Code No: R1622022 **R16** SET - 1

II B. Tech II Semester Regular Examinations, April - 2018
ELECTRICAL MACHINES-II
(Electrical and Electronics Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B**)
2. Answer **ALL** the question in **Part-A**
3. Answer any **FOUR** Questions from **Part-B**

~~~~~~

PART –A

1. a) List any two differences between cage rotor and slip ring rotor? (2 M)
   b) Prove that maximum internal torque developed by the polyphase induction motor does not depend on the rotor circuit resistance? (3 M)
   c) List the applications of shaded pole motor? (2 M)
   d) Define pitch factor and distribution factor? (3 M)
   e) What are the conditions required for the parallel operation of alternator? (2 M)
   f) Draw the family of curves of synchronous motor at no load and full load showing the relation between armature current and field current? (2 M)

PART -B

2. a) Discuss the points of similarities between a transformer and an induction motor. Hence, explain why an induction machine is called a generalized transformer? (7M)
   b) A three phase, 400 V, 50 Hz induction motor takes a power input of 35 kW at its full load speed of 980 rpm. The total stator losses are 1 kW and the friction and windage losses are 1.5 kW. Calculate (i) slip (ii) rotor ohmic losses (iii) shaft power (iv) shaft torque and (v) efficiency (7M)

3. a) Explain the principle of speed control of a 3-phase induction motor by V/f method and draw the corresponding torque-speed characteristics and discuss the applications and limitations of these methods. (7M)
   b) Explain briefly about the tests to be conducted on three phase induction motor to get its equivalent circuit? (7M)

4. a) Using double field revolving field theory explain the torque–slip characteristics of a single phase induction motor and prove that it cannot produce starting torque? (7M)
   b) Explain the construction and operation of AC series motor? What are the differences between AC series motor and DC series motor? (7M)

5. a) Derive an emf expression of an alternator from fundamentals showing clearly the expressions for pitch and distribution factors. Also derive the ratio of induced emfs of n^{th} harmonic to fundamental (7M)
   b) The phase emf of a 3 phase, 50 Hz alternator consists of a fundamental, a 20 % third harmonic and a 10% fifth harmonic. The amplitude of the fundamental voltage is 1000 V. Calculate the rms line voltage when the alternator windings are in (i) Star and (ii) Delta (7M)
~~~~~~

Code No: R1622022 **R16** SET - 1

6. a) Explain the effect of variation of excitation and mechanical input on the parallel operation of alternators with necessary phasor diagrams? (7M)
   b) Two 50 MVA, 3 Phase alternators operate in parallel. The settings of the governors is such that the rise in speed from full load to no load is 2%in one machine and 3 % in the other, the characteristics being straight lines in both the cases. If each machine is fully loaded when the total load is 100 MW, what would be the load on each machine when the total load is 60 MW. (7M)

7. a) What are the differences between synchronous motor and induction motor? Explain the operation of synchronous motor with variable excitation at constant load? (7M)
   b) An industrial plant has an average load demand of 800 kW at a p.f of 0.71 lagging. A synchronous motor of 400 kVA is installed for driving an additional load and for improving the plant power factor. The synchronous motor load is 160 kW at efficiency of 90 %. For synchronous motor operation at rated kVA, calculate the total load kVA and the resultant power factor? (7M)

Code No: R1622022 **R16** SET - 2

II B. Tech II Semester Regular Examinations, April - 2018
ELECTRICAL MACHINES-II
(Electrical and Electronics Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B**)
2. Answer **ALL** the question in **Part-A**
3. Answer any **FOUR** Questions from **Part-B**

~~~~~~

PART –A

1.	a)	Explain the concept of Rotating magnetic Field?	(2 M)
	b)	Explain the phenomenon of cogging?	(2 M)
	c)	What are the constructional differences between ac series motor and dc series motor?	(3 M)
	d)	What are the sources of harmonics in the generated EMF in case of alternator? How to minimize them?	(2 M)
	e)	What is synchronizing power? Explain its significance?	(3 M)
	f)	Explain armature reaction in synchronous motor?	(2 M)

PART -B

2.	a)	Describe the principle of operation of three phase induction motor. Explain why the rotor is forced to rotate in the direction of rotating magnetic field	(7M)
	b)	A 20 kW,6 pole ,400 V, 50 Hz, 3 Phase induction motor has a full load slip of 0.02.If the torque lost in mechanical losses is 20 Nm, find the rotor ohmic losses, motor input and efficiency. Stator losses are 900 watts.	(7M)
3.	a)	Draw the torque-slip characteristics of a 3-phase induction motor. Explain them briefly?	(7M)
	b)	A 3-phase, 400 V, 50 Hz induction motor has a rotor resistance of 0.1 Ω and standstill reactance of 0.9 Ω per phase. The full load slip is 4%, Calculate (i) Full load torque as a percentage of maximum torque and the value of extra resistance to be added in the rotor circuit to have 80% of maximum torque at start.	(7M)
4.	a)	Explain the constructional features and principle of operation of a capacitor start induction run motor. Draw the torque speed characteristics and list out its merits over resistance start split phase motor	(7M)
	b)	Describe the construction and working of shaded pole motor with the help of a neat diagram.	(7M)
5.	a)	Explain the two reaction theory of salient pole alternator and draw its phasor diagram for lagging p.f. load?	(7M)
	b)	A 500 kVA, 1,100 V, 50 Hz star connected 3-phase alternator has armature resistance per phase of 0.1 Ω and synchronous reactance per phase of 1.5 Ω. Find its voltage for (i) 0.9 pf lag and (ii) 0.8 pf lead. Also find the voltage regulation in each case.	(7M)
~~~~~~

Code No: R1622022 **R16** SET - 2

6. a) What are the conditions to be satisfied before a 3 phase alternator is synchronized to the infinite bus bar? Describe any one method of synchronizing the alternator to the infinite bus? (7M)

   b) Two identical three phase alternators are coupled in parallel to a load of 1500 KW at 11000 V, 0.8 pf lag. The synchronous reactance of each machine is 60 Ω/ph and resistance is 2.8 Ω/ph. The power supplied by each machine being maintained the same, the excitation of the first alternator is adjusted so that its armature current is 45 A(lag).Calculate (7M)
   (i) The armature current of the second alternator
   (ii) Power factor of each alternator

7. a) What is synchronous condenser? What are the advantages of installing a synchronous condenser in an electrical system? Illustrate your answer with an example? (7M)

   b) A 3 phase , 500 V, synchronous motor draws a current of 50 A from the supply while driving a certain load. The stator is star connected with armature resistance of 0.4 Ω/ph and a synchronous reactance of 4Ω/ph. Find the power factor at which the motor would operate when the field current is adjusted to give the line emf of 600V. (7M)

Code No: R1622022 **R16** SET - 3

II B. Tech II Semester Regular Examinations, April - 2018
ELECTRICAL MACHINES-II
(Electrical and Electronics Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B**)
2. Answer **ALL** the question in **Part-A**
3. Answer any **FOUR** Questions from **Part-B**

~~~~~~

PART –A

1. a) Why rotor core losses are negligible when compared stator core losses under running condition? (2 M)
   b) What is represented by the circle diagram of an induction motor? What information can be obtained from it? (3 M)
   c) List applications of A.C series motor? (2 M)
   d) What is air gap line? Explain its significance with respect to magnetization characteristic of an alternator? (2 M)
   e) Draw and explain the Power vs Load angle characteristics of cylindrical alternator? (3 M)
   f) What are the differences between synchronous motor and induction motor? (2 M)

PART –B

2. a) Develop the equivalent circuit of a polyphase induction motor. Explain how this equivalent circuit is similar to the transformer equivalent circuit? (7M)
   b) A 10 kW, 400 V, 3 Phase , 4 pole , 50 Hz delta connected induction motor is running at no load with a line current of 8 A an input power of 660 watts. At full load, the line current is 18 A and the input power is 11.2 kW. Stator effective resistance per phase is 1.2 Ω and friction and windage loss is 420 watts. For negligible rotor ohmic losses at no load, calculate (i) stator core loss (ii) total ohmic loss of rotor at full load (iii) full load speed (iv) shaft torque and (v) motor efficiency (7M)

3. a) Explain the phenomena of cogging and crawling in three phase induction motor (7M)
   b) The short circuit current of SCIM on normal voltage is 3 times the full load current and the full load slip ids 4%. Determine the percentage tapping required to an autotransformer starter to start the motor against 1/3rd full load torque. Neglect magnetizing current (7M)

4. a) Explain the constructional details and principle of operation of a split phase induction motor. List out its industrial applications (7M)
   b) Explain the construction and operation of AC series motor? (7M)
~~~~~~

Code No: R1622022 **R16** SET - 3

5. a) What is armature reaction? Explain the effect of armature reaction on the terminal voltage of an alternator at ZPF lag and ZPF lead with the help of necessary phasor diagram? (7M)

   b) A 30 kVA, 440 V, 50 Hz, 3 Phase, Star connected alternator gave the following test data (7M)

I_f(A)	2	4	6	7	8	10	12	14
V_{oc}(V)	155	287	395	440	475	530	570	592
I_{sc}(A)	11	22	34	40	46	57	69	80

   Armature resistance/ph is 0.15 Ω. Find the regulation at full load 0.8 pf lag by MMF method

6. a) What is synchronizing power of an alternator? Derive an expression for the synchronizing power between the two alternators connected in parallel? (7M)

   b) The governors of each 2000 kW, rating turbo alternators running in parallel are so adjusted that the frequency of one of the alternators drops uniformly from 50 Hz to 45 Hz and that of other from 50 Hz to 47 Hz from No load to full load. Calculate the load on each machine when the total load is 3000 kW (7M)

7. a) Show that a Synchronous motor has no net starting torque? Explain different methods of starting synchronous motor? (7M)

   b) A 400 V, 50 Hz, 33.7 kW, 3 phase star connected synchronous motor has a full load efficiency of 88%. The synchronous impedance of the motor is (0.2+j1.6) Ω/ph. If the excitation of the motor is adjusted to give a leading p.f of 0.9, Calculate induced emf developed for full load? (7M)

Code No: R1622022 **R16** SET - 4

II B. Tech II Semester Regular Examinations, April - 2018
ELECTRICAL MACHINES-II
(Electrical and Electronics Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B**)
2. Answer **ALL** the question in **Part-A**
3. Answer any **FOUR** Questions from **Part-B**

~~~~~~

PART –A

1. a) Three phase induction motor operates at a very low power factor. Explain? (2M)
   b) Explain the phenomenon of crawling? (2M)
   c) Explain the concept of double field revolving theory? (3M)
   d) List the differences between salient pole and non salient pole synchronous generators? (2M)
   e) Draw and explain the Power vs Load angle characteristics of Salient pole alternator? (3M)
   f) What is Synchronous condenser? Explain? (2M)

PART -B

2. a) Develop the phasor diagram for a polyphase induction motor. How does it different from the phasor diagram of a transformer? (7M)
   b) The power supplied to a three phase induction motor is 40 kW and the corresponding stator losses are 1.5 kW. Calculate net mechanical power developed and rotor cu losses when the slip is 0.04 per unit. What will be the net power developed if the speed of the above motor is reduced to 40 % of the synchronous speed by means of external rotor resistors assuming the torque and stator losses to remain unaltered? Friction and windage losses may be assumed to be 0.8 kW. (7M)

3. a) Explain how the circle diagram for a poly-phase induction motor can be drawn from its test data. (7M)
   b) For a three phase induction motor, the rotor ohmic loss at maximum torque is 16 times that at full load torque. The slip at full load torque is 0.03.If the stator resistance and rotational losses are neglected, then calculate
      (i) The slip at maximum torque
      (ii) The max. torque in terms of full load torque
      (iii) The starting torque in terms of full load torque

4. a) Describe the construction and operation of shaded pole motor? (7M)
   b) Using double field revolving field theory explain the torque–slip characteristics of a single phase induction motor and prove that it cannot produce starting torque? (7M)
~~~~~~

Code No: R1622022 **R16** SET - 4

5. a) Explain how the potier triangle can be drawn with the help of OCC and any two points on the ZPFC? What are the observations we can derive from the potier triangle? (7M)
   b) The stator of a 3-phase, 16 pole alternator has 144 slots and there are 4 conductors per slot connected in two layers and the conductors of each phase are connected in series. If the speed of the alternator is 375 rpm, calculate the emf induced per phase. Resultant flux in the air-gap is 0.05 webers per pole sinusoidally distributed. Assume the coil span as 150^0 electrical. (7M)

6. a) A synchronous generator is connected to an infinite bus. Discuss with the help of phasor diagrams (7M)
      (i) Effect of changing excitation at constant mechanical input
      (ii) Effect of changing the input at constant excitation
   b) Two alternators A and B operate in parallel and supply a load of 10 MW at 0.8 p.f lagging (7M)
      (i) By adjusting steam supply of A, its power output is adjusted to 6000 kW and by changing its excitation, its p.f is adjusted to 0.92 lag. Find the p.f of alternator B
      (ii) If the steam supply of both the machines is left unchanged but excitation of B is reduced so that its p.f becomes 0.92 lead find the p.f of A

7. a) Explain the construction of damper winding. With neat diagram & explain how damper winding prevents oscillations? (7M)
   b) A 1000 kVA, 11,000 V, 3-Phase star connected synchronous motor has an armature resistance and reactance per phase of 3 Ω and 40 Ω respectively. Determine the induced emf and angular retardation of the motor when fully loaded at (i) unity pf and (ii) 0.9 pf lead (7M)