Code No: V3111 **R07** **Set No: 1**

III B.Tech. I Semester Supplementary Examinations, April/May - 2013

ELECTRICAL MACHINES -III

(Electrical and Electronics Engineering)

Time: 3 Hours **Max Marks: 80**

Answer any FIVE Questions

All Questions carry equal marks

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1. a) Explain the differences between the integral slot and fractional slot windings?
   b) A 3-phase, 4-pole, 50Hz, star connected alternator has 60 slots with 4 conductors per slot and having armature winding of the double layer type. Coils are short pitched such that, if coil side lies in slot number 1, the other coil side lies in slot number 13. Find the useful flux per pole required to induce a line voltage of 13.2 kV . [8M+8M]

2. a) Explain how the synchronous impedance and reactances are determined experimentally?
   b) The flux distribution curve of the a smooth core, 50 Hz generator due to harmonics is $B = 10\sin\theta + 2\sin 3\theta + 2\sin 5\theta + 2\sin 7\theta$ Kilo-gauss when θ measure from neutral axis. The area of pole pitch is 0.112 m^2. Determine winding factors for all the contained harmonics and instantaneous equation of the e.m.f. induced per turn of the generator? [8M+8M]

3. a) Explain what are the differences in the determining of regulation of alternator by E.M.F., Z.P.F., and A.S.A. methods?
   b) A 10 kVA, 380 V, 50 Hz, 3- phase star connected salient pole alternator has direct axis and quadrature axis reactances of 12 Ω and 8 Ω respectively. The armature has resistance of 1 Ω per phase. The generator delivers rated load at 0.8 power factor lagging with terminal voltage bein g maintained at rated value. If the load angle is 16.15^0 determine (i) the direct axis and quadrature axis components of armature currents (ii) Excitation voltage of the generator (iii) percentage regulation? [8M+8M]

4. a) Explain in detail, the effect of change in mechanical power input of the one alternator in the group of alternators are operated in parallel?
   b) Two identical 3-phase alternators are operated in parallel and supplies a total load of 1600 kW at 11 kV at a power factor of 0.92. Each machine supplies half the total power. The synchronous reactance of each is 50 Ω/phase and 2.5 Ω/phase. The field excitation of the first machine is adjusted so that armature current is 50 A lagging. Determine armature current of the second alternator, the power factor at which each machine is working? [8M+8M]

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Code No: V3111 **R07** **Set No: 1**

5. a) Explain operation of synchronous motor with different excitations of field current? What is its effect on the power factor of the synchronous motor?
   b) A 400 V, 6-pole, 50 Hz, 3-phase star connected synchronous motor has synchronous impedance of (0.5 + j3.96) Ω per phase. It draws an armature current of 15A at unity power factor when operating certain field current. Keeping the field current constant the load torque is increased until the armature current is increased to 60 A. Calculate the new power factor and the mechanical torque developed? [8M+8M]

6. a) Explain the principle of synchronous induction motor? Discuss the required modifications in the constructional features of the synchronous motor to run as synchronous induction motor?
   b) What are the methods of starting synchronous motor? Briefly explain? [8M+8M]

7. a) Describe the different types of split phase motors? Explain how the starting torque is produced in these motors?
   b) Briefly explain the starting torque, running torque and speed reversal aspects of shaded pole motor? [8M+8M]

8. a) Describe the two different types of compensatory windings in AC series motor? Explain how they are useful in the working of AC series motor?
   b) Explain the constructional details and working principle of reluctance motor? [8M+8M]

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Code No: V3111 **R07** **Set No: 2**

III B.Tech. I Semester Supplementary Examinations, April/May - 2013

ELECTRICAL MACHINES -III

(Electrical and Electronics Engineering)

Time: 3 Hours **Max Marks: 80**

Answer any FIVE Questions

All Questions carry equal marks

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1. a) Briefly describe about distributed armature windings? How the integral and fractional slot windings are distributed in the armature of the alternator?
   b) The stator of 3-phase, 20 pole alternator has 120 slots, and there are 4 conductors per slots accommodated in two layers. If the speed of the alternator is 300 r.p.m. Calculate the e.m.f. induced in the alternator if the windings are full pitched and short pitched by 30^0. [8M+8M]

2. a) Draw the phasor diagram of synchronous generator when the operating with different power factors of the loads?
   b) The flux distribution curve of the a smooth core, 50 Hz generator due to harmonics is $B = 10\sin\theta + 2\sin 3\theta + 2\sin 5\theta + 2\sin 7\theta$ Kilo-gauss when θ measure from neutral axis. The area of pole pitch is 0.112 m^2. Determine winding factors for all the contained harmonics and instantaneous equation of the e.m.f. induced per turn of the generator? [6M+10M]

3. a) Explain the experimental determination of X_d and X_q? Why this test is called slip test?
   b) A 3-phase star connected, 275 kW, 6600 V, 50 Hz non-salient pole alternator gave the following open circuit and short circuit readings:

O.C.C:				
Field current, A	46.5	58	67.5	96
Line Volts, V	5600	6600	7240	8100

S.C.C

Short circuit current 35 A with an exciting current of 50 A.

   Leakage reactance on full load: 8%. Calculate as accurately as possible the exciting current (for full-load) at 0.8 p.f. lagging. Neglect armature resistance. [8M+8M]

4. a) Explain in detail, the effect of change in excitation of the one alternator in the group of alternators operated in parallel?
   b) The following loads are supplied by two alternators running in parallel:
   (i) 1400 kW at p.f. of 0.86 lagging. (ii) 900 kW at p.f of 0.8 lagging.
   (iii) 800 kW at p.f. of unity (iv) 500 kW at p.f. of 0.8 leading.
   If the load on one machine is adjusted to 2100 kW at p.f. of 0.92, find the load and power factor of the machine? [8M+8M]

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Code No: V3111 **R07** **Set No: 2**

5. a) Draw the phasor diagrams of the synchronous motor for different excitations of field currents? What is the effect of change in excitation on the power factor of the synchronous motor?
   b) An industrial plant has a load of 800 kW at a power factor of 0.8 lagging. It is desired to purchase a synchronous motor of sufficient capacity to deliver a load of 200 kW and also serve to correct the overall plant power factor to 0.92. Assuming that the synchronous motor has an efficiency of 92%, determine its kVA input rating and power factor at which the synchronous motor will operate? [8M+8M]

6. Draw and explain excitation and power circles diagrams of synchronous motor? How they are useful in determining the performance of the motor? [16M]

7. a) Why the single phase induction motor is not self starting, explain with the help of cross field theory?
   b) Briefly explain the production of starting torque, running torque capability and speed reversal operation of shaded pole motor? [8M+8M]

8. a) Draw the circuit diagram of AC series motor with modifications adapted with DC series motor? Explain how it is operating to give satisfactory operation?
   b) Explain working principle of universal motor with its constructional details? [8M+8M]

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Code No: V3111 **R07** **Set No: 3**

III B.Tech. I Semester Supplementary Examinations, April/May - 2013

ELECTRICAL MACHINES -III

(Electrical and Electronics Engineering)

Time: 3 Hours **Max Marks: 80**

Answer any FIVE Questions

All Questions carry equal marks

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1. a) Describe the constructional details of turbo-alternator and salient pole alternator?
   b) A pair of synchronous machines is required to generate power at 60 Hz and 50 Hz from the given source of prime mover on the same shaft. Determine the minimum number of poles that the individual machines could have for this type of operation and find the shaft-speed in r.p.m. [8M+8M]

2. a) Briefly describe different harmonics generated in the e.m.f of the alternator? How they are suppressed?
   b) Find the RMS value of fundamental & third harmonic EMF per phase for an alternator having following data: 50Hz, 3-Φ, 6poles, 4 slots/pole/phase, double layer winding with 6 conductors/slot, coil span of 150^0, flux per pole: fundamental is 0.1wb, third harmonic 19 % of fundamental. All coils of a phase are connected in series. [8M+8M]

3. a) Explain advantages and disadvantages of E.M.F., Z.P.F., and A.S.A. methods of determining the regulation of alternator?
   b) A 3-phase star connected, 1000 kVA, 2000 V, 50 Hz alternator gave the following open circuit and short circuit readings:

Field current, A	10	20	25	30	40	50
Line Volts, V	800	1500	1760	2000	2350	2600
Short circuit armature current, A	--	200	250	300	--	--

   Draw the characteristics curves and estimate the full load percentage voltage regulation by A.S.A method at (i) 0.8 power factor lagging, (ii) 0.8 power factor leading. The armature effective resistance/phase may be 0.2 Ω. [6M+10M]

4. a) Draw and explain the short circuit wave form of the alternator? How different reactances are determined from this waveform?
   b) A 3 MVA, 6-pole alternator runs at 1000 r.p.m in parallel with other machines on 3300 V bus bars. The synchronous reactance is 25%. Calculate the synchronizing power per one mechanical degree of displacement and corresponding synchronizing torque? [10M+6M]

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Code No: V3111 **R07** **Set No: 3**

5. a) Derive the expression for torque developed in 3-phase cylindrical rotor synchronous motor?
   b) A 6-pole, 400 V, 50 Hz, 3-phase star connected synchronous motor has impedance of (0.4 + j4.0) Ω per phase. While running on no load, the excitation voltage is equal and opposite to the applied voltage. With certain load torque applied, the rotor retards by 2 mechanical degrees. Calculate armature current and power factor of the motor? [8M+8M]

6. a) Explain the phenomenon of hunting in synchronous motor? How it is suppressed in synchronous and synchronous induction motors?
   b) Explain what are the loci of excitation and power circles in the synchronous motor? [10M+6M]

7. a) Describe the constructional details of the single phase induction motor? Explain why it is not self starting?
   b) Compare the torque-speed characteristics of the different split phase motors? [8M+8M]

8. a) Describe the two different types of compensatory windings in AC series motor? Explain how they are useful in the working of AC series motor?
   b) Describe the constructional details of the permanent magnet motor? Explain its working principle? [8M+8M]

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Code No: V3111 **R07** **Set No: 4**

III B.Tech. I Semester Supplementary Examinations, April/May - 2013

ELECTRICAL MACHINES -III

(Electrical and Electronics Engineering)

Time: 3 Hours **Max Marks: 80**

Answer any FIVE Questions

All Questions carry equal marks

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1. a) Deduce the expressions for the winding factors? Give the reasons for to consider those factors in e.m.f equation?
   b) A 3-phase star connected alternator has the following data: voltage required to be generated on the open circuit = 4000 V, at 50 Hz, speed = 500 r.p.m. stator slots/pole/phase = 3, conductors/ slot = 12. Calculate (i) number of poles (ii) useful flux/pole. Assume that all conductors per phase are connected in series and coil to be full pitch. [8M+8M]

2. a) What are the reasons for harmonics present in the generate e.m.f. of the alternator? State the different harmonics in generated e.m.f?
   b) Draw phasor diagrams and load characteristics of the alternator in which factors these are depends? [8M+8M]

3. a) Explain two reaction theory to as applied to salient pole synchronous machine?
   b) A 3-phase star connected, 275 kW, 6600 V, 50 Hz non-salient pole alternator gave the following open circuit and short circuit readings:

O.C.C:				
Field current, A	46.5	58	67.5	96
Line Volts, V	5600	6600	7240	8100

S.C.C

Short circuit current 35 A with an exciting current of 50 A.

Leakage reactance on full load: 8%. Calculate as accurately as possible the exciting current (for full-load) at 0.8 p.f. lagging. Neglect armature resistance. [8M+8M]

4. a) Deduce the expressions for synchronous power and synchronizing torque when an alternator is synchronized with infinite bus?
   b) A 6.6 MVA, 3-phase alternator has a reactance of 20% and is delivering full load at 0.8 p.f. If reactance is 20% and resistance is negligible. By changing the excitation the e.m.f. is increased by 25% at this load. Calculate the new current and power factor, the machine is connected to infinite bus. [8M+8M]

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Code No: V3111 **R07** **Set No: 4**

5. a) Explain the circumstances leading a synchronous motor to work as an ideal synchronous condenser? [8M]
   b) A 3-phase, star connected motor takes at 0.8 p.f. lagging full load current of 116 A at 500V. The total armature copper loss at this current is 1200 W. The reactance per phase of the motor is 0.3 Ω. Calculate the internal power developed, net mechanical power developed and e.m.f. generated by the motor. Assume 95% efficiency at full-load. [8M]

6. a) Explain methods of starting synchronous motor with neat sketches?
   b) Show that the current locus of the synchronous motor developing constant power is circle. Determine its centre and radius? [8M+8M]

7. a) Explain the principle of single phase induction motor based on double revolving field theory?
   b) Explain working principle of shaded pole motor? Draw its speed torque characteristics? [8M+8M]

8. a) Describe the constructional details of the universal motor? Explain its working principle under a.c and d.c supply?
   b) Explain the working principle of reluctance motor with neat diagrams? [10M+6M]

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