Total Pages—5

**B. Tech**
**BEG 1003**

## Second Semester Examination, 2004

## Basic Electrical Engineering

*Full Marks* : 70

*Time* : 3 hours

Answer six questions including
Q. No. 1 which is compulsory

*The figures in the right-hand margin indicate marks*

1. Answer the following : $2 \times 10$

(a) A series R-C circuit is excited by d.c. voltage E through a switch. Find the value of initial current.

(b) Find the value of final current in a series R-L circuit impressed by d.c voltage V.

(c) In a single phase a.c. circuit
$V = (100 + j\,100)$ V, $Z = (3 + j4)\,\Omega$,
find the current in polar form.

(d) A 3-phase delta-connected balanced load each phase having resistance of 200 Ω is supplied by 3-phase star-connected voltage source of 200 V per phase. Find the total active power consumed by the load.

*(Turn Over)*

(e) What is the relative permeability of a non-magnetic material ?

(f) A single-phase autotransformer is excited by 230 V, I-phase a.c. supply. What would be the range of voltage values available on the secondary side ?

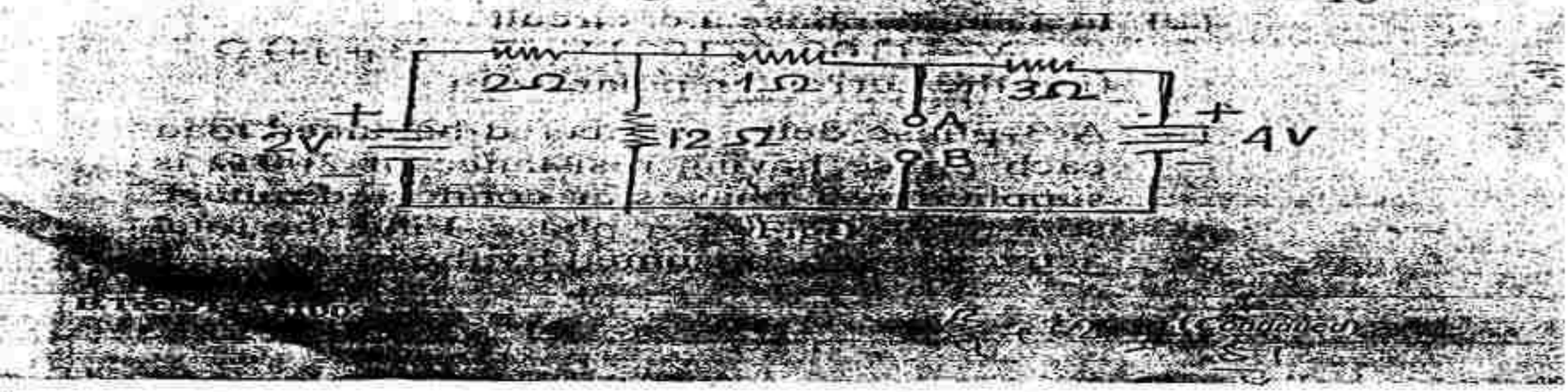
(g) What are the different methods of excitation of d.c. generators ?

(h) Why are I-phase induction motors used in domestic appliances ?

(i) Which type of generation is preferred for pollution-free environment ?

(j) Name four industrial applications of electrical energy.

2. Use (a) Thevenin's theorem and (b) the principle of Superposition to find the current in a 2Ω resistor connected between A and B in the circuit shown in Fig. 1. 10




(Continued)

3. When a voltage of 100 V at 50 Hz is applied to a coil A having resistance $R_A$ and inductance $L_A$; the current taken and power consumed are 8 A and 120 W respectively. When applied to a coil B having resistance $R_B$ and inductance $L_B$ the current taken and power consumed are 10 A and 500 W respectively. What current and power will be taken when 100 V is applied across these two coils connected in series ? 10

4. Three identical impedances are connected in star across a 440 V, 3-phase, 50 Hz supply. The line current is 40 A and the p.f. is 0·8 leading. Find the value of resistance and capacitance in each phase. 10

5. (*a*) An electromagnet has an air-gap of length 2 mm and an iron path of length 30 cm. Find the number of ampere-turns necessary to produce a flux density of 0·8 $Wb/m^2$ in the gap.

Take $\mu_r = 1500$ for the magnetic material of the electromagnet. 7

(*b*) The eddy current loss in a cold rolled grain oriented silicon steel sheet is 100 W when the supply frequency is 50 c/s. Find the eddy current loss when the frequency is 40 c/s, the flux density remaining the same. 3

6. (*a*) Explain the principle of operation of a single-phase transformer. 4

(*b*) The emf per turn of a single-phase, 6600 V/440 V, 50 Hz transformer is 12 V. Calculate

(*i*) the number of turns in the primary and secondary windings ;

(*ii*) the net cross-sectional area of the core for a maximum flux density of 1·5 Wb/m$^2$. 6

7. (*a*) What are the different methods of speed control of d.c. shunt motor ? 2

(*b*) A 500 V d.c. shunt motor has a speed of 1200 rpm, the line current being 5A. Find the speed when line current increases to 30 A. The shunt field resistance and armature resistance are 250 Ω and 1·1 Ω respectively. 8

8. (*a*) State the indicating and integrating type instruments that you have studied. 3

(*b*) A moving coil instrument has a resistance of 7·5 Ω and its full scale deflection corresponds to 50 mA. How this instrument can be used to measure,

(*i*) current up to 10 A and

(*ii*) voltage up to 300 V. 7