

Code No: R21041

R10
SET - 1

II B. Tech I Semester Supplementary Examinations, June - 2015
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) State and explain Fleming's right hand thumb rule. [5]  
 b) Derive from first principles an expression for the emf of a DC generator. [10]
- 2 a) How is a shunt motor started? Why it should not be started direct on line? [6]  
 b) A 4-pole, lap wound DC motor has 540 conductors. Its speed is found to be 1000rpm. the flux per pole is 25mWb. It is connected to 230 Volts dc supply. Armature resistance  $R_a$  is  $0.8\Omega$ . Calculate induced emf and armature current. [9]
- 3 a) Derive an emf equation of a single phase transformer. [7]  
 b) The maximum flux density in the core of 250/300V, 50Hz single- phase transformer is 1.2 tesla. If the emf per turn is 8V. Determine primary and secondary turns and area of core. [8]
- 4 The following data were obtained on a 20kVA, 50 Hz, 2000/200V distribution transformer: [15]
 

|                                 | Voltage (V) | Current (A) | Power (W) |
|---------------------------------|-------------|-------------|-----------|
| OC test with HV open-circuited  | 200         | 4           | 120       |
| SC test with LV short circuited | 60          | 10          | 300       |

Draw the approximate equivalent circuit of the transformer referred to the HV and LV sides respectively.
- 5 a) What are the advantages of three-phase induction motors over single-phase motors? Also list their applications. [8]  
 b) Draw and explain the torque-slip characteristics of an induction motor. [7]
- 6 What is an alternator? Explain its principle of operation. With a neat diagram, explain the constructional features of a three-phase alternator. [15]
- 7 a) What are different types of single phase induction motors? [6]  
 b) Explain the operation of a capacitor start, capacitor run induction motor. [9]
- 8 a) Define and explain *Deflecting torque*, *Controlling torque* and *Damping torque*. [8]  
 b) Compare between moving coil and moving iron instruments. [7]

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- 1 a) What are the types of DC generators? List their applications. [7]  
b) A 4-pole, lap wound, d.c machine has total number of 800 armature conductors and produces 0.03 Wb flux per pole when field is excited. If the machine is driven by a prime mover at 1000 rpm, calculate the generated emf across the armature. [8]
  - 2 a) What is back emf? Explain the significance of back emf. [6]  
b) A 10 kW, 250V, DC shunt motor with an armature resistance of  $0.8\Omega$  and a field resistance of  $275\Omega$  takes 3.91A, when running at no-load at rated voltage and rated speed. Calculate the machine efficiency as a generator when delivering an output of 10kW at rated voltage and speed; and as a motor drawing an input of 10kW. [9]
  - 3 a) Discuss the principle of operation of a single-phase transformer. [7]  
b) What are different types of single-phase transformers? Explain its constructional features. [8]
  - 4 The efficiency of a 1000 kVA, 110/220V, 50Hz, single-phase transformer is 98.5% at half full-load at 0.8 pf leading and 98.8% at full-load upf. Determine: i) iron loss, ii) full-load copper loss, and iii) maximum efficiency at upf. [15]
  - 5 a) List and explain different types of induction motors. Mention few applications of induction motors. [7]  
b) Explain the rotor resistance starting scheme for a slip-ring induction motors. [8]
  - 6 a) Define and explain *pitch factor* and *distribution factor*. [6]  
b) Derive the expression for emf induced in an alternator. [9]
  - 7 a) What are different application of single-phase induction motors [6]  
b) Explain in detail the operation of a shaded-pole single-phase induction motor. [9]
  - 8 With a neat diagram, explain the operation of a permanent magnet moving coil instruments. Also mention its applications. [15]

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- 1 a) Explain with a neat sketch, the constructional details of a DC machine. [9]  
b) A DC generator is found to develop an armature voltage of 200 V. If the flux is reduced by 25% and speed is increased by 40%, calculate the armature generated voltage. [6]
  - 2 a) What are different losses that occur in a DC motor? Explain briefly. [6]  
b) A 4-pole DC motor is lap-wound with 400 conductors. The pole shoe is 20 cm long and average flux density over one-pitch is 0.4T, the armature diameter being 30 cm. Find the torque and gross mechanical power developed when the motor is drawing 25A and running at 1500 rpm. [9]
  - 3 a) With a phasor diagram, explain the operation of a single phase transformer on no-load condition. [7]  
b) Define and explain the terms: step-up transformer, step-down transformer, ideal transformer and isolated transformer. [8]
  - 4 What are different losses that occur on a transformer? Explain the conduction of open-circuit and short-circuit tests on transformers. [15]
  - 5 List and explain in detail different starting methods for a three-phase induction motor. [15]
  - 6 a) What are different types of alternators? [5]  
b) A 3-phase, 16 poles alternator has a star-connected winding with 144 slots and 10 conductors per slot. The flux per pole is 0.03 Wb, sinusoidally distributed and the speed is 375 rpm. Find the frequency of generated voltage, the magnitude of phase voltage and line voltage. Assume full-pitched coil. [10]
  - 7 a) Explain the working of an AC servomotor. Also list their applications. [8]  
b) What are stepper motors? List different types of stepper motors. [7]
  - 8 a) List the advantages and limitation of permanent magnet moving coil instruments. [7]  
b) A PMMC instrument has a coil resistance of  $100\Omega$  and gives a fullscale deflection (FSD) for a current of  $500\mu\text{A}$ . Determine the value of shunt resistance required if the instrument is to be employed as an ammeter with a FSD of 5A. [8]

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- 1 a) What is residual magnetism? Explain its use. [6]  
b) A 4-pole, lap wound 750 rpm DC shunt generator has an armature resistance of  $0.4\Omega$  and field resistance of  $200\Omega$ . The armature has 720 conductors and the flux per pole is 30m Wb. If the load resistance is  $15\Omega$ , determine the terminal voltage. [9]
  - 2 a) Discuss a scheme to control the speed of a DC motor above its rated speed. [7]  
b) Explain the operation of the three point starter with neat sketch. [8]
  - 3 a) What is a transformer? Differentiate between a core-type and a shell-type transformer. [8]  
b) State and prove the condition for maximum efficiency of a transformer. [7]
  - 4 A 100KVA, 1-phase transformer has full load primary current of 400A and total resistance referred to primary is 0.006. If the iron loss amounts to 500W, find the efficiency at full load and half load at  
i) Unity power factor  
ii) 0.8 power factor. [15]
  - 5 a) Compare between Slip ring and Squirrel cage induction motors. [9]  
b) Define and explain the terms: *slip* and *slip speed* of an induction motor. [6]
  - 6 What is regulation? Explain the predetermination of regulation of an alternator by Synchronous Impedance Method [15]
  - 7 a) What is a tachometer? Explain the operation of AC tachometer. [8]  
b) What is a synchro? What is the primary purpose of a synchro system? What are the two major components of a synchro? [7]
  - 8 Explain in detail the construction and basic principle operation of Moving-iron Instruments. Also mention its applications. [15]