

This question paper contains 4 printed pages.]

Your Roll No.

8485

A

B.Tech. (P/T)/III
Paper EEE-303-POWER SYSTEM-I

Time : 3 Hours

Maximum Marks : 70

*(Write your Roll No. on the top immediately
on receipt of this question paper.)*

Answer any five questions.

Question No. 1 is compulsory.

Assume missing data, if any.

1. (a) A conductor of 1 cm dia. passes centrally through a porcelain cylinder of internal dia. 2 cm and external dia. 7 cm. The cylinder is surrounded by a tightly fitting metal sheath. The permittivity of porcelain is 5 and the peak voltage gradient in air must not exceed 34 kV/cm. Determine the maximum safe working voltage. 7
- (b) A single core lead covered cable is to be designed for 66 kV to earth. Its conductor radius is 0.5 cm and its three insulating materials A, B and C have relative permittivities of 4, 2.5 and 4.6

[P.T.O.]

- with maximum permissible stresses 60, 40 and 50 kV/cm respectively. Determine the minimum internal diameter of lead sheath. Discuss the arrangement of the insulating materials. 7
2. (a) Explain clearly the 'skin effect' and 'proximity effect' when referred to overhead lines. 5
- (b) Derive expression for the inductance of a 3- ϕ line with conductors untransposed. What is the significance of imaginary term in the expression for inductance ? Hence derive the expression for inductance for a completely transposed line. 7
- (c) Explain clearly the 'Ferranti effect' with a phasor diagram. 2
3. (a) A short 3-phase transmission line has a series line impedance per phase of $(20 + j 50)$ ohm. The line delivers a load of 50 MW at 0.7 p.f lag. Determine the regulation of the line and the A, B, C, D parameters of the line. If the same load is delivered at 0.7 p.f lead, determine the regulation of the line. System voltage is 220KV. 8
- (b) Explain how you obtain A, B, C, D parameters of a model of a long transmission line in the laboratory. 6
4. (a) An overhead line has the following data : span length 185 metre. Difference in levels of supports 6.5 metres, conductor dia. 1.82 cm, weight per unit length of conductor 2.5 kg/metre, wind

pressure 49 kg/m^2 of the projected area. Maximum tensile stress of the conductor 4250 kg/cm^2 . factor of safety 5. Calculate the allowable sag in metres at the lower support. 8

- (b) An overhead line of a river crossing is supported from two towers of heights 30 metres and 90 metres above water level with a span of 300 metres. The weight of the conductor is 1 kg/metre and the working tension is 2200 kg. Determine the clearance between the conductor and the water level midway between the towers. 6
5. (a) Determine the voltage across each disc of suspension insulators as a percentage of the line voltage to earth. The self and capacitance to ground of each disc is $1C$ and $0.2C$ respectively. The capacitance between the link pin and the guard ring is $0.1C$. 7
- (b) A string of six insulator units has mutual capacitance 10 times the capacitance to ground. Determine the voltage across each unit as a fraction of the operating voltage. Also determine the string efficiency. 7
6. (a) Explain briefly the 'Intersheath Grading Method' of insulated cable. 7
- (b) Derive the expression for the capacitance of a 3-core cable. 7

7. (a) Distinguish between a feeder, distributor and service main in a distribution scheme. 5
- (b) List and explain the different equipments used in a sub-station. 5
- (c) Why is the charging current more in cables than in Transmission lines? 4
8. Write short notes on any *two* : 14
- (a) Radial main distributors
- (b) Ring main distributors
- (c) Shunt Compensation
- (d) Arcing horn