Code No: R21041 **R10** SET - 1

II B. Tech I Semester Regular Examinations, March – 2014
ELECTRICAL TECHNOLOGY
(Com. to ECE, EIE, BME)

Time: 3 hours Max. Marks: 75

Answer any **FIVE** Questions
All Questions carry **Equal** Marks
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1. a) Draw a neat sketch of a DC generator and explain the function of each part.
   b) A short-shunt compound d.c generator delivers 100 A to a load at 250 V. The generator has shunt field, series field and armature resistance of 130 Ω, 0.1 Ω and 0.1 Ω respectively. Calculate the voltage generated in armature winding. Assume 1V drop per brush. (8M+7M)

2. a) Discuss different methods of speed control of a DC shunt motor.
   b) A 4-pole, 250 V, wave-connected shunt motor gives 10kW when running at 1000 r.p.m. and drawing armature and field currents of 60 A and 1 A respectively. It has 560 conductors. Its armature resistance is 0.2 Ω. Assuming a drop of 1 V per brush, determine: i) Total Torque; ii) Useful Torque; iii) Useful flux per pole; iv) Rotational Losses; v) Efficiency. (7M+8M)

3. a) Describe the operation of a single-phase transformer, explaining clearly the functions of the different parts. Why are the cores laminated?
   b) A 230/110 V single-phase transformer takes an input of 350 V A at no load and at rated voltage. The core loss is 110 W. Find i) the iron-loss component of no-load current, ii) the magnetizing component of no-load current and iii) no-load power factor. (7M+8M)

4. a) A transformer is rated at 100 kVA. At full load its copper loss is 1200 W and its iron loss is 960 W. Calculate i) The efficiency at full load, unity power factor, ii) The efficiency at half load, 0.8 power factor, iii) The efficiency is 75% full load, 0.7 power factor, iv) The load kVA at which maximum efficiency will occur, v) The maximum efficiency at 0.85 power factor.
   b) Define voltage regulation of a transformer and derive the conditions for i) zero regulation ii) maximum regulation (7M+8M)
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5. a) Compare and contrast between squirrel-cage and slip-ring motors with respect to construction, operation, and performance..
   b) The frequency of emf in the stator of a 4-pole induction motor is 50 Hz, and that in the rotor is 1.5 Hz. Compute i) slip ii) rotor speed (8M+7M)

6. a) Explain the Synchronous Impedance Method to predetermine the regulation of an alternator.
   b) A 4-pole, 50 Hz star-connected alternator has a flux per pole of 0.12 Wb. It has 4 slots per pole per phase, conductors per slot being 4. If the winding coil span is 150^0, find the induced emf. (8M+7M)

7. a) Describe the constructional features and operating characteristics of a shaded-pole motor. Discuss its uses.
   b) Explain the principle of operation of a single phase induction motor. (7M+8M)

8. Sketch and describe the construction of a Moving Coil Ammeter and give the principle of operation. Also discuss its advantages and disadvantages. (15M)

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Time: 3 hours Max. Marks: 75

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1. a) Explain why the external characteristic of a dc shunt generator is more drooping than that of a separately excited generator.
   b) A long-shunt compound generator delivers a load current of 50 A at 500 V, and the resistances of armature, series field and shunt fields are 0.05 Ω, 0.03 Ω and 250 Ω respectively. Calculate the generated e.m.f and the armature current. Allow 1.0 V per brush for contact drop. (8M+7M)

2. a) Describe Swinburne's test with the help of a neat diagram to find out the efficiency of a d.c. machine. What are the main advantages and disadvantages of this test?
   b) A Series motor, with an unsaturated magnetic circuit and 0.5 Ω total resistance, when running at a certain speed takes 60 A at 500 V. If the load torque varies as the cube of the speed, calculate the resistance required to reduce the speed by 25%. (7M+8M)

3. a) Develop the exact equivalent circuit of a 1-phase transformer. From this derive the approximate and simplified equivalent circuits of the transformer. State the various assumptions made.
   b) A single –phase 240/20 V, 50 Hz transformer has the secondary full-load current of 180 A. It has 45 turns on its secondary. Calculate i) the voltage per turn, ii) the number of primary turns iii) the full-load primary current; and iv) the kVA output of the transformer. (7M+8M)

4. a) Describe the tests on a 1-phase transformer that gives its ohmic losses and core losses. Give the determination of the equivalent circuit parameters which can be determined from these tests.
   b) A single –phase transformer working at unity power factor has an efficiency of 90% at both half load and at the full-load of 500 W. Determine the efficiency at 75% full load and the maximum efficiency. (7M+8M)
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5. a) Discuss the principle of operation of 3-phase Induction Motor.
   b) A 3-phase, 6-pole, 50 Hz induction motor has a slip of 1% at no load, and 3% at full load. Determine i) synchronous speed ii) No-load speed iii) full-load speed iv) frequency of rotor current at stand still v) frequency of rotor current at full load. (8M+7M)

6. a) State the advantages and disadvantages of using short-pitched winding and distributed winding in an alternator.
   b) Derive the emf equation of an alternator and explain the effect of coil span factor and distribution factor on the induced emf. (8M+7M)

7. a) Explain the construction, working and applications of a stepper motor.
   b) Draw the connection diagram of capacitor-start and capacitor-run single phase induction motor and explain its operation. (7M+8M)

8. a) What are the basic requirements of indicating instruments? Briefly discuss them.
   b) Explain the principle of operation of Permanent Magnet Moving Coil Instruments (15M)

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Time: 3 hours Max. Marks: 75

Answer any **FIVE** Questions
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1. a) Distinguish between self-excited and separately excited d.c. generators. How are self-excited d.c. generators classified? Give their circuit diagrams
   b) A 4-pole d.c. generator has 1200 armature conductors and generates 250 V on open circuit when running at a speed of 500 r.p.m. The diameter of the pole-shoe circle is 0.35 m and the ratio of pole arc to pole pitch is 0.7 while the length of the pole shoes is 0. 2 m. Find the mean flux density in the air gap. Assume lap-connected armature winding. (8M+7M)

2. a) What is the necessity of a starter for a d.c. motor. Explain, with a neat sketch, the working of a 3-point d.c. shunt motor starter, bringing out the protective features incorporated in it.
   b) A 500 V shunt motor takes 4 A on no load. The armature resistance including that of brushes is 0.2 Ω and the field current is 1 A. Estimate the output and the efficiency when the input current is i) 20 A and, ii) 100 A. (7M+8M)

3. a) Develop the phasor diagram of a single-phase transformer under load condition. Assuming lagging power factor load.
   b) A single-phase transformer has a no-load voltage ratio of 400/3300 V. The low-voltage winding has 80 turns and the net cross-sectional area of the core is 200 cm^2. The frequency of the applied voltage is 50 Hz. Calculate the maximum value of the flux density and the number of turns on the secondary. (7M+8M)

4. a) Define voltage regulation of a transformer. For which type of load the voltage regulation is negative? Derive the expression using the equivalent circuit.
   b) The maximum efficiency of a 500 kVA, 3300/500 V, 50 Hz, 1-phase transformer is 0.97 per unit and occurs at 75% full load and unity power factor. If the leakage impedance is 10%, calculate the voltage regulation at full load, power factor 0.8 lagging. (7M+8M)
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5. a) Derive the expression of rotor frequency in terms of main supply frequency and slip.
   b) Describe the constructional details of squirrel cage induction motor? Explain the constructional difference between squirrel cage and slip ring induction motors. (8M+7M)

6. a) Explain the constructional details and principle of operation of a synchronous machine.
   b) Calculate the r.m.s value of the induced emf per phase of a 10-pole, 3-phase, 50 Hz alternator with 2 slots per pole per phase and 4 conductors per slot in two layers. The coil span is 150^0 and the flux per pole is 0.12 Wb. (8M+7M)

7. a) Explain the principle of operation of an AC servomotor. Discuss its applications.
   b) Explain why single phase induction motor is not self starting. (7M+8M)

8. a) A dc voltmeter has a resistance of 28600 ohm. When connected in series with an external resistor across a 480V dc supply, the instrument needs 220V. What is the value of the external resistance?
   b) Give the constructional details of moving iron instruments. (7M+8M)

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Time: 3 hours Max. Marks: 75

Answer any **FIVE** Questions
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1. a) Explain the open circuit characteristics of a dc generator and explain its significance.
   b) A 110 V d.c. shunt generator delivers a load current of 50 A. The armature resistance is 0.2 Ω, and the field circuit resistance is 55 Ω. The generator, rotating at a speed of 1800 r.p.m., has 6 poles, lap-wound, and a total of 360 conductors. Calculate the no-load voltage at the armature and the flux per pole. (7M+8M)

2. a) Explain the speed-current, torque-current and speed-torque characteristics of d.c. shunt motor.
   b) A 200 V d.c. series motor runs at 1000 r.p.m. and takes 20 A. Combined resistance of armature and field is 0.4 Ω. Calculate the resistance to be inserted in series so as to reduce the speed to 800 r.p.m., assuming torque to vary as square of the speed and linear magnetization curve. (7M+8M)

3. a) Explain briefly the action of a transformer and show that the voltage ratio of the primary and secondary windings is the same as their turns ratio.
   b) A single-phase transformer has 400 primary and 1000 secondary turns. The net cross-sectional area of the core is 60 cm^2. If the primary winding be connected to a 50 Hz supply at 500 V, calculate i) the peak value of the flux density in the core, and ii) the voltage induced in the secondary winding. (7M+8M)
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4. a) Describe the various losses in a transformer. Explain how each loss varies with the load current, supply voltage and frequency.
   b) Open-circuit and short-circuit tests on a 5 kVA, 220/400 V, 50 Hz, single-phase transformer gave the following results:

O.C. test	220 V	2 A	100 W (i.v. side)
S.C. test	40 V	11.4 A	200 W (h.v side)

   Determine the efficiency and approximate regulation of the transformer at full load 0.9 power factor lagging. (8M+7M)

5. a) Explain briefly different starting methods of an induction motor?
   b) Draw the torque-speed characteristics of a poly phase induction motor and clearly indicate the effect of changing the rotor resistance? (7M+8M)

6. a) Explain the OC and SC tests on an alternator. How the regulation can be calculated by the use of their results.
   b) A 3-phase, 8-pole, 750 rpm star connected alternator has 72 slots on the armature. Each slot has 12 conductors and winding is short chorded by 2 slots. Find the induced emf between the lines, given the flux per pole is 0.06 Wb. (7M+8M)

7. a) Explain the principle of operation of an AC tachometer. Discuss its applications.
   b) Write a short notes on synchros. (7M+8M)

8. a) Differentiate between PMMC and moving iron instruments.
   b) Explain the basic principle involved in indicating instruments and classify them. (7M+8M)