Reg. No. :

Question Paper Code: U3302

B.E./B.Tech. DEGREE EXAMINATION, APRIL 2024

Third Semester

Electrical and Electronics Engineering

21UEE302 – Electrical Machines - I

(Regulations 2021)

Duration: Three hours   Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. According to Fleming's left-hand rule if the forefinger points in the direction of the   CO2- U
    field than the middle finger will point in the direction of

    (a) Current in the conductor   (b) Resultant force on the conductor

    (c) Movement of the conductor   (d) None of the above

2. While comparing magnetic and electric circuits, the flux of magnetic circuit is   CO2- U
    compared with which parameter of electrical circuit?

    (a) E.m.f.   (b) Current   (c) Current density   (d) Conductivity

3. The armature reaction in d.c. machine causes distortion in the main field   CO1- U
    flux. This effect of armature reaction can be reduced by

    (a) Increasing the length of air gap   (b) Decreasing the length of air gap

    (c) Increasing the number of poles   (d) Decreasing the number of poles

4. In D.C. generators, current to the external circuit from armature is given   CO1- U
    through

    (a) commutator   (b) solid connection   (c) slip rings   (d) none of above

5. Which of the following application requires high starting torque?   CO4- U

    (a) Air blower   (b) Elevator   (c) Locomotive   (d) Centrifugal Pump

6. A 4 pole wave wound dc motor having flux per pole of 9.56×10^{-3} wb contains   CO4- App
    460 armature conductors. Calculate the back emf produced when it is running
    at a speed of 1500 rpm.

    (a) 220 volt   (b) 230 volt   (c) 240 volt   (d) 440 volt

7. A transformer has 500 turns in the primary and 1,000 turns in the secondary CO5- App windings. The transformation ratio is

   (a) 2   (b) 4   (c) 5   (d) 6

8. The Transformer ratings are usually expressed in terms of CO5- U

   (a) Volts   (b) Amps   (c) KW   (d) KVA

9. An Auto-transformer makes effective saving on copper, when its transformation CO5- U ratio is

   (a) Approximately equal to one   (b) less than one

   (c) Greater than one   (d) None of the above

10. The efficiency of two identical transformers under load conditions can be CO5- U determined by

    (a) SC Test   (b) Back to Back Test   (c) OC Test   (d) BDV Test

PART – B (5 x 2= 10Marks)

11. State Faraday's law of electromagnetic induction   CO2- U

12. How is the inter pole winding in dc machine excited?   CO1- U

13. DC series motor is used to start heavy loads - Identify?   CO4- U

14. What is an ideal transformer?   CO5- U

15. Define all day efficiency. Explain why all day efficiency is lower than CO6- U commercial efficiency.

PART – C (5 x 16= 80 Marks)

16. (a) Use the electro mechanical energy conversion principle to develop   CO2-App   (16)
        the expression for mechanical force developed by magnetic field
        with neat diagram.

Or

    (b) Apply the concepts of co-energy and field energy to develop the   CO2-App   (16)
        expression for the electromagnetic torque for the singly –excited
        machines.

17. (a) Explain the effect of armature reaction in a dc generator. How are its   CO1- U   (16)
        demagnetizing and cross magnetizing calculated.

Or

    (b) Derive an expression for the EMF generated in the DC machine.   CO1- U   (16)

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18. (a) Analyze various methods of speed control technique and choose the appropriate method to obtain below and above rated speed in dc shunt motors.   CO4- Ana   (16)

Or

(b) Analyze the operation of different types of starters and Select suitable starter for the motor used in high starting torque and constant speed applications. Discuss why starting current is high at the moment of starting a DC Motor?   CO4- Ana   (16)

19. (a) Explain the constructional details and working of core type and shell type transformers with neat sketches.   CO5- U   (16)

Or

(b) A 40 KVA transformer has iron loss of 450W and full load copper loss of 850W. If the power factor of the load is 0.8 lagging, Calculate (i) full load efficiency (ii) the load at which maximum efficiency occurs and (iii) the maximum efficiency   CO6- App   (16)

20. (a) Explain the parallel operation of three phase transformers.   CO5- U   (16)

Or

(b) Interpret in detail about the autotransformer, their principle. Arrive at the expression for saving of copper.   CO5- U   (16)

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