Reg. No. \_\_\_\_\_\_\_\_\_\_\_\_



**End Semester Examination – Nov / Dec – 2019**

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| **Code :** | **17EE2003** | **Duration :** | **3hrs** |
| **Sub. Name :** | **DC MACHINES AND TRANSFORMERS** | **Max. Marks :** | **100** |

**ANSWER ALL QUESTIONS (5 x 20 = 100 Marks)**

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| **Q. No.** | **Sub Div.** | **Questions** | **Course**  **Outcome** | **Marks** |
| 1. | a. | Describe with neat diagram the constructional details of a DC generator and state its working principle. | CO1 | 12 |
| b. | A short-shunt compound generator delivers a load current of 30 A at 220 V and has armature, series-field and shunt-field resistances of 0.05 Ω, 0.30 Ω and 200 Ω respectively. Calculate the induced e.m.f. and the armature current. Allow 1 V per brush for contact drop. | CO1 | 8 |
| **(OR)** | | | | |
| 2. | a. | Depict the three important characteristics of a DC generator and highlight their significance. | CO1 | 10 |
| b. | A 6 pole DC machine has 664 wave connected armature conductors. (i) Calculate the induced emf when the flux per pole is 0.05 Wb and the speed is 275 r.p.m. (ii) At what speed must the armature be driven in order to generate an emf of 500 V if the flux per pole is increased to 0.059 Wb? | CO1 | 10 |
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| 3. | a. | Outline the significance of the commutation process in a DC generator and suggest methods to improve commutation. | CO3 | 10 |
| b. | A 4-pole wave-wound motor armature has 880 conductors and delivers 120 A. The brushes have been displaced through 3 angular degrees from the geometrical axis. Calculate (a) demagnetizing amp-turns/pole (b) cross-magnetizing amp-turns/pole (c) the additional field current for neutralizing the demagnetization of the field winding has 1100 turns/pole. | CO3 | 10 |
| **(OR)** | | | | |
| 4. | a. | A 400 V, DC shunt generator has a full-load current of 190 A. Its armature resistance is 0.08 Ω; shunt field resistance 200 Ω; iron and mechanical losses together 2000 W. Find the full load efficiency and also find the load current at which efficiency is maximum and the value of maximum efficiency. | CO3 | 10 |
| b. | Describe a suitable test for predetermining the efficiency of a DC motor. State its advantages and disadvantages. | CO5 | 10 |
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| 5. | a. | Derive an expression for the torque developed in a DC motor. | CO2 | 10 |
| b. | The input to 230 V, DC shunt motor is 11 kW. Calculate:  (i) the torque developed (ii) the efficiency (ii) the speed at this load. The particulars of the motor are as follows:  No-load current = 5 A; No-load speed = 1150 r.p.m  Armature resistance = 0.5 Ω; shunt field resistance = 110 Ω | CO3 | 10 |
| **(OR)** | | | | |
| 6. | a. | Point out the need for starters in a DC motor. With a neat diagram, explain the working of a three point starter for DC shunt motor. | CO2 | 10 |
| b. | A 500 V DC shunt motor has armature and field resistances of 1.2 Ω and 500 Ω respectively. When running on no-load, the current taken is 4 A and the speed is 1000 rpm. Calculate the speed when motor is fully loaded and the total current drawn from the supply is 26 A. Estimate the speed at this load if (a) a resistance of 2.3 Ω is connected in series with the armature and (b) the shunt field current is reduced by 15%. | CO2 | 10 |
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| 7. | a. | Derive the EMF equation of transformer and state its principle of operation. | CO4 | 8 |
| b. | A single phase transformer with a ratio of 6.6 kV / 415 V take a no-load current of 0.75 A at 0.22 pf. If the secondary supplies a current of 120 A at a pf of 0.8 lagging, estimate the current taken by the primary. | CO4 | 6 |
| c. | A 3300/230 V, 50 kVA transformer is found to have impedance of 4% and a Cu loss of 1.8% at full load. Find its percentage reactance and also the ohmic values of resistance, reactance and impedance as referred to primary. | CO4 | 6 |
| **(OR)** | | | | |
| 8. | a. | With neat diagrams, explain the various types of 3-phase transformer connections. State its merits and demerits. | CO4 | 10 |
| b. | A 50 kVA, 4400/220 V transformer has R1=3.45Ω, R2=0.009Ω. The values of reactances are X1=5.2Ω and X2=0.015 Ω. Calculate for the transformer (i) equivalent resistance as referred to primary (ii) equivalent resistance as referred to secondary (iii) equivalent reactance as referred to both primary and secondary (iv) equivalent impedance as referred to both primary and secondary (v) total Cu loss, first using individual resistances of the two windings and secondly, using equivalent resistances as referred to each side. | CO4 | 10 |
|  | | **Compulsory**: |  |  |
| 9. | a. | A 200 kVA transformer has an efficiency of 98% at full load. If the maximum efficiency occurs at three quarters of full load, calculate the efficiency at half load. Assume negligible magnetizing current and p.f. 0.8 at all loads. | CO3 | 8 |
| b. | With a neat diagram describe the back-to-back test of a transformer. | CO5 | 6 |
| c. | Outline the need for parallel operation and the conditions to be satisified for parallel operation of transformers. | CO6 | 6 |