Exam. Code: 0933
Sub. Code: 6657

2063

B.E. (Electrical and Electronics Engineering)
Third Semester
PC-EE-302: Electrical Machine - I

Time allowed: 3 Hours **Max. Marks: 50**

NOTE: *Attempt <u>five</u> questions in all, including Question No. 1 (Section-A) which is compulsory and selecting two questions each from Section B-C. All questions carry equal marks.*

x-x-x

Section -A

1. Write briefly
   a) Why core of transformers is made with silicon steel laminations.
   b) Why OC test on a transformer is not done at rated current.
   c) Derive induced EMF equation in DC machine.
   d) Draw the per-phase equivalent circuit diagram of a three phase induction motor.
   e) Explain the use of start winding in single phase induction motor.

Section-B

2. A 110 KVA, 1-phase transformer has a ratio of 11000/440 V. The iron loss measured on open circuiting 440 V side is 1100 W with excitation current of 0.5 A. With the secondary winding short circuited, a voltage of 500 V at normal frequency applied to the primary produces full load current at a wattmeter reading of 1000 W. Calculate
   a) the secondary terminal voltage.
   b) the efficiency, when a current of 250 A at a lagging power factor of 0.8 is taken by a load connected to the low voltage terminals, the primary voltage being 11000 volts.

3. A DC shunt motor is fed with a 250 V supply. The shunt field winding resistance is 100 Ω and armature resistance is 0.25 Ω. The motor draws 75 A of armature current at a speed of 1000 rpm. It is desired to run the machine at 700 rpm with torque requirement of one-half of that at 1000 rpm. This is effected by putting a resistance in series with the supply. Determine:
   a) The value of resistance to be connected for the above condition.
   b) The current in the field and armature for the new condition.

4. A DC series lift motor is fed with a 240 V supply. The machine has total resistance of 0.2 Ω and takes a current of 40 A from the supply at a speed of 1800 rpm. Determine
   a) The resistance to be inserted in series to increase the speed to 3600 rpm when the current drawn is 10A, assuming the magnetic circuit of the machine to be linear till 40 A.
   b) The resistance to be inserted in series to make the speed 900rpm when the supply current is 60 A, given that the flux at 60 A is 18 % greater than that at 40 A.

Section-C

5. A 440 V, 3-phase, 50 Hz, 6 pole, 945 rpm, delta connected induction motor has the following parameters referred to the stator: $R_s = 2\ \Omega$, $R_r' = 2\ \Omega$, $X_s = 3\Omega$, $X_r' = 4\ \Omega$, $X_m = 100\ \Omega$. When driving a load whose torque varies linearly with speed, at rated voltage it runs at rated speed. If the motor speed is controlled using stator voltage control.
   a) Motor terminal voltage, current and torque at 800 rpm.
   b) Motor speed, current and torque for the terminal voltage of 280 V.

P.T.O.

6. A pump has a torque speed curve given by

$$T_L = \left(\frac{1.4}{10^3}\right)\omega_m^2$$

It is proposed to use a 240 V, 50 Hz, 4-pole, star connected induction motor to run this pump. The equivalent circuit parameters of the motor are

$$R_s = 0.25\,\Omega\ ;\ X_s = 0.36\,\Omega\ ;\ X_m = 17.3\,\Omega\ ;\ R_c = 1000\,\Omega\ ;\ R_r' = 0.6\,\Omega\ ;\ X_r' = 0.36\,\Omega$$

The pump speed is required to be controlled from 1250 rpm to 750 rpm.

a) Calculate the range of voltages required to be applied to the induction machine for this speed variation.
b) Find the efficiency(η) and power factor at 750 rpm and 1250 rpm.

7. Write Short Notes on the following

a) Split Phase Motor.

b) Capacitor Start Capacitor Run Motor.

x-x-x