Hall Ticket No | | | | | | | | | | | Question Paper Code: AEE011

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

MODEL QUESTION PAPER

B. Tech V Semester End Examinations, November – 2019

Regulation: R16

TRANSMISSION AND DISTRIBUTION SYSTEMS

(Electrical and Electronics Engineering)

Time: 3 hours **Max. Marks: 70**

Answer ONE Question from each Unit
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

UNIT – I

1. a) A 3-phase , 50hz, 66kv over head transmission line has conductors arranged at the corners of an equivalent triangular of 3m sides and the diameter of each conductor is 1.5cm determine 'L' and 'C' per phase, if l=100km. also calculate charging current. **[7M]**

   b) Calculate the inductance/ph if diameter=1.5cm. **[7M]**

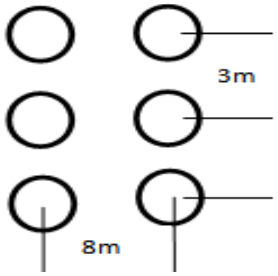

Figure: 1

2. a) Determine the capacitance and the charging inductance per Km. when the transmission line of figure operating at 132kv. **[7M]**

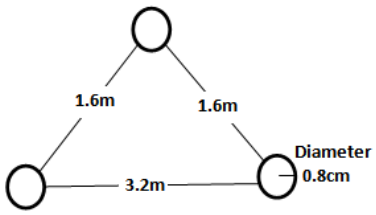

Figure: 3

   b) A 3-phase, 220 kV, 50 Hz transmission line consists of 1·5 cm radius conductor spaced 2 metres apart in equilateral triangular formation. If the temperature is 40ºC and atmospheric pressure is 76 cm, calculate the corona loss per km of the line. Take $m_o = 0{\cdot}85$. **[7M]**

UNIT – II

3. a) A 1-phase transmission line has a resistance of 0.20 ohm and an inductance of 0.40 ohm. Find the voltage at the sending end to give 500KVA at 2KV at the receiving end at power factor of (i) Unity (ii) 0.707 lagging. Illustrate with suitable phasor diagrams. **[7M]**

   b) Show that for a transmission line receiving end voltage and current (V_r and I_r) in terms of sending end voltage and current (V_s and I_s) and auxiliary constants are given by $V_r = DV_s - B_s$ and $I_r = -CV_s + AI_s$. **[7M]**

4. a) A three phase 5 km long transmission line, having resistance of 0.5 Ω / km and inductance of 1.76mH/km is delivering power at 0.8 pf lagging. The receiving end voltage is 32kV. If the supply end voltage is 33 kV, 50 Hz, find line current, regulation and efficiency of the transmission line. **[7M]**

   b) A 50Hz transmission line 300 km long total series impedance of 40+j25 Ω and total shunt admittance of 10-3 mho. The 220 KV with 0.8 lagging power factor. Find the sending end voltage, current, power and power factor using nominal-pi method. **[7M]**

UNIT – III

5. a) A string of 5 insulators is connected across a 100 kV line. If the capacitance of each disc to earth is 0·1 of the capacitance of the insulator, calculate (i) the distribution of voltage on the insulator discs and (ii) the string efficiency. **[7M]**

   b) A string of 6 suspension type insulators is to be graded to obtain uniform distribution of voltage across the string. If the pin- to earth capacitances are all equal to C and the mutual capacitance of the top insulator is 10 C find the mutual capacitance of each unit in terms of C. **[7M]**

6. a) Calculate the insulation resistance for 5km length of a 1-core cable. Resistance of insulation(impregnated paper) is 5×10^{14} ohm-cm, insulation thickness is 1 cm and radius of conductor is 1.25 cm. **[7M]**

   b) The capacitances of a 3-phase belted cable are 12·6 μF between the three cores bunched together and the lead sheath and 7·4 μF between one core and the other two connected to sheath. Find the charging current drawn by the cable when connected to 66 kV, 50 Hz supply. **[7M]**

UNIT – IV

7. a) A 132 kV transmission line has the following data : Wt. of conductor = 680 kg/km ; Length of span = 260 m Ultimate strength = 3100 kg ; Safety factor = 2. Calculate the height above ground at which the conductor should be supported. Ground clearance required is 10 metres. **[7M]**

   b) A transmission line has a span of 275 m between level supports. The conductor has an effective diameter of 1·96 cm and weighs 0·865 kg/m. Its ultimate strength is 8060 kg. If the conductor has ice coating of radial thickness 1·27 cm and is subjected to a wind pressure of 3·9 gm/ cm^2 of projected area, calculate sag for a safety factor of 2. Weight of 1 c.c. of ice is 0·91 gm. **[7M]**

8. a) Derive expressions for sag and tension in a power conductor strung between to supports at equal heights taking into account the wind and ice loading also. **[7M]**

b) A transmission line conductor at river crossing is supported from two towers at heights of 50 metres and 80 meters above water levels. The horizontal distance between the towers is 300 meter. If the tension in the conductor is 2000 kg, find the clearance between the conductors and water level at a point between the towers. Weight of conductor per meter= 0.844 kg. Assume that the conductor takes the shape of parabola. **[7M]**

UNIT – V

9. a) Discuss how voltage drop is calculated in a distribution system **[7M]**

b) A single phase feeder circuit has total impedance (2+j6) ohms, receiving end voltage is 11 kv and current is $40\angle -45^0$A. **[7M]**

Determine

i) P.f of load

ii) Load p.f for which the drop is maximum

iii) Load p.f for which impedance angle is maximum and also , derive the formula used.

10. a) Explain briefly about different types of D.C distributors **[7M]**

b) Four lines A,B,C and D are connected to a common point O. Resistances of AO,BO,CO and DO are respectively 1,2,3 and 4 ohms(both go and return) and feeding points A,B,C and D are maintained at 230,250,240 and 220 volts respectively. Find the potential of common point O assuming no load to be tapped from there. **[7M]**

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COURSE OBJECTIVES:

I	Determine the performance parameters of transmission lines.
II	Evaluate the voltage regulation and efficiency of short, medium and long transmissions lines.
III	Demonstrate the mechanical design of overhead lines, cables and insulators.
IV	Illustrate the importance sag in the design of overhead transmission lines.
V	Discuss the operation of different distribution schemes and design of feeders.

COURSE OUTCOMES:

CO 1	Determine the value of Resistance, inductance and capacitance of transmission lines and study the effect of corona.
CO 2	Model the short, medium and long transmission lines and study the Ferranti effect and surge impedance loading.
CO 3	Demonstrate the working of different types of insulators, calculate the string efficiency and also illustrate the importance of underground cables.
CO 4	Estimate the Sag and tension in overhead transmission lines in different conditions.
CO 5	Discuss the different types of distribution systems, its economic considerations along with the Indian electricity rules and present grid scenario.

COURSE LEARNING OUTCOMES:

AEE011.01	Formulate the transmission line parameters(resistance, inductance and capacitance)
AEE011.02	Estimate the value of inductance and capacitance of different configurations.
AEE011.03	Illustrate the effect of ground on the capacitance calculations
AEE011.04	Explain corona, effects of corona in power system, power loss due to corona, advantages and disadvantages
AEE011.05	Classify the transmission line based on the length of the conductor and voltage levels.
AEE011.06	Analyze the nominal T model, nominal-π models and end capacitor models of medium transmission lines and long length transmission lines
AEE011.07	Evaluate the efficiency and regulation of short, medium and long length transmission lines.
AEE011.08	Describe Ferranti effect in long transmission lines.
AEE011.09	Differentiate different insulators used in overhead and underground transmission lines
AEE011.10	Deduce the string efficiency of suspension type insulators, voltage distribution across string of insulators and methods to improve string efficiency.
AEE011.11	Construct single core and three core underground cables for transmission of power in highly populated areas.
AEE011.12	Calculate the sag and tension with equal and unequal heights of towers

AEE011.13	Illustrate the effect of wind and ice on weight of the conductors for the calculation of sag.
AEE011.14	Compare different distribution systems (AC Vs DC distribution, Ring main Vs Radial).
AEE011.15	Evaluate the voltage drops in AC distributors and DC distributors. Design of substation
AEE011.16	Discuss Indian electricity rules, various voltage levels of transmission and distribution systems, Indian grid scenario.
AEE011.17	Explore the knowledge and skills of employability to succeed in national and international level competitive examinations.

MAPPING OF SEMESTER END EXAMINATION – COURSE OUTCOMES:

SEE Question No		Course Learning Outcomes		Course Outcomes	Bloom Taxonomy Levels
1	a	AEE011.04	Explain corona, effects of corona in power system, power loss due to corona, advantages and disadvantages	CO 1	Understand
	b	AEE011.02	Estimate the value of inductance and capacitance of different configurations so as to compensate it	CO 1	Understand
2	a	AEE011.02	Estimate the value of inductance and capacitance of different configurations so as to compensate it	CO 1	Understand
	b	AEE011.02	Estimate the value of inductance and capacitance of different configurations so as to compensate it	CO 1	Understand
3	a	AEE011.06	Analyze the nominal T model, nominal-π models and end capacitor models of medium transmission lines and long length transmission lines	CO 2	Understand
	b	AEE011.07	Evaluate the efficiency and regulation of short, medium and long length transmission lines.	CO 2	Understand
4	a	AEE011.07	Evaluate the efficiency and regulation of short, medium and long length transmission lines.	CO 2	Understand
	b	AEE011.07	Evaluate the efficiency and regulation of short, medium and long length transmission lines.	CO 2	Understand
5	a	AEE011.11	Construct single core and three core underground cables for transmission of power in highly populated areas.	CO 3	Understand
	b	AEE011.10	Deduce the string efficiency of suspension type insulators, voltage distribution across string of insulators and methods to improve string efficiency.	CO 3	Understand
6	a	AEE011.11	Construct single core and three core underground cables for transmission of power in highly populated areas.	CO 3	Understand
	b	AEE011.11	Construct single core and three core underground cables for transmission of power in highly populated areas.	CO 3	Understand
7	a	AEE011.12	Calculate the sag and tension with equal and unequal heights of towers	CO 4	Understand
	b	AEE011.12	Calculate the sag and tension with equal and unequal heights of towers	CO 4	Understand
8	a	AEE011.12	Calculate the sag and tension with equal and unequal heights of towers	CO 4	Understand
	b	AEE011.12	Calculate the sag &tension with equal &unequal tower	CO 4	Understand
9	a	AEE011.15	Evaluate the voltage drops in AC distributors and DC distributors. Design of substation	CO 5	Understand
	b	AEE011.15	Evaluate the voltage drops in AC distributors and DC distributors. Design of substation	CO 5	Understand

10	a	AEE011.14	Compare different distribution systems (AC Vs DC distribution, Ring main Vs Radial).	CO 5	Understand
	b	AEE011.14	Compare different distribution systems (AC Vs DC distribution, Ring main Vs Radial).	CO 5	Understand

Signature of Course Coordinator **HOD,EEE**