Class test 3 session 2017-18

Date : 11.4.2018
Time : 9-10.00 Am

Subject: Electrical Machine II EE306 Max mark 15 Time : 1 Hr

Q1Explain the method for open circuit tests on three phase alternator in laboratory with neat circuit diagram.

Q2. Explain construction & working of capacitor start split phase single phase induction motor.

Q3.A three phase, 16pole, alternator has star connected stator winding with 144 slots & 10 conductor per slot. The flux per pole is 0.03 Wb. & speed is 375 RPM. Calculate induced e. m. f if coil pitch is 160^0 electrical.

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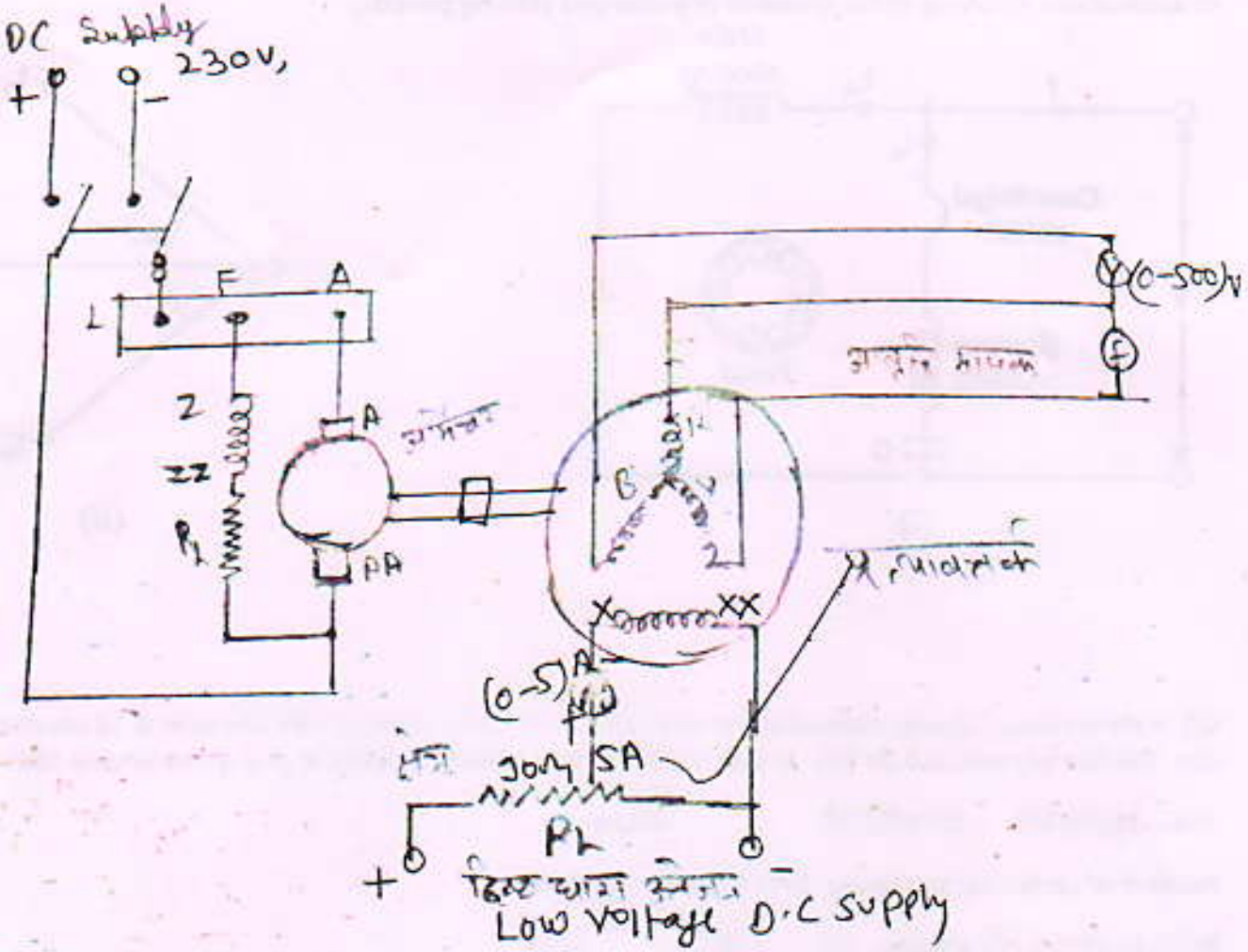
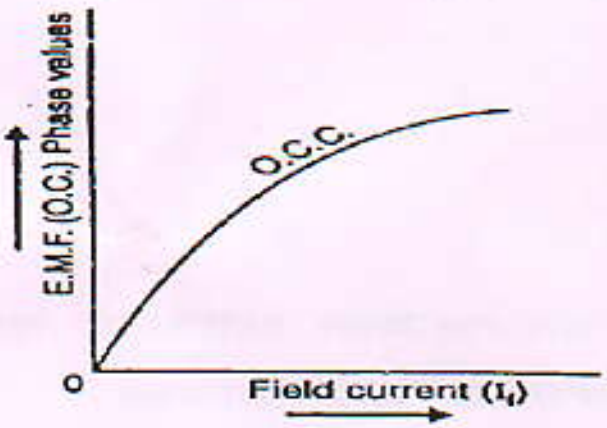
Q1 Explain the method for open circuit tests on three phase alternator in laboratory with neat circuit diagram.

Ans. Open-circuit Test

Open-circuit characteristic of an alternator is the curve between armature terminal voltage (phase value) on open circuit and the field current when the alternator is running at rated speed.

Fig shows the circuit for determining the O.C.C. of an alternator. The alternator is run on no-load at the rated speed. The field current If is gradually increased from zero (by adjusting field rheostat) until open-circuit voltage E0 (phase value) is about 50% greater than the rated phase voltage. The graph is drawn between open-circuit voltage values and the corresponding values of If as shown in Fig.





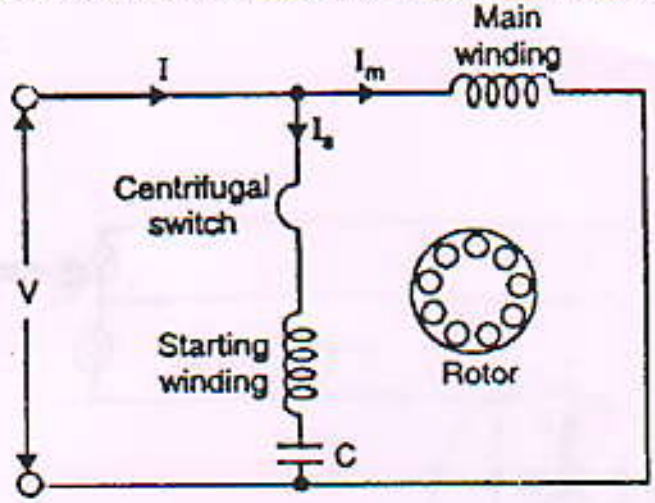
Q2. Explain construction & working of capacitor start split phase single phase induction motor.

The capacitor-start motor is identical to a split-phase motor except that the starting winding has as many turns as the main winding. Moreover, a capacitor C is connected in series with the starting winding as shown in Fig. The value of capacitor is so chosen that Is leads I_m by about 80° (i.e., a ~ 80°) which is considerably greater than 25° found in split-phase motor . Consequently, starting torque ($Ts = k\, I_m\, I_s \sin\phi$) is much more than that of a split-phase motor Again, the starting winding is opened by the centrifugal switch when the motor attains about 75% of synchronous speed. The motor then operates as a single-phase induction motor and continues to accelerate till it reaches the normal speed.

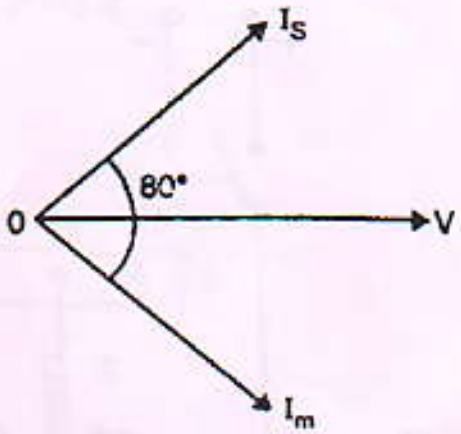
Characteristics

(i) Although starting characteristics of a capacitor-start motor are better than those of a split-phase motor, both machines possess the same running characteristics because the main windings are identical.

(ii) The phase angle between the two currents is about 80° compared to about 25° in a split-phase motor. Consequently, for the same starting torque, the current in the starting winding is only about half that in a split-phase motor. Therefore, the starting winding of a capacitor start motor heats up less quickly and is well suited to applications involving either frequent or prolonged starting periods.



(i)



(ii)

Q3. A three phase, 16pole, alternator has star connected stator winding with 144 slots & 10 conductor per slot. The flux per pole is 0.03 Wb. & speed is 375RPM. Calculate induced e. m. f if coil pitch is 160^0 electrical.

Ans. $f=p*n/120 = 16*375/120 = 50$ Hz

Number of conductor per phase $Z=144*10/3 = 480$

Number of turn per phase = $Z/2 = 480/2 = 240$

Short pitch angle $\rho = 180^0-160^0 = 20^0$

Pitch factor $K_p = \cos(\rho/2) = \cos(20^0/2) = 0.9848$

n = number of slot per pole =144/16 =9

m= number of slot per pole per phase = 9/3 =3

distribution factor $K_d = \sin(m\beta/2) / (m* \sin(\beta/2)) = \sin(3*20/2)/(3*\sin(20/2)) = 0.5/(3*0.1736) = 0.96$

induced EMF per phase $E = 4.44*K_p*K_d*f*\phi*T = 4.44*0.9848*0.96*0.03*240*50 = 1511.14$ Volt

prepared by G S Rathore