Code No: RR310205 **Set No. 1**

III B.Tech I Semester Regular Examinations, November 2006
ELECTROMECHANICS-III
(Electrical & Electronic Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Derive the expression for distribution factor and Calculate the distribution factor for a 36-slots,4-pole,single-layer three-phase winding.
   (b) Determine the pitch (or coil span) factors for the following windings:
      i. 36 stator slots, 4-pole, coil span 1to 8
      ii. 96 stator slots, 6poles, coil span 1to 12. [8+8]

2. (a) Draw and explain the phasor diagram of an alternator at lagging power factor
   (b) A 6-pole alternator rotating at 1000 r.p.m has a single-phase winding housed in 3 slots per pole, the slots in groups of three being 20^0 apart. If each slot contains 10 conductors, and the flux per pole is $2x10^{-2}$Wb,Calculate the voltage generated, assuming the flux distribution to be sinusoidal. [8+8]

3. (a) What is voltage regulation? Discuss the synchronous impedance method of calculating voltage regulation.
   (b) A 500V, 50KVA, 1-phase alternator has an effective resistance of 0.2Ω.A field current of 10A produces an armature current of 200A on short circuit and an emf of 450V on open circuit. Calculate
      i. Synchronous impedance and reactance
      ii. Full-load regulation with 0.8p.f. lagging. [8+8]

4. (a) What conditions must be fulfilled before an alternator can be connected to an infinite bus?
   (b) Calculate the synchronizing torque for unit mechanical angle of phase displacement for a 5000KVA, 3- phase alternator running at 1500 rpm when connected to 6600 volt. 50 Hz , bus-bars. The armature has a short circuit reactance of 15%. [8+8]

5. (a) Prove that sharing of common load by the alternators in parallel depends upon input to the prime movers.
   (b) Two identical 2000KVA alternators operate in parallel. The governor of first machine is such the frequency drops uniformly for 50Hz on no-load to 48 Hz on full - load. The corresponding uniform speed drop of the second machine is 50 to 47.5 Hz.
      i. How will the two machines share a load of 3000kw?
      ii. What is the maximum load at unity p.f. that can be delivered without over loading either machine? [8+8]

6. (a) What are the advantages and disadvantages of the synchronous motor?
   (b) A Synchronous motor takes 25KW from 400V supply mains. The synchronous reactance of the motor is 4Ω. Find the power factor at which the motor would operate when the exciting current is so adjusted that the generated emf is 500V. [8+8]

7. (a) What are the causes of faulty starting of synchronous motor?
   (b) The input to a 11KV, 3-phase star connected synchronous motor is 60A. The effective resistance and synchronous reactance per phase are 1Ω and 30Ω. Find the power supplied to the motor and the induced emf for power factor of 0.8 leading. [8+8]

8. (a) Explain about two-value capacitor run motor.
   (b) A ¼ h.p. 110V, 60Hz, 4 pole capacitor start motor has the following constants and losses

   Auxiliary winding r_a= 2Ω x_a= 2.79Ω

   Main winding r_m=4Ω xm= 2.0Ω.

   Magnetizing reactance is 66.8Ω.

   Core loss=24W rotational loss of 13W.

   Determine the stator current, power factor and efficiency when the motor is running as a single-phase motor at the rated voltage and frequency with its starting winding open. [8+8]

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Code No: RR310205 **Set No. 2**

III B.Tech I Semester Regular Examinations, November 2006
ELECTROMECHANICS-III
(Electrical & Electronic Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Describe the main constructional features of cylindrical rotor and salient pole alternators.
   (b) Derive the expressions for distribution and pitch factors. [8+8]

2. (a) Draw and explain the phasor diagram of an alternator at leading power factor
   (b) A 3-phase, 16-pole alternator has a star-connected winding with 144 slots and 10 conductors per slot. The flux per pole is 0.03 Wb, Sinusoidally distributed and the speed is 375 r.p.m .Find the frequency in rpm and the phase and line e.m.f. assume full ?pitched coil. [8+8]

3. (a) Derive an expression for finding regulation of salient -pole alternator using two reaction theory .Draw its phasor diagram.
   (b) A 2000 KVA, 11KV, 3- ϕ, star connected alternator has a resistance of 0.3 ohm and reactance of 5 ohm per phase It delivers full-load current at 0.8 lagging p.f at rated voltage. Compute the terminal voltage for the same excitation and load current at 0.8 p.f leading.. [8+8]

4. (a) Describe the slip test method for the measurement of Xd to Xq of synchronous Machines.
   (b) A 3.5 MVA, slow-speed, 3-phase synchronous generator rated at 6.6KV has 32 poles its direct - and quadrature - axis synchronous reactances as measured by the slip test are 9.6Ω and 6Ω respectively. Neglecting armature, determine the regulation and the excitation emf needed to maintain 6.6KV at the terminals when supplying a load of 2.5MW at 0.8pf lagging. What maximum power can the generator supply at the rated terminal voltage, if the field becomes open-circuited? [8+8]

5. (a) Explain the procedure how to bring the incoming machine to operate in parallel with running machines.
   (b) Two alternators working in parallel supply a lighting load of 300kw and a motor load aggregating to 5000kw at a p.f. of 0.71. One machine is loaded to 5000kw at 0.8 p.f. Lagging. What is the load and Power factor of the other Machine. [8+8]

6. (a) What are the advantages and disadvantages of the synchronous motor?
   (b) A Synchronous motor takes 25KW from 400V supply mains. The synchronous reactance of the motor is 4Ω. Find the power factor at which the motor would

operate when the exciting current is so adjusted that the generated emf is 500V. [8+8]

7. (a) Explain the procedure for starting of synchronous motor.

   (b) A 500V, 3-phase mesh connected motor has an excitation emf of 600V. The motor synchronous impedance is (0.4+j5) Ω while the windage, friction and iron losses are 1200W. What maximum power output can it deliver? [8+8]

8. (a) Explain capacitor split phase motor.

   (b) A 220V, 4 pole, 50Hz, capacitor split phase motor has the following impedance at standstill.

   Auxiliary winding $r_a = 3\Omega$ $x_a = 6\Omega$

   Main winding $r_m = 2\Omega$ $x_m = 5\Omega$.

   The resistance of the rotor winding when referred to the main stator winding is 0.5Ω. Assuming the number of turns of the main winding and Auxiliary winding are equal, estimate the starting torque, maximum starting torque and the capacitance to be inserted to get maximum starting torque. [8+8]

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Code No: RR310205 **Set No. 3**

III B.Tech I Semester Regular Examinations, November 2006
ELECTROMECHANICS-III
(Electrical & Electronic Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Describe the main constructional features of cylindrical rotor and salient pole alternators.
   (b) Derive the expressions for distribution and pitch factors. [8+8]

2. (a) Draw and explain the phasor diagram of an alternator at leading power factor
   (b) A 3-phase, 16-pole alternator has a star-connected winding with 144 slots and 10 conductors per slot. The flux per pole is 0.03 Wb, Sinusoidally distributed and the speed is 375 r.p.m .Find the frequency in rpm and the phase and line e.m.f. assume full ?pitched coil. [8+8]

3. (a) Discuss the m.m.f method of calculating voltage regulation?
   (b) A 3-phase star connected, 1000KVA, 2000V, 50Hz,alternator gave the following. open circuit and short circuit test readings.

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

   Draw the characteristic curves and estimate the full load percentage regulation at
   i. 0.8pf lagging and
   ii. 0.8pf leading The armature effective resistance/phase may be taken as 0.2Ω [8+8]

4. (a) Explain the two reaction theory applicable to salient pole synchronous Machine.
   (b) A 4500 KVA,50 Hz,3-phase,synchronous generator having a synchronous reactance of 0.3 p.u. is running at 1500 r.p.m and is excited to give 11000 V.If the rotor deviates slightly from its equilibrium position, what is the synchronizing torque in N-m per degree mechanical displacement. [8+8]

5. (a) Describe the effect of sudden short circuit on the performance of synchronous generator.
   (b) Two similar 6000v, 3- phase generators are running in parallel on constant - voltage and frequency bus bars. Each has an equivalent resistance and reactance of 0.05Ω and 0.5Ω respectively and supplies one half of a total load of 10,000KW at a lagging power factor of 0.8, the two machines being similarly excited. If the excitation of one machine be adjusted until the armature current is 438A and the steam supply to the turbine remains unchanged, find the

armature current, the turbine remains unchanged, find the armature current, the e.m.f and the power factor of the other alternator [8+8]

6. (a) Explain about different torques of a synchronous motor?
   (b) A 400V, 3-phase synchronous motor takes 52.5A at a power factor of 0.8 leading. Calculate the power supplied and induced emf. The motor impedance per phase is (0.25+j3.2)Ω. [8+8]

7. (a) What could be the reasons if a synchronous motor fails to start?
   (b) The synchronous reactance per phase of a 3-phase star connected 6600V synchronous motor is 10Ω. For a certain load, the input is 900KW and the induced line emf is 8900V(line value). Evaluate the line current. Neglect resistance. [8+8]

8. (a) Explain what is meant by the split-phase method of motor starting.
   (b) Compare operating characteristics of a resistance-start induction - run-motor with those of a capacitor start induction-run motor. [8+8]

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Code No: RR310205 **Set No. 4**

III B.Tech I Semester Regular Examinations, November 2006
ELECTROMECHANICS-III
(Electrical & Electronic Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Describe the different types of prime movers employed in case of alternators.
   (b) Calculate the pitch factor of an alternator having 24 stator slots with 4 poles when the coil span is 1 to 6 slots. [8+8]

2. (a) Derive emf equation for an alternator from fundamentals.
   (b) A 50Hz alternator has a flux of 0.1 wb/pole, sinusoid ally distributed. Calculate the rms value of the emf generated in one turn of the winding, which spans $^{3}/_{4}$ of a pole pitch. [8+8]

3. (a) What is voltage regulation? Discuss the synchronous impedance method of calculating voltage regulation.
   (b) A 500V, 50KVA, 1-phase alternator has an effective resistance of 0.2Ω.A field current of 10A produces an armature current of 200A on short circuit and an emf of 450V on open circuit. Calculate
      i. Synchronous impedance and reactance
      ii. Full-load regulation with 0.8p.f. lagging. [8+8]

4. (a) What is an infinite bus? State the characteristics of an infinite bus. What are the operating characteristics of an alternator connected to an infinite bus?
   (b) A 3 MVA,6-pole alternator runs at 1000 r.p.m in parallel with other machines on 3.3 KV bus-bars. The synchronous reactance is 20%.Calculate the synchronizing power per one mechanical degree of displacement and the corresponding synchronizing torque. [8+8]

5. (a) Show that in order to obtain a constant - voltage constant frequency of Practical bus bar systems the number of alternators connected in parallel Should be as large as possible.
   (b) Two single - phase alternators are connected in parallel, and the excitation of each machine is such as to generate an open - circuit e.m.f of 3500 V. the stator winding of each machine has a synchronous reactance of 30Ω and negligible resistance if there is a phase displacement of 40 electrical degrees between the e.m.fs calculate
      i. The current circulating between the two machines,
      ii. The terminal voltage and

      the power supplied from one machine to the other.Assume that the is no external load. Sketch the phasor diagram. [8+8]

6. (a) Write short notes on the power factor improvement with synchronous motor?
   (b) A 2300V, 3-phase, star connected synchronous motor has a resistance of 0.2Ω per phase and a synchronous reactance of 2.2 Ω per phase. The motor is operating at 0.6 power factor leading with a line current of 200A. Determine the value of generated emf per phase. [8+8]

7. (a) What are the causes of faulty starting of synchronous motor?
   (b) The input to a 11KV, 3-phase star connected synchronous motor is 60A. The effective resistance and synchronous reactance per phase are 1Ω and 30Ω. Find the power supplied to the motor and the induced emf for power factor of 0.8 leading. [8+8]

8. Write short notes on following:
   (a) Double revolving field theory.
   (b) Capacitor Start single phase induction motor. [8+8]

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