BACHELOR OF ENGINEERING (ELECTRICAL ENGINEERING) EXAMINATION, 2019

(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

1. Justify the statements, with proper correction, if necessary (any four)   4x2.5

    a) Stepped core is used for large transformer to reduce material cost and weight.

    b) Interleaved joint is not used for large transformer due to increase in cost and size.

    c) To minimize the cost, transposition of conductors is done when parallel conductors are used.

    d) Buchholz's relay can protect a transformer from any type of winding fault.

    e) Double gap provided in arching horn for ease of fitting in small space.

    f) Explosion vent is provided at the top lead of transformer to protect from lightning.

    g) With increase in size, rating of transformer reduces due to increase in heat dissipating surface area.

    h) CRGOS is used for construction of transformer core.

2. Answer any one from (a) and (b):   10

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

    b) Develop equivalent circuit of a single phase autotransformer. State the assumptions clearly.

3. Answer any one from (a) and (b):   10

    a) Explain the operating principle of an auto transformer. Show that an auto transformer is more efficient than a two winding transformer.

    b) From the basic principle, explain the operation of a two winding transformer. Clearly state all the assumptions.

[Turn over

4. Answer any one from (a) and (b):   10

a) What is voltage regulation of a transformer? Why is it important? Derive an expression for voltage regulation.

b) Write short notes (any two)

    (i) Inrush current of a transformer

    (ii) No-load current of a transformer

    (iii) All-day efficiency of a transformer

5. Answer any one from (a) and (b):   10

a) A 10kVA,2500V/ 250V single phase transformer gave the following test results:

Open circuit test: 250V, 0.8 A, 50W

Short circuit test :   60V,3A, 455W

Find the voltage regulation of the transformer at full load, 0.8 p.f. (leading).

b) A 20 kVA, 2300 V/ 230 V, two winding transformer is to be used as a step-up auto-transformer, with constant source voltage of 2300 V. If the efficiency of the two-winding transformer at 0.8 p.f. is 96%, find the autotransformer efficiency at the same p.f.

Ref No. : Ex/EE/T/215/2019

B.E. Electrical Engineering 2ⁿᵈ Year 1ˢᵗ Semester Examination, 2019

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 question no. 6 and any two from the rest.

6.   Correct and/or justify the following (any six) :   **6x3**

i)   A separately excited DC generator has better voltage regulation than a shunt one.

ii)   Lap connected DC machine requires the equalizer connections whereas wave connected DC machine doesn't require it.

iii) Shifting of bush position is not a solution for armature reaction.

iv)   Armature core of a DC machine is made of non-laminated iron.

v)   Swinburne's method of testing of DC machine cannot predict the performance of a DC machine under load.

vi)   DC shunt motor can run in AC supply as well.

vii) DC motor cannot run at maximum efficiency condition.

viii) In real-life we do not get exactly linear commutation.

7. i) What is armature reaction in DC machines? What are the methods of   **7+6+3**
reducing the adverse effects of armature reaction?

ii)   Discuss the commutation process in a DC motor with proper diagram.

[Turn over

Question No.		Marks

iii) How do interpoles help in commutation process in DC motor?

8. i) Discuss different method of speed control of a DC series motor.   8+8

ii) A 400V DC shunt motor takes 6A at no load. Its armature resistance including brushes is 0.4Ω, and shunt field resistance is 200Ω. Estimate the kW output and efficiency when the motor takes 40A on full load. Find also the percentage change in speed from no-load to full load.

9. i) Derive speed-torque characteristics of a DC shunt motor. How to determine the operating point based on the load characteristics?   6 +2 + 8

ii) Why DC series motor is preferred for traction applications?

iii) A 6 pole, 230V, DC Series motor has a flux per pole of 4mWb/A over the working range of the magnetizing curve which is assumed to be linear. The load is proportional to square of the speed and it value is 20 N-m. at 800 r.p.m. There are 432 wave connected conductors and total resistance of the motor is 1.0 Ω. Determine the motor seed and current when the motor is connected to the rated supply voltage.

10. i) What are the conditions to be fulfilled to get voltage build-up in a DC shunt generator?   6+2+8

ii) What will happen if the supply voltage is withdrawn during running condition of Hopkinson's test?

iii) Two identical DC shunt machines when tested by Hopkinson's method, gave the following data:
Line voltage - 240V, line current excluding both the field currents – 40A, motor armature current- 250A, field currents are 4A and 3A. If the armature resistance of each machine is 0.02Ω, calculate efficiency of both the machine.