http://www.makaut.com

Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.Tech (EEE)/SEM-5/EEE-501/2010-11

2010-11

ELECTRICAL MACHINES – I

Time Allotted : 3 Hours Full Marks : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following : $10 \times 1 = 10$

i) The main function of interpole is to minimize

a) friction b) heat

c) sparking d) current.

ii) The main purpose of commutator in DC generator is

a) convert *dc* to *ac* b) convert *ac* to *dc*

c) reduce sparking d) both (a) and (b).

iii) The flux is maximum in part of a *dc* motor which ?

a) Pole core b) Under the interpole

c) Under leading pole tip d) Under trailing pole tip.

iv) A transformer has maximum efficiency at $\frac{3}{4}$th full load. The ratio of iron loss (p_i) and full load copper loss (p_c) *i.e.* p_i / p_c is

a) $\frac{3}{4}$ b) $\frac{4}{3}$

c) $\frac{9}{16}$ d) $\frac{16}{9}$.

v) Transformer fails to operate on DC because

a) DC supply has polarity

b) DC supply produces constant and steady flux

c) DC supply gives very low primary current

d) Transformer as on open circuit on DC.

vi) In a transformer

a) *emf* per turning in *hv* winding is more than the *emf* per turn in *lv* winding

b) *emf* per turn in both the windings are same

c) *emf* per turn in *hv* winding is less than the *emf* per turning *lv* winding

d) none of these.

vii) Maximum efficiency of transformer for constant load current occurs at

a) any p.f. b) zero p.f. leading

c) zero p.f. lagging d) unity p.f.

viii) The function of oil in a transformer is to provide

a) insulation and cooling

b) protection against lightning

c) protection against short circuit

d) lubrication.

ix) A transformer taking 1000 W forwards iron losses at full load. The iron loss at half full load is

a) 1000W b) 500W

c) 250W d) 125W.

x) In an auto-transformer, transfer of power is done by

a) Conduction

b) Electromagnetic coupling

c) Convection

d) Both conduction and electromagnetic coupling.

xi) Conversion of power from three phase to two phase can be done by

a) V-V connection b) Scott-connection

c) Zig-Zag connection d) None of these.

xii) The brush shortcircuits armature coils when the brush is on

a) MNA b) pole axis

c) GNA d) any position.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. 3 × 5 = 15

2. a) What is the function of commutator ?

   b) Explain the external characteristics of DC shunt motor.

3. a) What is the necessity of a starter in a *dc* motor ?

   b) If the load is removed from a *dc* series motor in operation, what will happen ?

4. Why the main flux in a transformer is constant from no-load to full-load ? Draw the no-load and load phasor diagram of a single phase transformer.

5. a) Derive the expression of induced *emf* in a *dc* generator.

   b) What are critical speed and critical resistance of DC shunt generator ?

6. Explain the different losses that occur in a transformer. Derive the condition of maximum efficiency.

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. 3 × 15 = 45

7. a) Explain the voltage and power equation of a DC motor expressing the importance of each term. 5

   b) What are shaft torque and armature torque ? What is the difference between them ? 4

   c) In a brake test conducted on a DC shunt motor, the full-load readings are observed as: Tension on tight side – 9·1 kg, Tension on slack side – 0·8 kg, Total current – 10A, Supply voltage – 110 V, Speed – 1320 rpm, Diameter of pulley – 15 cm. Calculate its full-load efficiency. 6

8. a) Define the voltage regulation of a transformer. Deduce the expression for the voltage regulation in terms of transformer parameters. 5

   b) How does it help for selection of a transformer ? 2

   c) 15 kVA, 2300/230 V, 50 Hz single phase transformer has the test results as follows :

OC test :	230 V	2·1 A	50 W
SC test :	47 V	6 A	160 W

   Obtain the following :

   i) Equivalent circuit referred to the LV side and referred to the HV side,

   ii) The percentage regulation of the transformer at full-load, 0·8 pf lagging,

   iii) Efficiency of transformer at full-load, 0·8 pf lagging,

   iv) The terminal voltage on the LV side at rated load and 0·8 pf leading. 8

9. a) What is an auto-transformer ? What are the advantages and limitations of an auto-transformer ? 5

b) The primary and the secondary voltages of an auto-transformer are 230 V and 75 V respectively.

i) Calculate the currents in the different parts of the winding when load current is 200A.

ii) Calculate the savings of copper w.r.t. 2-winding transformer.

iii) VA rating of transformer. 6

c) Prove that power is transferred by conduction as well as induction in an auto-transformer. 4

10. a) State the conditions needed to be satisfied for successful operation of transformers connected in parallel. 3

b) State the significance of vector grouping of transformers. Draw the physical connection and phasor diagram of the following connections :

i) Yd1

ii) dY11 6

c) What is V-V connection of transformer ? What are the advantages and limitations of V-V connection ? 6

11. Write short notes on any *three* of the following : 3 × 5

a) All-day efficiency

b) Scott connection of transformer

c) Different excitation systems of DC machines

d) Speed control of DC shunt motor

e) Characteristics of compound generators.