Question Paper

Exam Date & Time: 28-Nov-2018 (09:30 AM - 12:30 PM)

MANIPAL ACADEMY OF HIGHER EDUCATION

INTERNATIONAL CENTRE FOR APPLIED SCIENCES
IV SEMESTER B.S. ENGG. END SEMESTER EXAMINATION - NOV./ DEC. 2018
Analysis And Control Of Electromagnetic Devices [EE 242]

Marks: 100 **Duration: 180 mins.**

Answer 5 out of 8 questions.

1) Mention the properties of an ideal transformer (4)

A)

B) A single phase transformer has 500 turns in the primary and 1200 turns in the secondary. The cross sectional area of the core is 80cm^2 If the primary winding is connected to a 50Hz supply at 500V. Calculate (i) Peak flux density (ii) Voltage induced in the secondary. (4)

C) With neat diagrams, explain the construction of core type and shell type transformer. (12)

2) Deduce the complete equations for a single phase transformer on load. Using these equations, draw the phasor diagram of the transformer when it is supplying a (i) capacitive load (ii) resistive load. (10)

A)

B) A 2200/220V transformer has primary resistance and reactance of 24Ω and 30Ω respectively. The corresponding figures for the secondary are 0.5Ω and 0.8Ω. Calculate, (5)

i) Primary resistance and reactance with respect to secondary

ii) Secondary resistance and reactance with respect to primary

iii) Total resistance and reactance with respect to primary

iv) Total resistance and reactance with respect to secondary

C) A 600kVA, single phase transformer has an efficiency of 92% both at full load and half load at unity power factor. Determine its efficiency at 60% of full load at 0.8 pf lag. (5)

3)	A)	Explain with neat diagram, the conduction of a suitable test to find out the no load losses of a transformer.	(5)
	B)	A 230/230V, 3 kVA transformer gave the following results. O.C test: 230V, 2A, 100W S.C test: 15V, 13A, 120W Determine the regulation and efficiency at full load 0.8 power factor lagging.	(5)
	C)	Draw and explain the full load voltage regulation curve of a single phase transformer as the power factor is varied.	(10)
4)	A)	Explain how a rotating magnetic field is produced in an induction motor.	(12)
	B)	A 1100V, 50Hz delta connected induction motor has a star-connected slip-ringRotor with a phase transformation ratio of 3.8 (stator/rotor). The rotor resistance and standstill leakage reactance are 0.012 ohm and 0.25 ohm per phase respectively. Neglecting stator impedance and magnetizing current determine. i) The rotor current at start with slip rings shorted ii) The rotor power factor at start with slip rings shorted iii) The rotor current at 4% slip with slip rings shorted iv) The rotor power factor at 4% slip with slip rings shorted v) The external rotor resistance per phase required to obtain a starting current of 100A in the stator supply lines.	(8)
5)	A)	Explain the necessity of a starter for a 3 phase induction motor. With neat diagram explain the autotransformer starter and derive the relation between starting and full load torque.	(10)
	B)	With neat diagram explain the Torque slip characteristics of an induction motor and derive equations for full load torque and maximum torque.	(10)
6)	A)	Draw an appropriate electrical equivalent circuit for a single phase transformer with all the basic quantities and give an account of all the quantities and assumptions made and in drawing the same.	(10)
	B)	A 440V, 3phase, 50Hz, 4-pole, Y connected induction motor has a full-load speed of 1425 rpm. The rotor has an	(10)

impedance of (0.4+j4) ohm and rotor/stator turn ratio of 0.8. Calculate (i) Full load torque (ii) Rotor current and full load rotor Cu loss (iii) Power output if windage and friction losses amount to 500W (iv) Maximum torque and the speed at which it occurs (v) Starting current (vi) Starting torque.

7) A) Explain the construction and working principle of synchronous motor. (10)

B) A 75-kW, 3 phase, Y-connected, 50-Hz, 440-V cylindrical rotor synchronous motor operates at rated condition with 0.8pf leading. The motor efficiency excluding field and stator losses, is 95% and Xs=2.5 ohm. Calculate (i) mechanical power developed (ii) armature current (iii) back emf (iv) power angle and (v) maximum or pull out torque of the motor. (10)

8) A) Explain the effect of excitation on armature current and p.f. in a synchronous motor. Draw the V and inverted V-curves. (12)

B) Derive the expression for the power developed in a synchronous motor. (8)

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