Code No: RR220402 **Set No. 1**

II B.Tech II Semester Regular Examinations, Apr/May 2006
ELECTRICAL TECHNOLOGY
(Common to Electronics & Communication Engineering, Computer Science & Engineering, Information Technology, Computer Science & Systems Engineering, Electronics & Telematics, Electronics & Computer Engineering and Instrumentation & Control Engineering)

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

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Sketch the Magnetisation and Load characteristics of a D.C. shunt Generator? Explain them.
   (b) The open-circuit characteristic of a shunt generator at 800rpm gives:

Field Current (A)	0	0.5	1.0	2.0	3.0	4.0	5.0
Induced emf (V)	10	50.0	100.0	175.0	220.0	245.0	262.0

   Find graphically the critical resistance of shunt field circuit. If the field circuit resistance is changed to 75Ω, what will be the critical speed for the machine to build up. [8+8]

2. (a) Explain various power stages of in a D.C. Motor.
   (b) What will happen when a D.C. Series Motor is started without a load connected to it?
   (c) A 200V d.c. series motor runs at 750 rpm when taking a current of 30A. The resistance of the armature is 0.5Ω and that of field is 0.3Ω. If the current remains constant, calculate the resistance necessary to reduce the speed to 250rpm. [4+4+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) Explain how the equivalent circuit parameters can be obtained from open circuit and short circuit tests.
   (b) A 300 kVA, 11000 / 440 V, single phase, 50 Hz, transformer gave the following test results. Open circuit test on LV side a normal voltage and frequency input 1.3 kW, 4 Amps; short circuit test HV side with voltage 600 V, input 2.80 kW, 15.0 amps. Calculate the efficiency and regulation for full load at 0.8 p f lagging. [8+8]

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 synchronous impedance method of computing the voltage regulation.

   (b) A 3 phase, 12 pole, star connected alternator has 180 slots with 10 conductors per slot and the conductors of each phase are connected in series. The coil span is 144 degrees (electrical). Determine the phase and line value of e.m.f. If the machine runs at 1600 r.p.m and the flux per pole is 0.06 Weber distributed sinusoidally over the pole. [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: RR220402 **Set No. 2**

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

Answer any FIVE Questions
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1. (a) Why brushes and commutator are necessary for operation of a D.C. Machine.
   (b) How D.C. Generators are classified?
   (c) The armature of a 6-pole d.c. generator has a wave winding containing 664 conductors. Calculate the generated e.m.f. when flux per pole is 0.06 weber and the speed is 250rpm. At what speed must the armature be driven to generate an e.m.f. of 250V if the flux per pole is reduced to 0.058 weber? [5+5+6]

2. (a) What are all the various losses in a D.C. Machine?
   (b) A series motor of resistance 1 ohm between terminals runs at 1,000rpm at 250Vwith a current of 20A. Find the speed at which it will run when connected in series with a 6Ω resistance and taking the same current at the same supply voltage.
   (c) Derive an expression for efficiency of a D.C. Machine. [4+8+4]

3. (a) Draw the phasor diagram of a 1-phase transformer with lagging loads. Explain.
   (b) A 1-Q, 440/220V, 5 KVA, 50Hz transformer, draws a no-load current of 0.8A at a.p.f of 0.25 lag on h.v side. Determine the magnitising component, careless component, emf / turn as either side and the primary current when the secondary current is 18A at a p.f. of 0.9 lag. [6+10]

4. (a) Obtain an expression for the regulation of a single-phase transformer from its equivalent circuit / phasor diagram.
   (b) A 20 kVA, 2500 / 250 volts, 50 Hz, 1-phase transformer gave the following test results:

O.C. test(L.V. side):	250 V	1.4 A	105 W
S.C. test (H.V. side):	104 V	8 A	320 W

   Compute the parameters of the approximate equivalent circuit referred to L.V. [6+10]

5. (a) Sketch the torque-speed curve of an induction motor and indicate how this will change when the rotor resistance is doubled keeping stator voltage and frequency unchanged.

(b) A 3-phase star-connected, 440 V, 50 Hz, 4-pole induction motor has the following constants in ohms per phase referred to stator side $r_1 = 0.294$, $x_1 = 0.503$, $r_2 = 0.144$, $x_2 = 0.209$. The stator core losses are negligible. Total friction and other losses (assumed constant) = 1400 W. Find the power output in kW and the rated output in Nm if the motor is being operated at rated voltage and frequency with 5 percent slip. [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) Explain the working principle of the synchronous motor on no load and on load with the help of phasor diagrams.

(b) A 3 phase, 44 V, 50 Hz star connected synchronous motor develops 7.4 kW. The effective resistance per phase of the stator winding is 0.5 ohm. The motor operates at power factor of 0.75 lagging. Iron and mechanical losses amount to 500W and the excitation loss is 650W.

Calculate

i. armature current
ii. efficiency of the motor. [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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Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
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1. (a) Sketch the symobilic representation following types of D.C. Generators
   i. Shunt
   ii. Series and
   iii. Compound
   (b) State with reason the area of application of various D.C. Generator is used?
   (c) A 4-pole machine running at 1000rpm has an armature with 90 slots having 6 conductors per slot. The flux per pole is $6X10^{-2}Wb$. Determine the induced emf as a D.C. Generator if the coils are lap connected. If the current per conductor is 50 amperes, determine the electrical power output of the machine. [3+4+9]

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) Draw the phasor diagram of a transformer on
   i. no load,
   ii. full load with inductive load and explain.
   (b) A 1-phase transformer is supplied 6000 V. The terminal voltage on the secondary side when loaded at power factor 0.8 is 254 V. The equivalent resistance and reactance drops are 1 and 5%. Find the turn ratio. [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) 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) Compare $3-\phi$ induction motor with $3-\phi$ synchronous motor if any four aspects.

(b) The input to an 1100 V, 3 phase star connected synchronous motor is 60 A. The effective resistance and synchronous reactance per phase is 1 ohm and 30 ohm respectively. Find the power supplied to the motor and the induced e.m.f for a power factor of 0.95 leading. [6+10]

8. (a) Discuss the function of an a.c.tacho.meter. Explain its construction and operations.

(b) What are the applications of stepper motor and synchros? [10+6]

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Code No: RR220402 **Set No. 4**

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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) What is the difference between the short-shunt and long-shunt Compound Generators?
   (b) What is the function of an armature in a D.C. Generator.
   (c) Enumerate the conditions necessary for self excitation of a D.C. Generator.
   (d) A 20 kw, 200V shunt generator has an armature resistance of 0.05Ω and a shunt field resistance of 200Ω. Calculate the power developed in the armature when it delivers rated output. [3+3+4+6]

2. (a) State the reasons for drop in speed of a D.C. shunt motor when it is loaded.
   (b) Explain why a D.C. series motor is best suited for electric traction applications.
   (c) Explain why a D.C. shunt motor can be referred as Constant Speed Motor.
   (d) 250 V d.c. shunt motor takes 41 A at full load. Resistances of motor armature and shunt field windings are 0.1Ω and 250Ω respectively. Find the back emf on full load. What will be its generated emf, if working as generator and supplying 41A to load at terminal voltage of 250 V? [3+3+2+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) Explain how the equivalent circuit parameters can be obtained from open circuit and short circuit tests.
   (b) A 300 kVA, 11000 / 440 V, single phase, 50 Hz, transformer gave the following test results. Open circuit test on LV side a normal voltage and frequency input 1.3 kW, 4 Amps; short circuit test HV side with voltage 600 V, input 2.80 kW, 15.0 amps. Calculate the efficiency and regulation for full load at 0.8 p f lagging. [8+8]

5. (a) With a neat sketch, explain the construction of a 3-phase induction motor.
   (b) 3-phase, 4-pole, 1440 rpm, 50 Hz induction motor has star-connected rotor winding, having a resistance of 0.2Ω per phase and a standstill leakage reactance of 1Ω per phase. When the stator is energised at rated voltage and frequency, the rotor-induced e.m.f at standstill is 120 V per phase.

i. calculate the rotor current, rotor power factor and torque both at starting and at full load and compare these results

ii. If an external resistance of 1 ohm per phase is inserted in rotor circuit, calculate rotor current, rotor power factor and torque at the time of starting.

[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) Explain the principle of working of synchronous motor.

   (b) A 3 phase, 1385 V star connected synchronous motor having synchronous reactance of 2ohm per phase and negligible resistance takes an input of 207.8 kw with an induced e.m.f of 916.5V per phase. Calculate the motor line current and its power factor. [8+8]

8. (a) Describe the construction and working principle of shaded pole induction motor.

   (b) Enumerate the applications of

   i. $1-\phi$ capacitor start and run induction motor and

   ii. shaded pole induction motor. [10+6]

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