

- (c) Explain different type of losses that occur in a transformer. (3)
- 5 (a) Differentiate between Online, Offline, and Line-interactive UPS systems. (8)
- (b) Draw the block diagram of regulated power supply and explain the function of each block. (7)
- (c) What is a flyback converter? How does it work in an SMPS? (3)
- 6 (a) What is a series inverter? Explain its working principle using SCRs. (7)
- (b) Explain the working of Permanent-magnet Stepper motor. (7)
- (c) Why all-day efficiency is always less than ordinary efficiency in transformer. (4)
- 7 (a) Compare the characteristics of a DC series motor and a DC shunt motor. (8)
- (b) Explain the working of different types of compound motor. A 250-V, 4-pole, wave-wound d.c. series motor has 782 conductors on its armature. It has armature and series field resistance of 0.75 ohm. The motor takes a current of 40 A. Estimate its speed and gross torque developed if it has a flux per pole of 25 mWb. (7)
- (c) Explain the concept of latching and holding current in an SCR. (3)

(1000)

[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 5848

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Unique Paper Code : 2512043503

Name of the Paper : Power Devices and Electrical Machines

Name of the Course : B.Sc.(H) Instrumentation (CORE)

Semester : V

Duration : 3 Hours

Maximum Marks : 90

Instructions for Candidates

- Write your Roll No. on the top immediately on receipt of this question paper.
 - All question carry equal marks. Question No.1 is compulsory.
 - Use of non-programmable scientific calculator is allowed.
- (a) Differentiate between controlled and uncontrolled rectifiers (3)
 - (b) Explain how a DIAC is different in operation from an SCR. (3)

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- (c) A single-phase transformer has 400 primary and 1000 secondary turns. The net cross-sectional area of the core is 60 cm^2 . If the primary winding be connected to a 50-Hz supply at 520 V, calculate (i) the peak value of flux density in the core (ii) the voltage induced in the secondary winding. (3)
- (d) What happens during a power failure in an online UPS vs offline UPS? (3)
- (e) Define step angle in stepper motor. A stepper motor has a step angle of 2.5° . Determine resolution and number of steps required for the shaft to make 25 revolutions. (3)
- (f) Why is a DC series motor not suitable for no-load operation? (3)
2. (a) Draw the turn-off characteristics of SCR and explain the mechanism of turn-off. (8)
- (b) Which type of triggering circuit is used for an SCR to achieve a firing angle greater than 90° degrees? Explain with the help of a diagram. (7)
- (c) Explain the need for snubber circuits in SCR. (3)
3. (a) What is the necessity of starter in dc motor? Explain the function and working of a 3-point starter for a DC motor. (7)

- (b) How does rotor rotate in an induction motor? A 4-pole, 3-phase induction motor operates from a supply whose frequency is 50 Hz. Calculate: (7)
- (i) Speed of the rotor when the slip is 0.04
- (ii) Speed at which the magnetic field of the stator is rotating.
- (iii) Frequency of the rotor current when the slip is 0.03.
- (c) A single-stack, 3-phase Variable Reluctance (VR) motor has a step angle of 15° . (4)
- Find the number of its rotor and stator poles.
- (i) When $N_s > N_r$ and
- (ii) When $N_s < N_r$
4. (a) Explain how a single winding transformer can be used for copper saving? Why we use single winding transformer in comparison of two winding transformer. (8)
- (b) Find all day efficiency of a transformer having maximum efficiency of 98 % at 15 kVA at unity power factor and loaded as follows : (7)
- 12 hours – 2 kW at 0.5 p.f. lag
- 6 hours – 12 kW at 0.8 p.f. lag
- 6 hours – at no load