

**Subject: PRINCIPLES OF ELECTRICAL ENGINEERING**

Time: 3 Hours

Max. Marks: 100

**JUNE 2011**

**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.
- The answer sheet for the Q.1 will be collected by the invigilator after 45 Minutes of the commencement of the examination.
- 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.

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**Q.1 Choose the correct or the best alternative in the following: (2×10)**

- a. The directions of the induced current depends upon
- (A) the length of the conductor
  - (B) the speed of the movement of the conductor
  - (C) the strength of the magnetic field
  - (D) the direction of the magnetic field
- b. In an iron cored coil, the iron core is removed so that the coil becomes an air cored coil. The inductance of the coil will
- (A) increase
  - (B) decrease
  - (C) remain the same
  - (D) none of these
- c. The efficiency of a transformer under open-circuit test condition is
- (A) 100%
  - (B) zero
  - (C) 50%
  - (D) 77.7%
- d. If full load copper loss of a transformer is 1600W, its copper loss at 75% full-load would be
- (A) 900 W
  - (B) 1200 W
  - (C) 1600 W
  - (D) 284.4 W
- e. The function of the starter in a d.c. shunt motor is
- (A) to avoid the excessive current at starting
  - (B) to control the speed
  - (C) to avoid armature reaction
  - (D) to avoid excessive heating

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- f. The direction of rotation of a d.c. shunt motor is reversed by
- (A) reversing armature connections
  - (B) interchanging the armature and field connection
  - (C) adding resistance to the field circuit
  - (D) reversing supply connections
- g. In a synchronous motor, minimum armature current occurs at
- (A) zero power factor
  - (B) unity power factor
  - (C) lagging power factor
  - (D) leading power factor
- h. What will be the maximum speed at which the field of an alternator can be operated to develop 60 Hz?
- (A) 1800 rpm
  - (B) 3600 rpm
  - (C) 7200 rpm
  - (D) 360 rpm
- i. Which of the following motors is used most frequently?
- (A) D.C. shunt motor
  - (B) Three phase commutator motor
  - (C) Stepper motor
  - (D) Three phase induction motor
- j. A 4-pole 3-phase 50Hz induction motor runs at speed of 1440 rpm. Calculate its slip.
- (A) 1 %
  - (B) 2 %
  - (C) 4 %
  - (D) 8 %

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

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- Q.2** a. What is meant by hysteresis? Explain the terms retentivity and coercivity. (8)
- b. A magnetic circuit has a mean core length of 160 cm and uniform cross-section of  $5 \text{ cm}^2$ . It has an air-gap of 0.8mm and is wound with coil of 1200 turns. Determine the self-inductance of the coil if the core material has a relative permeability of 1600. (8)
- Q.3** a. What are the various losses in a transformer? Derive an expression for the efficiency of a transformer. (8)
- b. Define voltage regulation of a transformer. Deduce an expression for voltage regulation. (8)
- Q.4** a. A d.c. shunt motor is rated to operate at 1200 rpm. Explain a method to achieve a speed of 1400 rpm for this machine. (8)

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- b. A 50kW, 230V dc shunt motor takes a current of 14.5 A when running light at 1640 rpm. The armature and field resistances are  $0.15\Omega$  and  $120\Omega$  respectively. Estimate the motor efficiency when the motor is drawing 215A. What would be the maximum efficiency of the motor and the load current at which it would occur? (8)
- Q.5** a. With the help of a neat diagram explain the construction and principle of operation of a synchronous machine. (8)
- b. Write short note on V-curves for a synchronous motor. (8)
- Q.6** a. What is an induction generator? Explain its applications. (8)
- b. The efficiency of a 400V, 3-phase, 6-pole induction motor draws a line current of 80A at 0.75 pf at 4% slip is 85%. Calculate the shaft output and shaft torque. (8)
- Q.7** Write notes on any **TWO** of the following; (2×8)
- (i) Hysteresis motor
  - (ii) Reluctance motor
  - (iii) Split-phase motor
- Q.8** Discuss in detail the various environmental aspects of electric energy generation. (16)
- Q.9** a. What are the various merits and limitation of HVDC transmission over the conventional AC transmission? (8)
- b. Discuss three important methods of energy storage. (8)