

**B.Tech. Civil (Construction Management) /
B.Tech. Civil (Water Resources Engineering)**

Term-End Examination

June, 2008

**ET-202(B) : PRINCIPLES OF ELECTRICAL
SCIENCES**

Time : 3 hours

Maximum Marks : 70

Note : Answer any five questions in all. Use of calculator is permissible.

1. (a) Define resistance, inductance and capacitance. Give their $v-i$ relationships. 6

(b) Express the phasors of the following sinusoidal signals in both rectangular and polar coordinate forms : 6

(i) $v(t) = 100 \sin(\omega t - 45^\circ)$

(ii) $v(t) = 50\sqrt{2} \cos(\omega t + 135^\circ)$

(iii) $i(t) = -10\sqrt{2} \sin(\omega t + 120^\circ)$

(c) What is the advantage of an iron-cored inductor over an air-cored inductor ? 2

2. (a) Give relationship between line and phase quantities (voltage and current) in a star connected circuit and show them on a phasor diagram. 6
- (b) A capacitor draws a current of 5 mA from 200 V, 50 Hz a.c. supply. What current does it draw from 40 V, 400 Hz supply? 6
- (c) A balanced 3-phase load is formed by three impedances of $60 + j90$ ohms each, connected in delta. If this load is equivalent to a star-connected load having \bar{Z}_y in each leg of the star, calculate Z_y . 2
3. (a) What are the basic components used in electrical installations? State briefly the functions of each component. 6
- (b) Explain the necessity for power factor correction. What are different methods for power factor correction? 6
- (c) When are two 2-terminal networks said to be equivalent? 2
4. (a) Explain and draw the speed-torque characteristics of a d.c. series motor. 6
- (b) A d.c. machine generates an armature voltage of 220 V on no load at 1000 rpm, the field current being 2 A. The armature resistance is 0.5 Ω . Find its speed when it draws a current of 5 A as motor from the 220 V supply. (Neglect armature reaction and brush voltage drop). 6

(ii) A Lissajous pattern obtained on a CRO screen has $f_y = 50$ Hz. Number of touching points on horizontal tangent = 5 and number of touching points on a vertical tangent = 3. Find f_x .

2

5. (a) How is power measured in a 3-phase circuit using two wattmeter method? Draw the circuit diagram also.

6

(ii) A 400 V, 50 Hz, 4-pole, 3-phase induction motor has the following equivalent circuit parameters at standstill: $R_1 = 2.0 \Omega$, $R_2' = 4.0 \Omega$, $X_{1\phi} = 2.6 \Omega$, $X_{2\phi}' = 2.0 \Omega$ and $X_\phi = 70 \Omega$. Draw equivalent circuit of the machine and find the torque and power developed.

6

(c) What is KVL?

2

(ii) What are the applications of a CRO? Explain any two applications, with suitable diagram.

6

(ii) A 400 V, 50 Hz, 3-phase voltage source supplies the following loads:

6

(i) 10 kW at unity p.f.

(ii) 100 kW at 0.8 p.f. lagging

(iii) 40 kW at 0.9 p.f. lagging

Find the overall p.f. of the load.

(c) State and explain Norton's theorem.

2

7. (a) Explain working of a dual slope integrating type ADC. 6
- (b) What are different addressing modes available in the 8085 microprocessor? Give an example of each mode. 6
- (c) Find the decimal equivalent of 2
- (i) $(11110101)_2$
- (ii) $(101011)_2$