2021

ELECTRICAL MACHINES

Full Marks: 60

Time: Two hours

The figures in the margin indicate full marks for the questions.

A.   Multiple Choice Questions   1 x 20=20

1.   An ideal transformer will have maximum efficiency at a load such that

   a.   Copper loss = iron loss

   b.   Copper loss > iron loss

   c.   Copper loss < iron loss

   d.   None of the above

2.   The full-load copper loss of a transformer is 1600 W. At half-load, the copper loss will be

   a.   6400 W

   b.   1600 W

   c.   800W

   d.   400 W

3.   In a DC generator, rectification provided with commutator is

   a.   Half wave rectification

   b.   Full wave rectification

   c.   Semi controlled rectification

   d.   Uncontrolled rectification

4.   In a DC generator, the effect of armature reaction on the main pole flux is to

   a.   Reduce it

   b.   Distort it

   c.   Reverse it

   d.   Reduce and distort it

5. Commutator performs rectification so that output of the machine is bi-directional.

   a. True

   b. False

   c. None of the above

   d. Both a and b

6. Direction of rotation of motor is determined by

   a. Faraday's law

   b. Lenz's law

   c. Coulomb's law

   d. Fleming's left hand rule

7. In which of the following case we will get maximum power in dc motor?

   a. $E_b = 2$ x supply voltage

   b. $E_b =$ supply voltage

   c. 2 x $E_b =$ supply voltage

   d. 4 x $E_b =$ supply voltage

8. In a DC machine brushes are normally located along GNA

   a. True

   b. False

   c. Cannot determine

   d. None of the above

9. The frame of an induction motor is made of

   a. Aluminium

   b. Silicon steel

   c. Cast iron

   d. Stainless steel

10. What is the relation between number of parallel paths(A) and number of poles(P) in lap winding connection?

   a. $A = P$

   b. $A < P$

   c. $A > P$

d. No relation exists

11. Armature winding is mounted on a

    a. Stator

    b. Rotor

    c. Can be mounted anywhere on stator or rotor

    d. Not required

12. Coil span for 4-pole, 12-slot armature winding is

    a. 24

    b. 48

    c. 3

    d. 8

13. In wave winding number of parallel paths is equal to

    a. P (number of poles)

    b. 2

    c. 4

    d. 2 P

14. What will happen if the back emf of a DC motor vanishes suddenly?

    a. The motor will stop

    b. The motor will continue to run

    c. The armature may burn

    d. The motor will run noisy

15. For constant torque drive which of the following speed control method is preferred?

    a. Field control

    b. Armature voltage control

    c. Shunt armature control

    d. Voltage control

16. Wave winding machines are used in _____ currents applications.

    a. High

    b. Moderate

    c. Low

d. Can be used anywhere

17. The speed of a DC motor can be varied by changing

    a. Field current

    b. Applied voltage

    c. Resistance in series with armature

    d. Field current, applied voltage or resistance in series with armature any method will work

18. Synchronous speed is given by

    a. (30 f) / P

    b. (60 f) / P

    c. (220 f) / 3P

    d. (120 f) / P

19. In a DC machine, the direct axis is

    a. Axes of main poles

    b. Axes perpendicular to axes of main poles

    c. Not determined from the poles position

    d. Can be drawn anywhere

20 When coil sides are pole pitch apart, the DC armature winding is called as

    a. Multiplex

    b. Fractional-pitch

    c. Full-pitch

    d. Pole-pitch

B. Very Short Question   2*6=12

1. What is the function of commutator?

2. Derive the condition of maximum efficiency of transformer.

3. What is the function of brushes?

4. Derive the condition of maximum power in dc motor.

5. Define synchronous speed.

6. What is meant by armature reaction?

C   Short Question   4*7=28

1. A transformer has 8 windings in its primary core and 5 in its secondary

coil. If the primary voltage is 240 V, find the secondary voltage

2. A single-phase auto-transformer has a voltage ratio 320V:250V and supplies a load of 20 kVA at 250V. Assuming an ideal transformer, determine the current in each section of the winding.

3. A 2400V/400V single-phase transformer takes a no-load current of 0.5A and has a core loss of 400W. Determine the values of the magnetizing and core loss components of the no-load current.

4. A 4-pole dc shunt generator with a shunt field resistance of 100 Ω and an armature resistance of 1 Ω has 400 lap connected conductors in its armature. The flux per pole is 20 mWb. The rotational loss is 500 Watts. If the generator is driven at 1200 rpm, compute

   (a) terminal voltage

   (b) the efficiency

5. A 3-phase, 440 V, 50 Hz induction motor has a speed of 950 r.p.m. on full-load. The machine has 6 poles. Calculate the (i) full-load slip and

   (ii) frequency of rotor e.m.f.

6. A 4-pole, 240 Volt DC shunt motor has armature resistance of 0.25 ohm on load it takes an armature current of 50A and runs at 750rpm. Find the flux per pole of the motor.

7. In a 110 V compound generator, the resistance of the armature, shunt and series windings are 0.06, 25 and 0.05 Ω respectively. Find the shunt field current when machine is connected for long shunt.

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