Question Paper

Exam Date & Time: 01-Jun-2018 (09:30 AM - 12:30 PM)

MANIPAL ACADEMY OF HIGHER EDUCATION

INTERNATIONAL CENTRE FOR APPLIED SCIENCES
IV SEMESTER B.S. DEGREE EXAMINATION-MAY/JUNE 2018
DATE: 1 JUNE 2018
TIME:9.30 AM TO 12.30 PM

Analysis And Control Of Electromagnetic Devices [EE 242]

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

Answer ANY FIVE full Questions.
Missing data, if any, may be suitably assumed

1)		Prove that a rotating field is produced when 3 phase windings are supplied with 3 phase currents.	(6)
	A)		
	B)	A 3 phase, 15 hp, 400 V, 50 Hz, 4 pole induction motor runs at 1440 rpm with a PF of 0.86. The Mechanical losses total 1 h, Calculate a) slip b) rotor copper loss c) Input if the stator losses amount to 50 W d) line current e) efficiency f) rotor frequency g) Torque produced.	(8)
	C)	Draw and explain the phasor diagram of a transformer supplying inductive load.	(6)
2)		Compare squirrel cage rotor and slip ring rotor.	(4)
	A)		
	B)	Mention the properties of an ideal transformer	(4)
	C)	The power input to a 3 phase, star connected 3.3 kV synchronous motor is 200 kW per phase. Find the stator current & power factor if the excitation voltage of 2500 V per phase. Synchronous impedance is (0.1+j10)Ω . Also Find the hp output	(12)
3)		From the equivalent circuit derive the torque equation of a 3 phase induction motor.	(4)
	A)		
	B)	Explain the characteristics and find the condition for maximum torque and the maximum torque.	(6)
	C)	A 3.3 kV, star connected 3 Phase load takes a current of	(10)

200 A at 0.8 PF lag. A synchronous motor without any load is connected to make the overall PF 0.98 lag. Find the kVA ratings of the motor.

4) A) What is the necessity of a starter for an induction motor ? With a neat sketch explain the Y/Δ starter. (8)

B) Find the number of tapping required on the autotransformer to limit the starting current to 2 times the full load current. Short circuit current is 5 times the full load current. Find the ratio of starting torque to full load torque. Slip at full load is 4%. (6)

C) Derive the condition for maximum efficiency of a transformer. (6)

5) A) Derive the expression for the power input and power output of a synchronous motor in terms of E, V, δ & θ. Find the condition for maximum input and maximum output. (12)

B) A 3 phase, 4 pole, 50 Hz, star connected 400 V induction motor has rotor resistance of 0.1 Ω and rotor reactance of 1 Ω. The ratio of stator to rotor turns is 3. Find the torque developed at 6 % slip, maximum torque and starting torque. (8)

6) A) A 100 kVA, 50 Hz distribution transformer is loaded as follows (10)

12 hours - 75 kW at PF of 0.8 lag
6 hours - 50 kW at unity PF
6 hours - 80 kW at 0.9 PF lag
Find all day efficiency
Iron loss= full load copper loss = 5 kW.

B) Explain the significance of O.C & S.C tests conducted on a single phase transformer. (2)

C) An 11 kV, 3 Phase, star - connected synchronous motor is taking a current of 200 A at unity power factor. The excitation is increased by 20%. Find the new current and PF. Assume constant load. Xs= j8 Ω. (8)

7) A) Find the input current, PF, secondary terminal voltage and efficiency for a 200/400 V, 50 Hz transformer. Following are the approximate equivalent circuit parameters referred to LV side. (7)

R_c= 200Ω R_{eq}= 1Ω

X_m= 400Ω X_{eq}= 2Ω

$R_{load}=4\Omega$ $X_{load}=3\Omega$

B) Derive the emf equation of a transformer. (4)

C) A 6000/250 V, 100 kVA, 50 Hz single phase transformer has a mutual flux of about 0.06 wb. Find the number of turns and cross section of conductors in each winding. Assume current density of 4 A per mm^2. (5)

D) Derive the equation for the excitation voltage of a synchronous motor. (4)

8) Find the iron loss and full load copper loss of a 1KVA, 50 Hz, 200/400 V transformer. (8)

A) The efficiency is 0.88 both at 50 % full load and 131 % full load. Also find load kVA at maximum efficiency.

B) The rotor resistance and reactance per phase of a 4 pole, 50 Hz, 3 phase induction motor are 0.025 Ω and 0.2 Ω respectively.Find the value of external resistance to get (8)

a) 80% of maximum torque at starting

b) Maximum torque at starting.

C) Explain any two methods of starting synchronous motor. (4)

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