

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.**

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

- 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 %

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

- 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 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)

- 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 0.15Ω and 120Ω 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)