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Reg. No._____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

THIRD SEMESTER B.TECH DEGREE EXAMINATION, JULY 2017

Course Code: **EE205**

Course Name: **DC MACHINES AND TRANSFORMERS (EE)**

Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions.

1. Compare lap and wave windings used for DC machine armature (5)
2. Draw the magnetization characteristic of self excited DC shunt generator and explain. (5)
3. How back emf is generated in a DC motor? Explain its significance. (5)
4. Draw and explain the detailed phasor diagram of a practical transformer supplying lagging power factor load. (5)
5. Define all-day efficiency of a transformer. What is done to improve the all-day efficiency of a distribution transformer? (5)
6. List out and explain the necessary and desirable conditions for parallel operation of transformers. (5)
7. Enumerate the purposes which dictate the use of tertiary winding in a three winding transformer. (5)
8. Draw the diagram for V-V connection of transformers and explain the voltage and current relations of line and phase values. Derive the capacity ratio as a fraction of Δ-Δ capacity. (5)

PART B

Answer any 2 questions.

9. a. Derive the electro-dynamic equation of rotating electrical machines and explain the principle of energy conversion. (5)

   b. Draw the developed winding layout of a lap connected simplex double layer DC armature with 16 slots and 4 poles. Furnish the winding table and show connections to 4 equalizer rings. (5)

10. a. Derive the EMF equation of a DC generator, from first principles (5)

    b. A shunt generator delivers 195 A at a terminal voltage of 250 V. The armature and shunt field resistances are 0.02 Ω and 50 Ω respectively. The iron and frictional losses

are equal to 950 W. Find (i) emf generated (ii) Copper losses (iii) output of prime mover (iv) commercial, mechanical and electrical efficiencies. (5)

11. a. What is armature reaction and explain its effects? Derive expressions for cross magnetizing and demagnetizing ampere turns per pole (5)

b. A 4 pole, wave wound armature of a DC machine has 880 conductors and delivers 120 A. The brushes are displaced through 3 angular degrees from the geometrical axis. Calculate (i) demagnetizing ampere turns per pole (ii) cross-magnetizing ampere turns per pole and (iii) the additional field current for neutralizing the demagnetization if the field winding has 110 turns per pole. (5)

PART C

Answer any 2 questions.

12. a. Draw and explain the electrical and mechanical characteristics of DC shunt motors. (5)

b. A 250 V DC shunt motor has an armature resistance of 0.5 Ω and a field resistance of 250 Ω. The motor draws 21 A when driving a constant torque load at 600 rpm. What will be the new speed of the motor if an additional 250 Ω resistance is inserted in the field circuit? (5)

13. a. Enumerate the losses in a loaded transformer. Derive the condition for maximum efficiency in a transformer. (5)

b. A 200 / 2000 V transformer is fed from a 200 V supply. The total winding resistance and leakage reactance as referred to the LV side is 0.15 Ω and 0.6 Ω respectively. The resistance representing core loss is 450 Ω and magnetizing reactance is 250 Ω. A load of impedance (600+j400) Ω is connected across the secondary terminals. Calculate (i) input current (ii) secondary terminal voltage and (iii) primary power factor. (5)

14. a. With neat diagrams, explain the speed control methods in separately excited DC motors. (5)

b. The efficiency of a 200 KVA, single phase transformer is 98.75% when delivering full load at 0.8 pf and 99% at 80% of full load at 0.9 pf. Calculate (i) the iron loss and (ii) the full load copper loss. (5)

PART D

Answer any 2 questions.

15. a. With a neat diagram, describe the Sumpner's method of testing transformers. How can the voltage regulation be predetermined using this test? (5)

b. A 3 ϕ step down transformer is connected to 6.6 kV supply mains and takes 80A. Calculate its secondary line voltage and line current for the following connections if the ratio of turns per phase is 16 (i) Y-Y (ii) Y- Δ (iii) Δ – Y (iv) Δ – Δ. (5)

16. a. Derive expression for saving in copper effected by using an autotransformer instead of a two winding transformer. (5)

b. A load of 6 kW is supplied by an autotransformer at 120 V and upf. If the primary voltage is 240 V, determine (i) transformation ratio (ii) secondary current (iii) primary current (iv) number of secondary turns if the total number of turns is 280 (v) power transformed and (vi) power conducted directly from supply mains to load. (5)

17. a. Explain with neat circuit diagram and phasors, how a 2-phase supply can be obtained from a 3-phase supply. (5)

b. Explain the vector groupings Yy0, Dd0, Yd1, Dy1, Yd11 and Dy11 in three phase transformers. (5)

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