College of Engineering, Pune
End Semester Exam – May 2012
S. Y. B. Tech. (Electrical)
Electrical Machines I (EE207)

Day & Date: Friday, 9th May 2012 Time: -9.00 pm to 12.00 pm.
Maximum Marks: 50 Duration – 3 hrs.

Instructions:

1. **Answer FIVE questions out of which Q1 is compulsory and answer any FOUR from the rest.**
2. **Assume suitable data wherever necessary and state clearly the same.**
3. **Draw figures/diagrams neatly.**

			MARKS
Q1		State with reasons whether the following statements are TRUE or FALSE :- a) Armature reaction mmf in a d.c. machine acts in the same direction as the field mmf. b) Increasing armature voltage of a d.c. shunt motor decreases motor speed while the full load torque capability of the motor remains unaffected. c) For a given torque, reducing the diverter resistance of a d.c series motor, decreases its speed demanding more armature current. d) In a level compounded generator the series field ampere-turns act at 90° (electrical) to the shunt field ampere-turns. e) A transformer is switched on from a 50Hz sinusoidal voltage source on no load. The no-load current is sinusoidal with a frequency of 150 Hz.	2*5
Q2	a)	Discuss the function and properties of transformer oil.	5
	b)	The efficiency of a 1000kVA, 220V/110V, 50 Hz single phase transformer is 98.5% at half-full load at 0.8 p.f leading and 98.8% at full load and unity p.f. Determine (i) iron loss; (ii) full load copper loss; and (iv) efficiency maximum at u.p.f	5
Q3	a)	Derive an expression for the magnetizing in-rush current of a single-phase transformer. State clearly any assumptions made.	5
	b)	Two single-phase transformers, each rated 250kVA, 11kV/2kV, 50 Hz are connected in open-delta on both primary and secondary. (i) Determine the load kVA that can be supplied from this transformer connection. (ii) A delta connected load of 250kVA, 2kV, 0.8p.f is connected to the L.V side of the transformer combination. Estimate the transformer currents on the H.V side.	5
Q4	a)	With a neat circuit diagram, explain the working of a d.c shunt motor starter.	5
	b)	The o.c.c of a d.c generator operating at 1800 rpm is given by the following	

		data :- I_f(A) 0 0.5 1.0 1.5 2.0 3.0 3.5 4.0 5.0 6.0 E(V) 8 40 74 113 152 213 234 248 266 278 (i) Plot the o.c.c for 1500 rpm. (ii) Calculate the generated voltage when the generator is operating on no-load with a field current of 4.6A and at a speed of 1000 rpm. (iii)The machine is operated as a shunt generator at 1800 rpm with a field current of 4.6A. Determine the no-load voltage when the generator is operating at 1500 rpm.	1 2 2
Q5		Write short notes on any THREE of the following :- a) Braking methods for d.c. shunt motor; b) Speed control methods for d.c. series motor; c) Swinburne's Test; d) Armature reaction in dc machines; e) Principles of electro-mechanical energy conversion.	 3 3 4 3 3
Q6	**a)**	A 50kW, 230V dc shunt motor has armature resistance of 0.12 ohm and a field resistance of 230 ohm. It runs at a no-load speed of 1400 rpm drawing a line current of 10 A from the 230V dc mains. The motor draws a current of 200A from the mains while delivering a certain load. Determine the speed at which it will run and the torque developed. Assume field circuit resistance remains as 230 ohm and armature reaction causes a reduction of 4% in flux/pole of its no-load value.	5
	b)	A two layer lap winding (progressive type) is to be designed for a d.c machine with the following data :- Poles = 4; coil sides/slot = 2; No. of slots = 12. (i) Determine back pitch, front pitch, commutator pitch. (ii) Write the winding table. (iii)Draw the sequence diagram. (iv)Select the position of brushes. (v) Estimate the number of parallel paths from sequence diagram.	 1 1 1 1 1

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