Registration No. : | | | | | | | | | | |

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B. Tech

BENG 1201

Third Semester Examination – 2010

ELECTRICAL MACHINES

Full Marks – 70

Time – 3 Hours

*Answer Question No. **1** which is compulsory and any **five** from the rest.*

The figures in the right-hand margin indicate marks for the questions.

1. Answer the following questions : 2×10

(a) Explain the requirement of commutator in DC Machines.

(b) What will happen to the performance of electrical machines if the iron parts are made of solid structure instead of laminated one ?

(c) How does the flux distribution in the core affect hysteresis and eddy current loss ?

(d) What are the essential conditions for a DC shunt generator to build up voltage ?

(e) How does the frequency of AC supply regulate the emf induction in transformer windings ? Can emf be induced in the secondary winding, if primary winding is fed from a DC supply ?

(f) List two properties of an ideal transformer.

(g) What is necessity of connecting a starter while starting a DC motor ?

(h) Is it possible to use a step-down transformer as a step-up transformer without any physical modification ? Justify your answer.

(i) What is the operating condition that results in maximum efficiency of transformers?

(j) Synchronous motors always rotate at synchronous speed whereas induction motors rotate at speeds below synchronous speed? Explain.

2. (a) Derive the emf equation for a DC Generator for the conditions as given below : 5

Number of field poles : P,

Flux per pole :

Number of armature conductors : Z,

Rotational speed of armature : N (rpm),

Number of parallel paths in the armature winding : A

(b) A DC shunt generator when running at 1200 rpm supplies 200 A at 110 V to a load circuit of constant resistance. Assuming that the armature winding resistance is 0.05 ohm and a total brush drop of 1 V occurs in the machine, calculate the emf that is being induced in the armature. If the machine has four numbers of field poles, calculate the current that would be flowing in each armature conductor for the following cases : 5

(i) Lap wound armature

(ii) Wave wound armature.

3. (a) Which parameters need to be regulated for controlling the speed of a DC motor? Explain the procedure for obtaining speed control by controlling field flux. Give a neat circuit diagram in support of your explanation. 5

(b) A DC shunt generator has the OC test data as given below at 1000 rpm.

I_f (A)	0.4	0.8	1.2	1.6	2.0	2.4	2.8
E_g (V)	140	275	375	440	500	540	570

Explain the procedure that you would follow to find the critical field resistance for voltage buildup. 5

4. Explain the starting mechanism of DC shunt motors and hence justify the necessity of a starter during starting. Also derive the expression of torque for a generalized DC machine and draw the speed torque characteristics for a DC shunt motor. 10

5. (a) Draw the equivalent circuit of a single phase transformer and explain the similarity/differences that exist between a transformer and a three phase induction motor. 5

(b) Draw the torque-slip characteristics of a three phase squirrel cage induction motor and find out the expression for the slip at maximum torque. 5

6. (a) What do you mean by voltage regulation of a transformer? Derive the condition for maximum efficiency for a single phase transformer. 5

(b) The two windings of a 11,000/2, 200 V, 1000 kVA, single phase transformer get connected in series to form an autotransformer. Determine its voltage and power. 5

7. Explain the methods of OC test and SC test on single phase transformers and hence explain the procedure to find the parameters of the equivalent circuit. 10

8. Write short notes on any two of the following: 5×2

(a) Iron loss and copper loss in machines and methods for reducing these losses.

(b) Constructional features of three phase induction motor.

(c) Relationship between synchronous speed and system frequency.
