BEE-256

RollNo: | | | | | | | | | |

B. Tech (EE)

EvenSemester(4th)

Minortest examination2025-2026

Fundamental of AC Electrical Machines

Time: 2Hrs. **MaxMarks:20**

Note: Answer all questions

Q.1	**Attempt any two parts of the following**	Marks
a)	Draw and explain the phasor diagrams of a loaded three phase synchronous generator under the following conditions. (i) 0.8 Lagging power factor (ii) 0.8 Leading power factor (iii) Unity power factor	4
b)	A 4 pole ,3-phase, 50Hz, star connected synchronous generator has 64 slots with 2 conductors per slot and has armature winding of two-layer type. Coils are short pitched in such a way that if one coil side lies in slot number 1, the other lies in slot number 13. Determine the useful flux per pole required to generate a line voltage of 6600 V	4
c)	Explain the effect of varying excitation on armature current and power factor in a synchronous motor. Draw and explain the V-curves at different loads.	4
Q.2	**Attempt any two parts of the following**	
a)	Derive complex power output of synchronous generator and also find maximum power output conditions.	3
b)	Explain the Two Reaction theory applicable to salient pole machine. Derive emf equation for salient pole synchronous generator.	3
c)	Define voltage regulation of a Synchronous machine under different load of power factors. A 3-phase star connected synchronous generator is rated 1600kVA, 13,500 V. The armature effective resistance and synchronous reactance are 1.5 Ω and 30 Ω respectively per phase. Calculate the percentage regulation for a load of 1250 kW at power factors of (i) 0.8 lagging (ii) 0.9 leading -6.44	3
Q.3	**Attempt any two parts of the following** 18-133	
a)	Discuss why synchronous motor is not self-starting. What methods are generally used to start synchronous motors?	3
b)	A three-phase synchronous motor of 5.8kW at 410 V synchronous reactance of 10 ohm per phase. Find the minimum current and corresponding induced emf for full load condition. The efficiency of the machine is 80%. Neglect armature resistance.	3
c)	Define necessary conditions and requirement of working two or more alternators in parallel; explain the term synchronizing of alternators.	3

Paper Code	BEE-256

Roll No.	2	0	2	4					

B.Tech.
Year:2nd,Semester:4
Major Exam:2025-26
Fundamentals of AC Electrical Machines

Time: 03 Hrs. Max. Marks: 50

Note: Attempt ALL questions. ALL questions carry equal marks

Ql.	**Attempt any Five parts of the following (Unit1&2)**	**Marks**
(a)	Describe the term synchronizing power and synchronizing torque in a synchronous machine.	2
(b)	What are the necessity and advantages of parallel connected synchronous generators?	2
(c)	Explain the term **Hunting** in Synchronous Machine, discuss its causes and effects.	2
(d)	Explain the effect of armature reaction on a three-phase synchronous generator when delivering a load current at different power factors	2
(e)	Describe the slip test method for measurement of X_d and X_q of synchronous machines	2
(f)	A three phase, 410 Volt synchronous motor takes 53A at a power factor of 0.8 leading. Calculate the induced e.m.f and power input. The motor impedance per phase is 0.2+j3.2 Ω	2
(g)	Derive an expression for the output power developed in a three phase synchronous motor.	2
Q2.	**Attempt any Two parts of the following. (Unit-3)**	
(a)	Draw and explain the torque slip characteristics of induction motor under different slip region and derive the condition for maximum torque.	5
(b)	What are methods for starting of three phase Induction motors, explain any two methods with connection diagrams.	5
(c)	A 10 KW, 3 phase, 50 Hz, 4 pole induction motor has full load slip of 0.03. Mechanical and stray load losses at full load are 3.5% of output power. Calculate: (i)Power delivered by stator to rotor (ii)Electromagnetic torque at full load and (iii)Rotor ohmic losses at full load	5
Q3.	**Attempt any Two parts of the following. (Unit-3)**	
(a)	Why rotor of three phase induction motor can not run with same speed of rotating stator magnetic field? An 8-pole, 50 Hz, 3-phase, induction motor develops a maximum torque of 150 Nm at 650 rpm. The rotor resistance is 0.7 ohm/phase. Find the torque at 4% slip.	5
(b)	Describe the followings effects on performance of three phase Induction	5

	Motor; (i) change in rotor circuit resistance on torque-slip characteristics (ii) change in voltage and frequency on torque-slip characteristics	
(c)	A 3-phase, 20 kW, 6-pole, 400 V, 50 Hz, induction motor develops mechanical power of 20kW at 980 rpm. Calculate: (i) Rotor Copper loss. (ii) Input power (iii) rotor frequency The stator loss is 1800W. Neglect mechanical losses.	5
Q4.	**Attempt any Two parts of the following. (Unit-4)**	
(a)	Why single-phase induction motor is not self-starting? Explain torque slip characteristics of single-phase induction motor and draw equivalent circuit diagram.	5
(b)	Explain the working of (i) Capacitor-start and (iii) shaded pole type induction motor. Give some industrial and domestic applications of such motors.	5
(c)	A 230-volt, 50 Hz, 4 pole single phase induction motor has following equivalent circuit parameters: R_{1m} =2.2Ω, R'_2=4.5Ω, X_{1m}=3.2 Ω, X'_2=2.6Ω and X_M=80Ω. Friction, windage and core loss=40 W. For a slip of 3%, calculate (i) input current (ii) power factor (iii) developed power and (iv) motor efficiency.	5
Q 5.	**Attempt any Two parts of the following. (Unit-4)**	
(a)	Explain working, operating characteristics and applications of following motors (i) Hysteresis Motor (ii) Repulsion motor	5
(b)	Explain why dc series motor will not work satisfactorily when connected across ac supply, what modifications are required to work that motor with ac supply?	5
(c)	Describe working and operating characteristics and some applications of single phase Reluctance motor.	5

Paper Code	BEE-253

B. Tech.
Year: 2nd. Semester: 4
Test 2: 2023-24
Electrical Machine-II

Time: 01 Hrs Max. Marks: 10

Q1.	**Attempt any Two parts of the following.** **Q. 1 (a) is compulsory. (Unit III)**	Marks
(a)	A 18.6 kW, 4 pole 50 Hz, 3-phase induction motor has friction & windage loss of 3 % of the output. The full load slip is 4%. Calculate for full load (i) Rotor ohmic loss (ii) Rotor Input and (iii) Shaft Torque.	3
(b)	Explain, why starter is required to start three phase induction motor? Describe any one method for starting of three phase Induction Motor.	2
(c)	Explain why in three phase squirrel cage induction motor having low starting and poor power factor, how high starting torque is achieved by using double cage rotor construction of Induction Motor.	2
Q2.	**Attempt any Two parts of the following.** **Q.2 (a) is compulsory. (Unit-IV)**	
(a)	Explain double revolving field theory concept on Single phase induction motor and draw torque speed characteristic and develop equivalent circuit model of single-phase induction motor.	3
(b)	Describe working principle and operating characteristics and applications of split phase type single phase Induction Motor.	2
(c)	Explain No Load and Blocked rotor test on single phase Induction Motor and determine equivalent circuit parameters from above tests.	2

Paper Code	BEE-253

B. Tech.
Year: 2nd, Semester: 4
Major Exam: 2023-24
Electrical Machine-II

Time: 03 Hrs. Max. Marks: 50

Note: Attempt ALL questions. ALL questions carry equal marks

Ql.	**Attempt any Five parts of the following. (All Units)**	**Marks**
(a)	What is synchronous impedance? Define the terms unsaturated and saturated synchronous reactance.	2
(b)	What are the necessity and advantages of parallel connected synchronous generators?	2
(c)	Describe the role of damper bars used in Synchronous Machines	2
(d)	Discuss the necessity of starter in three phase induction motor, draw and explain circuit diagram of any one of starter.	2
(e)	A 6 pole, 3-phase, 50 Hz, Induction motor develops a maximum torque of 35 Nm at 960 rpm. Determine the torque exerted by motor at 5% slip. The rotor resistance per phase is 0.8 ohm.	2
(f)	The power input to a three phase 50 Hz Induction Motor is 50 kW. The total stator loss is 800 W. Find the total mechanical power developed, if the rotor emf makes 90 complete cycle per minute.	2
(g)	Explain working and construction of single-phase Hysteresis Motor.	2
Q2.	**Attempt any Two parts of the following. (Unit-I)**	
(a)	Define voltage regulation of Synchronous Machine, explain any two method for determining the voltage regulation.	5
(b)	Derive complex power input and power output expressions for a synchronous generator. Also, find expression for maximum power output input and Synchronizing power coefficient.	5
(c)	In a 60 kVA, star connected, 440 V, 3 phase 50 Hz, Synchronous Generator, the effective armature resistance is 0.25 ohm/phase. The synchronous reactance is 3.2 ohm/phase, and the leakage reactance is 0.5 ohm/phase. Determine at rated load and at unity power factor (i) excitation emf (ii) no load emf and (iii) percentage voltage regulation at full load.	5
Q3.	**Attempt any Two parts of the following. (Unit-II)**	
(a)	Draw and explain the phasor diagram of a synchronous motor operating at (i) lagging power factor (ii) leading power factor and derive expression for excitation emf and power output.	5
(b)	Explain the term **Hunting** in Synchronous Machine, discuss its causes and effects.	5
(c)	A 400 V, 7.5 HP, 3 phase, Synchronous Motor has negligible armature resistance and a synchronous reactance of 10 ohm/phase. Determine	5

	the minimum current and the corresponding emf for full load condition. Assume motor efficiency of 80%.	
Q4.	**Attempt any Two parts of the following. (Unit-III)**	
(a)	Draw and explain complete torque-speed characteristics of three phase Induction Motor. Show low slip and high slip regions in above characteristics. Also, derive the condition for maximum torque and find ratio of T_f/T_{max} and T_{st}/T_{max}	5
(b)	Explain the method of speed control of three phase Induction motor by varying the supply frequency rotor resistance.	5
(c)	A 400 V, 3 phase, 50 Hz, 8 pole star connected Induction motor has $r_1=r_2'=0.1$ ohm, $x_1=x_2'=0.7$ ohm and $R_0=100$ ohm, $X_0=25$ ohm. Calculate the rotor current as referred to stator, stator current, input power factor, torque and motor efficiency at 4% of slip. Given, Mechanical losses are 1 KW. Use approximate equivalent circuit.	5
Q 5.	**Attempt any Two parts of the following. (Unit-IV)**	
(a)	Explain why single-phase induction motor starting torque does not have, how it is able to start based on double revolving field theory concept. Draw Torque speed characteristics, equivalent circuit model.	5
(b)	Explain why dc series motor will not work satisfactorily when connected across ac supply, what modifications are required to work that motor with ac supply? Explain operating characteristics and performance of AC series motor.	5
(c)	A 230 volt, 50 Hz, 4 pole single phase induction motor has following equivalent circuit parameters: R_{1m} =2.4Ω,. R'_2=4.0 Ω, X_{1m}=3.2 Ω, X'_2=2.8 Ω and X_M=80Ω. Friction, windage and core loss=40 W. For a slip of 3%, calculate (i) input current (ii) power factor (iii) developed power and (iv) efficiency at rated voltage.	5

Paper Code	BEE-253

Roll No.	2	0	2	1	0	3	1	0	44

B. Tech.
Year: 2nd. Semester: 4
Test-2: 2022-23
Electrical Machine-II

Time: 01 Hrs Max. Marks: 10

Ql.	**Attempt any Two parts of the following.** **Q. 1 (a) is compulsory. (Unit-III)**	Marks
(a)	A 3 phase, 440-V,50 Hz, Y-connected induction motor has rotor resistance of 0.1 Ω and reactance of 0.9 Ω per phase. The ratio of stator to rotor turn is 3.5. Calculate: (i) Gross Mechanical power (ii) Maximum torque and corresponding slip	3
(b)	Draw and explain torque-speed characteristics of Induction Motor. Derive the condition for maximum torque; hence show that in a three phase Induction Motor. $\frac{T_{em}}{T_{fl}} = \frac{1}{2}\frac{\beta^2 + S_{fl}^2}{\beta S_{fl}}$ where $\beta = \frac{r_2}{x_2}$	2
(c)	Explain the method of speed control of three phase induction motor by (i) V/f control method and (ii) pole changing control method	2
Q2.	**Attempt any Two parts of the following.** **Q.2 (a) is compulsory. (Unit-IV)**	
(a)	Explain double revolving field theory concept on Single phase induction motor and draw torque speed characteristic	3
(b)	Explain working of following Motors; give few applications of such motor. (i) Capacitor Start-Run Motor (ii) Split Phase single phase Induction Motor	2
(c)	Explain No Load and Blocked rotor test on single phase Induction Motor and determine equivalent circuit parameters from above tests.	2

Subject Code	BEE-253

B. Tech.
Year: 2nd.Year Semester: 4
Major Exam: 2022-23
Electrical Machine-II

Time: 03 Hrs. **Max. Marks: 50**

Note: Attempt ALL questions. ALL questions carry equal marks

Ql. **Attempt any Five parts of the following.** **Marks**

(a) Describe the difference in construction of two types of rotor construction of the synchronous generator. **2**

(b) Describe the synchronizing power and synchronizing torque of synchronous machine. **2**

(c) Calculate the distribution factor of a three-phase winding with 120^0 phase spread when the winding is (i) Uniformly distributed (ii) occupies 6 slot/pole **2**

(d) Discuss the necessity of starter in three phase induction motor, draw and explain circuit diagram of star delta starter. **2**

(e) A 18.65 kW, 6-pole, 3phase 50 Hz, slip ring Induction motor runs at 960 rpm on full load with a rotor current per phase of 35A. Assume 1 kW of Mechanical loss, find the resistance per phase of three phase rotor winding **2**

(f) Derive expressions for stating torque and maximum torque of three phase Induction Motor. **2**

(g) Explain the working and characteristics of Capacitor start single phase Induction motor. **2**

Q2. **Attempt any Two parts of the following.**

(a) Explain the effect of armature reaction on a three-phase synchronous generator when delivering a load current at different power factors. **5**

(b) Draw and explain the phasor diagram of a salient pole synchronous generator supplying full load lagging current. Show that the power output per phase is given by **5**

$$P = \frac{VE_f}{X_d}\sin\delta + \frac{V^2}{2}\left[\frac{1}{X_q} - \frac{1}{X_d}\right]\sin 2\delta$$

(c) A 2 MVA, three phase, 8-pole Synchronous generator is connected to 6600 Volt, 50 Hz bus bar and has synchronous reactance of 4 Ω per phase. Calculate the synchronizing power and synchronizing torque per mechanical degree of rotor displacement at no load. Assume normal excitation. **5**

Q3. **Attempt any Two parts of the following.**

(a) Explain V-curves of synchronous motor under different load power factors. A three phase, 410 Volt synchronous motor takes 53A at a power factor of 0.8 leading. Calculate the induced e.m.f and power input. The motor impedance per phase is 0.2+j3.2 Ω — 5

(b) Show that for two synchronous generators running in parallel, the division of load between them is governed by speed load characteristics of their prime movers. — 5

(c) What is the necessity of parallel operation of synchronous generators? Derive the expression for power shared by two alternators. — 5

Q4. **Attempt any Two parts of the following.**

(a) An Induction Motor has an efficiency of 90% when the load is 50 HP. At this load, stator copper loss and rotor copper loss are equal to the iron loss. The mechanical losses are $1/3^{rd}$ of the no load losses. Calculate the value of slip. — 5

(b) Describe how get high starting torque in squirrel cage type Induction motor by change in rotor design construction. Compare a single cage motor with double cage induction motor of same rating. — 5

(c) Describe the speed control of three phase induction motor using (i) stator voltage and (ii) rotor resistance method. — 5

Q 5. **Attempt any Two parts of the following.**

(a) Explain double revolving field theory concept on Single phase induction motor. Draw and explain the equivalent circuit of a single-phase induction motor and discuss the procedure for determining the parameters. — 5

(b) Explain working, operating characteristics and applications of following motors — 5

(i) Repulsion Motor

(ii) Hysteresis Motor

(c) A 220 Volt, single phase Induction motor gave following test results: — 5

No load test: 220 Volt, 4.8 A, 128 W

Blocked rotor test: 120 Volt, 9.6 A, 450 W

Stator winding resistance is 1.5 Ohm and during blocked rotor test starting winding is open. Calculate the equivalent circuit parameters. Also calculate core friction and windage loss.