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Question Paper Code : 60501

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2016.

Fourth Semester

Electrical and Electronics Engineering

EE 2251/EE 42/EE 1251 A/10133 EE 402/080280003 — ELECTRICAL MACHINES — I

(Regulations 2008/2010)

(Common to PTEE 2251/10133 EE 402 — Electrical Machines — I for B.E. (Part–Time) Third Semester — Electrical and Electronics Engineering — Regulations 2009)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What are the basic types of rotating electric machines?

2. Draw the typical magnetization curve of ferromagnetic material.

3. Differentiate oscillator and amplifier.

4. State the Barkhausen criterion for sustained oscillation. What will happen to the oscillations if the magnitude of the loop gain is greater than unity?

5. Define co-energy.

6. What do all practical energy conversion devices make use of the magnetic fields as a coupling medium rather than electric fields?

7. What is magnetic leakage flux?

8. Why is the efficiency of a three-phase induction motor less than that of a three-phase transformer?

9. Define commutation.

10. State the methods of speed control in dc series motor.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Discuss the magnetic circuits and the electrical analog of magnetic circuits. (10)

(ii) Explain the eddy current and the eddy-current loss. (6)

Or

(b) (i) Explain the power losses that occur in a magnetic material when it undergoes cyclic magnetization. (10)

(ii) The total core loss of a specimen of silicon steel is found to be 1500 W at 50 Hz. Keeping the flux density constant the loss becomes 3000 W when the frequency is raised to 75 Hz. Calculate separately the hysteresis and eddy current loss at each of those frequencies. (6)

12. (a) Explain the constructional details and working of core type and shell type transformers with neat sketches. (16)

Or

(b) Obtain the equivalent circuit of a 200/400 V, 50 Hz; 1-phase transformer from the following test data :

O.C. test: 200V, 0.7 A, 70W – on L.V side

S.C. test: 15 V, 10 A, 85 W – on H.V side

Calculate the secondary voltage when delivering 5 kW at 0.8 p.f. lagging, the primary voltage being 200 V. (16)

13. (a) Derive the expression for energy and force in a doubly excited magnetic field system. (16)

Or

(b) Two coupled coils have self and mutual inductance of $L_{11} = 2 + 1/2x; L_{22} = 1 + 1/2x; L_{12} = L_{21} = 1/2x$ over a certain range of linear displacement of x. The first coil is excited by a constant current of 20 Amps and the second by constant current of –10 Amps. Find mechanical work done if x changes from 0.5 to 1 m and also the energy supplied by each electrical source. (16)

14. (a) (i) Describe the working of a Schmitt trigger circuit with the help of necessary Sketches. (10)

(ii) A square wave whose peak - peak amplitude is 4V extends ± 2V w.r.t ground. The duration of the positive section is 0.1 secs and negative section is 0.3 secs. The circuit time constant is 0.3 secs. If this wave form is impressed upon.

(1) RC integrating circuit

(2) RC differentiating circuit.

Find their steady state max and min values of the output wave form and draw the output wave form for both the case. (6)

Or

(b) (i) Sketch the response of RC high pass filter for the following inputs and explain

(1) Ramp

(2) Pulse. (8)

(ii) Explain the switching characteristics of transistor with a neat sketch. (8)

15. (a) (i) Derive from the fundamental, emf and torque equations and explain the characteristics of DC shunt motor. (12)

(ii) What are the merits and demerits of Hopkinson's test? (4)

Or

(b) (i) Discuss in detail about shunt armature speed control of dc shunt motor. (8)

(ii) A 500V dc shunt motor running at 700 rpm takes an armature current of 50 A. Its effective armature resistance is 0.4 Ω. What resistance must be placed in series with the armature to reduce the speed to 600 rpm, the torque remaining constant? (8)
