Total No. of Questions—**12**] [Total No. of Printed Pages—**8**

Seat No.	

[4657]-36

S.E. (Electrical) (Second Semester) EXAMINATION, 2014

POWER SYSTEM—I

(2008 PATTERN)

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

N.B. **:—** (*i*) Answer Q. No. **1** *or* Q. No. **2**, Q. No. **3** *or* Q. No. **4**, Q. No. **5** *or* Q. No. **6** from Section I and Q. No. **7** *or* Q. No. **8**, Q. No. **9** *or* Q. No. **10**, Q. No. **11** *or* Q. No. **12** from Section II.

(*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 tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.

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

SECTION I

1. (*a*) Define the following factors associated with the generating stations : [6]

(*i*) Demand Factor

P.T.O.

(*ii*) Diversity Factor

(*iii*) Load Factor.

(*b*) Write a short note on H.T. and L.T. customer. [4]

(*c*) The load on the power plant on a typical day is : [6]

Time (Hour)	**Load (MW)**
12—6 am	10
6—10 am	30
10 am—6 pm	60
6—10 pm	90
10 pm—12 am	20

Plot the daily load curve and load duration curve. Also find the energy supplied by the plant in 24 hours.

Or

2. (*a*) What are the economical advantages of interconnected operation of power generating stations ? [6]

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

(*c*) A generating station supplies different customer groups : [6]

(*i*) Industrial consumer : 700 MW load

(*ii*) Commercial consumer : 300 MW load

(*iii*) Domestic consumer : 500 MW load.

The maximum demand on the station is 1000 MW and number of kWh generated per year is 60×10^5. Determine :

(*i*) Diversity factor

(*ii*) Average load

(*iii*) Annual load factor.

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

(*b*) A string of suspension insulators consists of four units. The capacitance between each link pin and earth is 1/10th of the self-capacitance of a unit. The voltage between the line conductor and earth is 132 kV. Find the voltage distribution across each unit and string efficiency. [8]

Or

4. (*a*) What are the major electrical equipments used in a power plant ? List them all. [7]

(*b*) Discuss the necessity of excitation system used for alternators. Explain *one* of the types of excitation system used for alternators in brief. [9]

5. (*a*) Derive an expression for the inductance of a three-phase overhead transmission line when conductors are unsymmetrically spaced but transposed. [6]

(*b*) What is the effect of using bundled conductors on line inductance ? [6]

(*c*) Write a note on Skin effect. [6]

Or

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

(*b*) A three-phase 50 Hz single circuit bundled conductor overhead transmission line with two sub-conductors per phase has horizontal spacing with 6.1 m between the center lines of the adjacent phases. The distance between the sub-conductors of each phase is 30.5 cm and each sub-conductor has a diameter of 2.54 cm. Find the inductance per phase per km of the line. [8]

SECTION II

7. (*a*) Derive the expression for the capacitance per phase of a three-phase overhead transmission line with symmetrical spacing of conductors, taking into account the effect of earth. Assume complete transposition. Comment on the effect of earth on the capacitance of the transmission line. [10]

(*b*) A single-phase 10 km line is 6 m above the ground. The diameter of each conductor is 2 cm and is separated 4 m horizontally. Find : [8]

(*i*) Capacitance between the conductors with the effect of ground.

(*ii*) Capacitance between phase and neutral taking the presence of ground into account.

(*iii*) Capacitance between the conductors neglecting the presence of ground.

(*iv*) Charging current when the line is charged at 33 kV, 50 Hz.

Or

8. (*a*) Explain the 'Method of Images' in determining the effect of earth on the capacitance calculation for overhead transmission lines. [6]

(*b*) Derive the equation for capacitance per km of a single-phase overhead transmission line having distance 'D' between the conductors and radius of each conductor '*r*'. [6]

(*c*) A 220 kV, 50 Hz, 100 km long three-phase transmission line has its conductors at the corners of a triangle with sides 6 m, 6 m and 10 m. The conductor radius is 1.5 cm. Find the capacitance per phase per km and charging current per phase. [8]

9. (*a*) Determine the generalized circuit constants of medium transmission line. Also prove that the transmission line behaves like a symmetrical network and reciprocal network. [8]

(*b*) A single circuit, 50 Hz, three-phase, 250 km long transmission line has :

(*i*) $r = 0.3\ \Omega$/km,

(*ii*) L = 2.1 mH/km and

(*iii*) C = 0.014 μF/km.

Find A, B, C and D constants of the line using long line consideration. [8]

Or

10. (*a*) Give classification of transmission line. Explain the effect of load power factor on regulation and efficiency. [8]

(*b*) Derive the expression for parameters of equivalent "π" circuit in terms of line parameters for a long transmission line. [8]

11. (*a*) What is meant by sag in an overhead line ? Derive the expression for sag when supports are at equal level. [8]

(*b*) What are the types of cable faults ? Explain any *one* method of location of faults in underground cable. [8]

Or

12. (*a*) Derive an expression for capacitance of a single core cable. [8]

(*b*) A transmission line has a span of 120 m between level supports. The conductor has cross-sectional area of 3 cm^2. The tension in the conductor is 2000 kg. The specific gravity of the conductor material a 9.9 gm/cm^3. If the wind pressure is 1.5 kg/m length of conductor, calculate the sag. What is the vertical sag ? [8]