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) Describe the phenomenon of corona? How can the corona loss are minimized in transmission lines. **[7M]**

   b) Determine the inductance per Km of a double circuit 3-phase line is transposed within each circuit and each circuit remains at its outside. The diameters of each conductor in 15mm. **[7M]**

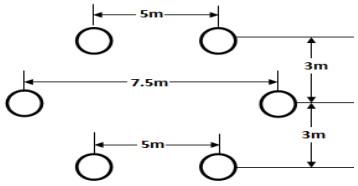

Figure: 1

2. a) Derive the expression for the capacitance per phase of the 3 Φ double circuit line flat vertical spacing with transposition. **[7M]**

   b) A 3-phase, 220 kV, 50 Hz transmission line consists of 1·2 cm radius conductors spaced 2 m at the corners of an equilateral triangle. Calculate the corona loss per km of the line. The condition of the wire is smoothly weathered and the weather is fair with temperature of 20ºC and barometric pressure of 72·2 cm of Hg. **[7M]**

UNIT – II

3. a) Using rigorous method, derive expression for sending end voltage for a long transmission line. **[7M]**

   b) A 3-Ph, 3km long line delivers 300 kW at a PF of 0.8 lag to a load if the voltage at the supply end is 11kV, determine the voltage at the load end, % regulation, sending end PF and the efficiency of Tr. line. The resistance and reactance of each conductor per km are 0.4 Ohm and 0.3 Ohm respectively. **[7M]**

4. a) Show how regulation and efficiency are determined in nominal T and nominal π method. **[7M]**

   b) Determine the efficiency and regulation of a three phase 200 km, 50Hz transmission line delivering 100MW at a pf of 0.8 lagging and 33kV to a balanced load. The conductors are of copper, each having resistance 0.1 Ω/km, and 1.5cm outside dia, spaced equilaterally 2m between centres. Neglect leakage reactance and use nominal T and π methods. **[7M]**

UNIT – III

5. a) Derive the expression for insulator resistance, capacitance and electric stress in a single core cable. Where is the stress maximum and minimum? **[7M]**

   b) The three bus-bar conductors in an outdoor substation are supported by units of post type insulators. Each unit consists of a stack of 3 pin type insulators fixed one on the top of the other. The voltage across the lowest insulator is 13·1 kV and that across the next unit is 11 kV. Find the bus-bar voltage of the station. **[7M]**

6. a) What is meant by capacitance grading of a cable? Derive expression for capacitance and maximum potential gradients in two (or more) dielectrics of a graded cable in terms of dielectric constants and radius of core and overall radius etc. **[7M]**

   b) Calculate the capacitance and charging current of a single core cable used on a 3-phase, 66 kV system. The cable is 1 km long having a core diameter of 10 cm and an impregnated paper insulation of thickness 7 cm. The relative permittivity of the insulation may be taken as 4 and the supply at 50 Hz. **[7M]**

UNIT – IV

7. a) Derive the expressions for sag and conductor length under bad weather conditions. Assume Shape of overhead line is a parabola. **[7M]**

   b) A transmission line has a span of 200 meters between level supports. The conductor has a cross-sectional area of 1·29 cm2, weighs 1170 kg/km and has a breaking stress of 4218 kg/cm2. Calculate the sag for a safety factor of 5, allowing a wind pressure of 122 kg per square meter of projected area. What is the vertical sag? **[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) An overhead transmission line conductor having parabolic configuration weight 1.925 kg per meter length cross of X section 2.2cm2 and ultimate strength of 8000 Kg per cm2 when erected between supports of 600 metres apart and having 5 meters distance in height determine the vertical sag from the taller of the two supports which must be allowed so that the factor safety shall be 5 with the wire loaded due to 1 Kg of ice per meter of no wind pressure **[7M]**

UNIT – V

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

   b) A 3 wire dc system with 400v between outer supplies lighting loads of 1200A and 1040A on the positive and negative sides and motor load of 400KW across the outers. **[7M]**

Calculate the load on the main generators and on each of the balancer machine assuming that at this load each balancer machine has a loss of 6KW.

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

b) Consider a three phase, 3 wire 240V secondary with balanced loads at A,B and C as shown in figure determine: **[7M]**

i. The voltage drop in one phase of lateral

ii. The real power per phase for each load

iii. The reactive power per phase for each load.

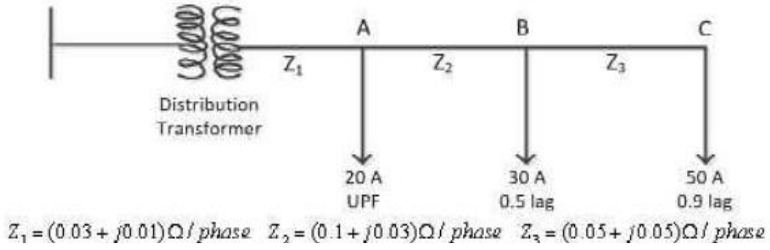

Figure: 2

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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 and tension with equal and unequal heights of towers	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**