TML034/EE/20070819

Electrical Machines

Time : 180 minutes   **Marks : 100**

Instructions for the students :
1. All questions are compulsory.
2. "Long Answer type Question (LAQ)" is a supply type question of 20 marks, which require typical answer of about 60-80 lines in about 32-40 minutes.
3. "Short Answer type Question (SAQ)" is a supply type question of 5 marks, which require typical answer of about 15-20 lines in about 08-10 minutes.
4. Use of non-programmable type of scientific calculator is allowed.
5. Draw neat diagrams wherever necessary.
6. Assume suitable data if necessary.

Q. No.	Question (Q)	Question Marks
	Long Answer type Questions (LAQ's)	
1.	(a) What is an autotransformer? What is a disadvantage of autotransformer? Explain the difference between a step up and step down transformer.	**5**
	(b) With reference to Figure 1, find all the missing value.	**10**

Figure 1

E_P = 208V	E_{SI} = 320V	E_{S2} = 120V	E_{S3} = 24V
I_P = ………	I_{SI} = ……….	I_{S2} = …….	I_{S3} = ……….
N_P = 800	N_{SI} = ……….	N_{S2} = ……….	N_{S3} = ……….
	Ratio 1 = ……	Ratio 2 = ……	Ratio 3 = …….
	R_1 = 12kΩ	R_2 = 6Ω	R_3 = 8Ω

Q. No.	Question (Q)	Question Marks
	(c) What are harmonics ? What are the effects of harmonics on electrical equipment ?	5
2.	(a) A dc motor is connected to a 120-V DC line and has a current draw of 1.3 A. The motor is operating a load that requires 8 lb. in of torque and is turning at a speed of 1250 RPM. What is the efficiency of the motor ?	5
	(b) Explain the theory of operation of dc generator. Mention the factors determining the amount of output voltage produced by the generator. What is armature reaction ?	10
	(c) Explain the various methods of speed control for dc motor.	5
3.	(a) A ½ HP squirrel cage motor is connected to a load. A wattmeter is connected to the motor and the load torque measurement is calibrated in pound-inches. The motor is operating at a speed of 1725 RPM and producing a torque of 16 lb/in. The wattmeter is indicating an input power of 500 W. Calculate output horsepower and motor efficiency.	5
	(b) What are the three basic types of three-phase motors ? What is the principle of operation of all three-phase motors ? What is synchronous speed ? Which two factors determine synchronous speed? Name three factors that cause magnetic field to rotate.	10
	(c) What conditions must be met before two alternators can be paralleled? How can the phase rotation of one alternator be checked in relationship to the other alternator ?	5
4.	Write explanatory notes on : **(any two)** a) Repulsion type motors b) Stepping motors c) Spilt phase motors	20
	Short Answer type Questions (SAQ's)	
5.	Explain zin-zag connection in transformers.	5
6.	Write a note on Brush less DC motor.	5
7.	Why must a synchronous motor never be stared when DC excitation current is applied to the rotor ? Name three characteristics that make a synchronous motor different from an induction motor.	5
8.	Explain 'Universal motor' in detail.	5