Syllabus

CODE	COURSE NAME	CATEGORY	L	T	P	CREDITS
EET 283	INTRODUCTION TO POWER ENGINEERING	Minor	3	1	0	4

Preamble : 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.

Prerequisite : EST 130Basics of Electrical & Electronics Engineering

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

CO 1	Illustrate various conventional sources of energy generation
CO 2	Analyse the economics of power generation
CO 3	Analyse the economics of power factor improvement
CO 4	Design mechanical parameters of a transmission system.
CO 5	Design electrical parameters of a transmission system.
CO 6	Classify different types of ac and dc distribution systems.

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	3										2
CO 2	3	3										2
CO 3	3	3										2
CO 4	3	3										2
CO 5	3	3										2
CO 6	3	3										2

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember (K1)	10	10	10
Understand (K2)	20	20	40
Apply (K3)	20	20	50
Analyse (K4)	-	-	-
Evaluate (K5)	-	-	-
Create (K6)	-	-	-

End Semester Examination Pattern : There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. Schematic and equipment of Conventional Power generation schemes (K1)
2. Comparison of various turbines associated with conventional generation (K2, K3)

Course Outcome 2 (CO2):

1. Definition and Calculation of various terms associated with power generation (K1, K2)
2. Problems on economics of power generation. (K2, K3)

Course Outcome 3 (CO3):

1. Problems on calculation of size of capacitors for power factor improvement (K2, K3).
2. Problems on economics of power factor placement (K2, K3).

Course Outcome 4 (CO4):

1. Derivation of various mechanical parameters associated with transmission line (K2, K3)
2. Derivation and problems of corona and insulators. (K2, K3).

Course Outcome 5 (CO5):

1. Derivation of various electrical parameters associated with transmission line (K2, K3).
2. Definition on transposition of line and changes in electrical parameters (K1,K2)

Course Outcome 6 (CO6):

1. Problems on AC and DC distribution systems (K2,K3).
2. Architecture and technologies in smart grid (K2,K3)

Model Question paper

QPCODE: PAGES:3

Reg.No:_____

Name :_____

APJABDULKALAMTECHNOLOGICALUNIVERSITY

FIRSTSEMESTERB.TECHDEGREEEXAMINATION, MONTH &YEAR

Course Code: EET 283

Course Name: Introduction to Power Engineering

Max.Marks:100 **Duration: 3Hours**

PART A

Answer all Questions. Each question carries 3 Marks

1. What are the main differences between nuclear and thermal power plants?
2. How are turbines classified? How is a turbine selected for a site?
3. Explain the significance of Load factor and Load curve.
4. Discuss the disadvantages of low power factor in power system.
5. What is corona? Explain the factors have an influence on corona loss
6. High voltage is preferred for transmission. Discuss the merits and demerits of high voltage transmission.
7. Draw and explain the equivalent models of a medium transmission line.
8. What is transposition of lines? Comment on its necessity in the system.
9. Discuss the requirements of a distribution system.
10. Discuss the main features of an interconnected distribution system.

(10x3=30)

PART B

Answer any one full question from each module. Each question carries 14 Marks

Module 1

11. (a) Explain thegeneral arrangement of gas turbine power plant. **(8)**

    (b) Discuss the importance of small hydro power generation along with their advantages and disadvantages. **(6)**

12. (a) Explain various elements of a elements of diesel power plant **(8)**

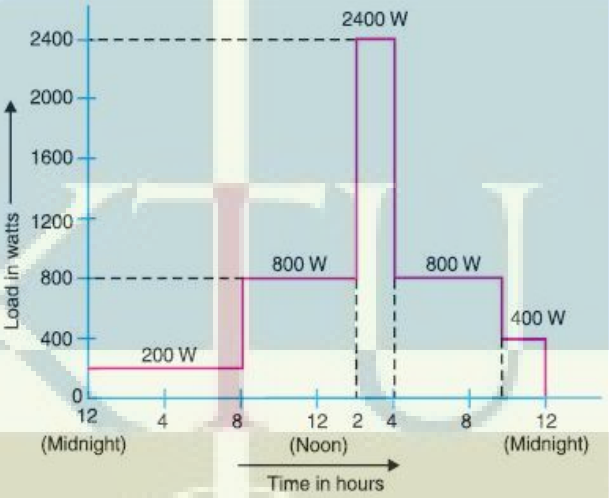
    (b) Explain the general layout of a nuclear power plant. **(6)**

Module 2

13. (a)A generating station has a maximum demand of 150000 kW. The annual load factor is 50% and plant capacity factor is 40%. Determine the reserve capacity of the plant. **(6)**

    (b) The power factor in a three-phase plant with supply voltage of 400 V and absorbing an average power of 300 kW is 0.8. Determine the kVAr of the capacitor required to improve the power factor to 0.93. Determine the reduction in current drawn from the supply after installation of the capacitors. **(8)**

14. (a) Determine average demand and load factor of the load curve shown below **(7)**



    (b) Explain any two methods of power factor improvement. **(7)**

Module 3

15. (a) Derive the equation for Sag in transmission lines, when the support is at equaland unequal heights. **(10)**

    (b) Discuss the difference between disruptive critical corona and visual critical corona **(4)**

16. (a) In a 33 kV overhead line, there are three units in the string of insulators. If the capacitance between each insulator pin and earth is 11% of self-capacitance of each insulator, find (i) the distribution of voltage over 3 insulators and (ii) string efficiency. **(9)**

    (b) Discuss various types of conductors used in power system. **(5)**

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Module 4

17. (a) A 3 phase 70km long Transmission line has its conductors of 1 cm diameter spaced at the corners of the equilateral triangle of 100cm side. Find the inductance per phase of the system. **(6)**

    (b) Derive loop inductance of a single phase two wire line. **(8)**

18. (a) The three conductors of a 3-phase line are arranged at the corners of a triangleof sides 2 m, 2·5 m and 4·5 m. Calculate the inductance per km of the line when the conductors areregularly transposed. The diameter of each conductor is 1·24 cm. **(6)**

    (b)A single-phase transmission line has two parallel conductors 3 m apart,radius of each conductor being 1 cm. Calculate the capacitance of the line per km. **(8)**

Module 5

19. (a) Compare radial and ring main distribution system with the help of appropriate schematics. **(6)**

    (b) A two conductor main, AB, 500m in length is fed from both ends at 250 V. Loads of 50A, 60A, 40A and 30A are tapped at distances of 100m, 250m, 350m and 400m from end A respectively. If the cross section of conductor is 1 cm^2 and specific resistance of the material is 1.7 μΩcm, determine the minimum consumer voltage. **(8)**

20. (a) A 2-wire dc distributor cable AB is 2 km long and supplies loads of 100A, 150A,200A and 50A situated 500 m, 1000 m, 1600 m and 2000 m from the feeding point A. Each conductor has a resistance of 0·01 Ω per 1000 m. Calculate the p.d. at each load point if a p.d. of 300 V is maintained at point A. **(7)**

    (b) Explain the architecture of smart grid with the help of a schematic **(7)**

(14x5=70)

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

Text Books

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.

Course Contents and Lecture Schedule:

No	Topic	No. of Lectures
1	**Conventional energy sources (9 hours)**	
1.1	Introduction and history ofpower generation	1
1.2	Hydel power plant- Schematic, components and turbines	2
1.2	Steam power plant – Schematic, components and turbines	2
1.3	Schematic and various turbines with diesel and GT power generation	3
1.4	Nuclear power generation	1
2	**Economics of power generation and power factor improvement (8 hours)**	
2.1	Important terms associated with power generation such as load factor, load curve, etc	1

2.2	Numerical problems on the economics of generation.	2
2.3	Significance of power factor in power system	1
2.4	Methods of power factor improvement	2
2.5	Numerical problems on capacitor value evaluation and economics of power factor improvement	2
3	**Transmission System (10 Hours)**	
3.1	Introduction to transmission systems	1
3.2	Mechanical design of transmission lines- line supports and conductors	2
3.3	Types of insulators	1
3.4	String Efficiency, Methods of improving string efficiency, Numerical problems	2
3.5	Corona - Critical disruptive voltage : Visual Critical Voltage –corona loss	1
3.6	Factor affecting corona and corona loss, Numerical problems on corona	2
3.7	Sag in transmission lines	1
4	**Electrical parameters of a transmission line (9 Hours)**	
4.1	Introduction to constants of transmission line	1
4.2	Derivation of inductance and capacitance of a single phase transmission line	2
4.3	Derivation of Inductance and capacitance of a three phase transmission line with symmetrical and unsymmetrical spacing, transposition of lines	3
4..4	Numerical problems on inductance, capacitance of transmission lines	3
5	**Distribution systems (9 Hours)**	
5.1	Introduction to distribution system	1
5.2	DC distribution system – various types	2
5.3	Numerical Examples of DC distribution system	1
5.4	AC distribution system – various types	2
5.5	Numerical Examples of DC distribution system	2
5.6	Introduction to smart grid	1