Reg. No. : | | | | | | | | | | | | |

Question Paper Code : X 20485

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2020
Third/Fourth Semester
Electrical and Electronics Engineering
EE 6401 – ELECTRICAL MACHINES – I
(Regulations 2013)

Time : Three Hours | Maximum : 100 Marks

Answer ALL questions

PART – A **(10×2=20 Marks)**

1. Define Stacking factor.
2. What are quasi static fields ?
3. Specify the applications of autotransformer.
4. Mention the role of tertiary winding in transformer.
5. Define Co-energy.
6. What is meant by winding inductance ?
7. What is meant by armature reaction ?
8. State the conditions under which a DC shunt generator fails to excite.
9. List various method of starting D.C. motor.
10. What is meant by dynamic braking in D.C. motor ?

PART – B **(5×13=65 Marks)**

11. a) Explain the methods of energy conversion via Electric Field, with examples of Electrical Machines.

(OR)

b) i) Specify the causes for Hysteresis and Eddy current losses in Electrical Machines. Also suggest the methods in construction to minimize the above losses. **(7)**

ii) State properties of magnetic material suitable for fabrication Permanent Magnet and Electromagnet. **(6)**

12. a) With a circuit explain how to obtain equivalent circuit by conducting O.C. and S.C. test in a single phase transformer.

(OR)

b) Explain the various three phase transformer connection and parallel operation of three phase transformer.

13. a) Two windings, one mounted in stator and other at rotor have self and mutual inductance of $L_{11} = 4.5$ and $L_{22} = 2.5$, $L_{12} = 2.8 \cos\theta H$, where θ is the angle between axes of winding. Winding 2 is short circuited and current in winding as a function of time is $i_1 = 10 \sin \omega t A$.

i) Determine the expression for numerical value in Newton-meter for the instantaneous value of torque in terms of θ. **(5)**

ii) Compute the time average torque in Newton-meter when $\theta = 45°$. **(5)**

iii) If the rotor is allowed to move, will it continuously rotate or it will come to rest ? If later at which value of θ_0. **(3)**

(OR)

b) i) In an electromagnetic relay, functional relation between the current i in the excitation coil, the position of armature is x and the flux linkage Ψ is given by $i = 2\Psi^3 + 3\Psi (1 - x + x^2)$, $x > 0.5$. Find force on the armature as a function of Ψ. **(7)**

ii) Show that the torque developed in a doubly excited magnetic system is equal to the rate of increase of field energy with respect to displacement at constant current. **(6)**

14. a) Explain the effect of armature reaction in a DC generator. How are its demagnetizing and cross magnetizing ampere turns calculated ?

(OR)

b) A four pole lap wound shunt generator supplies 60 lamps of 100W, 240V each; the field and armature resistances are 55Ω and 0.18Ω respectively. If the brush drop is 1V for each brush find :

i) Armature Current **(3)**

ii) Current per path **(3)**

iii) Generated emf **(3)**

iv) Power output of DC machine. **(4)**

15. a) In a Hopkinson's test on a pair of 500-V, 100-kW shunt generators, the following data was obtained.

Auxiliary supply, 30 A at 500 V; Generator output current, 200A Field currents, 3.5 A 1.8 A

Armature circuit resistances, 0.075Ω each machine. Voltage drop at brushes, 2V (each machine),

Calculate the efficiency of the machine acting as a generator.

(OR)

b) With a circuit, explain how to obtain efficiency of D.C. generator by conducting Swinburne's test.

PART – C **(1×15=15 Marks)**

16. a) A 1-φ 100 kVA, 2000 V/200 V two-winding transformer is connected as an Auto Transformer as shown in figure 16 a) such that more than 2000 V is obtained at the secondary. The portion 'ab' is the 200 V winding and the portion 'bc' is the 2000 V winding. Compute the kVA rating as a Auto transformer.

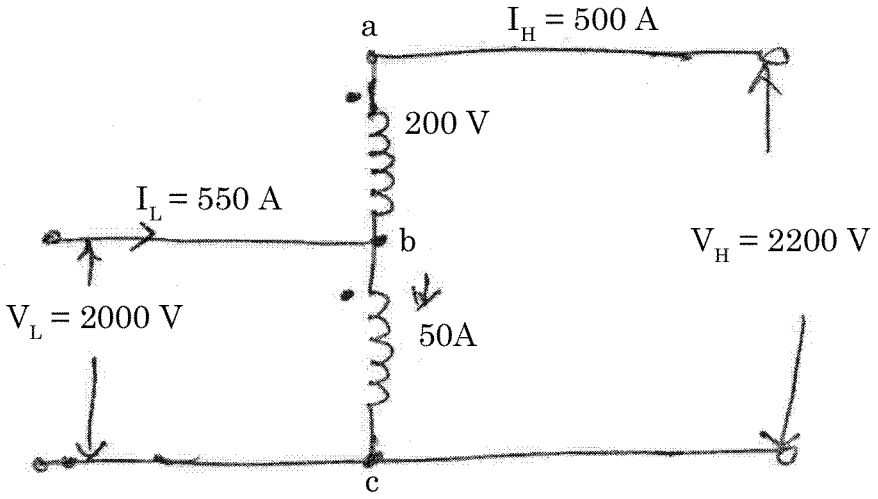

Figure 16 a)

(OR)

b) A DC shunt generator driven by a belt from an engine runs at 760 rpm while feeding 100 kW of electric power into 230 V mains. When the belt breaks it continuous to run as a motor drawing 9 kW from the mains. At what speed would it run ? Given armature resistance 0.08 Ω and field resistance 115 Ω.

Assume field excitation remains same.

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