Ref. No. : Ex/EE/5/T/212/2023(S)

BACHELOR OF ENGINEERING (ELECTRICAL ENGINEERING) SUPPLEMENTARY EXAMINATION –2023

(2nd Year, 1st Semester)

ELECTRICAL MACHINES-I

Time: Three hours

Full Marks: 100

(50 marks for each part)
Use a separate Answer-Script for each part

Part-I

Answer any three questions.
Two marks for well-organized answers.

1. a) Explain the operating principle of a single phase transformer. Develop E.M.F equation of a transformer. **8**

b) A 100 kVA transformer has its maximum efficiency of 0.98 at full load at unity power factor. During the day it is loaded as follows: **8**

12 hours: 20 kW at power factor 0.5
6 hours: 45 kW at power factor 0.9
6 hours: 80 kW at power factor 0.8

Calculate all-day efficiency of the transformer.

2. a) Develop the equivalent circuit of a single phase transformer. State the assumptions clearly. **8**

b) Two single phase transformers are operating in parallel. Derive an expression for the current drawn by each, sharing a common load, when no-load voltages are these are not equal **8**

3. a) Explain the operating principle of an auto-transformer. State the advantages and disadvantages of auto-transformers over two winding transformers. **4+4**

b) Derive an expression for saving in conductor material in a auto-transformer over a two-winding transformer of equal rating. **8**

4. a) Establish the condition for maximum efficiency of a single transformer with variation of load current. **8**

b) The efficiency of a 400 kVA, single phase transformer is 98.77% when delivering full load at 0.8 power factor, and 99.13% at half-load and unity power factor. Calculate (a) the iron loss, (b) the full load copper loss. **8**

[Turn over

Ref. No. : Ex/EE/5/T/212/2023(S)

BACHELOR OF ENGINEERING (ELECTRICAL ENGINEERING) SUPPLEMENTARY EXAMINATION –2023

(2nd Year, 1st Semester)

ELECTRICAL MACHINES-I

Time: Three hours | Full Marks: 100

(50 marks for each part)
Use a separate Answer-Script for each part

5. a) What is voltage regulation of a transformer? Derive an expression for voltage regulation. Why is it important? **2+6**

b) A 100 kVA, 6600/330 V, 50 Hz, single phase transformer takes 10 A and 436 W at 100 V in a short circuit test, the figures referring to the high-voltage side. Calculate the voltage to be applied to the high-voltage side on full load at power factor 0.8 lagging when the secondary terminal voltage is 330V. **8**

Ref No. : Ex/EE/5/T/212/2023(S)

Bachelor of Electrical Engineering(Evening) 2nd Year 1st Semester Supplementary Examination,2023

SUBJECT : ELECTRICAL MACHINES-I

Time: Three Hours

Full Marks: 100 (50 each part)

Use a separate Answer-Script for each part

PART - II

Answer Question No.1 and any two from the rest.
Answer any six questions.

Question No.			Marks
1.			
	i)	Wave connected D.C. machines require equalizer connection-Justify or correct.	6x3
	ii)	Due to armature reaction the magnetic neutral axis shifted in the direction of rotation for a D.C. motor-Justify or correct.	
	iii)	D.C. series motor should not be operated under no load condition-Justify or correct.	
	iv)	For high current and low voltage D.C. machines, lap connection is preferred-Explain.	
	v)	D.C. shunt generator has superior voltage regulation than the D.C. separately excited generator- justify or correct.	
	vi)	Swinburnes method of testing of D.C. machines is called regenerative test-Justify or correct.	
	vii)	D.C. series motor is preferred in traction drive-Justify or correct.	
	viii)	In D.C. machines normally short -pitch coil is used-Explain.	
2.	(i)	What is armature reaction in D.C. machines and what are the effects of it ?	8
	(ii)	Explain the commutation process in D.C. machines ?	8
3.			
	(i)	Derive the torque-current characteristic of D.C shunt motor. Why D.C. shunt motors are extensively used in industry?	8

(ii) A 220 V shunt motor on no-load runs at 1000 rpm and takes 10 A. The total armature and shunt field resistances are respectively 0.05 ohm and 110 ohms. Calculate the speed when loaded and taking a current of 50 A, if armature reaction weakens the field by 3%. **8**

4

(i) Explain the external characteristics of D.C. shunt generator. Explain why differentially compound D.C. generator is used in welding application. **8**

(ii) Discuss in brief the different methods of speed control of D.C.series motor. **8**

5.

(i) Derive the expression of torque in a D.C.motor. **8**

(ii) A shunt machine, connected to 240 V mains has an armature resistance of 0.03 ohm and resistance of the field winding is 120 ohms. Find the ratio of the speed as generator to the speed as a motor, the line current in each case being 80A. **8**