Code No: R7210405

II B.Tech I Semester(R07) Regular/Supplementary Examinations, December 2009
ELECTRICAL TECHNOLOGY
(Common to Electronics & Communication Engineering, Electronics & Instrumentation Engineering, Electronics & Control Engineering and Electronics & Computer Engineering)

Time: 3 hours Max Marks: 80

Answer any FIVE Questions
All Questions carry equal marks

1. (a) Distinguish between external and internal characteristics of dc shunt generator. How can internal characteristics be derived from external characteristics of dc series generator.

   (b) A series generator having an external characteristic which is a straight line through zero at 50V and 200 A is connected as a booster between a station bus bar and a feeder of 0.3 ohm resistance. Calculate the voltage between the far end of the feeder and the bus bar at a current of 100 A.[8+8]

2. (a) Explain the performance characteristics of dc shunt motor.

   (b) Explain Swinburne‘s test on a dc shunt motor. [6+10]

3. (a) Explain the principle of operation of a practical transformer.

   (b) A 1- φ transformer with a ratio of 440/110V takes no-load current of 5A at 0.2 p.f lagging. If the secondary supplies a current of 120A at a p.f 0.8 lagging, find the current taken by the primary. Also draw the phasor diagram.[8+8]

4. (a) Explain clearly what do you understand by voltage regulation of a transformer. Derive the voltage regulation in terms of the parameters of the transformer.

   (b) Define efficiency and voltage regulation of a 1- φ transformer. Explain how they vary with the power factor of the load.[8+8]

5. (a) Explain the construction of squirrel cage rotor and phase wound rotor .

   (b) A 3 phase induction motor having a star connected rotor has an inducted emf of 80 volts between slip rings at stand still on open circuit. The rotor has a resistance and reactance per phase of 1ohm & 4 ohms respectively. Calculate current/phase and power factor when:

      i. Slip rings are short circuited.

      ii. Slip rings are connected to a star connected rheostat of 3 ohms per phase.

   [8+8]

6. A 750-KVA, 11kV, 4-pole, 3-φ, star - connected alternator has percentage resistance and reactance of 1 and 15 respectively. Calculate the synchronizing power per Mechanical degree of displacement at :

   (a) no-load

   (b) at Full load 0.8p.f lag .
   The Terminal voltage in each case is 11kV. [16]

7. (a) Explain briefly how shaded pole motor operates with their characteristics.

   (b) What is the main advantage of a capacitive run motor? [8+8]

8. Discuss the following in indicating instruments:

   (a) Spring control

   (b) Gravity control

   (c) Deflecting torque

   (d) Damping torque [16]

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1. (a) Explain the internal and external characteristics of dc series generator.

   (b) A series generator, having an external characteristic which is a straight line through zero to 50V at 200 A, is connected as a booster between a station bus bar and a feeder of 0.2 ohm resistance. Calculate the voltage between the far end of the feeder and the bus bar at a current of

   i. 160A and

   ii. 50A. [8+8]

2. A 230 V shunt motor, running on no load and at normal speed, takes an armature current of 2.5A from 230V mains. The field circuit resistance is 230 Ω and the armature circuit resistance is 0.3 Ω. Calculate the motor output, in kilowatts and the efficiency when the total current taken from the mains is 35A.
   If the motor is used as a 230V shunt generator, find the efficiency and input power for an output current of 35A. [16]

3. Draw and discuss phasor diagrams of transformer for different load conditions and no - load. [16]

4. (a) Derive an approximate expression for voltage regulation in a transformer in terms of the parameters.

   (b) A 20 kVA , 400/200V, single phase, 50 Hz transformer has iron loss of 350W. The copper loss is found to be 150W, when delivering half full load current. Determine:

   i. the efficiency when delivering full load current at 0.8 lag p.f.

   ii. the efficiency when delivering half full load at unity power factor. [8+8]

5. (a) Sketch and explain the torque-slip characteristics of a 3-phase induction motor.

   (b) What is the effect of changing the rotor resistance on the above characteristics?

   (c) Based on this, draw a number of torque-slip curves for different values of rotor resistances on the same diagram.[4+4+8]

6. (a) What are the effects of harmonics on pitch and distribution factors?

   (b) Find the value of Kd for an alternator with 9 slots per pole for the following cases:

   i. One winding in all the slots

   ii. One winding using only the first 2/3 of the slots /pole

   iii. Three equal windings placed sequentially in 60_o group. [8+8]

7. Explain the constructional features, operation and characteristics of stepper motor. [16]

8. A permanent magnet moving coil instrument has a coil of dimensions 15mm ×12mm. The flux density in the air gap is 1.8×10^{-3} Wb/m^2 and the spring constant is 0.14×10^{-6} Nm/rad. Determine the number of turns required to produce an angular deflection of 90 degrees when a current of 5mA is flowing through the coil. [16]

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1. (a) Distinguish between external and internal characteristics of dc shunt generator. How can internal characteristics be derived from external characteristics of dc series generator.

   (b) A series generator having an external characteristic which is a straight line through zero at 50V and 200 A is connected as a booster between a station bus bar and a feeder of 0.3 ohm resistance. Calculate the voltage between the far end of the feeder and the bus bar at a current of 100 A.[8+8]

2. (a) Explain different types of dc motors with suitable diagrams.

   (b) Define back emf and explain its importance in the operation of dc motor.

   (c) Give different losses present in the dc motor. [6+6+4]

3. (a) What is an ideal transformer. Draw the no load phasor diagram of transformer.

   (b) The maximum flux density in the core of 240/2400V, 50Hz, single phase transformer is 1.0Wb/sq.m. If the emf per turn is 8 Volts, determine:

   i. the primary and secondary turns and

   ii. area of the core. [8+8]

4. (a) Describe the method of calculating regulation and efficiency of a 1- φ transformer by open circuit and short circuit tests.

   (b) A 200/400V, 50Hz, 1- φ transformer has the following test data

O.C. Test:	200V	0.7A	70 W -on L.V.Side
S.C Test:	15V	10A	85 W -on H.V.Side

   Calculate the secondary voltage when delivering 5kW at 0.8lag. V1=200V. [6+10]

5. (a) Explain how the revolving field is set up in a 3 - phase induction motor.

   (b) A 3 - phase, 20 pole induction motor is connected to a 600V, 60Hz source:

   i. What is synchronous speed?

   ii. If the voltage is reduced to 300V, will the synchronous speed change?

   iii. How many groups are there per phase? [8+8]

6. (a) What is an alternator?

   (b) Explain the alternatorconstruction with neat sketch. [4+12]

7. (a) Explain the two winding revolving field theory of a 1-φ induction motor.

   (b) Mention the devices used to produce starting torque in the above mentioned motors. [8+8]

8. (a) Explain the extension method of ammeters and voltmeters with diagrams.

   (b) Mention the main merits and demerits of moving coil instruments. [8+8]

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1. (a) A dc machine fails to excite. List the various causes for this phenomenon.

   (b) A 6 pole dc generator has a simplex wave winding with 144 coils of 10 turns each. The speed is 200 rpm and resistance of each turn is 0.01 ohm. The armature is 50 cm long, 50 cm in diameter. The flux density in the air gap is 0.6 wb/m_2 and each pole subtends an angle of 120 degrees.

   i. How many current paths are there in the winding?

   ii. Find the generated emf

   iii. Find the resistance of armature winding. [6+10]

2. (a) A 4 pole motor is fed at 440V and takes an armature current of 50A. The resistance of the armature circuit is 0.28 Ω. The armature winding is wave connected with 888 conductors and the useful flux per pole is 0.023 wb. Calculate the speed.

   (b) A motor runs from a 460V supply at 900 rpm. Calculate the approximate speed when the machine is connected across a 200V supply. Assume the new flux to be 0.7 of the original flux.[8+8]

3. (a) Give different types of transformers and explain them in detail.

   (b) Explain the operation of transformer on load which has resistance which leakage reactance on both the windings.[8+8]

4. A 100 kVA single phase transformer has N_1 =400, N_2 =80, R_1 =0.3Ω, X_1 =1.1 Ω, R_2 = 0.01 Ω, X_2 =0.035 Ω. The applied voltage is 2200V. Find

   (a) Total impedance as referred to primary

   (b) Voltage regulation and output-voltage at 0.8 lagging power factor.

   (c) Voltage regulation and output-voltage at 0.8 leading power factor. [16]

5. (a) Derive the relationship between the rotor copper losses and rotor input in a 3 phase induction motor.

   (b) A 40 H.p, 3 phase induction motor has a full load slip of 4%. The stator losses amount to 4% of the input and the mechanical losses are 1% of the output. If the current in each rotor phase is 50A, find the resistance per phase of the rotor and the efficiency of the machine.[8+8]

6. (a) What is the basic principle of an alternator?

   (b) Derive the e.m.f. equation of an alternator. [8+8]

7. (a) Explain the schematic diagram of a 2 phase AC servo motor.

   (b) Differentiate the torque-speed characteristics of a normal induction motor and AC servo motor. [8+8]

8. (a) Explain the deflecting torque in moving coil instruments.

   (b) A moving coil ammeter has a fixed shunt of 0.02 ohms with a coil circuit resistance of r=1 kilo ohm and need potential difference of 0.5 V across it for full scale deflection.

   i. To what total current does this correspond?

   ii. Calculate the value of shunt to give full scale deflection when the total current is 75A. [8+8]