Instructions –

(1) All Questions are Compulsory.

(2) Illustrate your answers with neat sketches wherever necessary.

(3) Figures to the right indicate full marks.

(4) Assume suitable data, if necessary.

(5) Use of Non-programmable Electronic Pocket Calculator is permissible.

Marks

1. Attempt any TEN of the following: 20

a) State Fleming’s right hand rule.

b) Write e.m.f. equation of generator.

c) State significance of back emf.

d) Define armature torque and shaft torque.

e) ‘D.C. series motor should never be started at no load’. Justify.

f) State the condition for maximum efficiency of a d.c. motor.

g) Draw the phasor diagram for practical transformer on no load.

h) Define all day efficiency.

i) Draw circuit diagram for polarity test on 1 φ transformer.

j) A 50 KVA transformer has iron loss of 2 KW on full load. Calculate its iron loss at 75% of full load.

k) List the types of transformer cooling using air.

l) State two advantages of 3-phase autotransformer.
2. Attempt any FOUR of the following: 16
   a) Draw the connection diagrams of different types of DC generators.
   b) State function of following parts of d.c. machine.
      (i) Yoke
      (ii) Brush
      (iii) Pole shoe
      (iv) Commutator
   c) Describe $T_a - I_a$ characteristic for DC series and DC shunt motor.
   d) A 220 V dc shunt motor runs at a speed of 850 rpm and takes a current of 30 A from mains. Calculate speed if the torque is doubled. Armature resistance is 0.2 Ω.
   e) Identify parts of d.c. motor starter shown in Figure No. 1. State function of each part.
   f) List any four applications of D.C. shunt motor.
3. **Attempt any FOUR of the following:**

a) Describe practical transformer on load with phasor diagram.

b) “All day efficiency is more than ordinary efficiency of a transformer.” Justify.

c) List the conditions for parallel operation of three phase transformer.

d) Derive the emf equation of a transformer.

e) List the advantages of O.C. and S.C. test. (any four)

f) A 500 KVA, distribution transformer having copper and iron losses of 5 KW and 3 KW respectively on full load. The transformer is loaded as shown below:

<table>
<thead>
<tr>
<th>Loading (KW)</th>
<th>Power factor (lag)</th>
<th>No. of hrs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>400</td>
<td>0.8</td>
<td>06</td>
</tr>
<tr>
<td>300</td>
<td>0.75</td>
<td>12</td>
</tr>
<tr>
<td>200</td>
<td>0.8</td>
<td>04</td>
</tr>
<tr>
<td>No load</td>
<td>–</td>
<td>02</td>
</tr>
</tbody>
</table>

Calculate all day efficiency.
4. Attempt any **FOUR** of the following: 16

a) The efficiency of a 100 KVA, 11000 / 440 V, 1 φ transformer is 87% on half load at 0.8 (lag) and 89% on full load at unity p.f. Determine iron and copper losses.

b) Identify the circuit diagram given in Figure No.2. Select proper range of all meters if the transformer is having rating of 220 / 110 V, 1 KVA.

c) Two single phase transformers of 250 KVA each are operated on parallel (both side). Their % drops are (1 + j6) Ω and (1.2 + j4.8) Ω. The load connected across the bus bar is 500 KVA at 0.8 p.f. lag. Calculate load shared by each transformer.

d) State advantages of parallel operation of transformers.

e) Draw the equivalent circuit of a typical 1 φ transformer referred to primary.
f) Identify the parts shown in the diagram of a transformer in Figure No. 3.

Fig. No. 3

5. Attempt any **FOUR** of the following: 16

a) List various losses in a transformer. State methods to minimize these losses.

b) “O.C. test is performed on HV winding and S.C. test is performed on LV winding of a transformer”. Justify.

c) Two transformers are having voltage regulation of 3% and 5% respectively. Which transformer is better in performance? Justify your answer.

d) State criteria for selection of distribution transformer.

e) Draw the construction of three phase autotransformer. State its two applications.

f) Compare distribution transformer and power transformer on basis of voltage level, turns ratio, type of cooling and cost.

g) Describe procedure to find polarity of windings of a three phase transformer.
6. **Attempt any FOUR of the following:**

a) Describe the method of converting three phase to two phase transformer by neat diagram.

b) Describe working of isolation transformer.

c) List any four advantages of 1 φ Autotransformer.

d) Draw circuit diagram of connected CT and PT in a 1 phase circuit.

e) Compare single phase autotransformer with two winding transformer on basis of no. of windings, copper loss, voltage regulation and cost.

f) List special features of welding transformer.