This question paper contains 4 printed pages.]

Your Roll No. .....

1411 **A**

B.Sc. (Hons.)/III

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 Insulation Resistance. What is its temperature coefficient ? 2

   (b) The inductance of a coil carrying a current of 2A is 0.5 henry. Find the energy stored in it. 2

   (c) Three similar resistors are connected in star across 400–V, 3 phase lines. The line current is 5A. Calculate the value of each resister. 2

   (d) What are the advantages of polyphase system over a single phase system ? 2

   (e) Derive the expression for back e.m.f. for a dc motor. 2

2. (a) Two coils connected in series have resistances of 600 Ω and 300 Ω at 20°C with temperature coefficient of 0.1% and 0.4%

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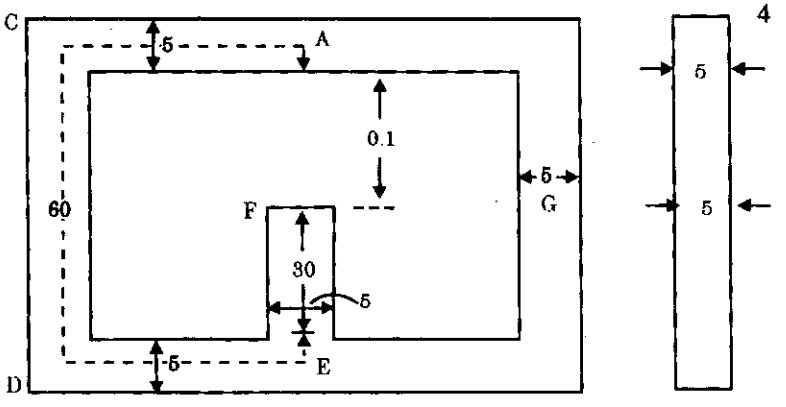
respectively. Find the resistance of the combination at a temp. of 50°C. What is the effective temperature coeff. of combination? 3

(b) A cast steel d.c. electromagnet shown. In fig. has a coil of 1000 turns on its central limb. Determine the current that the coil should carry to produce a flux of 2.5 mωb in the air gap. Neglect leakage. Dimensions are given in cm. The magnetisation curve for cast steel is as under.

FLUX DENSITY ($\omega b/m^2$)	0.2	0.5	0.7	1.0	1.2
Amp.-runs/meter	300	540	650	900	1150



3. (a) A square cross-sectional magnet of side of 4 cm has a strength of 0.5 mωb. Determine the magnetic flux density. 2

(b) Explain the concept of mutual inductance. Define coefficient of coupling and derive the expression between self inductances of

two coils, mutual inductance between them and the coefficient of coupling. 5

4. (a) A star connected 3-phase load has a resistance of 6Ω and an inductive reactance of 8Ω in each branch. A line to line voltage of 220V is impressed through a 3-ϕ auto-transformer. Find the voltage across each branch, line voltages and line currents and total active power. 4

(b) Deduce the relationship between the phase and line voltages and currents in a three phase star connected circuit. Draw phaser diagram to eastablish it. 3

5. (a) Calculate the r.m.s. value, the form factor and peak factor of a periodic voltage having the following values for equal time intervals changing suddenly from one value to the next : 0, 5, 10, 20, 50, 60, 50, 20, 10, 5, 0, – 5, – 10V, – 20V, etc. What would be the r.m.s. value of sine wave having the same peak value ? 5

(b) Write the exponential and polar form of a vector $5 + j7$, Illustrate it by means of vector diagram. 2

6. (a) With the help of phaser diagram, explain the operation of a single phase transformer under no load and full load condition. 5

(b) A sinusoidal flux 0.02 ωb (mex.) links with 55 turns of a transformer secondary coil. Calculate the r.m.s. value of the induced e.m.f. in the secondary. The supply frequency is 50 Hz. 2

7. (a) A dc generator has the following data :

(a) no. of poles = 6

(b) no. of slots = 54

(c) conductor per slot = 16

(d) speed of the machine = 100 r.p.m.

(e) useful flux/pole = 0.65×10^{-2} ωb.

(f) Type of winding = wave

Calculate the magnitude of the generated voltage. 2

(b) How will you find the critical resistance from open circuit characteristics (O. C. C.) of a dc shunt generator, and what is its significance ? 3

(c) A three phase 11 KV, 50 Hz synchronous generator runs at 1500 r.p.m. Determine the number of poles. 2