# 324712(24)



## B. E. (Seventh Semester) Examination,

## Nov.-Dec. 2015

(Old Scheme)

(Elect. Engg. Branch)

ELECTRICAL MACHINES-III

*Time Allowed : Three hours*

*Maximum Marks : 80*

*Minimum Pass Marks : 28*

*Note : Attempt all questions. Part (a) of each question is compulsory and carry 2 marks and attempt two parts from (b), (c) and (d) and carry 7 marks each.*



(a) What is the advantage of resolving armature mmf into d-q axes components.

(b) Show that for a three phase balanced input, Park's d-q variables happens to be independent of time.









(c) Show how a three-phase machine with variable inductance is converted to a machine with constant inductance?

(d) A three phase salient pole synchronous generator is developing rated voltage at its terminals when running at synchronous speed and at no-load. A 3 phase balanced short circuit suddenly occurs at alternator terminals. If armature and field resistances are neglected develop expressions for the armature, field currents.



2. (a) Give the necessary condition for a transformation to be power invariant.

(b) Show that rms value of three phase short circuit current in three phase induction motor in

$$I_1 = \left(\frac{1}{x'}\right) w \left(\frac{\lambda_{12}}{\lambda_{22}}\right) \left(\frac{1}{\sqrt{2}} \sqrt{\lambda_{2d_0}^2 + \lambda_{2q_0}^2}\right)$$

(c) Explain the single phasing phenomena for three phase induction motor accuring at (i) starting (ii) normal running.

(d) A 400 HP, 440 V, 60 Hz, star connected, 6 pole squirrel cage induction motor has a full load efficiency

of 93% and power factor of 30%. the constants in $\Omega$/phase referred to statar are as follows :

$$x_1 = 0{\cdot}06 \; ; \; x_2 = 0{\cdot}06 \text{ and } x_\phi = 2{\cdot}5$$



$$r_1 = 0{\cdot}0073, \; r_2 = 0{\cdot}0064$$

while the motor is operating in steady-state under rated conditions, a 3-phase short circuit occurs on its supply line near motor terminals. Determine the rms short circuit current.

**3.** (a) Give three reason why 3-phase induction motor is superior to a 1-phase induction motor.

(b) Show that a two phase tachometer with high resistance rotor the voltage induced on open phase is proportional to rotor speed and leads the other phase by 90°.

(c) A 2-phase, 4-pole servomotor has the following parameters at 50 Hz.

$$r_1 = 360\,\Omega, r_2 = 250\,\Omega, \; x_1 = x_2 = 50\,\Omega, X_m = 900\,\Omega$$

motor is operated at 115 V across the reference winding and 75 V across the control winding, the latter leading fermer by 90°.








Calculate the statar currents, out power and motor torque at a slip of 0·5. The rotational losses under conditions given above are 0·7 W both the windings have equal number of turns.

(d) With the help of two revolving field theory explain the operation of single phase induction motor and hence develop an equivalent circuit.



**4.** (a) Draw the phaser diagram of a 1-phase series motor. Mention all transformer and rotational emf induced.

(b) A 1-phase series motor, when connected to 230 V, 50 Hz, takes a rated current I at pf 0.88 and runs at rated speed $n$. If the supply frequency is reduced to 16(2/3) Hz, then calculate the supply voltage and pf for the same current I and speed $n$.

(c) In ac series motor show that ratio of ac speed to dc speed is



$$\frac{N_{ac}}{N_{dc}} = \cos\theta$$

A universal motor when operating on 220 V dc, draws 10 A runs at 1400 rpm. Find the new speed and power factor, when connected to 220 V, 25 Hz supply,

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the motor current remaining the same. The motor has total resistance of 1Ω and total inductance of 0.1 H



(d) Explain the behaviour of commutator as frequency convertor or changer

(a) Define step angle and give its formula for motor.



(b) A three stack variable reluctance stepper motor has 16 teeth on both stator and rotor. Find the angular displacement between stator stacks for achieving rotation of rotor at a speed of 810 rpm find frequency of currents given to stator phase windings.

(c) Describe the working principle and application of linear induction motor.



(d) What is reluctance motor? Prove that it can work only at synchronous speed.


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