Registration No :

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PEE3I103

3rd Semester Regular / Back Examination 2018-19
ELECTRICAL MACHINES – I
BRANCH : ELECTRICAL
Time : 3 Hours
Max Marks : 100
Q.CODE : E933

Answer Question No.1 (Part-1) which is compulsory, any EIGHT from Part-II and any TWO from Part-III.
The figures in the right hand margin indicate marks.

Part- I

Q1 Short Answer Type Questions (Answer All-10) (2 x 10)

a) Classify the AC machines?
b) Draw the phasor diagram for a practical transformer with lagging power factor load.
c) What do understand by an ideal transformer?
d) Explain why the primary mmf must be equal and opposite to the secondary mmf in an ideal transformer.
e) Why per unit system of measurement is required in machine performance analysis?
f) What is main drawback of an autotransformer as compared to an ordinary transformer? What is the application of auto transformer?
g) How third harmonic component in a power transformer can be eliminated without filter circuit?
h) A 208-V, 60-Hz, 4-pole, three-phase induction motor has a full-load speed of 1755 rpm. Calculate (a) its synchronous speed, (b) the slip, and (c) the rotor frequency.
i) Explain why aninduction motor cannot operate at its synchronous speed.
j) What would happen If the rotor of the induction motor is driven faster than synchronous speed? Draw the torque-speed characteristic showing the statement.

Part- II

Q2 Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve) (6 x 8)

a) The magnetization current in apractical transformer is not sinusoidal. Explain the statement with waveform.
b) Draw and explain the exact and approximate equivalent circuit of a transformer.
c) The available power out of the open-delta bank is only 57.7 percent of the original bank's rating. Justify.
d) Draw the experimental set-up for open and short circuit test of single phase transformer.
e) A 2000/200 V, 20kVA transformer is connected as a step-up auto-transformer (2000/2200V). Calculate its kVA rating, kVA transferred inductively, conductively and its efficiency at full load 0.8 p.f.
f) Describe the no-load test, blocked-rotor test of an induction motor.
g) Draw the flow diagram for power input to output including losses at various stages of the three phase induction motor.
h) Discuss about the crawling and cogging of induction motor.
i) Draw the experimental set-up of a back-to back connection of two single phase transformers. Why this is done so?
j) Derive the expression for copper saving of an auto-transformer as compared to ordinary transformer of same rating.
k) Develop the criteria for the maximum torque developed by induction motor during running.
l) Discuss the double field revolving theory. Draw the equivalent circuit for a single-phase induction motor considering both forward and backward rotor branches at rest.

Part-III

Long Answer Type Questions (Answer Any Two out of Four)

Q3 Define Voltage regulation and all-day efficiency of transformer. **(16)**

A 15-kVA, 2300/230-V transformer is to be tested to determine its excitation branch components, its series impedances, and its voltage regulation. The followingtest data have been taken from the primary side of the transformer.

Open-circuit test	Short-circuit test
$V_{OC} = 2300\,V$	$V_{SC} = 47\,V$
$I_{OC} = 0.21\,A$	$I_{OC} = 6.0\,A$
$P_{OC} = 50\,W$	$P_{SC} = 160\,W$

a) Find the equivalent circuit of this transformer referred to the high-voltage side.
b) Find the equivalent circuit of this transformer referred to the low-voltage side.
c) Calculate the full-load voltage regulation at 0.8lagging power factor, 1.0 power factor, and at 0.8 leading power factor.
d) Plot the voltage regulation as load is increased from no load to full load at power factors of 0.8lagging, 1.0, and 0.8leading.
e) What is the efficiency of the transformer at full load with a power factor of 0.8 lagging?

Q4 Draw the exact equivalent circuit to show the stator, rotor and load resistance of a three phase induction motor. **(16)**

A 10-hp, 4-pole, 440-V, 60-Hz, Y-connected, three-phase induction motor runs at 1725 rpm on full load. The stator copper loss is 212 W, and the rotational loss is 340 W. Determine (a) the power developed, (b)the air gap power, (c) the rotor copper loss, (d) the total power input, and (e) the efficiency of the motor. What is the shaft torque?

Q5 What are the different methods of speed control for three phase induction motor. Discuss the speed control by variable frequency control methods for considering variable mechanical load. Draw the torque speed characteristics for frequency control method. **(16)**

Q6 Write down the construction and principle of operation of three phase transformer. Draw the different vector group connections and their phasor diagram of three phase transformer. **(16)**