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3 Hours / 100 Marks Seat No. | | | | | | | | |

Instructions – (1) All Questions are *Compulsory*.

(2) Answer each next main Question on a new page.

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

(4) Figures to the right indicate full marks.

(5) Assume suitable data, if necessary.

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

(7) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Attempt any TEN of the following: **20**

a) State Fleming's Right Hand Rule.

b) Give the two functions of yoke in DC machine.

c) State the principle of operation of a dc motor.

d) Write the voltage and power equation of a dc motor.

e) How will you change the direction of rotation of a d.c. motor?

f) A dc motor operating on a supply voltage of 200V dc has armature resistance of 0.5Ω. If its armature current is 25A, Calculate the back emf.

Marks

g) Define:

(i) Transformation Ratio

(ii) Turns

Ratio related to 1–ϕ Transformer.

h) State working principle of a tranformer.

i) Name the two components of no load current I_o of 1–ϕ Transformer and also write down their formulae.

j) State the condition for maximum efficiency for single phase transformer.

k) State any two advantage of three phase transformer over a bank of three single phase transformer.

l) Give any two advantages of star-star connection in 3– ϕ transformers.

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

a) Distinguish between lap and wave winding. (Any four points)

b) Determine the flux per pole of a six pole generator required to generate 240V at 500rpm. The armature winding has 1080 conductors and are lap connected.

c) Draw the circuit diagram of

(i) DC series motor

(ii) DC long shunt

Compound motor. Also write down the related equation.

d) What is Back emf in DC Motor? Explain its significance.

e) Draw and explain the following characteristics in DC Shunt motor:

(i) Torque vs Armature current.

(ii) Speed vs Torque.

f) A 500 V DC shunt motor takes a current of 5 Amp on no load. The resistances of the armature and field circuits are 0.5 Ω and 250 Ω. Calculate the efficiency when the motor takes a current of 100 Amp.

Marks

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

a) With the help of neat diagrams, explain the following methods of speed control in DC series motor:

(i) Field diverter method

(ii) Armature diverter method.

b) Give the classification of transformer based on:

(i) Construction

(ii) Voltage Level

(iii) Number of phases

(iv) Applications

c) Compare core type and shell type transformer on any four parameters.

d) Derive the emf equation of a transformer.

e) Draw the connection diagram of Delta-star connection of 3-ϕ Transformer and give any two advantages and disadvantages of this connection.

f) A 3300/230V, 50Hz single phase transformer is to be operated at a maximum flux density of 1.2 Wb/m^2 in the core.The effective cross sectional area of the transformer is $150cm^2$. Calculate suitable values of primary and secondary turns.

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

a) A 1– ϕ Transformer with a ratio of 440/110V takes a no load current of 5A at 0.2 pf lagging. If the secondary supplies a current of 120 Amp at a pf of 0.8 lagging, estimate the current taken by the primary.

b) A 50 KVA, 4400/220 V transformer has $R_1 = 3.45\ \Omega$, $R_2 = 0.009\ \Omega$. The value of reactances are $X_1 = 5.2\ \Omega$ and $X_2 = 0.015\ \Omega$ Calculate for the transformer:

(i) equivalent resistance and reactance as referred to HV side.

(ii) equivalent resistance and reactance as referred to LV side.

Marks

c) Efficiency of 400KVA, 1– ϕ Transformer is 98.77% when delivering full load at 0.8 pf and it is 99.13% at half load unity pf. Calculate:

(i) Iron Loss

(ii) Full load copper loss

d) Two, 1–phase transformers with equal turns have impedance of (0.5 + j3) Ω and (0.6 + j10) Ω with respect to the secondary. If they are operated in parallel, determine how they will share a total load of 100 kW at a pf of 0.8 lagging?

e) Draw a neat experimental set up to conduct OC Test on a single phase transformer. Also give reason why it is preferable to conduct OC Test on LV side?

f) Describe the different losses in a transformer. And what measures should be taken to minimize them?

5. Attempt any <u>FOUR</u> of the following: **16**

a) Give any two advantages of parallel operation and any two conditions to be satisfied for parallel operation of 1– ϕ transformers.

b) A 1 phase 50 kVA, 2400/120V, 50Hz transformer gave following test results:-

OC Test (Instruments on LV side): 120V, 9.85A, 396W

SC Test (Instruments on HV side): 92V, 20.8A, 810W

Calculate:

(i) The equivalent circuit constants

(ii) Efficiency at Rated KVA and 0.8 pf lagging.

c) Find the all day efficiency of 500 kVA distribution transformer whose copper and iron losses at full load are 4.5 kW and 3 kW. It is loaded as under per day:

No. of hours	6	6	8	4
Load in kW	450	300	150	0
Power factor	0.9	0.75	1	–

d) Draw the connection diagram and phasor diagram of star-delta connection used for 3 phase transformer connection.

Marks

e) Compare Power and Distribution Transformer on the following parameters:

(i) Typical voltages

(ii) Power Ratings

(iii) Size

(iv) Load

(v) Insulation level

(vi) Installation

(vii) Maximum efficiency

(viii) Type of efficiency

f) With the help of neat diagram, explain the procedure of phasing out test on 3 phase transformer.

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

a) Describe the construction and operation of three phase autotransformer with the help of neat diagram.

b) Illustrate the saving in copper by using $1-\phi$ auto transformer instead of two winding transformer of the same rating by deriving proper expressions.

c) With the help of neat diagram, explain the construction of current transformer.

d) Draw schematic diagram of a welding transformer showing constructional features of a welding transformer. Also explain its working.

e) What is an isolation transformer? State any two applications of isolation transformer.

f) Draw a neat connection diagram of potential transformer. Also explain the two types of error that are likely to occur in the P.T.

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