Full Marks: 80

Time: 3 Hours

Answer any Five Questions including Q No. 1& 2

Figures in the right hand margin indicates marks

1. **Answer all the questions**

10x2

a) Define pitch factor in alternator and state its relation with short pitch angle α.

b) State any two applications of stepper motor.

c) Write any two advantages of polyphase induction motor over AC motors.

d) What is 'up' voltage regulation in alternators?

e) What are the V-curves in synchronous motor?

f) What is hunting and how it can be prevented?

g) How a single phase induction motor is made self starting?

h) What is the function of compensating winding in compensated repulsion motor?

i) How the direction of rotation of split phase induction motor can be reversed?

j) What is the effect of change in supply voltage on Torque and Speed in 3 phase induction motor?

2. **Answer any six questions**

a) Explain the principle of operation of universal motor with neat diagram.

6x5

b) Explain about the determination of voltage regulation of alternator by synchronous impedance method.

c) Derive the torque developed by the 3 phase induction motor at the instant of starting.

d) Describe about the operation of ON load tap changing transformer using resistors.

e) Write a short note on single phase capacitor start capacitor run induction motors.

f) Explain the 2-phase ON mode of operation in variable reluctance stepper motor briefly.

g) Describe the power flow within a 3 phase synchronous motor and find the mechanical power in rotor.

3. Describe the working principle of shaded pole motor with neat diagrams

10

4. Explain the double field revolving theory in single phase induction motor with Torque-slip graph.

10

5. Explain the effect of armature reaction on main flux in alternators at Unity Power Factor, Zero Power Factor lagging and leading loads.

10

6. Describe the effect of excitation on armature current and power factor in synchronous motor in details.

10

7. The power input to the rotor of a 440V, 50Hz, 6-pole,3 phase induction motor is 100 kW. The rotor electromotive force is observed to make 120 cycles per minute. Calculate (i) the slip (ii) the rotor speed (iii) mechanical power developed (iv) the rotor copper loss per phase and (v) speed of stator field with respect to rotor.

10

Th-2   Energy Conversion-II

Full Marks: 80   Time- 3 Hrs

Answer any five Questions including Q No.1 & 2
Figures in the right hand margin indicates marks

1.   Answer All questions   2 x 10
   a.   Why damper bars are used in synchronous motor?
   b.   What do you mean by Hunting?
   c.   Write the advantages of short pitch winding over full pitch winding.
   d.   Define Plugging.
   e.   Why centrifugal switch is used single phase induction motor?
   f.   Define pitch factor and write its value for full pitch winding.
   g.   Name the sources of Harmonics.
   h.   Write the four application of Hybrid stepper motor.
   i.   Why Synchronous motor is not self starting?
   j.   What are the condition of synchronization 3 phase Transformer.

2.   Answer Any Six Questions   6 x 5
   a.   Derive the EMF equation of synchronous generator.
   b.   With the help of diagram explain armature reaction of an alternator and its effect at different power factor of load.
   c.   A 4 pole,3 ph induction motor operates from a supply is 50Hz, calculate   2+1+2
       •   The speed at which the magnetic field of the stator is rotating.
       •   The speed of the rotor which slip is 0.04
       •   The frequency of the rotor currents when the slip is 0.03
   d.   Explain briefly Torque- slip characteristics of 3 phase induction motor with the help of characteristics diagram.
   e.   Explain briefly working principle and application of shaded pole induction motor with the help of diagram.
   f.   Explain briefly the effect of varying excitation with constant load in synchronous motor.
   g   A synchronous motor having 25% reactance and a negligible resistance   [1+1+1+2]
   is to be operated at rated load at (i) unity p.f (ii) 0.8 p.f lag (iii) 0.8 p.f. lead. What are the value of induced e.m.f?

3   a.   Explain briefly working principle and application of Induction   5
   Generator.
   b.   Write the Maintenance Schedule of Power Transformer.   5
4   A 3 phase induction motor having a 6 pole, star connected stator   4+3+3
   winding runs on 240V, 50 Hz supply. The rotor resistance and standstill reactance are 0.12Ω and 0.85 Ω per phase. The ratio of stator to rotor turns is 1.8. Full load slip is 4%. Calculate the developed torque at full load, maximum torque and speed at maximum torque.
5   With the help of diagram explain the working principle of Permanent   10
   magnet steeper motor.
6   Write the condition for parallel operation of an alternator and explain it   10
   by using dark and bright lamp method.
7   Calculate the R.M.S value of the induced e.m.f per phase of a 10-pole,   10
   3-phase, 50Hz alternator with 2 slots per pole per phase and 4 conductors per slot in two layers. The coil span is 150 degree. The flux per pole has a fundamental component of 0.12wb and a 20% third component.

5TH SEM./ ELECTRICAL/2020(W)NEW
TH2-ENERGY CONVERSION II

Full Marks: 80

Time: 3 Hours

Answer any Five Questions including Q No. 1 & 2

Figures in the right hand margin indicates marks

1. Answer all the questions   10x2

  a) Define slip speed in 3 phase induction motor and state its equation.

  b) What is plugging in 3 phase induction motor?

  c) Define pitch factor in alternator and state its value.

  d) What is the purpose of damper windings in alternators?

  e) State two applications of synchronous motor.

  f) What are the V-curves in synchronous motor?

  g) Define step angle in stepper motor and state its value.

  h) How a single phase induction motor is made self starting?

  i) What is the function of compensated winding in compensated repulsion motor?

  j) How the direction of rotation of split phase induction motor can be reversed?

2. Answer any six questions   6x5

  a) Explain the principle of operation of synchronous motor in details.

  b) Describe the power flow stages in 3 phase induction motor with a neat diagram.

  c) Derive the relation between torque and rotor power factor in 3 phase induction motor.

  d) Explain about the determination of voltage regulation of alternator by synchronous impedance method.

  e) Describe about types of rotors in alternators in details.

  f) Write a short note on capacitor start induction run motors.

  g) Explain the 1-phase ON or full step operation in variable reluctance stepper motor briefly.

3. Derive the relationship between rotor input, mechanical power & copper loss in 3-ph induction motor.   10

4. Explain about the double field revolving theory in 1-phase induction motor with torque-slip graph.   10

5. Describe the synchronizing of 3 phase alternator using two bright and one dark lamp method.   10

6. Write a short note on (a)Direct-On-Line starter (b)Parallel operation of alternators.   10

7. Explain the effect of excitation on armature current and power factor in synchronous motor in details.   10

5TH SEM./ELECTRICAL/ 2024(W)

TH2   Energy Conversion-II

Full Marks: 80   **Time- 3 Hrs**

Answer any five Questions including Q No.1 & 2
Figures in the right hand margin indicates marks

1.   Answer **All** questions   2 x 10

   a.   What is the major difference between squirrel cage induction motor and slip ring induction motor?

   b.   Define the term voltage regulation and efficiency of alternator.

   c.   Why single-phase induction motor has low power factor?

   d.   Write the advantage of group of winding.

   e.   What does plugging of induction motor mean?

   f.   What is Synchronous speed and slip of an IM?

   g.   Give the conditions for maximum torque for 3-phase induction motor and state the equation for maximum torque.

   h.   What does hunting of synchronous motor mean?

   i.   What are the effects of increasing rotor resistance on starting current and starting torque?

   j.   State Ferrari's principle.

2.   Answer **Any Six** Questions   5 x 6

   a.   A 3-Phase 50 Hz 6 pole IM has a shaft power of 10KW at 950 rpm. Friction and windage losses are 2% of Output. If the total stator copper loss 500W. Determine the rotor input and stator input.

   b.   Explain principle of operation of Universal motor with neat sketch.

   c.   Explain speed control of induction motor using Rotor resistance control.

   d.   Explain Working principle and torque-speed characteristics of Capacitor start, capacitor run motor.

   e.   Explain why a synchronous motor does not have self-starting torque?

   f.   Describe the conditions for parallel operation of three phase transformers.

   g   A 3 phase, 50 Hz , 8 pole alternator has a star connected winding with 120 slots and 8 conductors per slot. The flux per pole is 0.05 wb, sinusoidal distributed. Determine the phase and line voltages.

Answer **Any Three** Questions

3. a. A 12 pole,3-phase,600V, 50Hz star connected induction motor has rotor 5 resistance and standstill reactance per phase are 0.03Ω and 0.5Ω respectively. Calculate (i) speed of maximum torque (ii) ratio of full-load torque to maximum torque, if the full load speed is 495 rpm.

   b. Explain torque-slip characteristics of 3-phase IM.   5

4. Write short notes on (a) Permanent magnet stepper motor.   5+5
   (b) On-Load tap changing transformer.

5. A 1000kVA, 11000V, 3-phase star connected synchronous motor has an 4+3+3 armature resistance and reactance per phase of 3.5Ω and 40Ω respectively. Determine the induced emf in of the rotor when fully loaded at (a) unity p.f (b) 0.8 pf lagging (c) 0.8 pf leading with phasor diagram.

6. Explain about the double field revolving theory in 1-phase induction motor.   10

7. A 3-phase star connected 1000KVA, 11000V alternator has rated current of 10 52.5 A. The ac resistance of the winding per phase is 0.45 ohm. The test results are given below:
   O.C. Test: field current = 12.5 A, voltage between lines = 422 V
   S.C. Test: field current = 12.5A, line current = 52.5A
   Determine the full load voltage regulation of the alternator for 0.8p.f lagging and 0.8 p.f leading loads with synchronous impedance method.

2

5TH SEM./ELECTRICAL/ 2024(W)
TH2   Energy Conversion-II

Full Marks: 80   Time- 3 Hrs

Answer any five Questions including Q No.1& 2
Figures in the right hand margin indicates marks

1.   Answer **All** questions   2 x 10

a.   What is the major difference between squirrel cage induction motor and slip ring induction motor?

b.   Define the term voltage regulation and efficiency of alternator.

c.   Why single-phase induction motor has low power factor?

d.   Write the advantage of group of winding.

e.   What does plugging of induction motor mean?

f.   What is Synchronous speed and slip of an IM?

g.   Give the conditions for maximum torque for 3-phase induction motor and state the equation for maximum torque.

h.   What does hunting of synchronous motor mean?

i.   What are the effects of increasing rotor resistance on starting current and starting torque?

j.   State Ferrari's principle.

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a.   A 3-Phase 50 Hz 6 pole IM has a shaft power of 10KW at 950 rpm. Friction and windage losses are 2% of Output. If the total stator copper loss 500W. Determine the rotor input and stator input.

b.   Explain principle of operation of Universal motor with neat sketch.

c.   Explain speed control of induction motor using Rotor resistance control.

d.   Explain Working principle and torque-speed characteristics of Capacitor start, capacitor run motor.

e.   Explain why a synchronous motor does not have self-starting torque?

f.   Describe the conditions for parallel operation of three phase transformers.

g   A 3 phase, 50 Hz , 8 pole alternator has a star connected winding with 120 slots and 8 conductors per slot. The flux per pole is 0.05 wb, sinusoidal distributed. Determine the phase and line voltages.

Answer **Any Three** Questions

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torque to maximum torque, if the full load speed is 495 rpm.

   b. Explain torque-slip characteristics of 3-phase IM.   5

4.   Write short notes on (a) Permanent magnet stepper motor.   5+5
                    (b) On-Load tap changing transformer.

5.   A 1000kVA, 11000V, 3-phase star connected synchronous motor has an   4+3+3
armature resistance and reactance per phase of 3.5Ω and 40Ω respectively.
Determine the induced emf in of the rotor when fully loaded at (a) unity p.f
(b) 0.8 pf lagging (c) 0.8 pf leading with phasor diagram.

6.   Explain about the double field revolving theory in 1-phase induction motor.   10

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Determine the full load voltage regulation of the alternator for 0.8p.f lagging
and 0.8 p.f leading loads with synchronous impedance method.

5TH SEM./ELECTRICAL/2024(W)
TH2   Energy Conversion-II

Full Marks: 80

Time- 3 Hrs

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Figures in the right hand margin indicates marks

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    2 x 10

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    b. Explain principle of operation of Universal motor with neat sketch.

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torque to maximum torque, if the full load speed is 495 rpm.

    b. Explain torque-slip characteristics of 3-phase IM.   5

4.   Write short notes on (a) Permanent magnet stepper motor.   5+5
                    (b) On-Load tap changing transformer.

5.   A 1000kVA, 11000V, 3-phase star connected synchronous motor has an 4+3+3
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Determine the induced emf in of the rotor when fully loaded at (a) unity p.f
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