Question Paper

Exam Date & Time: 10-Jun-2019 (09:30 AM - 12:30 PM)

MANIPAL ACADEMY OF HIGHER EDUCATION

INTERNATIONAL CENTRE FOR APPLIED SCIENCES
IV SEMESTER B.Sc. (APPLIED SCIENCES) IN ENGENEERING
END SEMESTER THEORY EXAMINATION APRIL / MAY 2019
ELECTRICAL MACHINES [IEE 244]

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

Answer 5 out of 8 questions.

Missing data, if any, may be suitably assumed

1)		What is the necessity of a starter? With a neat sketch draw and explain the 3 point starter for a DC machine.	(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 hp, 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)	A 200 V DC shunt motor takes 22A at rated voltage and runs at 1000 rpm. Its field resistance is 100 Ω and armature resistance is 0.1Ω. Find the value of the additional resistance in the armature circuit to reduce the speed to 800 rpm. Assume load torque is independent of speed.	(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 200 A at 0.8 PF lag. A synchronous motor without any load is connected to make the overall	(10)

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, 6 pole, 50 Hz, star connected 400 V induction motor has rotor resistance of 0.1Ω and rotor reactance of 1Ω. 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. X_s= j8Ω. (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= 200 Ω R_{eq}= 1Ω

X_m= 400 Ω X_{eq}= 2Ω

R_{load}= 4 Ω X_{load}= 3 Ω

B) Find the voltage per phase and line voltage for a three phase 50 Hz, star connected alternator with 36 slots and 4 poles. There are 4 conductor per slot. The flux per pole is 0.06 Wb. Coils are chorded by 1 slot. (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 induced voltage of a synchronous generator. (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 Ωrespectively. (8)

Find the value of external resistance to get 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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