June 2006

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. Thevenin's equivalent circuit consists of _____.

(A) Series combination of R_{Th}, E_{Th} and R_L.
(B) Series combination of R_{Th}, E_{Th}.
(C) Parallel combination of R_{Th}, E_{Th}.
(D) Parallel combination of R_{Th}, E_{Th} and R_L.

b. In an R – L –C circuit, the phase of the current with respect to the circuit voltage will be_____.

(A) Leading.
(B) Same.
(C) Lagging.
(D) Depends upon the value of Land C.

c. The frequency of DC supply is_____.

(A) Zero.
(B) 16 ⅔ Hz.
(C) 50 Hz.
(D) 100 Hz.

d. Load factor is defined as the ratio of _____.

(A) Average Demand / Max. Demand.

(B) Max. Demand / Average Demand.
(C) Average Demand / Connected load.
(D) Connected load / Max. Demand.

e. Static Capacitors are used for_____.

(A) Power improvement. **(B)** Current improvement.
(C) Voltage improvement. **(D)** Power factor improvement.

f. The speed of an induction motor_____.

(A) Decreases too much with the increase of load.
(B) Increases with the increase of load.
(C) Decreases slightly with the increase of load.
(D) Remains constant with the increase of load.

g. Centrifugal switch is provided for disconnecting the auxiliary winding in a_____.

(A) Capacitor- start motor. **(B)** Capacitor run motor.
(C) Reluctance motor. **(D)** Hysteresis motor.

h. Rotating magnetic field is produced in a _____.

(A) Single- phase induction motor. **(B)** Three- phase induction motor.
(C) DC series motor. **(D)** AC series motor.

i. The frequency of the secondary voltage of a transformer will be_____.

(A) Less than the frequency of the primary voltage.
(B) Equal to the primary voltage.
(C) Greater than the frequency of the primary voltage.
(D) Very much greater than the frequency of the primary voltage.

j. The power formula for a three-phase circuit is_____.

(A) $3V_L I_L \cos \varphi$. **(B)** $\sqrt{3}V_L I_L \cos \varphi$.
(C) $3V_P I_P$. **(D)** $\sqrt{3}V_L I_L$.

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

Q.2 a. Derive the equivalent star circuit from a delta circuit. **(8)**

b. Three non- inductive resistances of 5Ω, 20Ω, and 25Ω are connected in delta. Obtain its equivalent star connected system maintaining the same phase sequence. **(8)**

Q.3 a. Explain the terms real power, apparent power and reactive power for ac circuits and also the units used. **(6)**

b. When a coil is connected to a 230V, 50Hz supply, it takes a current of 2A and the power consumption is 150W. Calculate the resistance and inductance of the coil. **(5)**

c. A coil, which has 10Ω resistance and 50mH inductance is connected to 230V, 50Hz supply. Calculate the current in the coil. **(5)**

Q.4 a. Explain the basic construction and working principle of a single –phase transformer. **(8)**

b. The secondary of a 750 KVA, 11000/ 400 V, 50 Hz transformer has 160 turns. Determine the primary number of turns, primary and secondary full load current neglecting losses. If the area of cross section of the core is 100 cm^2, what will be flux density in the core? **(8)**

Q.5 a. Explain DC series, shunt and compound motors and their speed torque characteristics. **(8)**

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

Q.6 a. Explain the working of a capacitor-start and capacitor-start and-run single-phase induction motors with suitable diagrams. **(8)**

b. A two-pole alternator runs at 3000 rpm and supplies power to a 10 – pole single – phase induction motor, which has full load slip of 5 %. Find the full load speed of the induction motor and the frequency of its rotor emf due to forward field. **(8)**

Q.7 a. Define the following terms:-
Reliability, Maximum demand, Reserve-generating capacity, Availability (operational). **(8)**

b. A, power supply is having the following loads:-

Type of load	Max. demand (kW)	Diversity of group	Demand factor
Domestic	1500	1.2	0.8
Commercial	2000	1.1	0.9
Industrial	10,000	1.25	1

If the overall system diversity factor is 1.35, determine the maximum demand and connected load of each type. **(8)**

Q.8 a. Explain, why a motor cannot be started directly and needs a starter at the time of starting. **(8)**

b. Write a note on selection of motors for specific engineering applications. **(8)**

Q.9 a. Explain, how Biofuels can be used to produce electricity. Also draw the biomass cycle. **(8)**

b. Write a note on solar cells. **(8)**