

DipIETE – ET (OLD SCHEME)

JUNE 2009

Code: DE05

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 the best alternative in the following: (2 × 10)

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 $\cos\phi$

(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) $V = E_b + I_a^2 R_a$
- e. The function of a transformer is
- (A) to decrease AC voltage.
 (B) to change the frequency of the supply.
 (C) to convert AC voltage to DC voltage.
 (D) to increase or decrease AC voltage.
- 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. A R-L-C circuit contains resistance of 10 ohms, inductance reactance of 10 ohms and capacitive reactance of 10 ohms. The power factor of the circuit is
- (A) 0.707 lagging. (B) 0.707 leading.
 (C) 0.5 lagging. (D) Unity.
- j. The unit of inductance is
- (A) Ohm. (B) Inductive reactance.

(C) Farad.

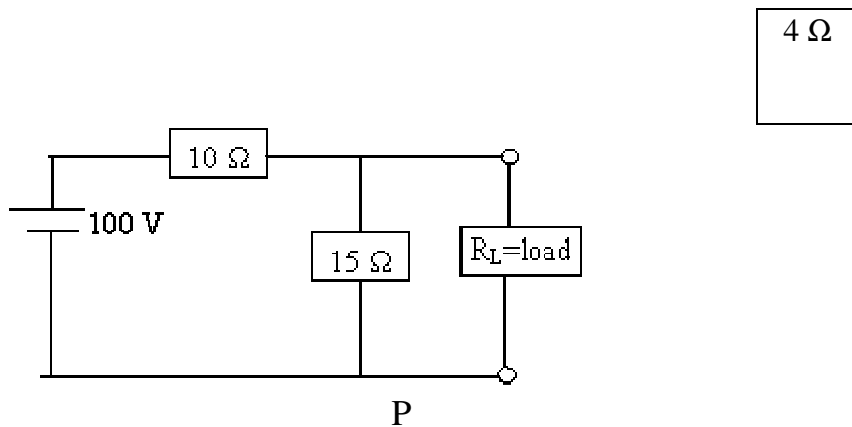
(D) Henry.

Answer any FIVE Questions out of EIGHT Questions.

Each question carries 16 marks.

Q.2 a. State maximum power transfer theorem and derive the conditions for maximum power transferred to the load. (8)

b. For the circuit shown below, find the value of load resistance R_L to which maximum power may be transferred from the circuit. Also determine the value of maximum power. (8)



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Q.3 a. Explain how power can be measured in a three-phase balanced star or delta connected system and also derive the value of power factor using two wattmeter methods. (8)

b. Three coils each of inductance and resistance of 1 H and $100\ \Omega$ are connected in delta and joined to a three phase 415 V, 50 Hz AC supply. Calculate the power factor, total power, impedance per phase, line and phase

current. (8)

Q.4 a. With suitable diagrams explain how open circuit and short circuit tests are conducted to determine the losses in a transformer. (8)

b. A single-phase transformer has 100 turns on the primary winding and 300 turns on the secondary winding. If the voltage applied across the primary is 100V, 50 Hz then calculate the induced emf in the secondary and the maximum flux density in the core when the cross sectional area of the core is 100 cm^2 .

(8)

Q.5 a. Explain the constructional features of a DC machine. (8)

b. The voltage applied to a DC shunt motor is 220 V. The armature current is 20 A. The armature resistance is 0.5Ω . The speed is 80 radians per second. Determine the induced emf, the electromagnetic torque and the speed in rpm. (8)

Q.6 a. Explain the construction of both squirrel cage and slip ring induction motor. (8)

b. A 3-phase, 400 V induction motor is wound for 4-pole and is supplied from 50 Hz supply. Calculate the synchronous speed, the speed of the motor when slip is 4%. (8)

Q.7 a. Write a note on selection of various motors for specific engineering applications. (8)

b. Draw and explain the schematic diagram of a nuclear reactor. (8)

Q.8 a. Draw the various symbols representing the components of a three-phase power system. Line, synchronous machine, two winding transformer, circuit breaker, star and delta connection. **(6)**

b. Explain the various terms-system, busbar, load, earthing, and outage. **(10)**

Q.9 a. Write a note on three-phase transformers. **(8)**

b. Draw the block diagram of variable speed constant frequency wind electrical system and also give the advantages of variable speed constant frequency wind electrical system. **(8)**