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Question Paper Code: R4304

B.E. / B.Tech. DEGREE EXAMINATION, APRIL / MAY 2025

Fourth Semester

Electrical and Electronics Engineering

R21UEE404 – ELECTRIC POWER TRANSMISSION AND DISTRIBUTION

(Regulations R2021)

Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. Classify the component that does not belong to the structure of an electric power system. CO1- U
a) Generation b) Transmission c) Distribution d) Consumption
2. Interpret what HVDC stands for in the context of power transmission and explain its importance in modern electrical systems. CO1- U
a) High Voltage Direct Control b) High Voltage Direct Circuit
c) High Voltage Direct Current d) High Voltage Dynamic Current
3. Outline the main advantage of using stranded conductors over solid conductors in transmission lines. CO1-U
a) Reduced corona discharge b) Better flexibility
c) Lower cost d) Improved transposition
4. Illustrate the purpose of transposing transmission line conductors. CO1-U
a) To reduce line losses
b) To equalize inductance and capacitance between phases
c) To increase power transfer capability
d) To minimize corona loss

5. Interpret the meaning of the attenuation constant in a transmission line. CO1-U
- a) Rate of energy loss along the line b) Phase difference between voltage and current
 - c) Capacitance of the line d) Surge impedance of the line
6. What is the conditions under which the Ferranti effect occurs in transmission lines? CO1-U
- a) Heavily loaded b) Lightly loaded or open-circuited
 - c) Resonant conditions d) Over-voltage conditions
7. Demonstrate the significance of the power circle diagram in analyzing transmission lines. CO1-U
- a) It shows the voltage profile along the line.
 - b) It represents the voltage and current phasors.
 - c) It illustrates the real and reactive power transfer characteristics
 - d) It calculates line losses.
8. Infer why insulation materials in DC cables differ from those used in AC cables. CO1-U
- a) DC cables require higher thermal conductivity materials.
 - b) DC does not cause dielectric losses like AC
 - c) DC cables are more prone to mechanical damage.
 - d) DC does not require capacitive grading.
9. Identify and compare the weather conditions that exert the maximum stress on transmission lines. CO1-U
- a) Normal weather b) Hot weather
 - c) Windy weather with ice loading d) Rainy weather.
10. Illustrate the importance of grounding in a substation. CO1-U
- a) To minimize the load on the transformer
 - b) To protect the system and personnel from electrical faults
 - c) To reduce the cost of the transmission line
 - d) To improve the efficiency of power transmission

PART – B (5 x 2= 10 Marks)

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| 11. Explain the benefits of interconnecting power systems. | CO1- U |
| 12. Examine the inductance per phase per km of a three-phase transmission line with conductors at the corners of an equilateral triangle with a 3m side and a conductor diameter of 1.63 cm. | CO2-App |
| 13. Show the ABCD constants of a medium T network. | CO1- U |
| 14. State the purpose of a guard ring or static shielding. | CO1- U |
| 15. Define tower spotting. | CO1- U |

PART – C (5 x 16= 80Marks)

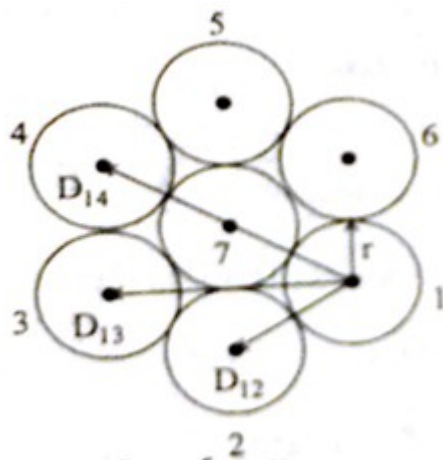
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| 16. (a) Explain EHVAC transmission systems with their advantages and limitations. | CO1- U | (16) |
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Or

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| (b) Compare radial and ring distributors in AC systems. | CO1- U | (16) |
| 17. (a) Develop a solution to determine the loop inductance per kilometer of a single-phase transmission line with two parallel conductors separated by 3 m, each having a radius of 1 cm. Utilize the material properties of the conductors, considering (i) copper and (ii) steel with a relative permeability of 100. | CO2-App | (16) |

Or

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| (b) Construct a solution to determine the GMR of a stranded conductor, as shown in Figure 1, consisting of 7 identical strands each with a radius 'r'. Solve for the ratio of the GMR to the overall conductor radius and comment on the result. | CO2-App | (16) |
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18. (a) Solve for the power output of a short transmission line with an impedance of $(6+j8)$ ohms per phase, given sending and receiving end voltages of 120 kV and 110 kV, respectively, for a receiving end load at 0.9 lagging power factor. CO3-App (16)
- Or
- (b) Utilize the given data to calculate the sending end voltage for a 15 km long three-phase overhead line delivering 5 MW at 11 kV with a power factor of 0.8 lagging, given that line loss is 12% of the delivered power and line inductance is 1.1 mH/km/phase. CO3-App (16)
19. (a) Identify different types of insulators and develop a discussion on how string efficiency can be improved using capacitance grading in suspension insulators. CO1-U (16)
- Or
- (b) Categorize different types of cables and inspect their general construction with a neat sketch. CO1-U (16)
20. (a) Construct a detailed explanation of sag and tension calculations and develop the derivation for sag when two supports are of equal height. CO1-U (16)
- Or
- (b) Discuss different methods of neutral grounding and illustrate them with a neat sketch. CO1-U (16)