

DECEMBER 2004

Code: D-05

Subject: ELECTRICAL ENGINEERING

Time: 3 Hours

Max. Marks: 100

NOTE: There are 11 Questions in all.

Question 1 is compulsory and carries 16 marks. Answer to Q. 1. must be written in the space provided for it in the answer book supplied and nowhere else.

Answer any THREE Questions each from Part I and Part II. Each of these questions carries 14 marks.

Any required data not explicitly given, may be suitably assumed and stated.

Q.1 Choose the correct or best alternative in the following: (2x8)

a. A series RLC circuit will have unity power factor if operated at a frequency of _____.

(A) $\frac{1}{LC}$. (B) $\frac{1}{\omega\sqrt{LC}}$.

(C) $\frac{1}{\omega^2LC}$. (D) $\frac{1}{2\pi\omega\sqrt{LC}}$.

b. The difference between synchronous speed and the actual speed of an induction motor is known as _____.

(A) regulation. (B) back lash.

(C) slip. (D) lag.

c. The efficiency of a transformer is given as _____.

(A) output/(output + losses). (B) (output + losses)/output.

(C) input/output. (D) (output + losses)/input.

d. Speed of a motor is given by _____.

(A) 120 f/p. (B) 120 p/f.

(C) 60f/p. (D) 60 p/f.

e. Load factor is defined as _____.

(A) average demand / maximum demand.

- (B) average demand / installed capacity.
- (C) maximum demand / average demand.
- (D) maximum demand / installed capacity.

f. Like a resonant R-L-C circuit, a parallel resonance circuit also _____.

- (A) has a power factor of unity. (B) offers minimum impedance.
- (C) draws maximum current. (D) magnifies current.

g. Slip rings for an induction motors are made of

- (A) Aluminium. (B) Carbon.
- (C) Phosphor bronze. (D) Cobalt steel.

h. The motor which has the least noise is the _____.

- (A) capacitor motor. (B) universal motor.
- (C) shaded pole motor. (D) hysteresis motor.

PART I

Answer any THREE Questions. Each question carries 14 marks.

Q.2 a. Define the following terms:-

(i) Node. (ii) Path.

(iii) Branch. (iv) Loop. **(1½×4)**

b. Apply Kirchoffs voltage law, to find the values of current i and the voltages V_1 and V_2 in the circuit of the Fig.1 given below, which contains a current dependent voltage source. What is the voltage of the dependent source? All resistance values are in ohms. **(8)**

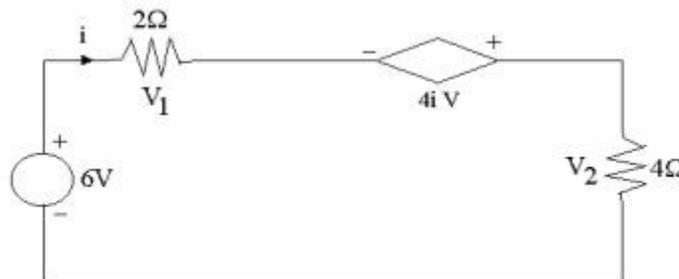


Fig.1

Q.3 a. Derive the value of equivalent resistance in both series and parallel combinations separately. **(8)**

b. Convert the given delta network (in Fig.2) into its equivalent star network. (6)

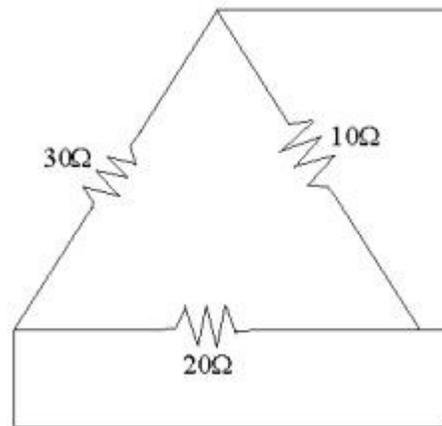


Fig.2

Q.4 a. What is meant by commutation? (3)

b. Define voltage regulation of a transformer. (3)

c. For the circuit shown in the Fig.3 below, find the values of

- (i) current
- (ii) V_1 and V_2
- (iii) p.f. (8)

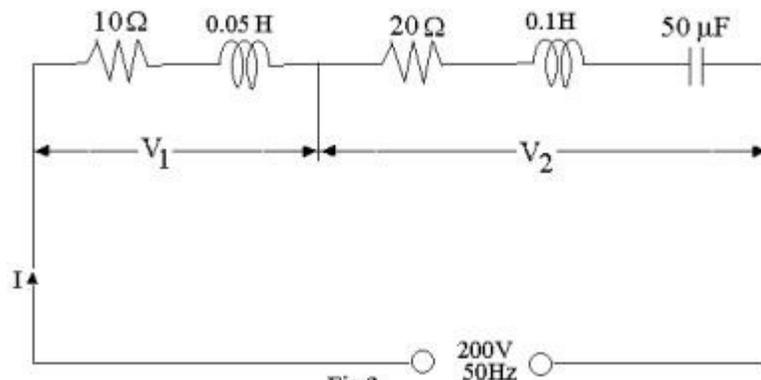


Fig.3

Q.5 a. With a circuit diagram explain the open circuit test of a transformer. (8)

b. A single-phase 50 KVA transformer has a primary voltage of 6,600 V and a secondary voltage of 254 V; also it has 32 secondary turns. Calculate the number of primary turns; also primary and secondary currents. (6)

Q.6 a. Draw the speed-torque characteristics of various types of dc motors. (6)

b. A dc shunt motor rated 50 kW connected to a 250 V supply is loaded and draws a current of 200A when running at a speed of 1250 rpm. Given $R_a = 0.22 \text{ ohms}$;

(i) determine the load torque if the rotational loss (including iron loss) is 600W.

(ii) determine the motor efficiency if the shunt field resistance is 125 ohms. (8)

PART II

Answer any THREE Questions. Each question carries 14 marks.

Q.7 a. Compare the features of shunt and series motors. (8)

b. A 400V, 3-phase, 6-pole induction motor draws a line current of 80A at 0.75 pf at 4% slip. Its efficiency is 85%. Calculate the shaft output and shaft torque. (6)

Q.8 Explain the construction, working and application of a shaded pole motor. (14)

Q.9 a. What are the advantages and disadvantages of HVDC systems? (8)

b. The maximum demand on a power station is 100 MW. If the annual load factor is 40%, calculate the energy generated in a year. (6)

Q.10 a. With the help of a diagram explain the basic structure of a PV cell. (6)

b. A diesel station supplies the following loads to various consumers:

Industrial consumers = 1500 kW Commercial establishment = 750 kW

Domestic power = 100 kW Domestic lighting = 450 kW.

If the maximum demand on the station is 2500 kW and the number of kWh

generated per year is 45×10^5 , determine

(i) the diversity factor and (ii) annual load factor. (8)

Q.11 Write notes on:

(i) Selection of motors for different engineering applications.

(ii) Low power factor and its improvement. (7+7)

