Hall Ticket No | | | | | | | | | | | Question Paper Code:AEEC15

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
(Dundigal-500043, Hyderabad)

B.Tech V SEMESTER END EXAMINATIONS (REGULAR) - DECEMBER 2022
Regulation:UG20

ELECTRICAL POWER TRANSMISSION SYSTEMS

Time: 3 Hours **(ELECTRICAL AND ELECTRONICS ENGINEERING)** **Max Marks: 70**

Answer ALL questions in Module I and II
Answer ONE out of two questions in Modules III, IV and V
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

MODULE – I

1. (a) Derive the expression for inductance of a composite conductor with GMR and GMD concept and supportive diagrams. [BL: Understand| CO: 1|Marks: 7]

   (b) A 3-phase, 50 Hz, 66 kV overhead line conductors are placed in a horizontal plane as shown in Figure 1. The conductor diameter is 1.25 cm. If the line length is 100 km, calculate i) Capacitance per phase ii) Charging current per phase, assuming complete transposition of the line. [BL: Apply| CO: 1|Marks: 7]

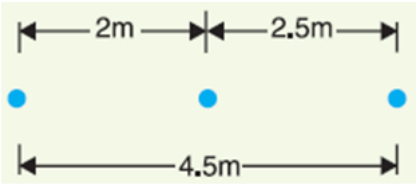

Figure 1

MODULE – II

2. (a) Explain the methods of increasing the string efficiency. Which method is generally preferred? Justify your answer. [BL: Understand| CO: 2|Marks: 7]

   (b) A three-phase overhead transmission line is being supported by three-disc suspension insulators. The potentials across the first and second insulator from the top are 8 kV and 11 kV respectively. Calculate i) The line voltage ii) The ratio of capacitance between pin & earth to self-capacitance of each unit iii) The string efficiency. [BL: Apply| CO: 2|Marks: 7]

MODULE – III

3. (a) Describe the classification of transmission line based on both voltage rating and length of line. [BL: Understand| CO: 3|Marks: 7]

(b) A 3-phase, 50 Hz transmission line 125 km long delivers 20 MW at 0.9 p.f. lagging and at 110 kV. The resistance and reactance of the line per phase per km are 0.16 Ω and 0.32 Ω respectively, while capacitance admittance is 2.0×10^{-6} Siemen/km/phase. Calculate: i) The current and voltage at the sending end ii) Efficiency of transmission. Use nominal T method.[BL: Apply| CO: 3|Marks: 7]

4. (a) Explain Ferranti effect with supportive phasor diagrams. How to minimize the Ferranti effect? [BL: Understand| CO: 4|Marks: 7]

(b) An 80-km long, 3-phase, 50-Hz transmission line has following line constants: Resistance/phase/km = 0.125Ω Reactance/phase/km = 0.625Ω Susceptance /phase/km = 12.5×10^{-6} Siemen If the line supplies load of 20 MW at 0.9 p.f. lagging at 66 kV at the receiving end, calculate by nominal π method i) Sending end power factor ii) Regulation iii) Transmission efficiency [BL: Apply| CO: 4|Marks: 7]

MODULE – IV

5. (a) Describe the attenuation, distortion, reflection and refraction coefficients pertaining to propagation of surges. [BL: Understand| CO: 5|Marks: 7]

(b) A 500 kV 2 μ sec rectangular surge on a line having a surge impedance of 350 ohms approaches a station at which the concentrated earth capacitance is 3000 pF. Determine the maximum value of the transmitted wave. [BL: Apply| CO: 5|Marks: 7]

6. (a) Explain how the corona considerations affect the design of a line. What are the advantages and disadvantages of corona? [BL: Understand| CO: 5|Marks: 7]

(b) A 3-phase, 220 kV, 50 Hz transmission line consists of 1.5 cm radius conductor spaced 2 meters apart in equilateral triangular formation. If the temperature is 40°C and atmospheric pressure is 76 cm, calculate the corona loss per km of the line. Take $m_o = 0.85$. [BL: Apply| CO: 5|Marks: 7]

MODULE – V

7. (a) Illustrate with neat diagram and supportive derivations for cable voltage, capacitance grading of Underground cable. [BL: Understand| CO: 6|Marks: 7]

(b) A single core cable has a conductor diameter of 1 cm and internal sheath diameter of $1 \cdot 8$ cm. If impregnated paper of relative permittivity 4 is used as the insulation, calculate the capacitance for 17km length of the cable. [BL: Apply| CO: 6|Marks: 7]

8. (a) With a neat diagram explain the types of DC links. Select and justify the most preferred DC link for HVDC Long Distance bulk power transmission. [BL: Understand| CO: 6|Marks: 7]

(b) The capacitance per kilometer of a 3-phase belted cable is 0.18 μF between two cores with the third core connected to sheath. Calculate the kVA taken by 20 km long cable when connected to 3-phase, 50 Hz, 3300 V supply. [BL: Apply| CO: 6|Marks: 7]