December 2005

Code: D-05
Subject: ELECTRICAL ENGINEERING
Time: 3 Hours
Max. Marks: 100

NOTE: There are 9 Questions in all.

- **Question 1 is compulsory and carries 20 marks. Answer to Q. 1. must be written in the space provided for it in the answer book supplied and nowhere else.**
- **Out of the remaining EIGHT Questions answer any FIVE Questions. Each question carries 16 marks.**
- **Any required data not explicitly given, may be suitably assumed and stated.**

Q.1 Choose the correct or best alternative in the following: (2x10)

a. The combined resistance of two equal resistors connected in parallel is equal to

(A) One half the resistance of one resistor.
(B) Twice the resistance of one resistor.
(C) Four times the resistance of one resistor.
(D) One fourth the resistance of one resistor.

b. Superposition theorem can be applicable only to circuits having _____ elements.

(A) Non- linear **(B)** Passive
(C) Resistive **(D)** Linear bilateral

c. The Q- factor of a coil is given by

(A) Its power factor cos φ.
(B) Ratio of max. energy stored & energy dissipated per cycle..
(C) Reciprocal of its power factor.
(D) Ratio R/Z.

d. Voltage equation of a dc motor is

(A) $V = E_b + I_a R_a$. **(B)** $E_b = V + I_a R_a$.
(C) $V = E_b / I_a R_a$. **(D)** $V = E_b + I_a {}^2R_a$.

e. The efficiency of a transformer is maximum when

(A) It runs at half full load. **(B)** It runs at full load.
(C) Its Cu loss equals iron loss. **(D)** It runs overload.

f. The crawling in an induction motor is caused by

(A) Improper design of the machine **(B)** Low voltage supply.
(C) High loads. **(D)** Harmonics developed in the motor.

g. The starting winding of a single-phase motor is placed in

(A) Rotor. **(B)** Stator.
(C) Armature. **(D)** Field.

h. Reduction in the capacitance of a capacitor- start motor results in reduced

(A) Noise. **(B)** Speed.
(C) Starting torque. **(D)** Armature reaction.

i. In an ac circuit, the ratio of kW / kVA represents

(A) Power factor. **(B)** Load factor.
(C) Form factor. **(D)** Diversity factor.

j. The unit of inductance is

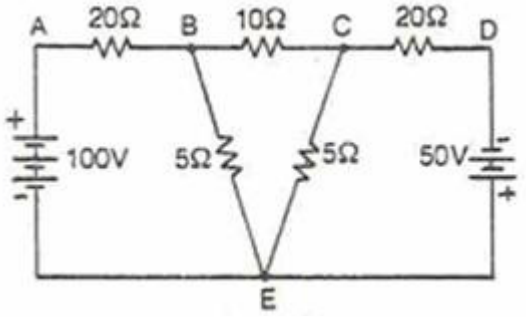
(A) Ohm. **(B)** Mho.
(C) Farad. **(D)** Henry.

Answer any FIVE Questions out of EIGHT Questions.
Each question carries 16 marks.

Q.2 a. State the following:

(i) Thevenin's Theorem.
(ii) Norton's Theorem.
(iii) Maximum power transfer theorem.
(iv) Kirchoff's laws. **(8)**

b. For the circuit shown find the current in various branches by nodal analysis. **(8)**



Q.3 Find the impedance, current and power factor of the following series circuits and draw the corresponding phasor diagrams i) R and L ii) R and C iii) R, L and C. In each case the applied voltage is 200volts and the frequency is 50Hz. R = 10 Ω, L =50 mH, C= 100 μF. **(16)**

Q.4 a. Derive the emf equation of a transformer. **(6)**

b. In a 25 kVA, 2000 / 200V transformer the iron and full load copper losses are 350W and 400W respectively. Calculate the efficiency at unity power factor at
(i) full load and (ii) half load. **(10)**

Q.5 a. Explain the process of commutation in a dc machine. Explain what are inter-poles and why they are required in a dc machine. **(8)**

b. A 6- pole lap wound shunt motor has 500 conductors in the armature. The resistance of the armature path is 0.05. The resistance of shunt field is 25Ω. Find the speed of the motor when it takes 120 A from the dc mains of 100 V supply. Flux per pole is 2×10^{-2} wb. **(8)**

Q.6 a. Explain the operation of a three phase induction motor. **(6)**

b. A 3-phase induction motor is wound for 4-poles and is supplied from a 50 Hz system. Calculate
(i) synchronous speed.
(ii) actual speed of the motor when running at 4 % slip.
(iii) frequency of emf induced in rotor. **(6)**

c. Explain the term slip in an induction motor. **(4)**

Q.7 a. What are the disadvantages of low power factor? How can it be improved? **(8)**

b. Explain why the following motors are used in the particular applications indicated against them. Synchronous motors – power-factor improvement, DC shunt motors – lathes, DC series motors- lifts and cranes, Cumulative compound motor – rolling mills. **(8)**

Q.8 a. What are the advantages and disadvantages of high voltage DC transmission? **(8)**

b. A power station has a load cycle as under: 260 MW for 6 hr: 200MW for 8 hr; 160 MW for 4hr; 100MW for 6hr. If the power station is equipped with 4 sets of 75 MW each. Calculate the load factor and capacity factor from the above data. **(8)**

Q.9 a. State a few applications of solar energy. Also explain the structure of a solar photovoltaic cell. **(2+6)**

b. State the factors, for the choice of electrical system for an aero turbine. Also draw the block diagram of VSCF wind electrical system. What are the advantages of VSCF wind electrical system? **(2+2+4)**