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

Question Paper Code : 27214

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2015.

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. Why transformer rating is in KVA?
4. What happen when a DC supply is applied to a Transformer?
5. What are the requirements of Excitation system?
6. What do you meant by SPP? What is its significant?
7. Why fractional Pitched Winding is required than full pitched winding?
8. Define Winding factor?
9. State Fleming's Left hand rule?
10. Why DC Series motor is called as Variable speed motor?

PART B — (5 × 16 = 80 marks)

11. (a) Explain clearly the statically and dynamically induced EMF. (16)

Or

(b) (i) Derive an expression for an energy density in a magnetic circuits.(6)

(ii) Explain in detail "Eddy current loss". (4)

(iii) The total core loss of a specimen of Silicon Steel is found to be 1500W at 50HZ keeping the flux density constant the loss become 3000W when the frequency is raised to 75HZ. Calculate separately the hysteresis and eddy current losses for each of these frequencies. (6)

12. (a) (i) Derive the expression for saving of copper in autotransformer. (6)

(ii) Calculate the efficiency for half, full load of a 100 KVA transformer for the P.F of unity and 0.8 the copper loss at full load is 1000 W and iron loss is 1000 W. (10)

Or

(b) The primary of the transformer is rated at 10 A and 1000 V. The open circuit reading are V_1 = 1000V, V_2 = 500V, I = 0.42A, Pac = 100W. The short circuit readings are I_1 – 10A, V_1 – 125V and Pac = 400 W. Draw the equivalent circuit for the Transformer. Predict the output voltage for the load impedance ZL = 19 + j12 ohms and draw the phasor diagram.(16)

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. (8)

(ii) Compute the time average torque in Newton-meter when θ = 45°. (4)

(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. (4)

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. (8)

(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. (8)

14. (a) (i) Explain the armature reaction and Commutation in detail for a Dc machine. (10)

(ii) Two Shunt generators are connected in parallel to supply a load of 5000 A each machine has a armature resistance of 0.03 Ω and field resistance of 60 Ω. EMF on one machine is 600V and in other machine is 640V.What power does each machine supply? (6)

Or

(b) (i) Draw and explain the load characteristics of DC Compound generators in detail. (8)

(ii) A long Shunt Compound generator has a shunt field winding of 1,000 turns per pole and series field winding of 4 turns per pole and a resistance of 0.05Ω. In order to obtain the speed voltage both at load and full load for operating as shunt generator. It is necessary to increase the field current by 0.2A.The full load armature current of the compound generator is 80A. Ca1culate the diverter resistance connected in parallel of series field to obtain flat compound operation? (8)

15. (a) Why starters are necessary? Explain in detail the construction and working operation of 4 point starter. (16)

Or

(b) (i) Explain in detail the construction and working operation of Retardation test on DC Motor. (10)

(ii) Derive in detail the condition for maximum efficiency of DC Machine. (6)
