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

II B. Tech II Semester Regular/Supplementary Examinations, April/May - 2019
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**

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PART –A

1. a) What is rotating magnetic field? (2M)
   b) List the various applications of 3-phase induction motor? (2M)
   c) What is the function of capacitor in single phase induction motor? (2M)
   d) Define pitch factor, distribution factor and winding factors. (3M)
   e) What is synchronizing power of an alternator? (2M)
   f) Why synchronous motor is not self starting motor? (3M)

PART -B

2. a) Explain, why the speed of 3-phase induction motor cannot be equal to synchronous speed? (4M)
   b) A 3-phase, 4-pole, 50 Hz, induction motor has a star connected wound rotor. The rotor emf is 50V between the slip rings at standstill. The rotor resistance and standstill reactance are 0.4 Ω and 2.0 Ω respectively. Calculate (10M)
      (i) rotor current per phase at starting when slip rings are short circuited
      (ii) Rotor current per phase at starting if 50 Ω per phase resistance is connected between slip rings.
      (iii) Rotor EMF when the motor us running at full load at 1440 rpm
      (iv) Rotor current at full load and
      (v) Rotor power factor at full load

3. Draw the circle diagram from no-load and short circuit test on a 3-phase, 14.92 kW, 440V, 6-pole induction motor from the following results: (14M)
   No-load : 400V , 11A, PF=0.2
   Short-circuit test : 100V, 25A, PF=0.4
   Rotor Cu losses at stand still is half the total Cu losses from the circle diagram, find
   (i) Line current, slip, efficiency and pf at full load a
   (ii) Maximum torque.

4. a) Explain the constructional features and working principle of single phase induction motor? (7M)
   b) Explain the role of compensating winding in the operation of AC series motor. (7M)

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5. a) Explain the principle of operation of a synchronous generator. (7M)

   b) A 220V, 50Hz, 6-pole star-connected alternator with ohmic resistance of 0.06ohm per phase are the following data for open circuit and full load ZPF characteristics: (7M)

Field Current(A)	0.2	0.4	0.6	0.8	1.00	1.2	1.4	1.8	2.2	2.6	3.0	3.4
Open circuit Voltage (Volts)	29.0	58.0	87.0	116	146	172	194	232	261.5	284	300	310
ZPF voltage (Volts)	-	-	-	-	-	0	29	88	140	177	208	230

   Find the percentage voltage regulation at full load current of 40Amps at power factor of 0.8 lagging.

6. a) Derive an expression for synchronizing torque when a 3-phase alternator is connected to infinite bus-bar. (7M)

   b) Two alternators A and B operate in parallel and supply a load of 10MW at 0.8pf lagging. (i) By adjusting steam supply of A, its power output is adjusted to 6,000KW and by changing its excitation, its P.F is adjusted to 0.92 lag. Find the Power Factor of alternator B. (ii) If steam supply of both machines is left unchanged, but excitation of B is reduced so that it's P.F becomes 0.92 lead, find new P.F of A. (7M)

7. a) Derive the expression for the maximum torque developed per phase of a synchronous motor. (7M)

   b) A 75KW, 400V, 4-pole, 3-phase, 50Hz, star connected synchronous motor has a resistance and synchronous reactance of 0.04Ω and 0.4Ω respectively. Compute for full load 0.8pf lead the open circuit emf per phase and gross mechanical power developed. Assume an efficiency of 92.5%. (7M)

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

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Time: 3 hours Max. Marks: 70

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2. Answer **ALL** the question in **Part-A**
3. Answer any **FOUR** Questions from **Part-B**

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PART –A

1. a) Define term slip of the induction motor? (2M)
   b) List the various starters used in 3-phase induction motor? (2M)
   c) State the various applications of a shaded pole motor? (2M)
   d) Why short-pitch winding is preferred over full pitch winding? (3M)
   e) Discuss the requirements for paralleling of alternators. (2M)
   f) Mention the need for starters in synchronous motors. (3M)

PART -B

2. a) List the difference between squirrel cage rotor and slip ring rotor? (7M)
   b) A 10kw, 400V, 3-phase, 4-pole, 50 HZ delta connected induction motor is running at no lode with a line current of 8A and an input power is 660 kW. At full load, the line current is 18 A and the input power is 11.20 kW. Stator effective resistance per phase is 1.2 ohm and friction, winding loss is 420 watts. For negligible rotor ohmic losses at no load, calculate (i) stator core loss (ii) slip at full load (iii) total rotor ohmic losses at full load (iv) full load speed. (7M)

3. a) Explain the phenomenon of crawling and cogging in a three phase induction motor? (7M)
   b) Derive the condition for maximum torque for an induction motor? (7M)

4. a) Explain the constructional features and working principle of shaded pole induction motor? (7M)
   b) Using double field revolving theory, explain the torque-slip characteristics of a single phase induction motor and prove that it cannot produce any starting torque. (7M)

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5. a) By taking necessary assumptions, derive EMF equation of a synchronous generator? (7M)

   b) A 6600V alternator gave the following test results: (7M)

Field Current(A)	16	25	37.5	50	70
Open circuit Voltage (Volts)	3100	4900	6600	7500	8300

   A field current of 22A is found necessary to circulate full-load current on short-circuit of the armature. Calculate the full-load regulation at 0.8 power factor lagging by:

   (i) The synchronous impedance method

   (ii) Ampere-turn method

   Comment the two values of regulation obtained by the above methods.

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) Two single-phase alternators operating in parallel have induced emf's on open circuit of $230\angle 0^\circ$ and $230\angle 10^\circ$ volts and respective reactances of $j2\Omega$ and $j3\Omega$. Calculate (i) terminal voltage (ii) currents and (iii) power delivered by each of the alternators to a load of impedance 6Ω (resistive). (7M)

7. a) Derive the equation for power developed in a synchronous motor. (7M)

   b) A 2000V, 3-phase, 4-pole, Y- connected synchronous motor runs at 1500rpm. The excitation is constant and corresponds to an open circuit voltage of 2000V. The resistance is negligible as compared to a reactance of 3Ω per phase. Determine the power input, power factor and torque developed for an armature current of 200A. (7M)

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

II B. Tech II Semester Regular/Supplementary Examinations, April/May - 2019
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(Electrical and Electronics Engineering)

Time: 3 hours Max. Marks: 70

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2. Answer **ALL** the question in **Part-A**
3. Answer any **FOUR** Questions from **Part-B**

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PART –A

1. a) Explain the operation principle of induction motor? (2M)
   b) Explain necessity for starter in an induction motor? (2M)
   c) What are the different methods of starting of a single phase induction motor. (3M)
   d) What are the advantages of salient pole type of construction used for synchronous machines? (3M)
   e) Explain the significance of synchronizing current in parallel operation of alternators. (2M)
   f) What is meant by hunting in synchronous motor? (2M)

PART -B

2. a) Draw a power flow diagram of a three phase induction motor and explain all the stages? (4M)
   b) A 3-phase, 4-pole, 50 hz, star connected induction motor running on full load develops a useful torque of 300 N-m the rotor EMF is completing 120 cycles per minute. If torque lost is frictional is 50 N-m, calculate (i) slip, (ii) Net power, (iii) rotor copper loss per phase, (iv) Rotor efficiency (v) Rotor resistance per phase if rotor current is 60A in running condition. (10M)

3. A 400V, 40 H.P, 50 Hz, 4-pole delta connected induction motor give the following test data: (14M)
   No-load test : 400V, 20A, 1200W
   Blocked rotor test : 100V, 45A, 2800W
   Draw the circle diagram and determine
   (i) full load line current and power factor
   (ii) maximum output power
   (iii) full-load rotor speed
   Assume stator and rotor Cu losses to be equal at stand still.

4. a) Explain the constructional features and working principle of capacitor start induction motor with their applications. (7M)
   b) Explain the construction and working of a shaded pole motor. (7M)

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5. a) Explain the EMF method of determining the regulation of an alternator. (7M)

   b) A 3-phase, 16-pole alternator has the following data: (7M)
   Number of slots=192; conductors/slot=8; coil span=160 electrical degrees; speed of the alternator=375 rpm; flux/pole=55 mWb; Calculate the phase and line voltages.

6. a) Describe a method of synchronizing the three phase alternator to the infinite bus giving the relevant circuit diagram. (7M)

   b) Two identical 3-phase alternators work in parallel and supply a total load of 1500KW at 11KV at a power factor of 0.867 lagging. Each machine supplies half the total power. The synchronous reactance of each is 50Ω per phase and the resistance is 4Ω per phase. The field excitation of the first machine is so adjusted that its armature current is 50A lagging. Determine the armature current of the second alternator and the generated voltage of the first machine (7M)

7. a) Explain the significance of V curves and inverted V-curves? (7M)

   b) A 75KW, 400V, 4-pole, 3-phase, 50Hz, star connected synchronous motor has a resistance and synchronous reactance of 0.04Ω and 0.4Ω respectively. Compute for full load 0.8pf lead the open circuit emf per phase and gross mechanical power developed. Assume an efficiency of 92.5%. (7M)

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

II B. Tech II Semester Regular/Supplementary Examinations, April/May - 2019
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(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**

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PART –A

1. a) A 4-pole, 3-phase, 50HZ, star connected induction motor has a full load slip 4% calculate full load speed of the motor. (3M)
   b) Define crawling in an induction motor? (3M)
   c) Why the single phase Induction motors do not have self starting torque. (2M)
   d) State the causes of voltage drop in an alternator when loaded (2M)
   e) What is the necessity of parallel operation of alternators? (2M)
   f) What is synchronous condenser? (2M)

PART -B

2. a) Explain how the rotating magnetic field is created in three phase induction motor. (7M)
   b) A 1000 V, 50 HZ, 3-phase induction motor has star connected stator. The ratio of stator to rotor is 3.6 the standstill impedance of rotor per phase is 0.01+j 0.2 ohm calculate (i) Rotor current at start (ii) Rotor P.F at start (iii) Rotor current at slip of 3% (iv) external resistance per phase the rotor circuit to limit starting rotor current to 200A. (7M)

3. a) Explain the torque slip characteristic of 3-phase induction motor. (7M)
   b) What is induction generator? Discuss the principle of operation of induction generator? (7M)

4. a) Explain the operation of single phase induction motor using double field revolving theory. (7M)
   b) What are different types of single phase induction motors and what are their applications? (7M)

5. a) Explain the concept of armature reaction in synchronous machines. (7M)
   b) Explain the two-reaction theory of salient pole synchronous machine. (7M)

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6. a) Explain the effect of increasing excitation of one of the alternators when two alternators are connected in parallel. (7M)
   b) Two identical three phase synchronous generators operating in parallel share equal loads of 2000kW at 11 kV and 0.8 lagging power factor. The armature current of the first generator is 100A at lagging power factor. Determine the armature current of the second generator and the power factor at which each machine operates. (7M)

7. a) Explain in detail about the concept of Hunting and how to overcome it in a synchronous motor. (7M)
   b) A 2000V, 3-phase, 4-pole, Y- connected synchronous motor runs at 1500rpm. The excitation is constant and corresponds to an open circuit voltage of 2000V. The resistance is negligible as compared to a reactance of 3Ω per phase. Determine the power input, power factor and torque developed for an armature current of 200A. (7M)

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