G 505 (Pages : 3) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, MAY 2014

Fourth Semester

Branch : Electrical and Electronics Engineering

EE 010 402—DC MACHINES AND TRANSFORMERS (EE)

(New Scheme—2010 Admission onwards)

[Regular/Improvement/Supplementary]

Time : Three Hours Maximum : 100 Marks

Part A

Answer **all** *questions.*
Each question carries 3 *marks.*

1. What is commutation ? Explain with neat diagram.
2. What is separate excitation and self excitation ? What do you do if a self exited DC Machine fails to buildup EMF ?
3. Derive the expression for back EMF of DC motor.
4. 33kVA, 2200/220V 1-phase Transformer has $r_1 = 2.4\Omega$, $x_1 = 6.00\ \Omega$, and $r_2 = 0.03\ \Omega$, $x_2 = 0.07\ \Omega$, Find equivalent resistance and reactance with respective secondary.
5. A three-phase transformer has 500 primary turns and 50 secondary turns. If the supply voltage is 2.4kV find the secondary line voltage on no-load when the windings are connected to (a) star-delta, (b) delta-star.

(5 × 3 = 15 marks)

Part B

Answer **all** *questions.*
Each full question carries 5 *marks.*

6. Explain principle of operation of dc generator. Explain about mechanical inverter.
7. A 6 pole d.c. machine has 300 conductors and each conductor is capable of carrying 80A without excessive temperature rise. The flux per pole is 0.015 Wb and the machine is driven a 1800 r.p.m. Compute the total current, EMF, power developed in the armature, for (a) wave connected ; (b) lap connected.
8. What happens if we start the machine without starter ? Derive the torque equation in DC motor.
9. What are the necessary and sufficient conditions for the parallel operation of transformer, and explain ?
10. Write some major differences between two winding transformer and auto-transformer. Explain how efficiency will be in auto-transformer ?

(5 × 5 = 25 marks)

Turn over

Part C

Answer **all** *questions.*
Each full question carries 12 *marks.*

11. State the maximum efficiency criterion for different types of DC Generator. A 50 kW, 120 V, long shunt compound generator is supplying a load at its maximum efficiency and the rated voltage. The armature resistance is 50mΩ, series field resistance is 20mΩ, shunt field resistance is 40Ω, and rotational loss is 2kW. What is the maximum efficiency of the generator ?

Or

12. Explain what is armature reaction? In each case explain how the resultant flux reacts.

13. (A) Explain the construction and working principle of the DC generator.

    (b) The shaft torque of a diesel motor driving a 100V d.c. shunt-wound generator is 25Nm. The armature current of the generator is 16 A at this value of torque. If the shunt field regulator is adjusted so that the flux is reduced by 15%, the torque increases to 35Nm. determine the armature current at this new value of torque.

Or

14. List out various tests on dc machines. Explain Hopkinson's test.

15. A 230V dc shunt motor, takes an armature current of 3.33A at rated voltage and at a *no-load* speed of 1000 rpm. The resistance of armature circuit and field circuit are respectively 0.3Ω, and 160 Ω. The line current at full load and rated voltage is 40A. Calculate, at full load the speed and the developed torque in case the armature reaction weakens the no load flux by 4%.

Or

16. The following data pertain to the magnetization curve of a dc shunt generator at 1500rpm :—

I_f A	...	0	0.4	0.8	1.20	1.60	2.0	2.40	2.80	3.0
Ea, volts	...	6	60	120	172.5	202.5	221	231	237	240

For this generator, obtain

(a) The voltage on open circuit to which the machine will build-up for a total shunt field resistance of 1000 Ω.

(b) The critical value of field resistance at 1500rpm.

(c) The magnetization curve at 1200 rpm. And therefore the open circuit voltage for field resistance of 100 Ω.

17. (a) Derive the expression for maximum efficiency and explain when it occurs.

    (b) The EMF per turn for a single phase, 2310/220 V, 50 Hz transformer is approximately 13 volts. Calculate (a) The number of primary and secondary turns. (b) The net cross-sectional area of the core, for a maximum flux density of 1.4T.

Or

18. Explain which tests have to carries out to know the characteristics of transformer. And explain each test in details.

19. (a) Explain in details what is tertiary winding write its application. Also derive the equivalent circuit of transformer with respective primary and draw it ?

(b) Briefly explain different cooling arrangement of transformer.

Or

20. (a) Explain the methods to increase co-efficient of coupling in three phase transformer.

(b) The self and mutual inductances of a two- winding transformer are $L_2 = 4mH$, $L_2 = 6mH$, $M_{12} = M_{21} = 1.8mH$. Calculate the current which would flow in the primary winding when this winding is connected to a 130 V, (500/π) Hz supply and the load of 0.2mH inductance is connected across the secondary winding. Assume power losses in the windings and magnetic circuit to be neglected.

(5 × 12 = 60 marks)