RN-8075

B. E. - II (Sem. III) Examination
May / June – 2010
Electrical Machines
(As per GTU Syllabus)

Time : **3** Hours]   [Total Marks : **100**

Instructions :

(1)

નીચે દર્શાવેલ ☛ નિશાનીવાળી વિગતો ઉત્તરવહી પર અવશ્ય લખવી.
Fillup strictly the details of ☛ signs on your answer book.
Name of the Examination :
☛ **B. E. - 2 (Sem. 3)**
Name of the Subject :
☛ **Electrical Machines**
☛ Subject Code No. : **8 0 7 5** ☛ Section No. (1, 2,.....) : **1&2**

Seat No. :

Student's Signature

(2)   Figures to the right indicate full marks.

(3)   Answers to the **two** sections must be written in **separate** answer books.

(4)   Attempt **all** questions.

(5)   Assume necessary data wherever necessary.

SECTION - I

1   (a)   Fill in the blanks :   **5**

    (i)   Interpoles are used in a d.c. generator to reduce _____ at the brushes.

    (ii)   Internal characteristic is a graph between _____ and _____.

    (iii)   Brushes facilitate the collection of _____ from the commutator.

    (iv)   Alternator converts _____ energy into _____ energy.

    (v)   Generally in alternators field is mounted on _____ part of the alternator.

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(b) State true/false :   **5**

    (i) In d.c. series motor field winding is connected in parallel with the armature winding.

    (ii) Alternator rotates at synchronous speed

    (iii) Lamination in the armature core reduces hysteresis loss.

    (iv) For d.c. generator armature current

         I_a = Load current I_L + Field current I_f.

    (v) Salient pole alternators are preferred where speed required is high.

(c) (i) On which basis generators are classified? Give detailed classification of generator with relevant diagram.   **6**

    (ii) A 4 pole, lap wound generator has 672 conductors. It is driven at 1120 rpm, if useful flux per pole is 21 mWb, calculate the generated emf. Find the speed at which it is to be driven to generate the emf as calculated above, with wave armature.   **4**

2 (a) Draw and explain internal and external characteristics of a separately excited d.c. generator and a self excited dc shunt generator.   **6**

(b) State the condition for voltage build up of shunt generator.   **2**

(c) A 4 pole lap wound dc motor has 480 conductors. The flux per pole is 24 mWb and the armature resistance is $1\,\Omega$. If the motor is connected to 200 V d.c. supply and running at 1000 rpm on no load, calculate   **7**

    (i) back emf

    (ii) armature current

    (iii) power output

    (iv) shaft torque

<div align="center">OR</div>

2 (a) Explain the types of alternator. Derive the frequency and emf equation of an alternator.   **6**

(b) State conditions for parallel operation of two alternators.   **2**

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(c) A 3-phase star connected alternator is rated at 7
1600 kVA, 13500 V. The armature effective resistance and synchronous reactance are 1.5 Ω and 3 Ω respectively per phase. Calculate the percentage regulation for a load of 1280 kW at power factor of (a) 0.8 leading and (b) 0.8 lagging.

3   Attempt any **three** :   15

(a) Four point starter

(b) Derive torque equation of D.C. motor.

(c) Construction of synchronous machine

(d) Explain torque ~ current and speed N torque characteristics of d.c. series motor.

SECTION - II

4   (a) Do as directed :

(i)   Define transformation ratio.   1

(ii) What test gives the iron losses of transformer?

(iii) Define slip.   1

(iv) Condition for maximum torque in induction motor.   1

(v)   Why the air gap between stator core and rotor   2
      of an induction motor is made very small ?

(vi) What is the magnitude value of rotating   1
      magnetic field in $3-\phi$ induction motor?

(vii) Types of induction motor.   1

(viii)An induction motor is supplied with $3-\phi$,   2
      50 Hz supply and running with speed 1500 rpm.
      What is the value of slip? No. of pole is 2.

(b) Why core losses are constant in transformer?   5

(c) A 1–ϕ transformer has 180 and 90 turns respectively **5** in its secondary and primary windings. The respective resistances are 0.233 Ω and 0.067 Ω. Calculate the equivalent resistance of

    (i) Primary referred to secondary

    (ii) Secondary referred to primary

    (iii) Total resistance referred to primary.

5 (a) Explain speed-torque charactristic of induction motor. **5**

    (b) The power input to the rotor of a 440 V, 50 Hz, **5** 3–ϕ, 6-pole induction motor is 60 kW. It is observed that the rotor emf makes 90 complete cycles per minute. Calculate

        (i) the slip

        (ii) the rotor speed

        (iii) rotor cu losses and

        (iv) mechanical power developed.

<div align="center">

OR

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    (b) An s.c. test when performed on the HV side of a **5** 10 kVA 2000/400 V 1–ϕ x'former gave the following data : 60 V, 4 A, 100 W. If the LV side is delivering full load current at 0.8 p.f. lag and at 400 V, find the applied voltage to HV side.

    (c) Explain different losses that occur in induction motor. **5**

<div align="center">

OR

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    (c) Explain different losses that occur in 3–ϕ transformer. **5**

6 Attempt any **three** : **15**

    (i) Equivalent circuit of transformer

    (ii) Auto transformer

    (iii) Construction of 3–ϕ transformer

    (iv) Different power stages of an induction motor.

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