JUNE 2007

Code: DE-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 rotating part of a DC machine is called

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

b. During charging, the electrolyte of a lead acid cell becomes

(A) Stronger. **(B)** Weaker.
(C) Water. **(D)** Diluted.

c. As compared to shunt and compound motors, series motor have the highest torque because of its comparatively _____ at the start.

(A) Lower armature resistance. **(B)** Stronger series field.
(C) Fewer series turns. **(D)** Larger armature current.

d. The motor in which rotor and stator fields rotate simultaneously is called

(A) DC. **(B)** Induction.
(C) Synchronous. **(D)** Universal.

e. The input of an ac circuit having p.f. of 0.8 lagging is 20 kVA. The power drawn by the circuit is _____ kW.

(A) 12. **(B)** 20.
(C) 16. **(D)** 8.

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. Under the condition of resonance, RLC series circuit behaves as a,

(A) Purely resistive circuit. **(B)** Purely inductive circuit.
(C) Capacitive circuit. **(D)** Reactive circuit.

h. The voltage ratio of the transformer is given as

(A) E_S/E_P **(B)** T_S/T_P
(C) T_P/T_S **(D)** E_P/T_S

i. The relationship between the frequency of ac wave and the time period is given by

(A) $f = T$ **(B)** $f = 1/T^2$
(C) $f = 1/T$ **(D)** $f = T^2$

j. Which of the following power plant has the maximum efficiency?

(A) Thermal **(B)** Hydroelectric
(C) Nuclear **(D)** Diesel

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

Q.2 a. Derive the condition for maximum power transfer from an active network to an external load resistance. **(8)**

b. For the circuit shown in Fig.1, find the value of **R** in the branch **AB**, so that maximum power is transferred to the load. Also calculate the maximum power transferred. **(8)**

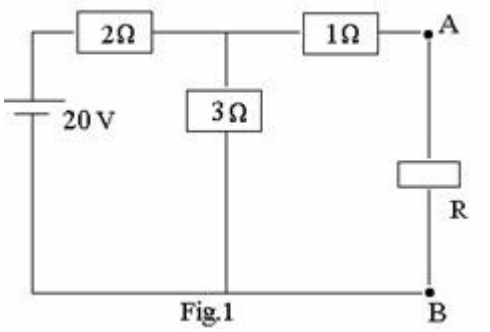

Fig.1

Q.3 a. Show that the power intake by a 3-phase circuit can be measured by two wattmeters connected properly in the circuit. **(8)**

b. Two wattmeters connected to measure the power input to a 3-phase circuit indicate 15 kW and 1.5 kW respectively, the latter reading being obtained after reversing the current coil connections. Calculate the power and power factor of the load. **(8)**

Q.4 a. Explain the following:-

(i) Losses in a transformer.
(ii) Efficiency of a transformer.
(iii) Voltage regulation of a transformer. **(4+2+2)**

b. A single – phase transformer working at unity power factor has an efficiency of 90% at both one-half load and at full load of 500 W. Determine the efficiency at 75% of full load. **(8)**

Q.5 a. Derive the back emf and torque equation of a DC motor. **(8)**

b. A 4 –pole, 220 V dc series motor has a wave-connected armature with 1200 conductors. The flux per pole is 20 mWb, when the motor is drawing 46 A. Armature and series field resistances are 0.25 and 0.15 Ω respectively. Find the

(i) speed (ii) total torque. **(8)**

Q.6 a. Explain, the different methods of starting squirrel-cage and slip-ring induction motors. **(8)**

b. A squirrel-cage induction motor has a full-load slip of 4%. Its starting current is 5 times its full load current. Calculate the starting torque in pu of the full load torque. Neglect the stator impedance and the magnetizing current. Also give a suitable remarks for the answer obtained. **(8)**

Q.7 a. Give, reasons why the following motors are used in - **(10)**

DC series motors – lifts and hoists.
DC shunt motors – Conveyor belts.
Synchronous motors – Power factor improvement.
Cumulative compound motors – rolling mills.
Capacitor run motor – fans.

b. Give two uses each of
(i) shaded –pole motor
(ii) capacitor start motor
(iii) Split–phase induction motor. **(6)**

Q.8 a. Define the following – Capacity factor, load factor, diversity factor, Maximum demand. **(8)**

b. A generating station has a connected load of 43 MW, and a maximum demand of 20 MW. The units generated being 61.5×10^6 per annum. Calculate demand factor and load factor. **(8)**

Q.9 Write notes on

(i) Photovoltaic cells. **(4)**
(ii) Bio fuels. **(4)**
(iii) Causes and improvement of low power factor. **(8)**