Code No: 114AB **R13**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B.Tech II Year II Semester Examinations, December - 2017
ELECTRICAL MACHINES – II
(Electrical and Electronics Engineering)

Time: 3 Hours **Max. Marks: 75**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A.
Part B consists of 5 Units. Answer any one full question from each unit.
Each question carries 10 marks and may have a, b, c as sub questions.

PART- A

(25 Marks)

1.a) Draw the vector diagram of a power transformer under full – load condition. [2]
b) What is meant by equivalent resistance of a transformer? How may it be calculated in primary terms and secondary terms? [3]
c) What are the various losses present in a transformer? [2]
d) Obtain the condition for maximum efficiency of a transformer. [3]
e) Give the applications, merits and demerits of auto transformer. [2]
f) An auto transformer is supplying a power to a load of 3 kW, 115 V unity power factor from 230 V supply. Calculate the power supplied inductively and conductively. [3]
g) Write the merits and demerits of slip-ring induction motor. [2]
h) Write the effects of crawling and cogging on the performance of induction motor. [3]
i) What is the procedure to conduct the blocked rotor test on 3-ϕ induction motor? [2]
j) Why starting methods are needed for 3-ϕ induction motor. [3]

PART-B

(50 Marks)

2.a) Discuss the effect of variation of frequency and supply voltage on losses in a transformer.
b) A 100 kVA transformer has 400 turns on the primary and 80 turns on the secondary. The primary and secondary resistances are 0.3 Ω and 0.01 Ω respectively and the corresponding leakage reactance are 1.1 Ω and 0.035 Ω . The supply voltage is 2200V. Calculate: (i) equivalent impedance referred to primary and (ii) the voltage regulation and the secondary terminal voltage for full load having a power factor of 0.8 leading. [4+6]

OR

3.a) With the help of phasor diagram, explain the operation of a transformer under no load and load conditions.
b) The core of a 100 kVA, 11000/550 V, 1-phase core type transformer has a cross-section of 400 cm^2. Find (i) the number of HV and LV turns per phase and (ii) the e.m.f per turn if the maximum core density is not exceeding 1.3 Tesla. Assume a stacking factor of 0.9. What will happen if its primary voltage is increased by 10% on no-load? [4+6]

4.a) A 4400 V, 50-Hz transformer has a hysteresis loss of 1200 W, eddy current loss of 1800 W and full-load copper loss of 4000 W. If the transformer is supplied at 6600 V, 75-Hz. What will be the losses?

b) Under what condition will there be no circulating current when two transformers are Operated in parallel at no-load? [5+5]

OR

5. The following readings were obtained from O.C. and S.C. tests on 8 kVA 400/ 120V, 50-Hz transformer.
O.C. Test: (l.v. side) : 120 V; 4 A; 75 W.
S.C. Test: (h.v.side) : 9.5 V; 20 A; 110W
Obtain
a) The equivalent circuit (approximate) constants,
b) Voltage regulation and efficiency for 0.8 lagging power factor load, and
c) The efficiency at half full – load and 0.8 power factor load. [4+3+3]

6.a) Explain with necessary diagrams how two 3-phase transformers can be used to convert a 3-phase supply to a 2-phase supply. If the load is balanced on one side, show that it will be balanced on other side.

b) Two single-phase furnaces working at 100V are connected to 3300-V, 3-phase mains through Scott-connected transformers. Calculate the current in each line of the 3-phase mains when the power taken by each furnace is 400-KW at a power factor of 0.8 lagging. Neglect losses in the transformer. [5+5]

OR

7. A 400 kVA load at 0.7 power factor lagging is supplied by three 'single-phase' transformers connected in Δ-Δ. Each of the Δ-Δ transformer is rated at 2000 kVA, 2300/230 V. If one defective transformer is removed from the service, calculate for the Δ-Δ connection: (a) the kVA load carried by each transformer (b) percent rated load carried by each transformer (c) total kVA rating of the transformer bank in Δ-Δ (d) ratio of V – V to Δ-Δ bank transformer ratings. [10]

8.a) Explain with the aid of diagrams the principal of operation of double cage induction motor. Sketch the torque –slip curves of such a motor.

b) Obtain the relation between rotor input, rotor copper losses and rotor output in terms of slip(s). [5+5]

OR

9.a) Explain the principle of production of rotating magnetic field in a 3-phase induction motor.

b) A 10 kW, 400 V, 3-phase, 4 pole, 50 Hz delta connected induction motor is running at no load with a line current of 8 A and an input power of 660 W. At full load, line current is 18 A and input power is 11.20 kW. Stator effective resistance per phase is 1.2 Ω and friction, windage loss is 420 W. For negligible rotor ohmic losses at no load, calculate
(i) stator core loss (ii) total rotor losses at full load (iii) total rotor ohmic losses at full load (iv) full load speed. [5+5]

10. A 3-phase, 400V induction motor gave the following test readings:
No-load: 400V, 1250W, 9A
Short-circuit: 150V, 4kW, 38A
Draw the circle diagram. If the normal rating is 20.27 hp (metric), find from the circle diagram, the full-load values of current, power factor and slip. [10]

OR

11.a) How is the speed of a 3-phase induction motor controlled by its stator voltage control?

b) A 4-pole induction motor and 6-pole induction motor are connected in cumulative cascade at 50 Hz supply. The frequency in the secondary circuit of the 6-pole motor is observed to be 1.0 Hz. Determine the slip in each machine and combined speed of the set. [6+4]

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