Code No: RR211001 **Set No.1**

II B.Tech. I Semester Regular Examinations, November -2005
ELECTRICAL TECHNOLOGY
(Common to Electronics & Instrumentation Engineering, Bio-Medical Engineering and Electronics & Control Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Explain the constructional features of a D.C. Machine with the help of a neat sketch.
   (b) Name the main parts of a D.C. Machine and state the materials of which each part is made.
   (c) Explain different methods of excitation of D.C. Generators with suitable diagrams. [10+3+3]

2. (a) Deduce the condition for maximum efficiency of a D.C. Generator.
   (b) What do you understand by Constant losses in a D.C. Machine.
   (c) A shunt generator has a full load current of 195A at 250V. The stray losses are 720W and the shunt field coil resistance is 50Ω. It has a full load efficiency of 90%. Find the armature resistance. Also find the current corresponding to maximum efficiency. [5+3+8]

3. (a) Derive the e. m. f. equation of a single-phase transformer and draw the no-load phaser diagram.
   (b) A 40 kVA transformer with ratio of 2000 / 250 V has a primary resistance of 1.15Ω and a secondary resistance of 0.0155Ω. Calculate
      i. the total resistance interms of secondary winding,
      ii. the total resistance drop on full load, and
      iii. the total copper loss on full load. [8+8]

4. Describe the exact and approximate equivalent circuit of a single-phase transformer. Also describe experiments to obtain the parameters of the equivalent circuits. [16]

5. (a) With usual notation deduce the expression for starting torque of a 3-phase induction motor.
   (b) The rotor of a 3-phase induction motor has 0.04Ω resistance per phase and 0.2Ω standstill reactance per phase. What external resistance is required in the rotor circuit in order to get half of the maximum torque at starting? Neglect stator impedance. By what percentage will this external resistance change the current and pf at starting? [8+8]

6. (a) Explain the tests to be conducted for determining synchronous impedance.

(b) A 100KVA, 6.6KV, 3phase star connected synchronous generator has a synchronous reactance of 25 ohm per phase. It supplies full load current at 0.75 p.f lagging and a rated terminal voltage. Compute the terminal voltage for the same excitation when the generator supplies full load current at 0.8 p.f leading. [8+8]

7. (a) Explain why a synchronous motor doesn't have self-starting torque. Explain one method of starting a synchronous motor.

   (b) A 3phase, 3300v, star connected synchronous motor has a synchronous reactance of 5ohm per phase. The input to the motor is 1000kw at a normal voltage and the induced line e.m.f is 4000v.Calculate the line current. Neglect armature resistance. [8+8]

8. (a) Explain the operation of a single phase induction motor on the basis of double revolving field theory.

   (b) Draw a typical torque-speed curve of a single-phase induction motor on the basis of double revolving field theory. [8+8]

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1. (a) State the reasons for a self exited DC shunt generator to fail to build up voltage, and suggest the necessary modifications.
   (b) Explain the importance of critical field resistance and how it can be determined.
   (c) A 4-pole generator having wave-wound armature winding has 48 slots each slot contains 20 conductors. What will be the voltage generated in the machine when driven at 1,500rpm assuming the flux per pole to be 7.0 mWb? [7+3+6]

2. (a) Compare the different methods of speed control of a D.C. Shunt Motor?
   (b) What is the application of divertors provided D.C. Motors?
   (c) A 250V shunt motor has an armature current of 20A when running at 1000rpm against full-load torque. The armature resistance is 0.5Ω. What resistance must be inserted in series with the armature to reduce the speed to 500rpm at the same torque, and what will be the speed if the load torque is halved with this resistance in the circuit. Assume the flux to remain constant throughout and neglect brush contact drop. [4+4+8]

3. (a) Discuss the constructional features of transformers. Draw neat diagrams.
   (b) Calculate the flux in the core of a single-phase transformer having a primary voltage of 230 V, at 50 Hz and 50 turns. If the flux density in the core is 1Tesla, calculate the net cross-sectional area of the core. [8+8]

4. (a) Describe the method of calculating regulation and efficiency of a single-phase transformer by open circuit and short circuit tests.
   (b) Obtain the equivalent circuit of a 200 / 400 V, 50 Hz, single phase transformer from the following test data:

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

   Also calculate the secondary voltage when delivering 5 kW at 0.8 lag. $V_1 = 200V$. [8+8]

5. (a) Explain various power stages of a 3-phase induction motor.
   (b) A 3-phase induction motor with r2 / x2 = 0.5, has a starting torque of 25.0 Nm. For negligible stator impedance and no-load current, determine the starting torque in case the rotor-circuit resistance per phase is

i. doubled
ii. halved. [6+10]

6. (a) Draw a neat sketch showing the various parts of a synchronous machine and explain each part briefly.
   (b) A 3ph, 50 Hz, 20 poles Salient pole alternator with star connected stator winding has 180 slots on the stator. Each slot consists of 8 conductors. The flux per pole is 25mwb and is sinusoidally distributed. The coils are full pitch.

   Calculate

   i. the speed
   ii. the generated e.m.f per phase and
   iii. the line e.m.f. [8+8]

7. (a) Explain why a synchronous motor doesn't have self-starting torque. Explain one method of starting a synchronous motor.
   (b) A 3phase, 3300v, star connected synchronous motor has a synchronous reactance of 5ohm per phase. The input to the motor is 1000kw at a normal voltage and the induced line e.m.f is 4000v.Calculate the line current. Neglect armature resistance. [8+8]

8. (a) Discuss the differences between capacitor start. Capacitor run and permanent split capacitor motors.
   (b) A small motor has an output torque of 0.25 N.m and a speed of 100 rad/sec. If the input current is 0.6 A at 230 V and 0.6 lagging p.f find

   i. output power in watts
   ii. efficiency. [10+6]

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Code No: RR211001 **Set No.3**

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Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Explain the constructional features of a D.C. Machine with the help of a neat sketch.
   (b) Name the main parts of a D.C. Machine and state the materials of which each part is made.
   (c) Explain different methods of excitation of D.C. Generators with suitable diagrams. [10+3+3]

2. (a) Why is starter necessary for a DC motor.
   (b) Explain the working of a 3-point starter with a circuit diagram for a DC shunt motor.
   (c) A 230V shunt motor has an armature resistance of 0.2Ω. The starting armature current must not exceed 50A. If the number of sections are 5, calculate the values of resistance steps to be used in the starter. [3+7+6]

3. (a) Explain the principle of operation of a single-phase transformer when it supplies lagging power factor load. Draw the phasor diagram under this condition.
   (b) A 4 kVA, 200 / 400 V, 50 Hz, transformer gave the following the test figures:

No Load:	Low voltage data:	200 V	0.7 A	60 W
Short Circuit:	High voltage data:	9 V	6A	21.6 W

   Calculate the magnetizing current and component corresponding to iron loss at normal voltage and frequency. Find the efficiency on full load at unity power factor. Also determine the regulation at half-full load 0.707 leading power factor. [8+8]

4. (a) Obtain the equivalent circuit of a 1-phase transformer from the fundamentals? What are the assumptions made to obtain approximate equivalent circuit?
   (b) A 20-kVA transformer has its maximum efficiency of 0.98 at 15kVA at upf. The iron loss is 350 W. Calculate the efficiency at full load 0.8 p f lag and upf. [8+8]

5. (a) Sketch torque-speed characteristics of an induction motor working at rated voltage and frequency, deriving necessary expressions.

(b) A 3-phase, 50 Hz, 400 V, wound-rotor induction motor runs at 960 r.p.m. at full-load. The rotor resistance and standstill reactance per phase are 0.2Ω *and* 1Ω respectively. If a resistance of 1.8Ω is added to each phase of the rotor at standstill, what would be the ratio of starting torque with full voltage and the added resistance to the full-load torque under normal running conditions? [8+8]

6. (a) Draw a neat sketch showing the various parts of a synchronous machine and explain each part briefly.

   (b) A 3ph, 50 Hz, 20 poles Salient pole alternator with star connected stator winding has 180 slots on the stator. Each slot consists of 8 conductors. The flux per pole is 25mwb and is sinusoidally distributed. The coils are full pitch.

   Calculate

   i. the speed
   ii. the generated e.m.f per phase and
   iii. the line e.m.f. [8+8]

7. (a) A 3-ϕ, 6600v; 50Hz; Y connected synchronous motor takes 50 A current. The resistance and synchronous reactance per phase are 1 ohm and 20Ω respectively. Find the power supplied to the motor and induced e.m.f. for a powerfactor of

   i. 0.8 lagging and
   ii. 0.8 leading.

   (b) Derive expressions for distribution factor and pitch factor. [8+8]

8. (a) Draw a diagram showing the construction of a stepper motor and discuss its operation.

   (b) Discuss the various applications of stepper motor. [10+6]

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Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Explain the constructional features of a D.C. Machine with the help of a neat sketch.
   (b) Name the main parts of a D.C. Machine and state the materials of which each part is made.
   (c) Explain different methods of excitation of D.C. Generators with suitable diagrams. [10+3+3]

2. (a) With the help of neat sketches, explain torque-speed characteristics of the
      i. D.C. Series
      ii. D.C. Shunt motors.
   (b) Find the torque in N-m exerted by a 4-pole series motor whose armature has 1200 conductors connected up in a 2-circuit winding. The motor current is 10A and the flux per pole is 0.02Wb. [8+8]

3. Discuss the constructional details of single-phase transformer and hence obtain the expression for induced e. m. f. of transformer. [16]

4. (a) Define efficiency of a transformer. Obtain the condition for maximum efficiency.
   (b) A 25 kVA, 2500 / 250 V, single-phase transformer gave the following test results.

O.C. test (LV side):	250 V	1.4A	105 Watts
S.C. test (HV side):	105V	8A	320 Watts

   Compute the equivalent circuit parameters referred to LV side and HV side. Also obtain percentage regulation at full load with 0.8 power factor lagging.

   [8+8]

5. (a) Explain the Autotransformer starters used in induction motors. What are its advantages?
   (b) A 200 kW, 3300 V, 6-pole, 50 Hz star-connected slip-ring induction motor has a star connected rotor. Stator to rotor turns ratio is 3.2. Rotor resistance and leakage reactance are 0.1Ω *and* 1Ω respectively. Neglect stator impedance. Find

i. current and torque at starting on rated voltage and with slip rings short circuited and

ii. the external resistance required to reduce the starting current to 50 A with across-the-line starting.

Compute also the starting torque under these conditions. [8+8]

6. (a) Define voltage regulation of an alternator. Explain synchronous impedance method of determining regulation of an alternator.

   (b) Calculate the voltage induced per phase in a 3phase 50 Hz, alternator having a flux per pole of 0.1515 wb. The no. of conductors in series are 360. Assume full pitch coil with a distribution factor of 0.96. [8+8]

7. (a) Explain the principle of operation of synchronous motors.

   (b) A 3-phase alternator is rated at 5 KVA, 110V, 26.3A, 50 Hz and 1200 r.p.m. The stator resistance between terminals as measured with dc is 0.2 ohm. With no load and rated speed the stator line voltage is 160V for a field current of 4A.At rated speed, the short circuit stator current per terminal is 50A for a field current of 4A.compute voltage regulation of alternator at 0.8 p.f. Lagging. Using synchronous impedance method. [8+8]

8. (a) Discuss the differences between capacitor start. Capacitor run and permanent split capacitor motors.

   (b) A small motor has an output torque of 0.25 N.m and a speed of 100 rad/sec. If the input current is 0.6 A at 230 V and 0.6 lagging p.f find

   i. output power in watts

   ii. efficiency. [10+6]

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