explain about proximity effect?	knowledge	4
10	What are the disadvantages of corona?	knowledge	4

UNIT V

LONG ANSWER QUESTIONS

S.No	Questions	Blooms Taxanomy Level	Course Outcome
1	An 800m distributor fed from both ends A and B is loaded uniformly at the rate of 1.2A/m run, the resistance of each conductor being 0.05 ohm per/km.Determine the minimum voltage and the point where it occurs if feeding points A and B are maintained at 255 V and 250 V respectively. Find also the current supplied from feeding point A and B.	Apply	5
2	A two conductor main AB, 500m in length is fed from both ends at 250V. Loads of 50A, 60A, 40A and 30A are tapped at distance of 100m, 250m, 350m and 400m from end A respectively. If the cross section of conductors be 1cm 2 and specific resistance of the material is 1.7μΩ-cm. Determine the minimum consumer voltage	Apply	5
3	A three phase ring main PQRS fed at P of 11 kV, supplies	Apply	5

	balanced loads of50 A at 0.8 p.f lagging at Q, 120 A at unity p.f at R and 70A at 0.866 lagging at S, the resistances being referred to the various sections are: Section PQ = (1+j0.6) ohm; section QR = (1.2+j0.9) ohm; Section RS = (0.8+j0.5) ohm; SectionSP=(3+j2) ohm. Determine the currents in various sections and station bus-bar voltages at Q, R and S		
4	A single phase AC distributor 1 km long has resistance and reactance per conductor of 0.1 ohm and 0.15 ohm respectively. At the far end, the voltageVB = 200 volts and the current is 100 A at the power factor of 0.8 (lagging). At the midpoint M of the distributor, a current of 100 A is tapped at a power factor0.6lagging with reference to the voltage VM at the midpoint. Calculate (a) Voltage at midpoint (b) Sending end voltage VA (c) Phase angle between VA and VB	Apply	5
5	A single phase two wire feeder, 1500m long, supplies a load of 60A at 0.8 p.f, 40A at 0.85 p.f and 50A at 0.88 p.f lagging at distances of 600, 1200 and 1500 meters respectively from the feeding point. The resistance and reactance of the feeder per Km length are 0.06 and 0.1 ohms respectively. If the voltage at the far end is to be maintained at 220V. Calculate the voltage at the sending endand its phase angle with respect to the receiving end voltage.	Apply	5
6	A2-wirefeederABChasaloadof120AatCandof60AatBbothatP.F.0.8 lagging. The impedance AB is (0.04+j0.08) Ω and that of BC is(0.08+j0.12) Ω. If the voltage at the far end C is to be maintained at 400V, determine the voltage a) at A and b) at B	Apply	5
7	A single phase distributor 2km long supplies a load of 120A at 0.8 power factor lagging at its far end and a load of 80A at 0.9 power factor lagging at its mid-point. Both power factors are referred to the voltage at the far end. The resistance and reactance per km (go and return) are 0.05ohms and0.1ohms respectively. If the voltage at the far end is maintained at 230V, calculate i) Voltageat the sending end. ii. Phase angle between the voltages at the two ends.	Apply	5

SHORT ANSWER QUESTIONS

S.No	Questions	Blooms Taxanomy Level	Course Outcome
1	Classify various types of dc distributors	knowledge	5
2	What are the undesirable effects of voltage variations	knowledge	5
3	Define feeder, distributor, service mains	knowledge	5
4	What are the factors affecting to design feeder	knowledge	5
5	What are the factors affecting to design distributor	knowledge	5
6	What are the advantages ring main distributor	knowledge	5
7	Compare DC and AC distribution systems	knowledge	5
8	Compare under-ground and over head distribution systems	knowledge	5
9	Explain briefly the various systems of a.c distribution	knowledge	5
10	Explain the following with neat diagrams: i. AC 3-phase, 3 wire distribution system ii. AC 3-phase, 4 wire system	knowledge	5

OBJECTIVE QUESTIONS: As Per JNTU, Hyderabad

UNIT-1

1. Which of following power plants is free from environmental problem?
   a)Steam b) Hydroelectric c) Nuclear d) Diesel engine
2. Gas turbine power plants for maximum efficient may have
   a)Reheating b) Heat exchangers c) Multistage compression d) All of above
3. Which of the following plants has the maximum capital cost?
   a) Diesel plants b) Nuclear plants c) Hydro-plants d) Steam plants
4. Which of following generating plants has the minimum operating cost?
   a) Diesel plants b) Nuclear plants c) Hydro-plants d) Steam plants
5. Direct conversion of heat energy into electrical energy is possible through.
   a) Thermal converters b) Fuel or solar cell. c) MHD generator d) Both A and C.
6. A regenerator in a gas turbine
   (a) reduces heat loss in exhaust (b) permits use of higher compression ratio
   (c) improves thermal efficiency (d) permits use of fuels of inferior quality..
7. The total power of a wind power is proportional to
   (a) velocity of stream (b) (velocity of stream)^2
   (c) (velocity of stream)^3 (d) 1/ (velocity of stream)
8. Batteries used for electrical energy storage are
   (a) Laclanche cells (b) Edison cells
   (c) Lead acid cells (d) Any of the above.
9. The function of a moderator in a nuclear reactor is.....
   (a)To slow down the fast moving electrons (b)To speed up the slow moving electron
   (c)To start the chain reaction (d)To transfer heat inside the reactor to exchanger
10. In a nuclear reactor function of reflector is to.....
    (a)Reduce the speed of the neutrons (b)Stop the chain reaction
    (c)Reflect the escaping neutrons back into the core (d)None of the above
11. _____power plants will take long period in erection and installation.
12. _____power plants can generate power at unpredictable or uncontrollable time.
13. A thermal power plant is being supplied with coal having much more ash content than that for which it was designed. _____units needs major modifications.
14. A generating station which has a high investment cost and low operating cost is usually operated as a _____.
15. A gas turbine power plant is best suited for _____plants.
16. Pulverized coal means_____.
17. In a hydro-electric plant _____conduct system for taking water from the intake works to the turbine is known as
18. Solar cells are made of_____.
19. _____are Batteries used for electrical energy storage.
20. The function of a surge tank is_____

UNIT-2

1. For economy in generation power
   a)diversity factor should be high b)plant utilization factor
   c)load factor should be high d)load factor and diversity factor should be low.
2. Size and cost of installation depends upon _____
   a) average load b) maximum demand c) square mean load d) square of peak load
3. For a thermal power plant, which is not the fixed cost ?
   a) Interest on capital b)Depreciation c)Insurance charges d)Cost of fuel.
4. Depreciation cost of a plant is calculated by
   a)Straight line method b)Diminishing value method
   c)Sinking fund method d)Any of the above.
5. For the same plant size, initial cost of which plant is the highest ?
   a)Steam power plant b)Diesel engine plant
   c)Nuclear power plant d)Gas turbine plant.

6. Capacity factor and load factor become identical when
   a) peak load is equal to the capacity of the plant
   b) Average load is half the capacity of the plant
   c) Average load is same as peak load
   d) Group diversity factor is equal to peak diversity factor
7. Which of the following relation is incorrect ?
   a) Capacity factor = Utilization factor x Load factor
   b) Load factor x Maximum load = Average load
   c) Demand factor x Connected load = Maximum demand
   d) None of the above.
8. A low utilization factor for a plant indicates that
   a) plant is under maintenance
   b) plant is used for base load only
   c) plant is used for stand by purpose only
   d) plant is used for peak load as well as base load.
9. Sinking fund is
   a) Initial value - Salvage value
   b) Capital cost - Operating cost
   c) Periodical maintenance - Breakdown maintenance
   d) Capital cost / Useful life.
10. In what practice is the value of diversity factor?
    a) Less than Unity b) Geater than Unity
    c) Equal to or greater than Unity d) Less than zero
11. The area under the load curve represents _____
12. The load of a consumer is generally measured in terms of_____
13. The ratio, maximum demand of the installation / sum of individual maximum demands is known as_____
14. The highest point on a load curve represents_____
15. When maximum and average loads are equal, the load factor will be_____
16. Coincidence factor is reciprocal of _____
17. Size and cost of installation depends upon _____
18. The normal connected load of a domestic consumer is usually_____
19. diversity factor is always _____unity
20. load factor is curve drawn between_____

UNIT-3

1. Which of the following material is not used for overhead line insulators?
   a) Porcelain b) Glass c) PVC d) Steatite
2. Which of the following is the main field of application of pin type insulator?
   a) Distribution system b) Transmission system
   c) Transmission and distribution system d) EHV transmission system
3. Which type of insulator is used where there is dead end of the line or there is a corner or a sharp curve, for high voltage line?
   a) Pin type insulator b) Shackle insulator c) Strain insulatord) Stay insulator
4. What is the most common cause of failure of overhead line insulators?
   a) Flashoverb) Mechanical stressc) Porosity of materialsd) Improper vitrification
5. The maximum voltage of the disc type insulators is at
   a. Same at all points b. Near the tower or starting of the insulator.
   c. Near to the conductors. d. None of these.

6. Why are sheaths used in cables?
   a. Provide proper insulation. b. Provide mechanical strength.
   c. Prevent ingress of moisture. d. None of these.
7. The thickness of insulation layer provided on the conductor, in cables depend on_____.
   a. Operating voltageb. Current to be carried.c. Power factor.d. Both (a) and (b)
8. What is the purpose of bedding on the underground cables?
   a. To avoid leakage of current. b. To protect the sheath against corrosion.
   c. To protect the sheath from mechanical injury due to armouring. d. Both (b) and (c)
9. What is empire tape?
   a. Impregnated paper b. Vulcanised rubber c. Enamel insulation d. Varnished cambric
10. To get a minimum value of stress (g_{max}) what should be the ratio of core diameter to sheath diameter?
    a. 1 / 2.718 b. 2.178 c. 1 / 3.78 d. 3.78
11. In cables the charging current drawn by the cable leads the voltage by _____.
12. Suspension insulator are made up of _____
13. _____type of insulator is used on 132 kV transmission lines?.
14. The number of discs in a string of insulators for 400 kV ac over head transmission line lies in the range of _____
15. The safety factor of an insulator is _____
16. _____type of insulators is used in guy wires.\
17. Each disc in a suspension type of insulators is designed for _____ voltage
18. The insulation resistance of a cable of length 10 km is 1M Ω . For a length of 100 km of the same cable, _____ will be the insulation resistance?
19. _____many cores are used in a cable for the transmission of voltages upto 66 kV?.
20. The cable best suited for the transmission of voltages from 33 kV to 66 kV is_____

UNIT -4

1. The bundling of conductors is done primarily to
   a)reduce reactance b)increase reactance
   c)increase ratio interference d)reduce radio interference.
2. When two conductors each of radius r are at a distance D, the capacitance between the two is proportional to
   a)$\log_e$ (D/r) b)$\log_e$ (r/D) c)1/$\log_e$ (D/r) d)1/$\log_e$ (r/D).
3. On which factor is the corona loss dependent on?
   a) Material of the conductor. b) Diameter of the conductor.
   c) Height of the conductor. d) None of these.
4. What is the effect on corona, if the spacing between the conductors is increased?
   a. Corona increases. b. Corona is absent. c. Corona decreases. d. None of these.
5. Which of these given statements is wrong in consideration with bundled conductors?
   a. Control of voltage gradient.b. Reduction in the radio interference.
   c.Reduction in corona loss. d. Increase in interference with communication lines.
6. The effect of dirt on the surface of the conductor is to _____ irregularity and thereby _____ the break down voltage.
   a. Decreases, reduces. b. Increases, increases.
   c. Increases, reduces. d. Decreases, increases.
7. On what factors does the skin effect depend upon?
   a. Cross section of the conductors. b. Supply frequency.
   c. Permeability of the conductor. d. All of these.

8. By using which conductor is the skin effect reduced?
   a. Bundled conductors. b. Stranded conductors.
   c. Hollow conductors. d. Solid conductors.
9. Proximity effect is due to the current flowing in the _____.
   a. Earth b. Sheath. c. Nearby conductors. d. All of these.
10. The inductance of a transmission line is minimum when_____
    a. GMD is high. b. GMR is high.
    c. Both GMD and GMR are high. d. GMD is low and GMR is high.
11. The leakage current in the transmission lines is referred by_____
12. Self GMD concept is used for the calculation of _____
13. GMD stands for_____
14. The fictitious resistance, " r' " implemented in the conductors for the calculation of the inductance is _____
15. Apart from the skin effect the phenomena which cause/s the non uniform distribution of the current is _____
16. ACSR stands for_____
17. _____ conductors are the latest trend of the extra high voltage lines.
18. The chances of corona are maximum during_____weather conditions.
19. Transposition of transmission lines means_____
20. If the diameter of the conductor is increased then inductance_____

UNIT-5

1. What is the main type of distribution system in India?
   a. Radialb. Parallel c. Network d. Both (b) and (c)
2. In a distribution system, which of the following items shares the major cost?
   a. Conductors b. Earthing systems c. Distribution transformer d. Insulators
3. Which distribution system is energized by two or more generating stations or substations?
   a. Radial systems. b. Interconnected systems.
   c. Ring main systems. d. All of these.
4. If the voltage of the system is about 230 V, then what would be the highest and the lowest permissible voltage?
   a. 242 and 214 V b. 240 and 210 V c. 244 and 216 V d. 244 and 212 V
5. A uniformly loaded dc distributor is fed at both ends with equal voltages. In comparison to a similar distributor fed at one end only, what will be the drop at the midpoint be?
   a. One fourth b. Half c. One third d. One sixth
6. Why are the boosters inserted in the circuit?
   a. Reduce current. b. Increase current.
   c. Reduce voltage drop. d. Compensate for voltage drop.
7. Which of these systems uses the 3 phase 4 wire system?
   a. Primary distribution b. Secondary distribution
   c. Primary transmission. d. Secondary transmission.
8. In the design of a distributor which of the following is the major consideration?
   a. Voltage drop b. Current carrying capacity
   c. Frequency d. KVA system
9. For most reliable distribution supply, the configuration used isa
   a. Radial main b) Ring main c) Parabolic main d) Balancing main
10. Which of the following materials are not used for the transmission and distribution of electrical power?
    a)Copper b)Aluminium c)Tungsten d)Steel
11. Name the cable which connects the distributor to the consumer terminals is called _____
12. _____ is the permissible limit of voltage variations allowed in the distribution systems?
13. _____of distribution is preferred in residential areas?
14. For purely domestic loads _____ type of distribution is employed?
15. The generating voltage and frequency in India is _____

16. Greater the power factor the _____ is the volume of copper required.
17. The most suitable practical voltage of primary distribution is_____
18. In a tap changing transformer, the tappings are provided on_____winding
19. _____main consideration while designing feeder
20. _____the voltage of the single-phase supply to residential consumers.

XI. ENGINEERING SERVICES WEBSITES:

1. www.upsc.gov.in
2. www.aceenggacademy.com
3. www.madeeasy.in

XII. JOURNALS (NATIONAL & INTERNATIONAL):

1. www.ieee.org
2. www.worldscientific.com
3. www.springer.com
4. www.sciencedirect.com