Roll No.:.....

National Institute of Technology, Delhi

Name of the Examination: B. Tech. (Backlog)

Branch	: Electrical & Electronics Engg.	Semester	: IV
Title of the Course	: Electrical Machines-I	Course Code	: EE252

Time: 3 Hours | Maximum Marks: 50

SECTION-A (10 Marks)

Note: All parts of this question are compulsory and carry two marks each.

Q1. Attempt all parts of this question at one place.

i. Explain why the ratings of transformers is given in VA or kVA?

ii. Explain the working principle of transformer operation at lagging power factor load with relevant phasor diagram.

iii. Explain following terms: (a) Pole pitch, (b) Chording angle, (c) Full-pitched coil, and (d) Short-pitched coil. Also derive the relationship between electrical and mechanical degree with proper explanation.

iv. Classify dc machines based on the types of excitations used.

v. What is a commutator? What purpose it does it serve in a DC generator and DC Motor?

SECTION-B (20 Marks)

Note: Attempt any four questions, each question carries 5 marks.

Q2. Derive the relation between (i) Speed-Armature current, (ii) Torque-Armature current and (iii) Speed-Torque for each of the following motors: (a) DC Shunt Motor (b) DC Series Motor and (c) DC Compound Motor. Also draw relevant characteristic plots.

Q3. A 250 V, DC series motor has armature and series field resistance of 0.25 ohms and 0.15 ohms respectively. (a) Calculate the current for developing a torque of 80 Nm at 1200 rpm. (b) Calculate the percentage reduction in flux when the motor runs at 1800 rpm at half the current obtained in part (a).

Q4. The maximum efficiency of a 100 kVA, single phase transformer is 98% and occurs at 80% of full load at 0.8 power factor. If the leakage impedance of the transformer is 5%, find the voltage regulation at rated load of 0.8 power factor lagging.

Q5. Three single phase transformers are used to design a 3-phase transformer. Draw the phasor and connection diagram for Yd11 connection of a three phase transformer. Also derive the relation between primary side and secondary side line and phase quantities.

Q6. Classify the different types of losses taking place in a transformer. Also give brief description about each loss. Also derive the condition for maximum efficiency of transformer.

SECTION-C (20 Marks)

Note: Attempt any two questions, each question carries 10 marks.

Q7. A dc shunt motor runs at 1200 rpm on no-load drawing 5A from 220V mains. Its armature and field resistances are 0.25 ohms and 110 ohms respectively. When loaded, the motor draws 62 amps from the mains. What would be its speed? Assume that the armature reaction demagnetizes the field by 5%. Also calculate the internal torque developed at no-load and at full load. What is the motor shaft torque at load?

Q8. Define voltage regulation of a transformer. Derive (i) the accurate expression of voltage regulation for lagging power factor load, (ii) condition for zero voltage regulation, and (iii) condition for maximum voltage regulation. Draw relevant phasor diagram for each condition.

Q9. Explain the procedure to conduct open circuit test and short circuit test on single phase transformer and hence develop the exact equivalent circuit using the obtained parameters.

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