Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 41006

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2018

Fifth Semester

Electrical and Electronics Engineering

EE6504 – ELECTRICAL MACHINES – II

(Regulations 2013)

Time : Three Hours Maximum : 100 Marks

Answer ALL questions

PART – A **(10×2=20 Marks)**

1. Two reaction theory is applied only to salient pole machines. State the reason.
2. What are the advantages of salient pole type construction used for Synchronous machines ?
3. How the synchronous motor can be used as synchronous condenser ?
4. How does a change of excitation affect its power factor ?
5. Why an induction motor will never run at its synchronous speed ?
6. Explain why an induction motor, at no-load, operates at very low power factor.
7. What is the need of starter for induction motor ?
8. What are the advantages of slip power scheme ?
9. What are the various methods available for making a single-phase motor self-starting ?
10. What is the principle of reluctance motor ?

PART – B (5×13=65 Marks)

11. a) Explain the procedure for POTIER method to calculate voltage regulation of alternator. (13)

(OR)

b) Describe the principle and construction of slow speed operation generator with neat diagram. (13)

12. a) A 5 kW, three-phase Y-connected 50 Hz, 440 V, cylindrical rotor synchronous motor operates at rated condition with 0.8 pf leading . The motor efficiency excluding field and stator losses is 95% and Xs = 2.5 Ω. Calculate :

i) Mechanical power developed

ii) Armature current

iii) Back emf

iv) Power angle

v) Maximum or pull out torque of the motor. (13)

(OR)

b) Explain the working of synchronous motor with different excitations. (13)

13. a) Explain the construction and working of three phase induction motor. (13)

(OR)

b) Develop an equivalent circuit for three phase induction motor. State the difference between exact and approximate equivalent circuit. (13)

14. a) Explain with neat diagram, the working of any two types of starters used for squirrel cage type three phase induction motor. (13)

(OR)

b) Explain briefly the various speed control schemes of induction motor. (13)

15. a) Give the classification of single phase motors. Explain any two types of single phase induction motor. (13)

(OR)

b) What is the principle and working of hysteresis motor and AC series motor ? Explain briefly. (13)

PART – C (1×15=15 Marks)

16. a) A 415 V, 11kW , 50 Hz, delta connected, three-phase energy efficient induction motor gave the following test results :

No load test : 415 V; 5.8 A; 488 W

Blocked rotor test : 40 V; 18.4 A; 510 W

Stator resistance per phase = 0.7 Ω.

For full-load condition, find

i) line current

ii) power factor

iii) input power

iv) slip and

v) efficiency.

(OR)

b) A 1.1 MVA, 2.2 kV, 3-phase, star -connected alternator gave the following test result during OC and SC tests :

Field current (A)	:	10	20	30	40	50
Open circuit voltage(kV)	:	0.88	1.65	2.20	2.585	2.86
Short circuit current (A)	:	200	400	–	–	–

The effective resistance of the 3-phase winding is 0.22 Ω/ph. Estimate the full-load voltage regulation at 0.8 p.f. lagging

i) By synchronous impedance method and

ii) Ampere-turn method.

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Question Paper Code : 20461

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2018.

Fifth Semester

Electrical and Electronics Engineering

EE 6504 — ELECTRICAL MACHINES II

(Regulations 2013)

(Common to PTEE 6504 – Electrical Machines II for B.E. (Part-Time) – Fourth Semester – Electrical and Electronics Engineering – Regulations 2014)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Write the equation for frequency of emf induced in an alternator.
2. Identify the type of synchronous generators that are used in hydroelectric plant.
3. Why a 3-phase synchronous motor will always run at synchronous speed?
4. Define synchronous condenser.
5. Classify the two types of 3-phase induction motor.
6. Define pullout torque.
7. Name the two windings of a single-phase induction motor.
8. Specify the use of single-phase induction motor.
9. Predict the type of motor that is used for ceiling fan.
10. What are the applications of linear induction motor?

PART B — (5 × 13 = 65 marks)

11. (a) Explain the operating principle of three-phase alternator.

Or

(b) Derive the equation of induced emf for an alternator.

12. (a) Explain V-curves and inverted V-curves.

Or

(b) Explain briefly the features and principle of operation of three-phase synchronous motor.

13. (a) Generate the slip-torque characteristics for a three-phase induction motor and explain.

Or

(b) A 3-Phase, 400 V induction motor gave the following test reading :

No-load: 400 V, 1250 W, 9 A, Short circuit: 150 V, 4 kW, 38 A

Draw the circle diagram. If the normal rating is 14.9 kW, find from the circle diagram, the full-load value of current, power factor and slip.

14. (a) Explain the concept of crawling and cogging of induction motor in detail.

Or

(b) Describe the constructional features and operating characteristics of single-phase shaded pole motor.

15. (a) Discriminate the construction and principle of working of stepper motor.

Or

(b) Explain the operation, characteristics and application of DC and AC servo motor.

PART C — (1 × 15 = 15 marks)

16. (a) (i) Why voltage regulation value obtained using the MMF method is considered to be optimistic? (6)

(ii) A 400 V induction motor runs at a speed of 1440 rpm when supplied from a 50 Hz source. Find its speed at 30 Hz when the load torque is constant. The frequency is varied while maintaining the ratio (V/f) constant. (9)

Or

(b) A three-phase, 12-pole, 500 rpm, star connected alternator has 144 slots with 8 conductors per slots. The coils are full pitched and the flux per pole is 0.08 wb. Determine the phase and line EMF's. What will be the phase voltage if the coils are connected to form a balanced two-phase winding? (15)

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Question Paper Code : 23504

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2018.

Fifth Semester

Electrical and Electronics Engineering

EE 2302 – ELECTRICAL MACHINES – II

(Regulations 2008)

(Common to PTEE 2302 – Electrical Machines – II for B.E. (Part – time) Fourth Semester – EEE – Regulations 2009)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Why is the field system of an alternator made as a rotor?

2. What is synchronizing power of an alternator?

3. What is hunting?

4. Write down the significance of V and inverted V curves.

5. Why are the slots on the cage rotor of induction motor usually skewed?

6. Define slip of an induction motor.

7. What are the different methods of speed control employed in three phase cage induction motor?

8. Why is it objectionable to start large three phase induction motor by switching it directly on the line?

9. Distinguish the terms rotating and pulsating magnetic fields.

10. State the limitations of shaded pole motors.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Describe the POTIER method of determining the regulation of an alternator. (8)

(ii) A 3.3 kV alternator gave the following results :

Field current (A) :	16	25	37.5	50	70
OC voltage (kV)	1.55	2.45	3.3	3.75	4.15

A field current of 18 A is found to cause the full load current to flow through the winding during short circuit test. Predetermine the full load voltage regulation at (1) 0.8 pf lag and (2) 0.8 pf lead by MMF method. (8)

Or

(b) (i) Describe the slip test for finding X_d and X_q. (8)

(ii) Two similar, 3 phase alternators work in parallel and deliver a total real power of 1800 kW at 11 kV and at 0.85 pf lagging to the load. Each alternator initially supplied half the load power. The excitation of the first alternator is then increased such that its line current becomes 60 A lagging. Find the line current delivered by the second alternator. (8)

12. (a) (i) Why are synchronous motors not self starting? Explain. (6)

(ii) Explain the effect of variable excitation on the behaviour of the synchronous motor under constant load conditions. (10)

Or

(b) (i) Derive an expression for the maximum torque developed per phase of a synchronous motor. (8)

(ii) Explain how synchronous motor can be used as a synchronous condenser. Draw the phasor diagram. (8)

13. (a) (i) Draw the equivalent circuit and derive expressions for maximum torque and power of a three phase induction motor. (8)

(ii) A 6-pole, 50 Hz, 3-phase induction motor running on full load develops a useful torque of 160 Nm when the rotor emf makes 120 complete cycles per minute. Let, the mechanical torque lost in friction and core-loss is 10 Nm. Determine the following,

(1) shaft power output.

(2) input to the motor, and

(3) efficiency

Let the total stator loss be 800W. (8)

Or

(b) (i) Draw the torque slip characteristics of an induction motor for varying frequency. stator voltage and rotor resistance. (8)

(ii) A 400 V, 6-pole, 3-phase. 50 Hz star-connected induction motor running light at rated voltage takes 7.5A with a power input of 700W. With the rotor locked and 150 V applied to the stator, the input current is 35 A and power input is 4000W; the stator resistance/phase being 0.55 ohms under these conditions. The standstill reactances of the stator and rotor as seen on the stator side are estimated to be in the ratio of 1:0.5. Determine the parameters of the equivalent circuit. (8)

14. (a) Why are starters necessary for starting 3Φ induction motors? What are the various types of starters? Explain star-delta type starter in detail. (16)

Or

(b) With neat diagram explain the slip power recovery scheme. (16)

15. (a) Explain with suitable diagram the working principle of split-phase and capacitor start induction motor. (8+8)

Or

(b) Discuss briefly the operation and characteristics of

(i) Repulsion motor (8)

(ii) AC series motor. (8)

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Question Paper Code : 80131

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2019.

Fourth Semester

Electrical and Electronics Engineering

EE 8401 — ELECTRICAL MACHINES — II

(Regulation 2017)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Distinguish between the 'Synchronous reactance' and the 'Potier reactance' of a synchronous generator.
2. Why the concept of Two reaction theory is applied only to salient pole machines.
3. Name the various torques associated with a synchronous motor.
4. What for damper windings are provided in a synchronous machines?
5. A 3-phase induction motor is wound for 4 poles and is supplied from 50 Hz system. Calculate the speed at which the magnetic field of the stator is rotating.
6. State the merits and demerits of double cage induction machines.
7. List the advantages of rotor resistance starter based induction motor starting.
8. What type of braking is employed during deceleration of an induction motor?
9. What is the role of 'magnetic bridges' in the operation of a shaded pole induction motor?
10. What is the necessity of having laminated yoke in an ac series motor?

PART B — (5 × 13 = 65 marks)

11. (a) A 3-phase, 50 Hz, star-connected alternator with 2-layer winding is running at 600 rpm. It has 12 turns/coil, 4 slots/pole/phase and a coil-pitch of 10 slots. If the flux/pole is 0.035 Wb sinusoidally distributed, find the phase and line emf's induced. Assume that the total turns/phase are series connected. (13)

Or

(b) A 3-phase, star-connected, 1000 kVA, 11 kV alternator has rated current of 52.5 A. The ac resistance of the winding per phase is 0.45 Ω. The test results are given below :

OC test: field current = 12.5 A, voltage between lines = 422 V

SC test; field current = 12.5 A, line current = 52.5 A

Determine the full-load voltage regulation of the alternator at (i). 0.8 p.f. lagging, and (ii). 0.8 p.f. leading. (13)

12. (a) (i) List the various methods used for starting of synchronous motors. Explain any two methods. (8)

(ii) Explain with the help of phasor diagram, the operation of a synchronous condenser. (5)

Or

(b) (i) Explain V curves as applied to synchronous motors. (7)

(ii) With the help of phasor diagram, obtain the expression for mechanical power developed by a synchronous motor. (6)

13. (a) (i) Derive an expression for the torque of a 3-phase induction motor under running condition and obtain the condition for maximum running torque. (8)

(ii) Write short notes on 'Synchronous Induction Motor'. (5)

Or

(b) With neat diagram, explain the constructional details and working principle of a 3-phase induction motor. (13)

14. (a) Describe the working of (i) Auto-Transformer starter and (ii) Star-Delta starter for a 3-phase induction motor with neat diagrams. (13)

Or

(b) Briefly discuss various methods to control the speed of a 3-phase induction motor. (13)

15. (a) Explain the experimental method to determine the equivalent circuit parameters of a single phase induction motor. (13)

Or

(b) Explain the construction and working principle of variable reluctance stepper motor. (13)

PART C — (1 × 15 = 15 marks)

16. (a) Explain the experimental tests to be conducted on an induction motor to draw the circle diagram. How the motor characteristics is determined from the circle diagram? (15)

Or

(b) Explain the operation of a single phase induction motor on the basis of double field revolving theory. (15)

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Question Paper Code : 52959

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2019.

Fifth Semester

Electrical and Electronics Engineering

EE 6504 — ELECTRICAL MACHINES – II

(Regulation 2013)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What is a distributed winding and what is meant by distribution factor?

2. What are the factors affecting the synchronous generator terminal voltage?

3. How can the speed of an synchronous motor be varied?

4. What is a damper winding? What is the function of it and where it is located?

5. What is meant by standstill reactance of induction motor's rotor? How does it vary with speed?

6. Write the expression for the resistance in the circuit model, the loss in which is equivalent to the mechanical power developed.

7. What are the methods used in starting squirrel cage induction motor?

8. Compare and contrast the speed control features of induction motor with DC shunt motor.

9. What is the advantage of a capacitor start motor over a resistance split phase motor?

10. Give reasons for the low efficiency of hysteresis and reluctance motors.

PART B — (5 × 13 = 65 marks)

11. (a) Draw the open-circuit and short-circuit characteristics using the data given below for a 150 MW, 13 kV, 0.85 pf, 50 Hz synchronous generator.

Open – circuit characteristic

I_f(A)	200	450	600	850	1200
V_{OC} (line) (kv)	4	8.7	10.8	13.3	15.4

Short – circuit characteristic I_f = 750 A, I_{SC} = 8000 A

(i) Determine the unsaturated synchronous reactance of the machine.

(ii) Determine the saturated synchronous reactance of the machine.

Or

(b) Describe with neat sketch,

(i) The basic principle of operation of three phase alternator

(ii) Advantages of having stationary armature

(iii) Details of construction with types of rotor.

12. (a) Draw the power flow diagram, equivalent circuit of a synchronous motor and derive the expressions for power developed by a synchronous motor.

Or

(b) A 1000 kVA, 11 kV, 3ph star connected synchronous motor has an armature resistance and reactance per phase of 3.5 and 40 respectively. Determine the induced emf and angular retardation of the rotor when fully loaded at

(i) Unity p.f,

(ii) 0.8 p.f, lagging,

(iii) 0.8 p.f, leading

13. (a) A 6–pole, 50 Hz, 3–phase induction motor running on full load develops a useful torque of 160 Nm when the rotor emf makes 120 complete cycles per minute. Calculate the shaft power output. If the mechanical torque lost in friction and that for core–loss is 10 Nm. Calculate :

(i) the copper-loss in the rotor windings,

(ii) the input to the motor, and

(iii) the efficiency

The total stator loss is given to be 800 W.

Or

(b) A 400 V, 3–phase, 6–pole, 50 Hz induction motor give the following test results:

No–load	400 V	8 V	0.16 power factor
Blocked–rotor	200 V	39 A	0.36 power factor

Determine the mechanical output, torque and slip when the motor draws a current of 30 A from the mains. Assume the stator and rotor copper losses to be equal. Use circle diagram method.

14. (a) Describe, various methods of starting of 3 phase squirrel cage induction motors.

Or

(b) A 150 kW, 3000 V, 50 Hz, 6–pole star–connected induction motor has a star–connected slip–ring rotor with a transformation ratio of 3.6 (stator/rotor). The rotor resistance is 0.1 W/phase and its per phase leakage inductance is 3.61 mH. The stator impedance may be neglected. Find :

(i) the starting current and torque on rated voltage with short-circuited slip–rings and

(ii) the necessary external resistance to reduce the rated–voltage starting current to 30 A and the corresponding starting torque.

15. (a) Develop the circuit model of a single–winding (referred to as the main winding), single–phase motor on semi–quantitative basis.

Or

(b) Derive the expressions for main field EMF, cross field EMF with circuit model and phasor diagram of AC series motor.

PART C — (1 × 15 = 15 marks)

16. (a) A (0.5) kW, 4–pole, 50 Hz, 220 V, two–value capacitor motor has the following circuit model parameters:

R_{1m} = 4.2 W, X_{1m} = 11.3 W R_{1a} = 5.16 W, X_{1a} = 12.1 W

X = 250 W, a = 1.05 W R_2 = 7.48 W, X_2 = 7.2 W

Friction, windage and core losses = 45 W

(i) Calculate the starting torque and current if the two capacitors in parallel equal to 70 mF.

(ii) Calculate the value of the run capacitor for zero backward field when the motor is running at a slip of 0.04. What is the meaning of the associated resistance value?

(iii) Calculate the motor performance for the value of the run capacitor as in part (ii). Assume R_C = 0.

Or

(b) The circuit model parameters in Ω/phase (referred to stator) of a 2 – phase, 1 kW, 220 V, 4–pole, 50 Hz squirrel– cage motor are given below:

$R_1 = 3\ W \quad R_2 = 2.6\ W \quad X_1 = X2 = 2.7\ W \quad X = 110\ W$

The windage, friction and core losses equal 200 W. The applied voltages are adjusted such that $Va = 110 - \lfloor 90°$ and $Vm = 220 - \lfloor 0°$

(i) Calculate the starting torque and starting current (in each phase).

(ii) Calculate the motor performance at s = 0.04.

(iii) With the motor running at s = 0.04, the phase a gets open–circuited What voltage will be developed across this phase?

Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 40487

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2021.

Fourth Semester

Electrical and Electronics Engineering

EE 8401 – ELECTRICAL MACHINES – II

(Regulations 2017)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. The value of voltage regulation obtained by EMF method is always higher than the actual value. State the reason for this error.

2. Draw the phasor diagram of salient pole synchronous generator at lagging power factor.

3. How synchronous motor can be used as synchronous condenser?

4. State the uses of damper winding in Synchronous machine. State its location also.

5. What are the advantages of skewing of cage rotor conductors?

6. Define the phenomena, skewing of an induction motor. Also draw the torque-slip characteristic due to fundamental and 7th harmonic fluxes.

7. A 3.7 kW, 3-phase induction motor has a locked rotor current of 5 times the full-load current and the full-load slip is 5%. Find the starting torque as a percentage of full load torque if the motor is started by Star-Delta starter.

8. How is the speed of an induction motor varied by varying the frequency of supply? Mention the advantages of this method.

9. State the application of (a) Capacitor start and run Induction motor and (b) Universal motor.

10. Why capacitors are connected in auxiliary and main winding of a 1-phase Induction motor?

PART B — (5 × 13 = 65 marks)

11. (a) Two generators G1 and G2 are running in parallel at no load. Analyse the sequence of effects when the prime mover input of G2 is increased and hence deduce the importance of synchronising power for satisfactory synchronous operation. Also derive the expression for the Synchronising power. (13)

Or

(b) Explain the synchronous impedance method of predetermining the voltage regulation of an alternator. (13)

12. (a) Explain the effect of varying excitation upon the armature current and power factor of a synchronous motor when the input active power to the motor is maintained constant. Support your answer with relevant phasor diagrams. (13)

Or

(b) A 600 V, 3-phase star connected synchronous motor draws a full load current of 80 A at 0.8 p.f. leading. The armature resistance is 22 Ω and synchronous reactance 22 Ω per phase. If the stray losses of the machine are 3200 W, determine

(i) the emf induced

(ii) the output power and

(iii) the efficiency. (13)

13. (a) Estimate the ratio between maximum and full load torque for a 20 HP, 50 Hz, 3-phase, star connected Induction motor with the following test results:

No load test : 400 V, 9 A, 0.2 pf lagging

Blocked rotor test: 200 V, 50 A, 0.4 pf lagging

Stator resistance per phase: 0.56 Ω. (13)

Or

(b) Derive an expression for torque developed in a 3-phase slip-ring induction motor and explain with the aid of speed-torque curve, the speed control of the motor when (13)

(i) the applied voltage is halved and

(ii) the rotor resistance is doubled.

14. (a) Explain with a neat diagram the electrical braking of three phase Induction motor. (13)

Or

(b) Describe the following methods of speed control for 3-phase induction motor, (i) by changing the applied voltage and (ii) by changing the number of poles. (13)

15. (a) Explain using Double revolving field theory, why a single-phase Induction motor is not self-starting. Also describe starting of single-phase induction motor using shaded pole technique and bring out its salient features and applications. (13)

Or

(b) Explain with a neat diagram, the operation of permanent magnet stepper motor. (13)

PART C — ($1 \times 15 = 15$ marks)

16. (a) A 3-phase slip-ring Induction motor has a star-connected rotor. The rotor emf between slip-rings at standstill is 600 V. The rotor standstill impedance per phase is $(0.5 + j\ 2.5)\ \Omega$. Find (i) Rotor current per phase at starting if the slip rings are short circuited (ii) Rotor current per phase at starting if a star connected rheostat of 4 Ω per phase is added to the rotor circuit and (iii) full load rotor current and rotor pf with slip-rings short circuited at 4% slip. (15)

Or

(b) A 1000 kVA, 11 kV, 3-phase, star-connected Alternator has an effective resistance of 2 Ω per phase. The OCC and ZPF lagging characteristic for full-load current are given below. Predetermine the voltage regulation for full-load condition at 0.8 pf lagging by ZPF method. (15)

Field current(A)	20	25	55	70	30
OCC Phase Voltage (V)	3348.6	4041.5	7216.9	7938.6	8660.3
ZPF phase Voltage (V)	0	866.0	4907.5	6062.2	7216.9

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Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 52959

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2019.

Fifth Semester

Electrical and Electronics Engineering

EE 6504 — ELECTRICAL MACHINES – II

(Regulation 2013)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What is a distributed winding and what is meant by distribution factor?

2. What are the factors affecting the synchronous generator terminal voltage?

3. How can the speed of an synchronous motor be varied?

4. What is a damper winding? What is the function of it and where it is located?

5. What is meant by standstill reactance of induction motor's rotor? How does it vary with speed?

6. Write the expression for the resistance in the circuit model, the loss in which is equivalent to the mechanical power developed.

7. What are the methods used in starting squirrel cage induction motor?

8. Compare and contrast the speed control features of induction motor with DC shunt motor.

9. What is the advantage of a capacitor start motor over a resistance split phase motor?

10. Give reasons for the low efficiency of hysteresis and reluctance motors.

PART B — (5 × 13 = 65 marks)

11. (a) Draw the open-circuit and short-circuit characteristics using the data given below for a 150 MW, 13 kV, 0.85 pf, 50 Hz synchronous generator.

Open – circuit characteristic

I_f(A)	200	450	600	850	1200
V_{OC} (line) (kv)	4	8.7	10.8	13.3	15.4

Short – circuit characteristic I_f = 750 A, I_{SC} = 8000 A

(i) Determine the unsaturated synchronous reactance of the machine.

(ii) Determine the saturated synchronous reactance of the machine.

Or

(b) Describe with neat sketch,

(i) The basic principle of operation of three phase alternator

(ii) Advantages of having stationary armature

(iii) Details of construction with types of rotor.

12. (a) Draw the power flow diagram, equivalent circuit of a synchronous motor and derive the expressions for power developed by a synchronous motor.

Or

(b) A 1000 kVA, 11 kV, 3ph star connected synchronous motor has an armature resistance and reactance per phase of 3.5 and 40 respectively. Determine the induced emf and angular retardation of the rotor when fully loaded at

(i) Unity p.f,

(ii) 0.8 p.f, lagging,

(iii) 0.8 p.f, leading

13. (a) A 6–pole, 50 Hz, 3–phase induction motor running on full load develops a useful torque of 160 Nm when the rotor emf makes 120 complete cycles per minute. Calculate the shaft power output. If the mechanical torque lost in friction and that for core–loss is 10 Nm. Calculate :

(i) the copper-loss in the rotor windings,

(ii) the input to the motor, and

(iii) the efficiency

The total stator loss is given to be 800 W.

Or

(b) A 400 V, 3–phase, 6–pole, 50 Hz induction motor give the following test results:

No–load	400 V	8 V	0.16 power factor
Blocked–rotor	200 V	39 A	0.36 power factor

Determine the mechanical output, torque and slip when the motor draws a current of 30 A from the mains. Assume the stator and rotor copper losses to be equal. Use circle diagram method.

14. (a) Describe, various methods of starting of 3 phase squirrel cage induction motors.

Or

(b) A 150 kW, 3000 V, 50 Hz, 6–pole star–connected induction motor has a star–connected slip–ring rotor with a transformation ratio of 3.6 (stator/rotor). The rotor resistance is 0.1 W/phase and its per phase leakage inductance is 3.61 mH. The stator impedance may be neglected. Find :

(i) the starting current and torque on rated voltage with short-circuited slip–rings and

(ii) the necessary external resistance to reduce the rated–voltage starting current to 30 A and the corresponding starting torque.

15. (a) Develop the circuit model of a single–winding (referred to as the main winding), single–phase motor on semi–quantitative basis.

Or

(b) Derive the expressions for main field EMF, cross field EMF with circuit model and phasor diagram of AC series motor.

PART C — (1 × 15 = 15 marks)

16. (a) A (0.5) kW, 4–pole, 50 Hz, 220 V, two–value capacitor motor has the following circuit model parameters:

R_{1m} = 4.2 W, X_{1m} = 11.3 W R_{1a} = 5.16 W, X_{1a} = 12.1 W

X = 250 W, a = 1.05 W R_2 = 7.48 W, X_2 = 7.2 W

Friction, windage and core losses = 45 W

(i) Calculate the starting torque and current if the two capacitors in parallel equal to 70 mF.

(ii) Calculate the value of the run capacitor for zero backward field when the motor is running at a slip of 0.04. What is the meaning of the associated resistance value?

(iii) Calculate the motor performance for the value of the run capacitor as in part (ii). Assume R_C = 0.

Or

(b) The circuit model parameters in Ω/phase (referred to stator) of a 2 – phase, 1 kW, 220 V, 4–pole, 50 Hz squirrel– cage motor are given below:

$R_1 = 3\ W \quad R_2 = 2.6\ W \quad X_1 = X2 = 2.7\ W \quad X = 110\ W$

The windage, friction and core losses equal 200 W. The applied voltages are adjusted such that $Va = 110 - \lfloor 90°$ and $Vm = 220 - \lfloor 0°$

(i) Calculate the starting torque and starting current (in each phase).

(ii) Calculate the motor performance at s = 0.04.

(iii) With the motor running at s = 0.04, the phase a gets open–circuited What voltage will be developed across this phase?

Reg. No. :

Question Paper Code : X 20492

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2020 AND APRIL/MAY 2021
Fifth Semester
Electrical and Electronics Engineering
EE 6504 – ELECTRICAL MACHINES – II
(Regulations 2013)
(Common to : PTEE6504 – Electrical Machines – II for B.E. (Part-Time) – Electrical and Electronics Engineering – Fourth Semester (Regulations – 2014))

Time : Three Hours | Maximum : 100 Marks

Answer ALL questions

PART – A **(10×2=20 Marks)**

1. What is meant by single layer and double layer winding ?
2. Define voltage regulation.
3. What are the various functions of damper winding provided with synchronous motor ?
4. What is meant by hunting ?
5. Why slots on the rotor of a 3-phase induction motor are skewed ?
6. List the salient characteristic features of double-squirrel cage induction motor.
7. Name the two windings of a single-phase induction motor.
8. Specify the use of single-phase induction motor.
9. Why single phase induction motor is not self starting ?
10. How can the direction of a capacitor run motor be reversed ?

PART – B **(5×13=65 Marks)**

11. a) List the methods used to predetermine the voltage regulation of synchronous machine and explain the MMF method.

(OR)

b) i) Describe with neat sketches, the constructional details of a salient pole type alternator. **(8)**

ii) Derive the emf equation of an Alternator. **(5)**

12. a) i) Explain V and inverted V curves as applied to synchronous motors. **(8)**

ii) Briefly describe the phenomenon of 'hunting' in a synchronous machine. How is it remedied ? **(5)**

(OR)

b) i) Describe in brief two methods used for starting a synchronous motor. **(8)**

ii) With a suitable phasor diagram, explain the improvement of power factor of a load by synchronous condenser. **(5)**

13. a) Explain in detail the construction of circle diagram of an induction motor.

(OR)

b) i) Sketch and explain the torque slip characteristics of the 3 phase cage and slip-ring induction motors. Show the stable region in the graph. **(6)**

ii) A 3 phase, 25 kW, 400 V, 50 Hz, 8-pole induction motor has rotor resistance of 0.08 ohm and standstill resistance of 0.4 ohm. The effective stator/ rotor turn ratio is 2.5/1. The motor is to drive a constant-torque load of 250 N-m. Neglect stator impedance.

1) Calculate the minimum resistance to be added in rotor circuit for the motor to start up on load.

2) At what speed would the motor run, if the added rotor resistance is (A) left in the circuit, and (B) subsequently short circuited. **(7)**

14. a) Explain the concept of crawling and cogging of induction motor in detail.

(OR)

b) Describe the constructional features and operating characteristics of single-phase shaded pole motor.

15. a) i) Explain the operating principle of hysteresis motor with neat diagram. **(7)**

ii) Explain the operating principle of Linear Induction motor with neat diagram. **(6)**

(OR)

b) Using double field revolving theory, explain why a single phase induction motor is not self starting. Also obtain the equivalent circuit of single phase induction motor with necessary equations.

PART – C **(1×15=15 Marks)**

16. a) Explain two reaction theory as applied to synchronous machines. **(15)**

(OR)

b) Explain with necessary circuit diagrams, the experimental tests conducted on an induction motor to draw the circle diagram. How will you determine the motor characteristics from the circle diagram ? **(15)**

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Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 20513

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2022.

Fourth Semester

Electrical and Electronics Engineering

EE 8401 – ELECTRICAL MACHINES – II

(Regulations 2017)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Distinguish between concentrated and distributed three-phase winding used in AC machines.

2. State the conditions necessary for paralleling the alternators.

3. Compare the salient features of synchronous motor with induction motor.

4. Why synchronous motor is not a self-start motor? State any two starting methods.

5. Compare Squirrel cage and Slip-ring induction motors with respect to construction and performance.

6. If the frequency of the supply voltage to the stator is 50 Hz while the frequency of the induced emf in the rotor is observed to be 90 cycles per min. Calculate the slip and speed of the motor, assuming that the stator is wound for 6-poles.

7. List the various methods of speed control by changing slip applicable to :

   (a) both cage and slip ring motors and

   (b) exclusively for slip ring motors

8. We can bring an induction motor to a quick stop either by plugging it or by exciting the stator from a DC source. Which method produces the least amount of heat in the motor? Justify.

9. Draw the equivalent circuit for single phase induction motor at running Condition.

10. Define magnetic levitation.

PART B — (5 × 13 = 65 marks)

11. (a) Explain with suitable diagram, the process of synchronizing Alternator with infinite bus bar and determining its voltage regulation. (13)

Or

(b) Explain the ampere-turn method of predetermining the voltage regulation of an alternator. (13)

12. (a) Explain the laboratory method of obtaining V and inverted V-curves of the synchronous motor. (13)

Or

(b) Explain the role of damper winding in Synchronous Machines. Also draw load angle versus time during hunting with and without damper windings. (13)

13. (a) Derive an expression for the torque developed in three-phase induction motor. Sketch the torque-slip characteristic and mark the starting torque, maximum torque and operating region. Also state how do starting and maximum torques vary with the rotor resistance? (13)

Or

(b) A three-phase Induction motor is excited with sinusoidal currents. Explain how a Rotating Magnetic Field is produced and justify the rotor will rotate in the direction of RMF with neat sketches. (13)

14. (a) Explain with a neat sketch, the construction and working of an Auto-transformer starter. (13)

Or

(b) Explain in detail the speed control of three phase induction motor by pole changing method. (13)

15. (a) Explain the construction and working of (i) Resistance split-phase induction motor and (ii) capacitor start induction motor. (13)

Or

(b) Explain with a neat diagram and characteristics the operation of universal motor. (13)

PART C — (1 × 15 = 15 marks)

16. (a) A 400 V, three-phase, star-connected induction motor gave the following test results: (15)

No-load: 400 V, 8.5 A, 1100 W

Blocked-rotor: 180 V, 45 A, 5700 W

Determine the ohmic values of the components in the circuit model and calculate the line current and power factor when the motor is operating at 5% slip. The stator resistance per phase is 0.5 Ω and the standstill leakage reactance of the rotor winding referred to the stator is equal to that of the stator winding.

Or

(b) A 3.5 MVA, slow-speed, 3-phase synchronous generator rated at 6.6 kV has 32 poles. Its direct and quadrature-axis synchronous reactances as measured by the slip test are 9.6 Ω and 6 Ω respectively. Neglecting armature resistance, determine the regulation and the excitation emf needed to maintain 6.6 kV at the terminals when supplying a load of 2.5 MW at 0.8 pf lagging. What maximum power can the generator supply at the rated terminal voltage, if the field becomes open-circuited? (15)

Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 90199

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2019

Fourth Semester

Electrical and Electronics Engineering

EE8401 – ELECTRICAL MACHINES – II

(Regulations 2017)

Time : Three Hours | Maximum : 100 Marks

Answer ALL questions

PART – A **(10×2=20 Marks)**

1. Define voltage regulation in Alternator.
2. Compare salient pole and cylindrical pole rotors.
3. How hunting can be prevented ?
4. List the merits of three phase synchronous motor over three phase induction motor.
5. A three phase, 6 pole, 50 Hz induction motor has a slip of 1% at no-load. Find synchronous speed and frequency of rotor currents at standstill.
6. Why one of the wattmeter shows negative reading while measuring power of the induction motor at no-load condition using two wattmeter method ?
7. Why V/f ratio should be maintained constant ?
8. Name the different types of starters suitable for three phase induction motor.
9. Mention the advantages of stepper motors.
10. Why single phase induction motor is not self-starting ?

PART – B (5×13=65 Marks)

11. a) A three star connected alternator is rated at 1500 kVA, 12000 V. The armature effective resistance and synchronous reactance are 2 ohms and 35 ohms respectively. Calculate the percentage regulation for a load of 1200 kW at 0.8 lagging and leading power factors. Draw the phasor diagram for the same. **(4+4+5)**

(OR)

b) Explain the effect of armature reaction in synchronous generator for zero power factor lagging as well as leading and at unity power factor. Draw necessary diagram and phasor diagrams.

12. a) The synchronous reactance per phase of a three phase star connected 6600 V synchronous motor is 20 ohms. For a certain load input, the input is 915 kW at normal voltage and the induced line emf is 8942 V. Neglecting resistance, determine line current and power factor. **(7+6)**

(OR)

b) Explain V and inverted V curves of a synchronous motor with necessary diagram and vector diagrams.

13. a) The starting and maximum torques of a three phase induction motor are 1.5 times and 2.5 times its full-load torque. Determine the change in rotor circuit resistance to obtain a full load slip of 0.03. Neglect stator impedance. **(13)**

(OR)

b) A 6 pole, 50 Hz, three phase induction motor running on full load with 3% slip develops a torque of 160 N-m at its pulley rim. The friction and windage losses are 210 W and the stator copper and iron losses equal to 1640 W. Calculate rotor output, rotor copper loss and efficiency at full load. **(13)**

14. a) A 400 V, 50 Hz, induction motor, when started directly from the mains takes 4 times the full load current and the torque produced is twice the full load torque. Determine :

i) The motor current, the line current and the starting torque when started by means of an auto-transformer of ratio 2.5 : 1. **(3+3+3)**

ii) The voltage to be applied and the motor current if the full load torque is to be obtained at starting. **(4)**

(OR)

b) The full load speed of a 8 pole, 50 Hz slip ring motor is 730 rpm. The rotor resistance per phase is 0.2 ohms. Calculate the external resistance per phase that must be added to lower the speed to 620 rpm. Given that the torque is same in the two cases.

15. a) Explain the working principle of shaded pole induction motor and linear induction motor. **(13)**

(OR)

b) The resistance and inductive reactance of each winding of a 50 Hz split phase induction motor are 75 ohms and 230 ohms respectively. Additional resistance R and condenser C are in series with one winding. Calculate their values to give the same current in each winding with a phase difference of 90 degrees. **(13)**

PART – C **(1×15=15 Marks)**

16. a) A three phase, 400 V induction motor gave the following test readings :

No load test : 400 V, 1250 W, 9 A

Short circuit test : 150 V, 4 kW, 38 A.

Draw the circle diagram. If the normal rating is 14.91 kW, find the full load values of current, power factor and slip from the circle diagram. **(5+5+5)**

(OR)

b) A 1500 kVA, 6600 V, three phase star connected alternator with a resistance of 0.4 ohm and resistance of 6 ohms per phase, delivers full load current at power factor 0.8 lagging and normal rated voltage. Estimate the terminal voltage for the same excitation and load current at 0.8 power factor leading.

Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 91494

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2019
Fifth Semester
Electrical and Electronics Engineering
EE 6504 – ELECTRICAL MACHINES – II
(Regulations 2013)

Time : Three Hours | Maximum : 100 Marks

Answer ALL questions

PART – A **(10×2=20 Marks)**

1. What is meant by armature reaction in alternator ?
2. Which method of predetermining the voltage regulation is called optimistic method ? Why ?
3. Why a 3-phase synchronous motor will always run at synchronous speed ?
4. What is meant by 'constant power circle' for synchronous motor ?
5. What is synchronous induction motor ?
6. Define pullout torque.
7. Why is a starter needed for starting a large capacity induction motor ?
8. Define slip power.
9. State double field revolving theory.
10. Identify the category of motor used in ceiling fan.

PART – B (5×13=65 Marks)

11. a) Explain the operating principle of three-phase alternator and derive the emf equation. (13)

(OR)

b) i) Explain how the voltage regulation is predetermined using ZPF method. (7)

ii) Describe about slip test. (6)

12. a) i) Explain V curve and inverted V curve. (4)

ii) Explain different starting methods of synchronous motor. (9)

(OR)

b) i) A 1000 kVA, 11000 V, 3-phase star-connected synchronous motor has an armature resistance and reactance per phase of 3.5 Ω and 40 Ω respectively. Determine the induced emf and angular retardation of the rotor when fully loaded at 0.8 p.f. lagging and 0.8 p.f. leading. (6)

ii) Derive the expression for power delivered by a synchronous motor in terms of load angle (α). (7)

13. a) i) Derive the expression for developed torque in a 3-phase induction motor and find the condition for maximum torque. (8)

ii) Explain construction and working of double cage induction motor. (5)

(OR)

b) i) Develop the equivalent circuit of a 3-phase induction motor. (8)

ii) A 440 V, 3-phase, 50 Hz, 6-pole induction motor running at 960 rpm takes 50 kW at a certain load. The friction and windgage loss is 1.8 kW. The stator losses are 1.2 kW. Calculate the

1) The rotor copper loss,
2) The output from the rotor and
3) Efficiency of the motor. (5)

14. a) Explain the speed control of a 3 phase induction motor using V/f control. (13)

(OR)

b) Explain the speed control of 3 phase induction motor with slip power recovery scheme. (13)

15. a) i) Explain the operation of a single phase induction motor using double field revolving theory. (7)

ii) Discuss with neat diagram the operation of shaded pole IM. (6)

(OR)

b) Explain the construction and working principle of

i) A.C. Series motor (6)

ii) Hysteresis motor. (7)

PART – C (1×15=15 Marks)

16. a) Explain with a neat diagram and clear steps how to construct a circle diagram for a 3ϕ induction motor. Also enumerate the procedure involved in obtaining its performance. (15)

(OR)

b) i) Construct the phasor diagram of non-salient pole synchronous generator connected to infinite bus. (8)

ii) Discuss the construction and working of Repulsion motor. (7)

Reg. No. : | | | | | | | | | | | | |

Question Paper Code : X 60503

B.E./B.Tech. DEGREE EXAMINATIONS, NOV./DEC. 2020
Fifth Semester
Electrical and Electronics Engineering
EE 2302/EE52/EE1301/10133 EE 505 – ELECTRICAL MACHINES – II
(Regulations 2008/2010)
(Common to PTEE 2302/10133 EE 505 – Electrical Machines II for B.E. (Part-Time) Fourth Semester Electrical and Electronics Engineering – Regulations 2009/2010)

Time : Three Hours | Maximum : 100 Marks

Answer ALL questions

PART – A **(10×2=20 Marks)**

1. Define distribution factor k_d.
2. Define synchronizing torque.
3. What are V curves ?
4. What are the starting methods of synchronous motor ?
5. Define 'slip' of an induction motor.
6. What are the advantages of double squirrel cage induction motor ?
7. What are the different methods of starting 3-phase induction motor ?
8. What is meant by slip power recovery scheme ?
9. Distinguish the terms rotating and pulsating magnetic fields.
10. State the limitations of shaded pole motors.

PART – B **(5×16=80 Marks)**

11. a) i) Describe the POTIER method of determining the regulation of an alternator. **(8)**

ii) A 3.3 kV alternator gave the following results :

Field current (A) :	16	25	37.5	50	70
OC voltage (kV) :	1.55	2.45	3.3	3.75	4.15

A field current of 18 A is found to cause the full load current to flow through the winding during short circuit test. Predetermine the full load voltage regulation at (1) 0.8 pf lag and (2) 0.8 pf lead by MMF method. **(8)**

(OR)

b) i) Describe the slip test for finding X_d and X_q. **(8)**

ii) Two similar, 3 phase alternators work in parallel and deliver a total real power of 1800 kW at 11kV and at 0.85 pf lagging to the load. Each alternator initially supplied half the load power. The excitation of the first alternator is then increased such that its line current becomes 60 A lagging. Find the line current delivered by the second alternator. **(8)**

12. a) i) Describe in detail about the effect of load change on load angle and power factor of a 3Φ synchronous motor operating on infinite bus bar and constant excitation. **(10)**

ii) Discuss in detail how V curves is obtained for a synchronous motor. **(6)**

(OR)

b) Describe the various methods of starting the synchronous motor. **(16)**

13. a) Explain the construction and working principle of three phase induction motor.

(OR)

b) A 110-V, 3-phase, star-connected induction motor takes 25 A at a line voltage of 30V with rotor locked. With this line voltage, power input to motor is 440 W and core loss is 40 W. The d.c. resistance between a pair of stator terminals is 0.1 ohm. If the ratio of a.c. to d.c. resistance is 1.6, find the equivalent leakage reactance/phase of the motor and the stator and rotor resistance per phase.

14. a) With neat diagrams, explain working of any two types of starter used for 3-phase squirrel cage induction motor. **(16)**

(OR)

b) i) Explain the speed control of 3-phase wound rotor induction motor by rotor resistance method. **(8)**

ii) Explain in details the slip recovery scheme. **(8)**

15. a) i) Illustrate the operation of single phase induction motor with double field revolving theory. **(8)**

ii) A 220V, 6-pole, 50 Hz, single-winding single-phase induction motor has the following equivalent circuit parameters as referred to the stator.

$R_{1m} = 3.0\ \Omega$, $X_{1m} = 5.0\ \Omega$

$R_2 = 1.5\ \Omega$, $X_2 = 2.0\ \Omega$

Neglect the magnetizing current. When the motor runs at 97% of the synchronous speed, compute the following:

1) The ratio E_{mf}/E_{mb}.
2) The ratio T_f/T_b.
3) The gross total torque. **(8)**

(OR)

b) i) Explain the theory of Brushless DC Machine. **(8)**

ii) Write short notes on Stepper Motor. **(8)**

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Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 80501

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2021.

Fifth Semester

Electrical and Electronics Engineering

EE 2302/EE 52/EE 1301/10133 EE 505 – ELECTRICAL MACHINES – II

(Regulations 2008/2010)

(Common to PTEE2302 for B.E (Part-Time) Fourth semester- EEE- Regulations- 2009)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. State the causes of voltage drop in an alternator when loaded.

2. What is meant by armature reaction?

3. What is meant by hunting of a synchronous motor?

4. What are the uses of damper winding in synchronous motor?

5. What is meant by Slip in Induction motor?

6. What is the purpose of conducting blocked rotor test?

7. State an important distinguishing factor of induction generator and alternator.

8. Draw the torque speed characteristics of an induction motor whose rotor resistance is very large compared to rotor inductance.

9. Draw the torque slip characteristics of single phase induction motor.

10. What will be the direction of rotation of a shaded pole single phase induction motor?

PART B — ($5 \times 16 = 80$ marks)

11. (a) (i) With neat sketch describe the construction and principle of operation of salient pole alternator. (6)

(ii) Derive the EMF equation of an alternator. (6)

(iii) A 4-pole alternator has an armature with 25 slots and 8 conductors per slot and rotates at 1500 rpm and the flux per pole is 0.05Wb, Calculate the e.m.f generated, If winding factor is 0.96 and all the conductors are in series (4)

Or

(b) (i) Explain the EMF method of determining the regulation of an alternator (8)

(ii) State and explain the conditions for parallel operation of alternators. (8)

12. (a) Illustrate through neat phasor diagram, the functioning of synchronous machine with varying excitation under constant real power load

Or

(b) Illustrate the phenomenon of hunting and the use of damper winding with the help of dynamic equations.

13. (a) (i) Derive the torque-slip characteristics of 3 phase induction motor and explain. (8)

(ii) The real power input to a 415 V, 50 Hz, 6 pole, 3-phase induction motor running at 970 rpm is 41 kW. The input power factor is 0.9. The stator losses amount to 1.1kW and the mechanical losses total 1.2 kW. Calculate the line current, slip, rotor copper loss, mechanical power output and efficiency. (8)

Or

(b) (i) Show how a 3 phase induction motor can be represented by an approximate equivalent circuit. (8)

(ii) Explain with necessary diagrams the principle of operation and characteristics of the double cage induction motor. (8)

14. (a) Discuss the following starters for three phase induction motor:

(i) Autotransformer starter (8)

(ii) Star-Delta starter (8)

Or

(b) Explain in detail with a neat diagram, the slip power recovery scheme.

15. (a) Explain with suitable diagram the working principle of split-phase and capacitor start induction motor. (8+8)

Or

(b) Discuss briefly the operation and characteristics of

(i) Repulsion motor (8)

(ii) AC series motor. (8)

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Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 70479

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2021.

Fifth Semester

Electrical and Electronics Engineering

EE 6504 — ELECTRICAL MACHINES II

(Regulations 2013)

(Common to PTEE 6504 — Electrical Machines II for B.E. (Part-Time) — Fourth Semester — Electrical and Electronics Engineering - Regulations 2014)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Write the equation for frequency of emf induced in an alternator.

2. Identify the type of synchronous generators that are used in hydroelectric plant.

3. When is synchronous motor is said to receive 100% excitation?

4. What are the causes of hunting?

5. How can the direction of rotation of 3 phase induction motor be reversed?

6. What is the advantages of skewing the rotor slots?

7. What is the effect of change in input voltage on starting torque of induction motor?

8. State two advantages of speed control of induction motor by injecting an e.m.f in the rotor circuit.

9. What is the function of centrifugal switch in a single phase induction motor?

10. Mention the applications of stepper motor.

PART B — (5 × 13 = 65 marks)

11. (a) (i) Explain step by step method of potier triangle method of determining the regulation of an alternator. (6)

(ii) A 30MVA, 15KV, 60Hz ac generator has a synchronous reactance of 1.2 pu and a resistance of 0.02 pu. Calculate

(1) the base voltage, base power and base impedance of the generator,

(2) the actual value of the synchronous reactance,

(3) the actual winding resistance, per phase

(4) the total full-load copper losses. (7)

Or

(b) A 3 phase Y-connected, 1000 KVA, 2000 V, 50 Hz alternator gave the following open-circuit and short circuit test readings :

Field current (A) :	10	20	25	30	40	50
O.C. Voltage (V) :	800	1500	1760	2000	2350	2600
S.C. armature current (A) :	–	200	250	300	–	–

The armature effective resistance per phase is 0.2 Ω. Draw the characteristic curves and determine the full load percentage regulation at

(i) 0.8 p.f lagging,

(ii) 0.8 p.f leading by MMF method. (13)

12. (a) Explain V-curves and inverted V-curves.

Or

(b) Explain briefly the features and principle of operation of three-phase synchronous motor.

13. (a) Sketch and explain the torque slip characteristics of the 3 phase cage and slip-ring induction motors. Show the stable region in the graph. (13)

Or

(b) (i) A 3 phase induction motor has a starting torque of 100% and a maximum torque of 200% of the full load torque. Determine:

(1) Slip at which maximum torque occurs;

(2) Full load slip;

(3) Rotor current at starting in per unit of full-load rotor current. (7)

(ii) Explain the working principle of 3 phase induction motor. (6)

14. (a) Explain the speed control methods of a three phase induction motor. (13)

Or

(b) With neat diagrams, explain the working of

(i) Star-Delta Starter

(ii) Auto Transformer Starter for 3 phase induction motor. (13)

15. (a) (i) Derive the equivalent circuit of a single phase induction motor with the help of double field revolving theory. (8)

(ii) Describe the working of repulsion motor. (5)

Or

(b) (i) Draw and explain the schematic diagram and torque-speed characteristic of capacitor-start, capacitor-run single phase induction motor. (6)

(ii) Write short notes on 'AC servo-motors'. (7)

PART C — (1 × 15 = 15 marks)

16. (a) Explain the V/F control technique in 3ϕ IM. (15)

Or

(b) With neat diagram, explain the construction and operation of shaded pole induction motor. (15)

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