Code No: 07A3EC13 **Set No. 1**

II B.Tech I Semester Regular Examinations, November 2008
ELECTRICAL TECHNOLOGY
(Common to Electronics & Communication Engineering, Electronics & Instrumentation Engineering, Bio-Medical Engineering, Electronics & Control 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) Derive the equation for induced emf of a dc machine.
   (b) Discuss the process of self excitation in a dc machine. What conditions must be fulfilled for self excitation? [8+8]

2. (a) Explain the principle of operation of dc motor using suitable diagram.
   (b) A 220V series motor runs at 800 rpm, when taking a current of 15 A. The motor has $R_a = 0.3\Omega$ and $R_f = 0.2\ \Omega$. Find the resistance to be connected in series with armature if it has to take the same current at the same voltage at 600 rpm. Assume flux is proportional to current. [8+8]

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) With neat circuit diagrams, explain the procedure for conducting OC and SC tests on a given single - phase transformer to determine the regulation for lagging and leading power factors.
   (b) A 100 kVA transformer has iron losses of 1.2 kW and full load copper losses of 1.5kW. Find
      i. the kVA for maximum efficiency
      ii. maximum efficiency. [8+8]

5. A 440V, 4pole, 50 Hz, 3-phase stator connected slip ring induction motor has a voltage of 80V between the slip rings when full voltage is applied to the stator and the slip rings are open circuited with the rotor stationary. The stator current is 2A at a power factor of 0.2 lagging. The resistance and stand still reactance per phase of the rotor winding are 0.05 and 0.25 ohms respectively. The rotor winding is star connected. For the motor running with slip rings short circuited and a slip of 5% determine:
   (a) The mechanical power developed
   (b) Rotor copper losses

(c) Stator current and power factor. (Neglect the stator resistance and reactance) [4+4+8]

6. (a) Explain the synchronous impedance method of regulation with vector diagram.

   (b) Find the synchronous impedance and reactance of an alternator in which a given field current produces an armature current of 200 A on short circuit and a generated e.m.f. of 50V on open circuit. The armature resistance is 0.1 ohm. To what induced voltage must the alternator be excited if it is to deliver a load of 100 A at a pf of 0.8 lagging, with a terminal voltage of 200 V. [8+8]

7. (a) Explain why the value of motor time constant is zero on no-load of a servo motor.

   (b) A capacitive start motor does not run when the breaker is closed; It hums loudly and starts to smoke. If the breaker is closed while the shaft is rotated by hand however the machine comes up to speed and operates properly. Explain the probable faults. [16]

8. (a) Explain the working of attracted disc type voltmeter with neat sketch. [8+8]

   (b) How will you use a PMMC instrument which gives full scale deflection at 50 mV p.d. and 10 mA current as

      i. Ammeter: 0-10A range

      ii. Voltmeter: 0-250V range.

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Code No: 07A3EC13 **Set No. 2**

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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) Develop from first principles an expression for the emf of a dc generator.
   (b) The wave connected armature of a four pole dc generator is required to generate an emf of 520V when driven at 600 rev/min. Calculate the flux per pole required if the armature has 144 slots with two coil sides per slot, each coil consisting of 3 turns. [8+8]

2. (a) Explain the internal and external characteristics of dc shunt motor.
   (b) Why starter is necessary for an operation of dc motor? Also explain the different protective devices used in 3 - point starter. [6+10]

3. (a) Explain with a neat sketches the constructional details of:
      i. core type transformer and
      ii. shell type transformer
   (b) The primary winding of a 50Hz single phase transformer has 500 turns and is supplied from 3300V supply. The secondary winding has 50 turns. Find peak value of the flux in the core and the secondary voltage. [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) Prove that in a 3 phase induction motor

   $\frac{Starting\ torque}{Maximum\ torque} = \frac{2\alpha}{1+\alpha^2}$ Where α is the ratio of resistance to rotor stand still reactance per phase.
   (b) A 3300V, 24 poles, 50Hz 3phase star connected induction motor runs at 247 rpm, while supplying full load torque. Rotor resistance and stand still reactance per phases are 0.016 and 0.265 ohms respectively. Find out:

i. Speed at maximum torque and
ii. Ratio of full load torque to maximum torque. [8+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. (a) Explain the operation of single phase induction motor on the basis of :
      i. double revolving field theory
      ii. Cross field theory
   (b) The following test results were obtained in case of 220V, 1-ϕ induction motor
      i. No load test: 220V, 5.8A, and 310watts
      ii. Locked rotor test: 120V, 13.8A, 530watts
      iii. Stator winding resistance is 1.4 ohms. Determine the approximate equivalent circuit of the motor. [8+8]

8. (a) Describe the construction and working of PMMC instrument.
   (b) Derive the equation for deflection if the instrument is controlled.
   (c) Describe the method of damping used in these instruments. [5+5+6]

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Code No: 07A3EC13 **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) Define the terms 'critical resistance' and 'critical speed' and bring out their role in the process of self excitation of a dc machine.
   (b) Distinguish between external and internal characteristics of dc generator. How internal characteristics are derived from external characteristics of shunt generator? [8+8]

2. (a) Explain the different protective devices used in 3 - point starters.
   (b) Explain the method of armature voltage speed control using neat diagram. [8+8]

3. (a) Explain the principle of operation of a transformer.
   (b) The maximum flux density in the core of 240/2400V, 50Hz, 1- ϕ transformer is 1.0Wb/sq.m. If the EMF per turn is 16 volts, determine:
      i. the primary & secondary turns and
      ii. area of the core. [8+8]

4. (a) A 20 kVA transformer has its maximum efficiency of 0.98 at 15 kVA at upf. The iron loss is 350W. Calculate the efficiency at full load, for 0.8 p.f lag and upf.
   (b) With neat circuit diagrams, explain the procedure for conducting OC & SC tests on a given 1- ϕ transformer to predetermine its regulation & efficiency. [8+8]

5. (a) Draw the diagram of connections of a plain auto transformer starter for an induction motor and explain its action.
   (b) A 25hp, 3-phase, 50 Hz, 6 pole slip ring induction motor has a full load speed of 960rpm. The stator loss is 5% of the input and mechanical losses are 4% of the output. The current in each rotor phase is 30 A. Find the resistance per phase of the rotor and the efficiency of the motor. If the rotor standstill resistance is five times the rotor reactance, find the speed at which the maximum torque occurs. [8+8]

6. (a) Explain the alternator armature winding types with neat sketches.

(b) An alternator on open circuit generates 360V at 60Hz when the field current is 3.6A. Neglecting saturation, determine the open circuit e.m.f. When the frequency is 40Hz and the field current is 2.4A. [8+8]

7. (a) What are the different types of capacitor start motors? Explain in detail any one type.

(b) A 250W, 230V, 50Hz capacitor start motor has the following constants for the main and auxiliary windings: Zm=(4.5+j3.7)ohms. Za=(9.5+j3.5)ohms. Determine the value of the starting capacitor that will place the main and auxiliary winding currents in quardrature at starting. [8+8]

8. The coil of a moving coil voltmeter is 40mm long and 30mm wide and has 100 turns on it. The control spring exerts a torque of 240×10^{-6} N-m. When the deflection is 100 divisions on full scale and the flux density of the magnetic field in the air gap is 1.0 Wb/m^2, estimate the resistance that must be put in series with the coil to give one volt per division. The resistance of the voltmeter coil may be neglected. [16]

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Code No: 07A3EC13 **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) With reference to OCC of a dc generator, explain the following:
   i. Why is the emf not zero when field current is zero?
   ii. Will the residual flux induce a voltage in the machine, if speed of the machine is zero
   iii. Why does the slope of the curve change, after a certain value of field current?

   (b) A 4 pole generator has 48 slots and 8 conductors per slot. The useful flux per pole is 30mWb and speed is 800 rpm. Find the generated emf, if the machine is wave connected. [9+7]

2. (a) Explain the principle of operation of dc motor with suitable diagram.

   (b) What are the different methods of speed control of dc shunt motor and explain any one of them in detail. [8+8]

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

   (b) The primary winding of a 50Hz, 1- ϕ transformer has 500 turns and is supplied from 3300V supply. The secondary winding has 50 turns. Find the peak value of the flux in the core and the secondary voltage. [8+8]

4. (a) A 25 kVA, 2500/250V, 1- ϕ transformer gave the following test figures:

O.C Test (LV Side):	250V	1.4A	105W
S.C Test (HV Side):	105V	8A	320W

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

   (b) Define efficiency of a transformer. Obtain the condition for maximum efficiency. [10+6]

5. (a) Explain briefly about principle of operation of 3-phase induction motor

   (b) A 4 pole, 3 - phase induction motor operates from a supply whose frequency is 50 Hz. Calculate

i. The speed at which the magnetic field of the stator is rotating.
ii. The speed of the rotor when the slip is 0.04.
iii. The frequency of the rotor current when the slip is 0.03.
iv. The frequency of the rotor current at stand still. [8+8]

6. (a) Draw the vector diagrams of a loaded alternator.
   (b) A 60 KVA, 220V, 50Hz, 1-ϕ alternator has effective armature resistance of 0.016 ohms and an armature leakage reactance of 0.07ohms. Compute the voltage induced in the armature when the alternator is delivering rated current at a load power factor of unity. [8+8]

7. (a) Explain how a capacitor-start split phase induction motor develops a rotating magnetic field.
   (b) An experimental 120V, 1/4hp ,60Hz split phase motor has the following locked rotor parameters referred to the main and the auxiliary windings.
   Rmax=3.94ohms Xmw=4.20ohms
   Raw=8.42ohms Xaw=6.28ohms
   Determine:
   i. Locked rotor current drawn by each winding
   ii. Line current at locked rotor. [8+8]

8. (a) Describe the general requirements for a material to be used for shunts for ammeters and multipliers for voltmeters for PMMC instruments.
   (b) What are the commonly used materials and describe their properties as regards to their suitability to be used for shunts or multipliers. [8+8]

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