Total No. of Questions—**12**] [Total No. of Printed Pages—**6**

Seat No.	

[5057]-56

S.E. (Electrical) (Second Semester) EXAMINATION, 2016

POWER SYSTEM-I

(2008 COURSE)

Time : Three Hours **Maximum Marks : 100**

N.B. **:—** (*i*) Answer *three* questions from each Section.

(*ii*) Answers to the two Sections should be written in separate answer-books.

(*iii*) Neat diagrams must be drawn wherever necessary.

(*iv*) Figures to the right indicate full marks.

(*v*) Use of logarithmic table, slide rule, Mollier chart, electronic pocket calculator and steam table is allowed.

(*vi*) Assume suitable data, if necessary.

SECTION I

1. (*a*) Define the following factors associated with load characteristics : [8]

(*i*) Load factor

(*ii*) Demand factor

(*iii*) Diversity factor

(*iv*) Annual plant use factor.

P.T.O.

(*b*) What are the objectives of tariff ? Explain the role of incentives and penalties to encourage the customer to keep load factor and power factor high. [8]

Or

2. (*a*) What do you understand by load curve and load duration curve ? What information is obtained from them ? [6]

(*b*) The maximum demand on a power plant is 60 MW. The plant capacity factor is 0.6 and the utilization factor is 0.8. Find : [6]

(*i*) Load factor

(*ii*) Plant capacity

(*iii*) Reserve capacity

(*iv*) Annual energy production.

(*c*) Write a short note on time of day tariff. [4]

3. (*a*) What are the major electrical equipments used in power plant ? List them all. [6]

(*b*) Define the term string efficiency. Why string efficiency of suspension type insulator is less than 100% ? State different methods of equalization of potential across each unit of a string of suspension insulators and explain any *one* of them in brief. [10]

Or

4. (*a*) Write a note on control room equipments in a generating station. [8]

(*b*) A string of 4 insulators has a self-capacitance equal to 10 times the shunt capacitance. Find, the voltage distribution across various units expressed as a percentage of total voltage across the string and string efficiency. [8]

5. (*a*) Derive the expression for inductance per phase of a three-phase overhead transmission line with unsymmetrical spacing between conductors (with transposition). [10]

(*b*) A two conductor single phase line operates at 50 Hz. The diameter of each conductor is 20 mm and the spacing between the conductors is 3 m. Calculate :

(*i*) The inductance of each conductor per km

(*ii*) The loop inductance of the line per km

(*iii*) The inductive reactance per km

(*iv*) The loop inductance per km of the line when the conductor material is steel of relative permeability 50. [8]

Or

6. (*a*) Derive the expression for internal and external flux linkage of a conductor carrying current I and thereafter derive the expression for inductance of a single phase line. [10]

(*b*) A three-phase 50 Hz line consists of three conductors each of diameter 21 mm. The spacing between the conductors is as follows :

A–B = 3 m, B–C = 5 m, C–A = 3.6 m.

Find the inductance and inductive reactance per phase per km of the line. [8[

SECTION II

7. (*a*) Derive the expression for capacitance per km of a single phase overhead transmission line having distance 'D' between the conductors and '*r*' as the radius of each conductor. [8]

(*b*) A three-phase line has conductors of 5 mm diameter placed at the corners of an equilateral triangle of 1.5 m side. Calculate the capacitive reactance and capacitive susceptance to neutral per phase per km. [10]

Or

8. (*a*) Explain the 'Method of images' in determining the effect of earth on the capacitance calculation for overhead transmission lines. [8]

(*b*) A two conductor single phase line operates at 50 Hz. The diameter of each conductor is 2 cm and is spaced 3 m apart.

Calculate :

(*i*) the capacitance of each conductor to neutral per km

(*ii*) line to line capacitance

(*iii*) capacitive susceptance of neutral per km. [10]

9. (*a*) Give classification of transmission lines based on length. Explain the influence of power factor on the performance of a transmission line. [8]

(*b*) Derive the expression for ABCD constants of a long transmission line in hyperbolic form. [8]

Or

10. (*a*) Obtain the relationship for the sending end voltage and current in terms of receiving end voltage and current for a medium length transmission line with nominal pi method. [8]

(*b*) Calculate ABCD constants for a three-phase, 50 Hz long transmission line with the following parameters : [8]

$R = 24\ \Omega$

$L = 0.192\ H$

$C = 1.28 \times 10^{-6}\ F$

$G = 0.$

11. (*a*) Derive the expression for sag and tension of a overhead transmission line supported between the towers of the same height. [8]

(*b*) Calculate the capacitance and charging current of a single core cable used for a 3-phase, 66 kV system. The cable is 1 km long having a core diameter of 10 cm and an impregnated paper insulation of thickness 7 cm. The relative permittivity of the insulation may be taken as 4 and the supply at 50 Hz. [8]

Or

12. (*a*) Derive the expression for maximum and minimum dielectric stress in a single core cable. [8]

(*b*) A transmission line has a span of 200 meters between level supports. The conductor has a cross-sectional area of 1.29 cm^2, weighs 1170 kg/km and has a breaking stress of 4218 kg/cm^2. Calculate the sag for a safety factor 5, allowing a wind pressure of 122 kg/m^2 of projected area. What is vertical sag ? [8]