

**Diploma in Electrical and Mechanical  
Engineering**

**Term-End Examination**

**December, 2007**

**BEE-031 : ELECTRICAL TECHNOLOGY**

*Time : 2 hours*

*Maximum Marks : 70*

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**Note :** Answer any **five** questions in all. Question number 1 is **compulsory**. Attempt any **four** of the remaining questions. Use of calculator is allowed.

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1. (a) State True or False for the following statements :  $1 \times 7 = 7$
- (i) When voltage and current are varying functions of time and are changing direction with time, such sources are referred to as DC sources.
  - (ii) Capacitor stores energy in an electric field.
  - (iii) Current flowing through a capacitor leads the voltage applied by  $90^\circ$ .
  - (iv) Superposition theorem is not applicable to DC sources.
  - (v) The direction of induced emf can be determined by Fleming's Right Hand Rule.

(vi) Iron losses of a transformer can be determined by performing the open circuit test.

(vii) Direction of rotation of DC motor cannot be reversed by reversing the direction of current in the armature.

(b) Fill in the blanks with the correct answer from the given choices : 1×7=7

(i) Inductor stores energy in a/an \_\_\_\_\_ .

- (a) Electric field
- (b) Magnetic field
- (c) Reactive field
- (d) None of the above

(ii) In an AC circuit, the induced emf (rms value) is given by \_\_\_\_\_ .

(a)  $\frac{E_m}{\sqrt{3}}$

(b)  $\frac{E_m}{2}$

(c)  $\frac{E_m}{\sqrt{2}}$

(d) None of the above

- (iii) Current flowing through an inductor \_\_\_\_\_  
behind the voltage applied by  $90^\circ$ .
- (a) leads
  - (b) lags
  - (c) constant
  - (d) None of the above
- (iv) Unit of apparent power is \_\_\_\_\_ .
- (a) volt-ampere reactive
  - (b) watt
  - (c) volt-ampere
  - (d) None of the above
- (v) In DC motors, the input is \_\_\_\_\_ .
- (a) Electrical energy
  - (b) Mechanical energy
  - (c) No input is required
  - (d) None of the above
- (vi) In a DC series motor,  $\phi \propto I_a$ , so torque 'T' is \_\_\_\_\_ .
- (a)  $T \propto I_a$
  - (b)  $T \propto \frac{I_a}{2}$
  - (c)  $T \propto I_a^3$
  - (d)  $T \propto I_a^2$

(vii) Synchronous speed of a 3-phase induction motor is given by \_\_\_\_\_ .

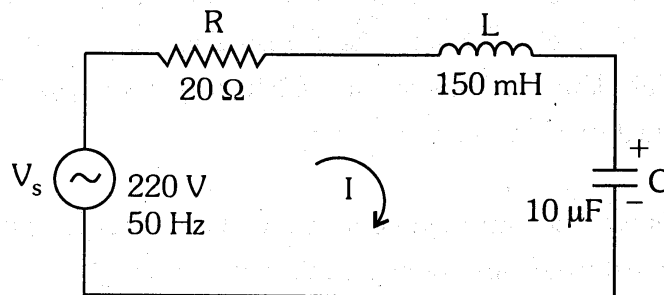
(a)  $N_s = \frac{120 f}{P}$

(b)  $N_s = \frac{\sqrt{3} f}{P}$

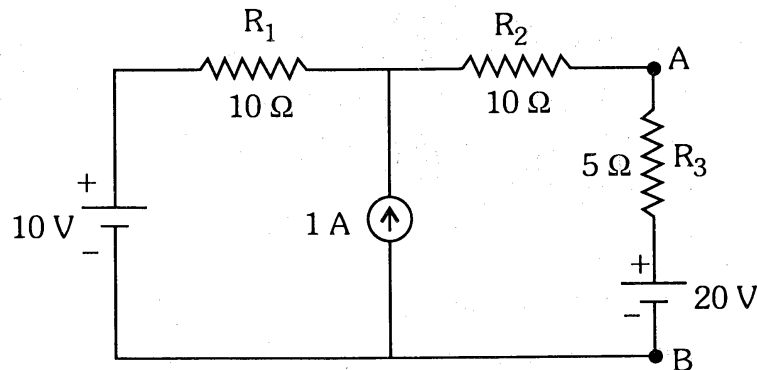
(c)  $N_s = \frac{f}{P}$

(d)  $N_s = \frac{120 P}{f}$

2. (a) Explain Kirchoff's Current Law with the help of a circuit diagram. 7
- (b) Find the current in the circuit given below. 7



3. (a) State and explain Superposition theorem. 7
- (b) Find the Thevenin's voltage across the open terminals A - B in the given circuit. Find out the value of current flowing through the resistance  $R_3$ . 7



4. (a) What is meant by 'armature reaction' in DC machines and how is its effect neutralized? 4
- (b) A 4 pole wave wound DC shunt generator delivers a load of 45 kW at a terminal voltage of 220 volts. Its armature has 150 single turn coils and has a resistance of 0.01 ohms. The air gap flux per pole is 0.02 Weber. Shunt field resistance is 50 ohms. Calculate the speed at which it is being driven. Neglect brush contact drop. 10
5. (a) Draw the arrangement of a basic single phase transformer and briefly explain its working. 7
- (b) A 440/220 volt, 100 kVA, single phase transformer has iron losses of 1.7 kW and a full load copper loss of 2.0 kW. Determine the kVA load for maximum efficiency. Also find the efficiency at half load and p.f. 0.8 lagging. 7
6. (a) What is meant by 'slip' of motor? What is the general range of slip? Write only the expression for calculation of slip and explain the terms used. 7

- (b) The power input to a 4 pole, 50 Hz, 500 V, 3-phase induction motor, running at 1450 rpm is 50 kW. The stator losses are 2 kW. Calculate the following : 7
- (i) Slip
  - (ii) Rotor copper loss
  - (iii) BHP developed
  - (iv) Efficiency
7. (a) What is a synchronous generator ? How are the alternators classified according to their pole construction ? 4
- (b) Why is a synchronous motor not self starting ? What are the methods of starting a synchronous motor ? Explain any one method of starting a synchronous motor briefly. 10
8. Explain any **two** of the following : 7×2=14
- (a) What is hunting or phase-swinging in a synchronous motor ? Briefly explain how hunting can be minimized.
  - (b) What is 'leakage flux' in a real transformer ? Draw the equivalent circuit of a real transformer considering the effects of resistance and leakage reactances.
  - (c) What are the methods of controlling the speed of a DC motor ? Draw the Ward-Leonard method of speed control of DC motor and mention the advantages and disadvantages of the system.