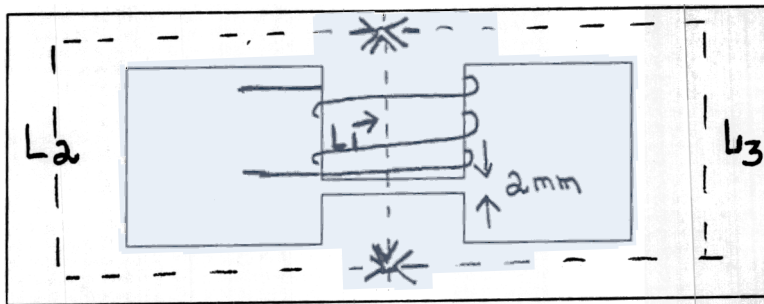


Answer Part A, Part B and Part C in separate answer sheets  
**PART A**

1. The magnetic circuit shown below has the following dimensions  
 $L_1=10\text{cm}$ ,  
 $L_2=L_3=18\text{cm}$ ,  
 Cross sectional area of L1 path =  $6.25 \times 10^{-4} \text{ m}^2$   
 Cross sectional area of L2 and L3 path =  $3 \times 10^{-4} \text{ m}^2$   
 Length of airgap = 2 mm. Taking the relative permeability of the material as 800  
 find the current in the 600 turn exciting coil to establish a flux of  $100 \times 10^{-6} \text{ wb}$  in  
 the air gap. Neglect leakage and fringing effect. **[8 Marks]**



2. Each phase of a star connected load consists of a non reactive resistance of 100 ohm in parallel with a capacitance of 31.8 micro farad. Calculate the line current, the power absorbed, the total KVA and power factor when connected to a 316 V, 3 phase, 50 Hz supply. **[10 Marks]**
3. Derive the RMS value, average value, Form factor and Peak factor of a half wave rectified voltage. **[10 marks]**

**PART B**

4. The following test results were obtained on an 8 kVA, 400/120 V, 50 Hz transformer:

OC test (LV side)	120 V, 4A, 75 W
SC test (HV side)	9.5 V, 20 A, 110 W

- (a) Draw the circuit model of the transformer referred to the HV side  
 (b) Calculate the efficiency at full load and unity power factor.  
 (c) Determine the load power factor (leading) for zero voltage regulation when the transformer is fully loaded. **[8+5+2 marks]**

5. Draw the circuit model of a dc machine and write the power balance equation, mentioning all the variables. [4marks]

6. With respect to dc shunt motor, answer the following:

- (a) Draw the speed-toque characteristic for a fixed field current and explain the nature of characteristic.
- (b) Discuss the effect of armature reaction on the above characteristic.
- (c) Explain the constant-torque drive. [3+2+3 marks]

### PART C

7 (a) A 230 V dc series motor has linear OCC with a slope of 10 V / field ampere at 1500 rpm. Find the speed at which the motor will run when developing a torque of 45 Nm. What current it will draw from mains. Total Field resistance is given as  $R_a + R_{se} = 0.6\Omega$ . [8 marks]

(b) Plot the complete torque slip characteristics of 3-phase Induction motor and explain its various modes of operation. [5 marks]

8. A 25 KW, 1500 rpm 3-phase, 50 Hz, 430V synchronous motor has a stator resistance of  $0.1\ \Omega$  per phase, a field resistance of  $35\ \Omega$  and synchronous reactance of  $1.5\ \Omega$  per phase. Calculate the Excitation voltage needed at a stator input of 40 kVA, 0.8 p.f leading. [7 marks]

9. The efficiency of a 400V, 3-phase, 50 Hz, 4 pole induction motor draw a line current of 85 A at 0.8 power factor at 5% slip is 90%. Calculate the shaft output and shaft torque. [5 marks]

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**BITS, PILANI – DUBAI, INTERNATIONAL ACADEMIC CITY, DUBAI**  
**SECOND SEMESTER 2007 – 2008**  
**ES UC272 ELECTRICAL SCIENCES – II**  
**TEST 2 (OPEN BOOK)**

**MAXIMUM MARKS: 20**  
**DATE: 08.05.08**

**WEIGHTAGE: 20%**  
**DURATION: 50 MINUTES**

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1) A single phase transformer has 500 turns on primary and 100 turns on secondary. The mean length of flux path is 1.6 m had the joints are equivalent to an airgap of 0.1mm. A voltage of 2000 V is applied to primary and maximum flux density in the core is 0.9 T.

Assume that the magnetic field strength for the given value of flux density is 350 ampere turns per meter. The core loss is 1.6 W per kg at 50 Hz and density of core material is  $7800\text{kg/m}^3$ . The frequency is 50Hz .

Find

- a) Cross sectional area of the core [1 M]
- b) the no load output voltage [1 M]
- c) no load primary current and power factor [4 +1 M]

- 2 a) Why transformer cores are made of high permeability sheet steel?
- 2 b) Mention the modes in which motors function as generators in electric traction systems.
- 2 c) Draw and explain the speed-torque characteristics of a dc motor matching traction type loads. Write the equations for speed and torque.

[2+2+4 M]

3) A Separately excited dc generator when running at 1000 r.p.m supplies 20A at 230V to a circuit of constant load resistance. What will be the current when speed is dropped to 700 r.p.m and the field current is dropped to 60%. Given Armature resistance  $R_a = 0.04 \Omega$ . Ignore saturation and armature reaction.

[5 marks]

**BITS, PILANI – DUBAI, INTERNATIONAL ACADEMIC CITY, DUBAI**  
**SECOND SEMESTER 2007 – 2008**  
**ES UC272 ELECTRICAL SCIENCES – II**  
**TEST I (CLOSED BOOK)**

**MAXIMUM MARKS: 25**  
**DATE: 30.03.08**

**WEIGHTAGE: 25%**  
**DURATION: 50 MINUTES**

- 1 A rectangular iron core is shown in Figure 1. It has a mean magnetic path of 100 cm, cross-section of (2 cm x 2 cm), relative permeability of 1400 and an air gap of 5mm cut in the core. The three coils carried by the core have number of turns  $N_a = 335$ ,  $N_b = 600$  &  $N_c = 600$ ; and the respective currents are 1.6A, 4 A and 0 A. The directions of currents are as shown. Find the flux in the air gap. [8 marks]

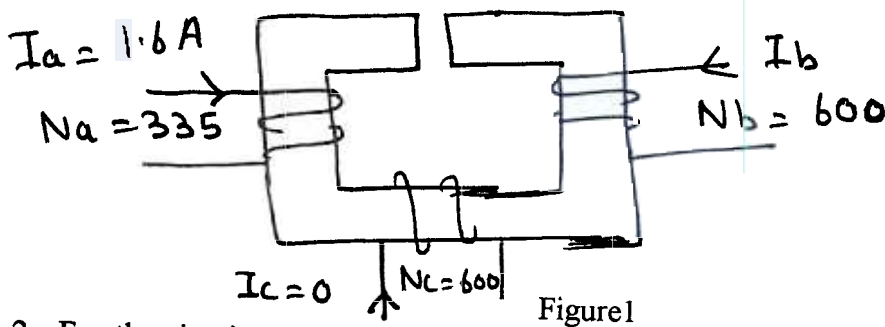


Figure 1

2. For the circuit of Figure 2 Find  $v(t)$  using phasor method. Given  $i(t) = \sqrt{2} \cos 2t$ . [8 marks]

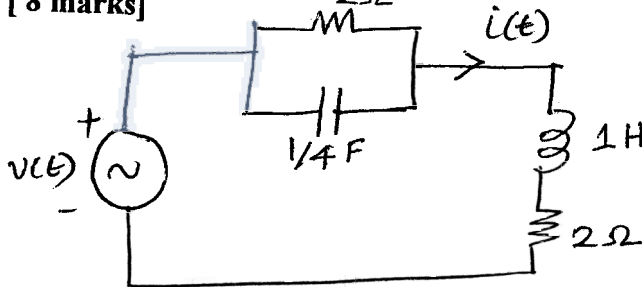


Figure 2

3. Consider the unbalanced delta connected load of Figure 3. Find line currents. The phase sequence given is acb. [9 marks]

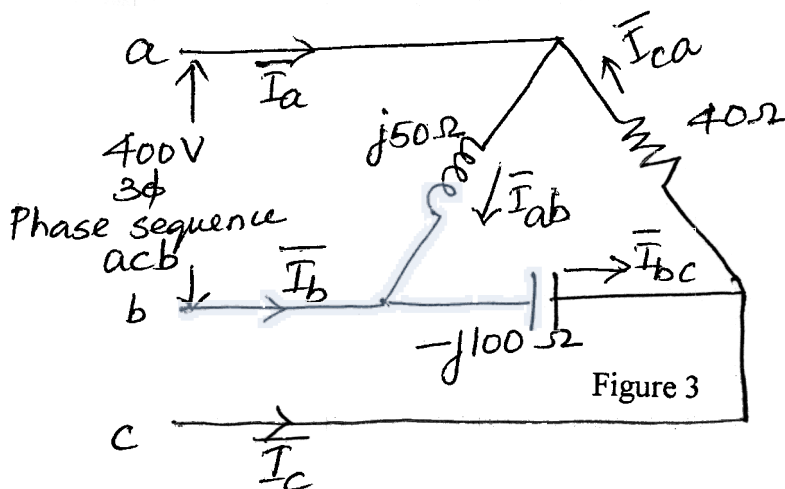


Figure 3