BITS, PILANI – DUBAI
Academic City, Dubai

Semester II 2009 – 2010
III Year (EEE)-CDC
Comprehensive Examination

Course No.: EEE C 371 Course Title: Electromechanical Energy Conversion

Date: 26.05.2010 Time: 03 hrs M.M. = 60 (30 %)

Q1. Draw the phasor diagram for pure inductive load for a practical transformer.
An 80KVA, 2000/200V, 50 Hz, single phase transformer has impedance drop of 8% and resistance drop of 4%. Calculate % voltage regulation of the transformer at full load, 0.8 p.f lagging. **[4 + 6]**

Q2. Derive the maximum efficiency condition for a DC generator.
A Shunt generator delivers 50 KW at 250V and 400 rpm. The armature resistance is 0.02 Ω and field resistance is 50 Ω. Calculate the speed of the machine when running as a shunt motor and taking 50KW input at 250V. **[4 + 6]**

Q3. Derive the EMF equation of a DC Machine.
A 500V dc shunt motor runs at its normal speed of 250 rpm when the armature current is 200A. The resistance of the armature is 0.12 Ω. Calculate the speed when the resistance is inserted in field reducing the shunt field to 80% of normal value and armature current is 100A.
[4 + 6]

Q4. Draw the equivalent circuit of single phase IM at standstill and at rotor running conditions. A 3 phase, star connected, 400V, 50Hz, 4 pole IM has the following per phase parameters referred to the stator:
R1=0.15 Ω, X1 = 0.45 Ω, R2' =0.12 Ω, X2' = 0.45 Ω, Xm = 28.5 Ω
Calculate the stator current and pf when the motor is operated at rated voltage and frequency with slip of 4%. **[4 + 6]**

Q5. Derive the EMF equation of a synchronous machine.
A 3 phase, 10kVA, 400V, 50Hz, star connected alternator supplies the rated load of 0.8 pf lagging. If the armature resistance is 0.5 Ω/phase and synchronous reactance is 10 Ω/phase, find the voltage regulation and power angle, δ. **[4 + 6]**

Q6. Discuss how to get continuous unidirectional torque in Synchronous motor?
A 2kV, 3 phase, star connected motor has resistance and synchronous reactance as 0.2 Ω/phase and 1.9 Ω/phase respectively. Calculate the generated back emf per phase with an input of 800kW at 0.8 pf lagging.
[4 + 6]

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Test -2 (Open Book)

Course No.: EEE C 371 **Course Title:** Electromechanical Energy Conversion

Date: 09.05.2010 **Time: 50**Minutes **M.M. = 20** (10 %)

- ***Attempt all Questions, maintain the serial order.***
- ***Assume missing data, if any.***
- ***Only textbook and handwritten class notes in original are allowed.***

Q1. The 3-phase IM having star connected rotor has an induced EMF of 50 V between the slip rings at standstill on open circuit. The rotor has a resistance and reactance per phase of 0.5 Ohm and 4.5 Ohms respectively. Find the current per phase and power factor at starting when

(i) The slip rings are short circuited. [2]

(ii) The slip rings are connected to a star connected rheostat of 4 Ohm/phase. [2]

(iii) Justify the impact on starting Torque, if any. [1]

Q2. A 25 HP, 6 pole, 50 Hz SRIM runs at 960 rpm on full load with a rotor current of 35 A. Allowing 250 W for the copper loss in the short circuiting gear and 1000 W for mechanical losses, find the resistance per phase of the 3 phase rotor winding. [5]

Q3. The resistance of armature circuit of a 250V dc shunt motor is 0.3 Ω and its full load speed is 1000 rpm. Calculate the resistance required in series with the armature to reduce the speed with full load torque to 800 rpm, the full load armature current being 50A. If the load torque is then halved, at what speed will the motor run? The armature reaction effect is to be neglected. [5]

Q4. A 1500 KW, 550V, 16 pole DC generator runs at 150 rpm. What must be the useful flux/pole if there are 2500 conductors in the armature and the winding is lap connected and full –load armature copper loss is 25 KW? Calculate the area of the pole shoe if the air gap flux density has a uniform value of 0.9Wb/m^2. Also find the no –load terminal voltage. Neglect change in speed. [5]

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Semester II 2009 – 2010
III Year (EEE)-CDC

Test -1 (Closed Book)

Course No.: EEE C 371 **Course Title:** Electromechanical Energy Conversion

Date: 28.03.2010 **Time:** 50Minutes **M.M. = 30** (15 %)

- ***Attempt all Questions, maintain the serial order.***
- ***Assume missing data, if any.***

Q1. A 3-phase transformer, ratio 33/6.6 kV, Delta/Wye, 2 MVA has a primary resistance of 8 ohm per phase and secondary resistance of 0.08 ohm per phase. The percentage impedance is 7 %. Calculate the secondary load voltage with rated primary voltage and hence the regulation for full load 0.75 pf lagging conditions. **[4+4]**

Q2. Derive the EMF equation of a DC generator.
A shunt motor takes 5 A at 100 V when running light. Shunt field resistance is 50 ohm and armature resistance is 0.2 ohm. Find the iron and friction losses. If the motor is loaded and takes 52 A, what is the B H P? **[3 + 2 + 2]**

Q3. A 4 pole dc generator supplies a current of 100A. It has 365 conductors wave connected, when delivering full load, the brushes given an actual lead of 10 degree. Calculate demagnetizing AT/Pole. Field winding is shunt connected and takes 10A. Also calculate extra shunt field turns necessary to neutralize demagnetization. For Lap winding calculate AT/Pole and extra shunt field turns necessary. **[4 + 4]**

Q4. A 6 KVA distribution transformer has full load efficiency of 98% at which Cu loss is equal to iron loss. The transformer is loaded for 24 hours as under

No load: 10 hr	:	Half full load: 5 hr
¼ of full load : 7 hr	:	Full load : 2hr

Calculate All –day efficiency? **[7]**

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Semester II 2009 – 2010
III Year (EEE)-CDC

Quiz 2 (Closed Book)

Course No.: EEE C 371 **Course Title:** Electromechanical Energy Conversion

Date: 12.04.2010 **Time: 20**Minutes **M.M. = 10** (10 %)

1. The amount of back EMF of a shunt motor will increase when
   (i) The load is increased
   (ii) The field is strengthened
   (iii) The field is weakened
   (iv) none of the above

2. Carbon brushes are preferable to copper brushes because
   (i) they have longer life
   (ii) they reduce armature reaction
   (iii) they have lower resistance
   (iv) they reduce sparking

3. The mechanical power developed in a DC motor is maximum when back emf is equal to
   (i) Twice the applied voltage
   (ii) Half of the applied voltage
   (iii) One third of the applied voltage
   (iv) None of the above

4. A DC motor runs at 1725 rpm at full load and 1775 rpm at no load. The speed regulation is
   (i) 4.7 %
   (ii) 2.9 %
   (iii) 7.6 %
   (iv) 1.5 %

5. The speed of a DC motor can be controlled by changing
   (i) its flux
   (ii) armature circuit resistance
   (iii) applied voltage
   (iv) all of the above

6. For the same rating, a DC machine has _____ an AC machine
   (i) the same weight as
   (ii) more weight than
   (iii) les weight than
   (iv) none of the above

7. The field winding of a DC shunt machine usually carries _____ of the rated current of the machine.
   (i) 2 to 5 %
   (ii) 15 to 20 %
   (iii) More than 20 %
   (iv) Less than 0.5 %

8. Why is the efficiency of a DC generator not determined by direct loading?

9. Why is the resistance of the field winding of DC shunt generator kept below critical filed resistance?

10. Why a DC series motor used to start heavy loads?

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BITS, PILANI – DUBAI

SECOND SEMESTER 2009 – 2010

Course Code: EEE C371 | THIRD YEAR-EEE | Date: 22.02.2010
Course Title: EMEC | QUIZ -1 | Max Marks: 10
Duration: 20 minutes | Weightage: 5%

Q1. Derive the EMF equation of a single phase transformer. [3]

Q2. Draw the phasor diagram of an Ideal Transformer at no load. Also write the assumption made. [2]

Q3. Derive the condition for maximum efficiency in transformer. [3]

Q4. Define all day efficiency and name the type of transformer where we calculate all day efficiency. [2]