II B.Tech II Semester Supplementary Examinations,
November/December 2005
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) 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) 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. 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) Explain the principle of rotating magnetic field and hence prove that it is of constant magnitude and rotates at synchronous speed.
   (b) A 3-phase, 4 pole 50 Hz induction motor has a full-load speed of 1440 r.p.m. For this motor, calculate the following
      i. full-load slip and rotor frequency
      ii. speed of stator field with respect to
         A. stator structure and
         B. rotor structure and

iii. speed of rotor field with respect to
   A. rotor structure
   B. stator structure and
   C. stator field. [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) 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) 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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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) 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) What are the transformer tests? Explain.
   (b) Calculate the efficiencies at half-full and $1\frac{1}{4}$ load of a 100kVA transformer for power factors of
      i. unity;
      ii. 0.8, the copper loss is 1000W at full load = iron loss. [10+6]

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) A 6-pole 3-phase, 50 Hz alternator has 12 slots per pole and four conductors per slot. The winding is five-sixths pitch. The flux per pole is 1.5wb; the armature coils are all connected in series. The winding is star connected. Calculate the induced e.m.f per phase.

   (b) A 3-phase, 10KVA, 400V, 50 Hz alternator has per phase armature resistance and synchronous reactance of 0.5ohm and 2.5 ohm respectively. Calculate the generated voltage corresponding to

      i. full load unity power factor

      ii. full load 0.85 lagging power factor. [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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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) From the first principles, derive an equation for torque developed in a D.C. Motor.
   (b) A 20kw, 250V d.c. shunt generator has armature and field resistances of 0.04Ω and 200Ω respectively. Determine the total armature power developed when working.
   i. as generator delivering 20kw output and
   ii. as a motor taking 20kw input. [8+8]

3. (a) Draw the phasor diagram of transformer under loaded conditions.
   (b) Explain the principle of working of 1-Phase transformer on no-load conditions. Also explain the nature of no-load current. [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) 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) Derive e.m.f equation for an alternator and explain distribution factor and pitch factor used in e.m.f. Equation.

   (b) Write the expression showing the relationship between speed frequency and no. of poles of a synchronous machine. The speed of rotation of the turbine driving an alternator is 166.7 r.p.m. What should be the no. of poles of the alternator if it is to generate voltage 50HZ. [10+6]

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) Give the description of A.C tachometer and mention its applications.

   (b) Write a short note on shaded pole type servo-motor. [8+8]

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

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Answer any FIVE Questions
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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) 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) 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) Define slip. Hence deduce the expression for
      i. Frequency of rotor current
      ii. Rotor induced e.m.f under running condition of a 3-phase induction motor.

(b) A 60 kW, 400 V, 3-phase, 6-pole, 50 Hz wound rotor induction motor has a full-load slip of 0.04 when operating at rated voltage and frequency with rotor winding short circuited at slip rings. The slip at maximum torque is 0.2. Stator resistance and rotational losses are neglected. Determine

i. the maximum torque and

ii. full-load rotor ohmic losses. Rotor resistance is now doubled by adding external series resistance in each rotor phase. For the rated power output, determine

iii. slip at maximum torque

iv. full-load slip and

v. full-load torque. [8+8]

6. (a) Discuss in details the predetermination of regulation of an alternator from the open circuit and short circuit tests.

(b) A 2000 V, single-phase alternator was tested on open circuit and short circuit. The details of which are as fallows:
A field current of 2.5A produced a short circuit current of 100 A. With open circuit, the same field current generated an e.m.f of 500V. The effective resistance of the armature is 0.8 ohm. Calculate the regulation at full load current of 100A

i. at a power factor of 0.75 lagging

ii. at a power factor of 0.65 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) 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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