Enrollment No......................................

Faculty of Engineering

End Sem Examination Dec-2023

EE3CO52 Electrical Machines -I

Programme: B.Tech.   Branch/Specialisation: EE

**Duration: 3 Hrs.**   **Maximum Marks: 60**

Note: All questions are compulsory. Internal choices, if any, are indicated. Answers of Q.1 (MCQs) should be written in full instead of only a, b, c or d. Assume suitable data if necessary. Notations and symbols have their usual meaning.

Q.1 i. The co energy density in single excited linear magnetic circuit is   **1**
expressed by the relation-

(a) $\frac{1}{2} \times H \times B^2$ (b) $H \times B$

(c) $\frac{1}{2} \times H^2 \times B$ (d) $\frac{1}{2} \times H \times B$

ii. Permeability of a magnetic circuit corresponds to_____ in   **1**
electrical circuits.
(a) Resistance   (b) Resistivity
(c) Conductivity   (d) Conductance

iii. Transformer cores are laminated to reduce-   **1**
(a) Hysteresis loss   (b) Eddy current loss
(c) Ohmic loss   (d) None of these

iv. The efficiency of the transformer will be maximum when-   **1**
(a) Iron loss is equal to the twice of copper loss
(b) Copper loss is equal to the twice of iron loss
(c) Iron loss is equal to the copper loss
(d) Iron loss is equal to the half of copper loss

v.   In scott connection, tapping essential on the primary of teaser   **1**
transformer is-
(a) 50%   (b) 28.8%   (c) 100%   (d) 86.6%

vi. Oil filled in transformer tank serve as-   **1**
(a) Cooling   (b) Insulation
(c) Insulation and cooling   (d) Lubrication

vii. Skewing of rotor slots by a certain angle with the shaft results in-   **1**
 (a) Reduce magnetic noise
 (b) More uniform torque
 (c) Avoiding magnetic locking of rotor with stator
 (d) All of these

viii. A 3-phase, 50 Hz, 4- pole induction motor runs at 1455 rpm. The   **1**
 corresponding slip is-
 (a) 5 %   (b) 3 %   (c) 6.5 %   (d) 4.5 %

ix. Induction generator delivers power at_____ power factor.   **1**
 (a) Lagging   (b) Leading   (c) Zero   (d) Unity

x. The starting torque of single-phase induction motor is-   **1**
 (a) High   (b) Low   (c) Zero   (d) Very low

Q.2 i. Define magneto motive force. What do you mean by reluctance?   **2**

ii. Compare on the basis of similarities and dissimilarities between   **3**
 electric and magnetic circuit.

iii. The magnetic frame shown in fig. is built of iron of square cross   **5**
 section, 3 cm side. Each air gap is 2 mm wide. Each of the coil is
 wound with 1000 turns and the exciting current is 1 A. The relative
 permeability of part A and part B may be taken as 1000 and
 1200 respectively. Calculate (a) Reluctance of part A (b) Reluctance of
 part B (c) Reluctance of two air gap (d) Total reluctance of complete
 magnetic circuit (e) The mmf.
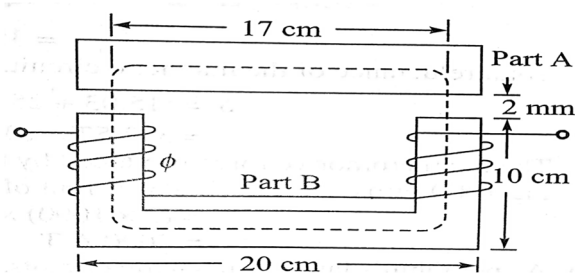
OR iv. Derive the relation for magnetic stored energy for singly excited   **5**
 magnetic system.

Q.3 i. What do you mean by inrush current in transformer? Specify its nature   **3**
 and problem during transformer charging.

ii. Draw the exact equivalent circuit of a single-phase transformer,   **7**
 describe the various parameters involved in it, also draw the phasor
 diagram assuming load at lagging power factor.

OR iii. In a 50 KVA, 1100/220V transformer, the iron and copper losses at full   **7**
 load are 350 W and 425 W, respectively. Calculate the efficiency at
 (a) Full load with unity power factor (b) Half load with unity power
 factor (c) Full load with 0.8 power factor lagging. Also determine the
 maximum efficiency and load at which maximum efficiency occurs.

Q.4 i. Explain the working of conservator and breather in a transformer.   **2**

ii. State the condition for satisfactory parallel operation of three phase   **3**
 transformer.

iii. Discuss the various three phase transformer groups and their   **5**
 significance.

OR iv. Explain how the scott- connection can be used to obtain two phase   **5**
 supply from a three-phase supply.

Q.5 i. Compare slip ring and squirrel cage three phase induction motor.   **4**

ii. Why starters are necessary for starting induction motor? Discuss in   **6**
 brief the various starting method of 3-phase induction motor.

OR iii. Explain no-load and blocked rotor tests on 3-phase induction motor.   **6**
 How the different parameters of equivalent circuit determined from
 test result?

Q.6   Attempt any two:

i. Using double revolving field theory, explain why a single-phase   **5**
 induction motor is not a self-start.

ii. Explain the phenomenon of cogging and crawling in a 3-phase   **5**
 induction motor.

iii. Classify induction motors according to NEMA.   **5**

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