UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, December 2018

Course   :   **Electrical Machines (EPEG 2001)**   Semester : III
Programme: **B.Tech – Mechatronics Engineering**
Time   :   **03 hrs.**   Max. Marks: 100
Instructions: **All sections are compulsory**

SECTION A

S. No.		Marks	CO
Q 1	What is role of commutator and brushes in dc machines .	**4**	**CO1**
Q 2	Define (i) voltage regulation of a transformer . (ii) Polarity of transformer .	**4**	**CO2**
Q 3	Derive the torque equation for three phase induction motor .	**4**	**CO3**
Q 4	What is brushless excitation system of the alternator .	**4**	**CO3**
Q 5	Explain the stepper motor operation . Mention some of its applications	**4**	**CO1, CO5**

SECTION B

Q 6	A 250 V , DC sries motor is running at 400 rpm and is taking a current of 25 A . The motor resistance is 1 Ω . Find (i) the resistance to be added in series to redue the speed to 300 rpm at constant torque (ii) the power wasted in the resistor .	**6+2**	**CO2**
Q 7	(a) How is a Brushless DC (BLDC) motor is different from normal DC motor . (b) What are the various electrical methods employed for producing the starting torque in a single – phase induction motor .	**8**	**CO5 CO3**
Q 8	A 500 kVA transformer has an iron loss of 5 kW and the maximum efficiency at 0.8 power factor occurs when the load is 300 kW . Calculate the efficiency at full load and 0.7 power factor lagging .	**8**	**CO4**
Q 9	A 3- phase , 50 Hz , 4 – pole , star – connected alternator has 72 slots with 4 condutors per slot . The coil span is 2 coils less than pole pitch . If the machine gives 6600 V between lines on open circuit , determine the useful flux per pole .	**8**	**CO3**
	OR		
Q 9	What are the application of the synchronous motor . Draw and explain V and	**8**	**CO3**

	inverted V curve of the synchronous motor .		
Q 10	What are the benefits of V/f control over simple f control or simple V control for an induction motor ?	8	CO5
	OR		
Q 10	How the performance of induction motor is effected (a) with change in supply voltage and frequency (b) addition of rotor circuit resistance (for slip ring induction motor) at start	8	CO5
	SECTION-C		
Q 11	(a) A 746 kW , three phase , 50 Hz , 16 pole induction motor has a rotor impedance of (0.02 + J 0.15) ohms at standstill . Full load torque is obtained at 350 rpm . Determine (i) the speed at which maximum torque occurs (ii) the ratio of maximum to full-load torque (iii) the external resistance per phase to be inserted in the rotor circuit to get maximum torque at starting . (b) Develop the equivalent circuit of cylindrical rotor alternator and explain the phasor diagram for lagging load .	12+8	CO1, CO4
Q12	The open –circuit test performed on the low-voltage side of a 50 MVA , 8kV/78 kV , 50 Hz transformer gives the following data : 8 kV , 62.1 A and 206 kW . A short – circuit test on the low –voltage side gives the following readings : 674 V , 6.25 kA and 187 kW (a) Determine the equivalent series impedance , resistance and reactance of the transformer as referred to low-voltage terminals. (b) Determine the efficiency and voltage regulation if the transformer is operating at the rated voltage and load (unity power factor). (c) Repeat part (b) assuming the load to be 0.9 power factor leading .	6+10+ 4	CO4
	OR		
Q12	(a) Explain why the external characteristics of a DC shunt generator is drooping in nature and why it tends to turn back at loads beyond its rated value ? (b) Explain the utility of open Delta connections of three phase transformer. (c) Under what operating state of a three –phase induction motor will the rotor frequency be more than the stator frequency. (d) Explain the effect of damper winding in synchronous machines ?	5 X 4	CO4, CO3

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SECTION A

S. No.		Marks	CO
Q 1	Explain the difference between cylindrical rotor and salient pole rotor used in large synchronous generator	4	CO1
Q 2	Describe briefly the various losses in a transformer .	4	CO1
Q 3	Compare three phase synchronous motor and three phase induction motor .	4	CO3
Q 4	Explain the characteristics of DC series motor and mention its application areas	4	CO5
Q 5	Explain the working of an Linear Induction Motor(LIM).	4	CO5

SECTION B

Q 6	For speed control of induction motor , though theoretically possible , but practically the frequency is never changed alone – explain why ?	8	CO3
Q 7	(a) Explain the working of capacitor split-phase motor . (b) Explain why field circuit of a dc shunt motor should never be disconnected when the motor is under running condition .	8	CO2
Q 8	A single phase , 6000/600 V transformer has primary and secondary resistances 0.25 Ω and 0.18 Ω respectively . If iron loss of the transformer is 200 W , calculate the secondary current at which maximum efficiency occurs . Also calculate the maximum efficiency at 0.9 p.f. lagging .	8	CO4
Q 9	A short-shunt compound generator supplies a current of 100 A at a voltage of 220 V . The resistance of the shunt field , series field and armature are 50 Ω , 0.025 Ω , 0.05 Ωrespectively . The total brush drop is 2 V and total iron and frictional losses are 1000 W . Find (a) the generated emf , (b) copper losses and (c) generator efficiency	8	CO4
	OR	8	
Q 9	A 18.65 kW , 4 – pole , 50 Hz , three – phase induction motor has friction and windage losses of 2.6 % of the output and full load slip is 4.2 % . Find out (a) the	8	CO4

	rotor copper loss (b) the rotor input (c) the output torque		
Q 10	What is the necessity of parallel operation of alternators ? State the conditions necessary for parallel operation of alternators .	**8**	**CO3**
	OR		
Q 10	The full load current of a 6.6 kV , star connected motor is 200 A at 0.8 p.f. lagging . The per phase resistance and reactance of the motor is 1 Ω and 7 Ω respectively . If the mechanical loss is 40 kW , find the excitation emf , torque angle , efficiency and shaft out of the motor .	**8**	**CO3**
	SECTION-C		
Q 11	(a) Explain the torque –slip characteristics of three phase induction motor (b) Develop the equivalent circuit of three phase induction motor .	**8+12**	**CO3, CO5**
Q12	In a 1500 kVA , 3300 V , 50 Hz , three phase , star connected synchronous generator , a field current of 50 A produces a short-circuit current of 250 A and open – circuit voltage of 1100 V line to line . Determine the voltage regulation at full load and (a) 0.8 power factor lagging , and (b) 0.8 power factor leading . Consider the armature resistance to be 0.3 Ω ,	**10+10**	**CO3, CO5**
	OR		
Q12	An industrial plant has a load of 800 kW at power factor of 0.8 lagging . It is require to install a synchronous motor to deliver a load of 200 kW and improve the overall power factor of a plant to 0.92 . Determine the kVA rating of the synchronous motor and its power factor . The efficiency of the motor is 90 %	**20**	**CO3, CO5**

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