

BACHELOR OF ENGINEERING (ELECTRICAL ENGINEERING) SUPPLEMENTARY EXAMINATION – 2024

(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.

Question No. 1 carries 18 marks

1. a) Why does the primary of a transformer draw current from the mains when the secondary is not carrying any load? **2+4+6+6**
- b) Explain how the primary current increases as the current on the secondary side of transformer is increased.
- c) Draw and explain the phasor diagram of the single phase transformer supplying a lagging power factor load.
- d) What is an auto transformer? State the advantages and disadvantages of autotransformers over two-winding transformer.
2. a) How are the transformer equivalent circuit parameters determined in the laboratory? **8+8**
- b) Derive an expression for computing the per unit voltage regulation of a transformer both for leading and lagging power factor load.
3. a) Discuss the necessary conditions for the successful parallel operation of single phase transformers. **8+8**
- b) A single phase 20 kVA, 2500/250 V, 50 Hz single phase transformer gave the following test results.
Open-circuit test (on l.v. side) : 250 V, 1.4 A, 105 watts.
Short-circuit test (on h.v. side): 104 V, 8 A, 320 watts.
Compute the parameters of the approximate equivalent circuit referred to high-

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voltage and low-voltage sides. Also draw the exact equivalent circuit referred to the low-voltage side.

4. a) A 5 kVA single phase transformer has a core loss of 40 watts and a full load copper loss of 100 watts. During the day it is loaded as follows: **8+8**

6 hours- 3KW at power factor 0.6

5 hours-2 KW at power factor 0.8

7 hours-6KW at power factor 0.9

6 hours at no-load

Calculate the all-day efficiency of the transformer.

- b) Under what condition does a transformer attain maximum efficiency? Derive an expression for maximum efficiency in terms rated kVA, rated copper loss, rated core loss.

5. Write short notes on any two of the following:

8×2

- (i) Different cooling methods of a transformer
- (ii) Buchholz relay
- (iii) Properties of transformer oil
- (iv) Types of winding of transformers

**Bachelor of Engineering (Electrical Engineering) 2nd Year 1st Semester
Supplementary Examination, 2024**

SUBJECT: ELECTRICAL MACHINES - I

Page 1 of 2

Time: Three Hours

Full Marks: 100 (50 each part)

Use a separate Answer-Script for each part.

Question No.	PART – II	Marks
	Answer any three questions. Two marks are reserved for neat and well organized answer.	
1.	Justify the following (any four) :	4x4
i)	Lap connected DC machine the equalizer connections whereas wave connected DC machine doesn't require it.	
ii)	Due to the armature reaction magnetic neutral is shifted in the direction of rotation in a DC generator.	
iii)	O.C.C or no-load characteristics cannot be obtained for series connected DC motor.	
iv)	For high-current and low-voltage DC machine lap connection is preferred whereas for low-current high-voltage DC machine wave connection is preferred.	
v)	DC series motor should not be operated under no-load.	
vi)	In real-life we do not get exactly linear commutation.	
vii)	In a DC machine short-pitched coil is not preferred.	
2. (i)	Why interpole winding is connected in series with the armature winding in a DC machine?	4
(ii)	(ii) What is armature reaction in DC machine and what are the effects of it. Discuss the methods of reducing the effects of armature reaction.	12

[Turn over

		Marks
3.(i)	Derive the expression of torque in a DC machine.	8
(ii)	Why DC series motor is suitable for traction applications?	4
(ii)	A 220V DC shunt motor takes 22A at rated voltage and runs at 1000 rpm. It's field resistance is $100\ \Omega$ and armature resistance is $0.1\ \Omega$. Compute the value of the additional resistance required to connected in the armature circuit to reduce the speed by 200 rpm in case of a fan load where the load torque is proportional to the square of the speed.	4
4. (i)	A DC shunt machine connected to 250V mains has an armature resistance (including brushes) of $0.12\ \Omega$ and the resistance of the field circuit is $100\ \Omega$. Find the ratio of the speed as generator to the speed as a motor, the line current in each case being 80A.	8
(ii)	Explain the commutation process in DC machine.	8
5.	Write short notes on any two of the following :	
(i)	Hopkinson's method of testing of DC machine.	8x2
(ii)	Speed control of DC series motor	
(iii)	External characteristics of different types of DC generators	
