BACHELOR OF ENGINEERING (ELECTRICAL ENGINEERING) EXAMINATION, 2019
(2ndYear, 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 are for well-organized answer.

1. a) What are two general types of transformers? Discuss their constructional differences and relative advantages and disadvantages. 4

   b) Why the primary of a transformer draws current from the mains when the secondary is not carrying any load? 2

   c) Derive an expression for induced emf of a transformer. 4

   d) Draw the phasor diagram of a single phase transformer supplying a lagging power factor load. 6

2. a) Develop the exact equivalent circuit of a single phase transformer. From this derive approximate and simplified equivalent circuits of a transformer. State the various assumptions made. 8

   b) Describe the tests on a single phase transformer that gives ohmic losses and core losses. Give the determination of the equivalent circuit parameters which can be determined form these tests. 8

3. a) Derive an expression for computing per-unit voltage regulation of a transformer for lagging power factor load. 12

   b) Define power efficiency and all-day efficiency of a transformer. 4

4. a) What is autotransformer? State the advantages and disadvantages of autotransformers over two-winding transformers. 6

   b) Derive an expression for saving in conductor material in a autotransformer over a two-winding transformer of equal rating. 10

5. Answer any two of the following: 2x8

a) The efficiency at unity power factor of a 6600/440 V, 250 kVA single phase transformer is 98% both at full load and half load. The power factor on no-load is 0.2 and full load regulation at a lagging power factor of 0.8 is 4%. Draw the equivalent circuit referred to 440 V side.

b) A 20 kVA, single phase transformer of 1100/220 V has an iron loss of 175 W; the resistance of the primary winding is 0.25 Ω and that of secondary is 0.012 Ω. The corresponding leakage reactances are 1.1 Ω and 0.055 Ω respectively. Calculate the percentage resistance and reactance drop at full load and power factor 0.8 lagging. At what percentage of full load will the efficiency be maximum?

c) The maximum efficiency of a 100 kVA, single phase transformer is 98% and occurs at 80% of full load at 0.8 power factor lagging. If the leakage impedance of the transformer is 5%, find the voltage regulation at full load.

Ref No. :Ex/ EE/5/T/212/2019

Bachelor of Electrical Engineering (Evening) 2ND Year 1ST Semester Examination,2019

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.

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 is shifted opposite to the direction of rotation for a D.C. generator-Justify or correct.	
iii)	D.C. series motor should not be operated under loaded condition-Justify or correct.	
iv)	For low current and high voltage D.C. machines, wave connection is preferred-Justify or correct.	
v)	D.C. shunt generator has poor voltage regulation than the separately exited D.C. generator-Explain.	
vi)	Swinburnes method of testing of D.C. machines cannot be performed on D.C. series motor-Justify or correct.	
2.		
(i)	What are the effects of armature reaction in D.C. machines and what are the methods for reducing the effects of armature reaction ?	**8**
(ii)	Explain linear commutation process in D.C. machine and what are the roles of interpole in the commutation process in D.C. machine?	**8**
3.		
(i)	Derive the expression of torque in D.C. motor.	**8**
(ii)	A 240V shunt motor on no—load runs at 1200rpm and takes 20 A. The total armature and shunt field resistances are respectively 0.05 ohm and 120 ohms. Calculate the speed when loaded and taking a current of 40 A, if armature reaction weakens the field by 4%.	**8**

4

(i) Derive the speed-current characteristic of a D.C. series motor. Why D.C. series motor is preferred in traction drive? **8**

(ii) A shunt machine, connected to 240 V mains has an armature resistance of 0.04 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 8A. **8**

5. Write short notes on any two of the following: **8X2**

(i) Parallel operation of D.C. shunt generators.

(ii) Hopkinsons method of testing of D.C. machines.

(iii) Speed control of D.C. series motors.