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Manipal Institute of Technology, Manipal

(A Constituent Institute of Manipal University)



V SEMESTER B.TECH (ELECTRICAL & ELECTRONICS ENGINEERING)

END SEMESTER EXAMINATIONS, NOV/DEC 2015

SUBJECT: GENERATION, TRANSMISSION & DISTRIBUTION

[ELE 307]

REVISED CREDIT SYSTEM

Time: 3 Hours

02 December 2015

MAX. MARKS: 50

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Instructions to Candidates:

- ✤ Answer ANY FIVE FULL questions.
- Missing data may be suitable assumed.
- Use of graph sheet is allowed
- **1A.** Bring out the difference between i) plant capacity factor and plant use factor ii) diversity factor and load factor
- **1B.** Define specific speed of a hydro turbine. Compare the specific speeds of different hydro turbines. The available discharge for a hydroelectric power plant under a head of 30m is 300m³/s. The turbine efficiency is 90% & the generator is directly coupled to the turbine. The frequency of generation is 50 cycle /sec & number of poles used is 24. Find the number of machines required when a Francis turbine with a specific speed of 280 is used.
- **1C.** With neat schematic diagrams, explain the Radial feeder and Ring main used in distribution system.
- **2A.** Explain the function and materials used for the following in a nuclear power plant (i) Moderator (ii) Coolant (iii) Control rods.
- **2B.** What is the function of condenser? Compare the different types of condenser used in thermal power plants.
- 2C. Discuss the possible ways of increasing thermal efficiency of a coal fired power plant. (04)
- **3A.** In a single phase system, line conductors a and a in parallel, form one circuit while conductors b and b in parallel, form the return path. Calculate the total inductance and capacitance of the line per km assuming that current is equally shared by the two parallel conductors. Conductor diameter in 2 cm.



(04)

- **3B.** Derive an expression for inductance per phase of a 3 phase transmission system with symmetrical spacing.
- **3C.** A 200km long, 3-phase, overhead line has R= 48.7 Ω /ph, X_L=80.20 Ω /ph and Capacitance (line to neutral) 8.42nF/km. It supplies a load of 13.5MW at a voltage of 88kV and power factor 0.9 lagging. Using nominal T circuit model, find the sending end voltage, current, regulation, and efficiency.
- 4A. The constants of a 3-phase line are A=0.9 ∠2° and B=140 ∠70° ohm/ph. The line delivers 60MVA at 132kV and 0.8pf lagging. Draw the receiving circle diagram and hence find i) Sending end voltage and approximate power angle ii) The maximum power which the line can deliver with the above values of sending and receiving end voltages iii) the rating of phase modifier when the load is removed and iv) the extra load which can be supplied when the magnitude of rating of phase modifier is maintained as calculated in (iii).
- **4B.** What is sag? Explain the factors affecting the sag. Derive the expression for sag when a conductor is suspended between two towers.
- **5A.** Consider a string of 3 suspension insulator where the capacitance from pin to earth is half of capacitance between link pins. The maximum voltage per unit is not to exceed 20 kV. Calculate i) the maximum voltage that the string can withstand ii) string efficiency and iii) the pin to line capacitance which is closer to the conductor, if the string efficiency is to be increased to 97% using guard ring. Take the pin to line capacitance of the top insulator as one tenth of capacitance between link pins.
- **5B.** Discuss the desirable properties of insulating materials used for overhead transmission lines.
- 5C. The total corona loss of 3 phase, 50 Hz, 200 km long line is 28149 kW. Each conductor has a diameter of 1 cm & placed 2.5 m apart. Temperature=27°C, Pressure= 73.15 cm of Hg, m_o=0.85, m_v for visual corona=0.83 & the breakdown strength of air is 30kV/cm (peak). Determine the operating line voltage and also check whether corona is visible or not.
- **6A.** With a neat sketch, explain the construction of single core underground cable.
- **6B.** A single core cable for use on 3-phase, 11 kV, 50 Hz system has conductor area of 0.65 cm² and internal diameter of sheath is 2.18 cm. The permittivity of the dielectric used in the cable is 3.5. Find (i) the maximum electrostatic stress in the cable, (ii) the minimum electrostatic stress in the cable, (ii) the minimum electrostatic stress in the cable per km length when the charging current is 0.76 A, iv) the economical diameter of the core?
- **6C.** Explain the tests conducted on three core belted cable to measure capacitance per phase of the cable. (03)

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