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Question Paper Code : 80495

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2021.

Fourth Semester

Electrical and Electronics Engineering

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

(Regulations 2008/2010)

(Common to PTEE 2251–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 quasi-static fields?

2. Define magnetic reluctance.

3. Define regulation of a transformer.

4. State the advantages and applications of auto transformer.

5. Draw the diagram indicating the flow of energy in electromechanical energy conversion via coupling medium.

6. Give the expression for energy stored in the magnetic field.

7. Write down the expression for torque in round rotor machine.

8. Why fractional pitched winding is preferred over full pitched winding?

9. Determine the value of capacitors to be used in an astable multivibrator to provide a train of pulse of $4\,\mu s$ wide at a repetition rate of 80 kHz if $R_1 = R_2 = 10\,k\ \Omega$.

10. List the applications of time base generators.

PART B — (5 × 16 = 80 marks)

11. (a) Draw and explain the typical magnetic circuit with air-gap and, its equivalent electric circuit. Hence derive the expression for air-gap flux. (16)

Or

(b) The magnetic circuit has dimensions: $A_c = 4 \times 4\ cm^2$, $1_g = 0.06\ cm$, $1_c = 40\ cm$ and $N = 600$ turns. Assume the value of $\mu_r = 6000$ for iron. Find the exciting current for $B_c = 1.2\ T$ and the corresponding flux and flux linkages. (16)

12. (a) (i) Explain the working of Hartley oscillator. Derive the expression for the frequency of oscillation and the condition for oscillation. (10)

(ii) Describe the operation of Twin -T oscillators. (6)

Or

(b) (i) Draw the circuit diagram of RC phase shift oscillator and explain its operation by deriving the expression for frequency of oscillation. (10)

(ii) Discuss about the frequency stability of an oscillator. (6)

13. (a) Derive an expression for co-energy density of an electromechanical energy conversion device.

Or

(b) The doubly – excited magnetic field has coil self – and mutual – inductances of

$L_{11} = L_{22} = 22$

$L_{12} = L_{21} = \cos\theta$

where θ is the angle between the axes of the coils. The coils are connected in parallel to a voltage source $V = V_m \sin wt$. Derive an expression for the instantaneous torque as a function of the angular position θ. Find the time – average torque. Evaluate for θ=30°; $\gamma = 100 \sin 314t$.

14. (a) (i) What is meant by the current sheet concept? Explain briefly. What is the phase angle difference between a sinusoidally distributed current sheet and its accompanying mmf wave? (8)

(ii) A 4-pole, lap wound dc machines has 728 armature conductors. Its field winding is excited from a dc source to create an air gap flux of 32 mWb/pole. The machine is run from a prime mover at 1600rpm. It supplies a current of 100A to an electric load.

(1) Calculate the electromagnetic power developed.

(2) What is the mechanical power that is fed from the prime mover to the generator?

(3) What is the torque provided by the prime mover? (8)

Or

(b) Explain briefly the production of rotating magnetic field. What are the speed and direction of rotation of the field? Is the speed uniform? (16)

15. (a) With neat sketch explain the working of 4 points starter. (16)

Or

(b) Explain the process of commutation and methods of commutation. (16)

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