BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: BE **SEMESTER : V**
BRANCH: EEE **SESSION : MO/19**

SUBJECT: EE5207 POWER SYSTEM - I

TIME: 3 HOURS **FULL MARKS: 60**

INSTRUCTIONS:
1. The question paper contains 7 questions each of 12 marks and total 84 marks.
2. Candidates may attempt any 5 questions maximum of 60 marks.
3. The missing data, if any, may be assumed suitably.
***4*. Before attempting the question paper, be sure that you have got the correct question paper.**
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

Q.1(a) With the equation for electric stress developed at the surface of the conductor, mention the reason of corona discharge. [2]

Q.1(b) Prove that a transmission line conductor between two supports at equal heights takes the form of a catenary? [4]

Q.1(c) A transmission line conductor at a river crossing is supported from two towers at height of 50 and 80 metres above water level. The horizontal distance between the towers is 300 metres. If the tension in the conductor is 2000 kg find the clearance between the conductor and water at a point midway between the towers. Weight of conductor per meter = 0.844 kg. Assume that the conductor takes the shape of parabolic curve. [6]

Q.2(a) With proper connection diagram, mention the importance of introducing tie line in radial distribution system. [2]

Q.2(b) A 2 wire d.c. distributor cable AB is 2 km long and supplies loads of 100 A, 150 A, 200 A, and 50 A situated 500 m, 1000 m, 1600 m and 2000 m from the feeding point A. Each conductor has a resistance of 0.01 ohm per 1000 m. Calculate the voltages at load point if a 300 V supply is maintained at A. [4]

Q.2(c) Drive the condition for the most economical cross sectional area of the conductor according to the Kelvin's law. Explain the findings with graphical representation. [6]

Q.3(a) A single core cable has a core diameter of 2.5 cm, insulation thickness of 1.25 cm and resistivity of the insulation is 4.5×10^4 ohm-cm. Calculate the insulation resistance per km. [2]

Q.3(b) With proper diagrams, describe different types of insulators used with transmission towers. [4]

Q.3(c) Each of the three insulators forming a string has a self –capacitance of C farads. The shunting capacitance of the connecting metal of each insulator is 0.2 C to earth and 0.1 C to the line. Calculate the voltage across each insulator as a percentage of the line voltage to earth and also the string efficiency. [6]

Q.4(a) Justify with proper equation that In loss line under surge impedance loading the voltage and current at any point along the line are constant in magnitude and are equal to their sending end values. [2]

Q.4(b) Utilizing the hyperbolic functions of ABCD parameters for long line, derive and draw the equivalent pi model of long line. Show the values of pi model are same as medium line if the length is shorter than long length values. [4]

Q.4(c) A 50 Hz three phase transmission line is 280 km long. It has a total series impedance of 35 + j 140 ohms and a shunt admittance of 930×10^{-6} mho. It delivers 40000 kW at 220 kV with 0.9 power factor lagging. Find the sending end voltage, voltage regulation, transmission efficiency and A, B, C, D constants by short line approximation. [6]

Q.5(a) Mention briefly the Static VAR compensator with proper diagram [2]

Q.5(b) Prove that the direction of power flow between two buses depends on the voltage angles of the two buses. [4]

Q.5(c) A three phase, 60 Hz, 500 Kv transmission line is 300 km long supplying a 3 phase load of 1000MVA,0.8 power factor lagging at 500 kV. Consider characteristic impedance Zc =290.43 ohm and ßl= 21.641^0. Determine the Mvar and the capacitance of the shunt capacitor to be installed at the receiving end to keep the receiving end voltage at 500 kV when the line is energized with 500 Kv. Consider the line is loss less line. [6]

Q.6(a) Define power factor tariff and mention the importance of this tariff. [2]

Q.6(b) Discuss the importance of keeping proper diversity factor and load factor in economic operation of power system. [4]

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Q.6(c) There are four consumers of diversity having different load requirements at different timings. [6]
Consumer 1 : Average load = 1 kW,Maximum demand = 5 kW at 8 p.m
Consumer 2:Maximum demand = 2 kW at 9 p.m.,Demand of 1.6 kW at 8 p.m., Daily load factor = 0.15
Consumer 3:Maximum demand = 2 kW at 12 noon,Load of 1 kW at 8 p.m.,Average load of 500 W
Consumer 4:Maximum demand = 10 kW at 5 p.m.,Load of 5 kW at 8 p.m.,Daily load factor = 0.25
The maximum demand of the system occurs at 8 p.m. Determine (a) the diversity factor (b) average load and load factor of each consumer, (c) Average load and Load factor of the combined load.

Q.7(a) Define Ferranti effect with proper equation. [2]

Q.7(b) Derive capacitance of a single phase two wire line and then derive capacitance between line and neutral. [4]

Q.7(c) A three phase 80 km long transmission line has its conductors of 1.0 cm diameter spaced at the corners of the equilateral triangle of 100cm side. Find the inductance per phase of the system. [6]

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