

This question paper contains 4+2 printed pages]

Your Roll No.....

**1020**

**B.Sc. (Hons.)/III**

**C**

**ELECTRONICS—Paper 3.6 (XX)**

**(Electrical Technology and Electrical Machines)**

*Time : 3 Hours*

*Maximum Marks : 38*

*(Write your Roll No. on the top immediately on receipt of this question paper.)*

Attempt *five* questions in all, including

Question No. 1 which is compulsory.

Use of non-programmable scientific calculator is allowed.

1. (a) Define statically and dynamically induced emf.
- (b) Explain the effect of rise in temperature on the resistance of semiconductors, insulators and conductors.

P.T.O.

(c) Name the parameters measured by short circuit and open circuit tests in a transformer.

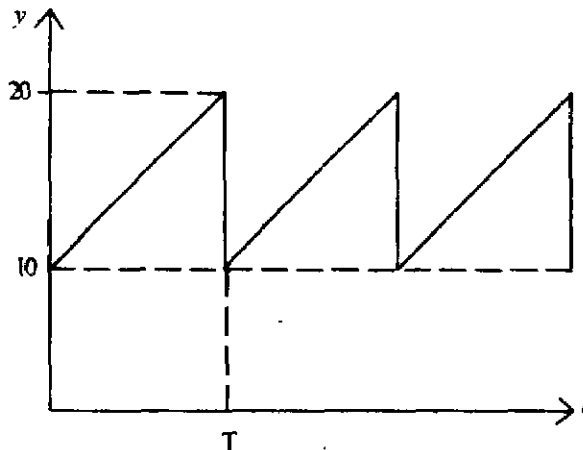
(d) How are polyphase circuits economical over single-phase circuits.

(e) In a d.c. motor, explain the significance of back emf. 5×2

2 (a) Find the rms of : 2

$$i(t) = 12 \sin \omega t + 6 \sin(3\omega t - \pi/6) + 4 \sin(5\omega t + \pi/3).$$

(b) Determine the form factor and crest factor for the following waveform : 5



3. (a) A toroid is composed of three ferromagnetic circuits and is equipped with a coil having 100 turns. First material has mean arc length of 0.3 meters. Second material has mean arc length of 0.2 meters and third has mean arc length of 0.1 meter.

Each material has a cross-sectional area of  $0.001 \text{ m}^2$ .

- (i) Find mmf needed to establish flux of  $6 \times 10^{-4} \text{ Wb}$ .
- (ii) What current must be made to flow through the coil to set up the above mentioned flux ?
- (iii) Compute relative permeability and reluctance of each ferromagnetic material.

Given :

$$H_1 = 10 \text{ AT/m}, H_2 = 66 \text{ AT/m}, H_3 = 324 \text{ AT/m}$$

corresponding to B of 0.6 Tesla.

(b) Draw analogy between electric and magnetic circuits.

5+2

4. (a) Deduce the relationship between phase and line voltages and currents in a 3  $\phi$  delta connected circuit. Draw phasor diagram to establish it.

(b) Three equal star-connected inductors take 8 kW at p.f. of 0.8 when connected to a 460 V 3- $\phi$ , 3 wire supply. Find line current, if one inductor is short circuited.

3+4

5. (a) How is auto-transformer better than a two-coil conventional transformer ? How much copper is saved in an autotransformer in comparison to two-coil transformer ?

- (b) Define regulation for a transformer. What is the condition for maximum efficiency for a transformer ? 4+3
6. (a) Describe the various types of d.c. generators with the help of diagram.
- (b) A 4 pole, lap wound d.c. shunt generator has a useful flux per pole of 0.07 Wb. The armature consists of 220 turns each of 0.004  $\Omega$  resistance. Calculate the terminal voltage when running at 900 rpm, if the armature current is 50 A. 3+4
7. (a) Derive expression for coefficient of coupling of two magnetically coupled coils.

- (b) Two magnetically coupled coils have a mutual inductance of 32 mH. What is the average emf induced in one, if the current through other changes from 3 to 15 mA in 0.004 sec. Given that one coil has twice the number of turns in the other. Calculate the inductance of each coil. Neglect leakage. 2+5