Question Paper

MANIPAL ACADEMY OF HIGHER EDUCATION

INTERNATIONAL CENTRE FOR APPLIED SCIENCES
IV SEMESTER B.Sc. (Applied Sciences) - in Engg
END SEMESTER THEORY EXAMINATION APRIL/MAY 2019
ELECTRICAL MACHINES [IEE 244 - S2]

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

Answer 5 out of 8 questions.

Missing data, if any, may be suitably assumed

1)

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

B) Find the voltage regulation of 3 phase star connected 1.6 MVA, 13.5 KV alternator at full load and 0.8 pf lagging. The synchronous impedance is Zs=(1.5 + j30)Ω (4)

C) An 11 kV, 3 Phase, star - connected synchronous motor is taking a current of 200 A at unity power factor. The excitation is decreased by 20%. Find the new current and PF. Assume constant load and synchronous reactance of 9 Ω. (12)

2)

A) Draw and explain the torque / slip characteristics of a 3 Phase induction motor. (6)

B) Obtain the condition for maximum torque and the maximum torque. (6)

C) 230 V DC shunt motor has an armature resistance of 0.4Ω and field resistance of 115 Ω. The motor drives a constant torque load and takes an armature current of 20A at 800 rpm. If the motor speed is to be changed to 1000 rpm, find the resistance to be included in the shunt field circuit. (8)

3)

A) Distinguish between squirrel cage rotor and slip ring rotor. (4)

B) What is the necessity if a starter for 3 phase induction motor? With a neat sketch explain the star/delta starter. (6)

C) A 250 V delta connected synchronous motor has an excitation voltage of 350 V. Find the Hp output, input current and PF. Assume a load angle of 30°, Z_s=(0.5 + j5)Ω . (10)

4)

A) What is the significance of All-day Efficiency? (4)

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. (6)

C) A 15 kVA transformer is loaded as follows (10)
    12 hours - 2 kW at PF of 0.5
     6 hours - 12 kW at PF of 0.8
     6 hours - 18 kW at PF of 0.9
     Find the all-day efficiency
     Iron loss= full load copper loss = 300 W.

5)

A) A 1000 kVA, 3 Phase load works at a power factor of 0.8 lag. Find the kVA rating of the synchronous motor to make the overall PF 0.98 lag. The synchronous motor has a load of 50 kW with an efficiency of 90 %. (10)

B) Determine the iron loss and full load copper loss of a 1 kVA, 50 Hz, 200/400 V transformer. (10)
The efficiency is 0.88 both at 50 % of full load and 131 % of full load.
Assume UPF load. Also find the load kVA at maximum efficiency.

6)

A) Explain the significance of O.C & S.C tests on a transformer. (3)

B) Determine R_c, X_m, R_{eq}, X_{eq} referred to primary of a 4 kVA, 200/400 V, 50 Hz transformer with the following test results. (10)
    O.C Test 200V, 0.7 A, 70 W (LV Side)
    S.C Test 15V, 5 A, 20 W (HV Side)
Also find the efficiency at full load 0.8 PF lag.

C) Find the line current of a 3 phase, 50 Hz, $\triangle$ connected 20 hp, 400 V induction motor stated using Y/$\triangle$ starter. Full load efficiency =0.8, Full load PF=0.85. (7)
The short circuit current is 5 times the full load value. Slip at full load is 5%.
Also find the ratio of starting torque / full load torque.

7)

A) Derive the expression for the power output of a synchronous motor in terms of E, V, δ & θ. Find the condition for maximum output neglecting resistance. (10)

B) The power input to a 500 V, 50 Hz, 6 Pole, 3 phase induction motor running at 975 RPM is 35 kW. The stator losses are 1.5 Kw. Calculate (10)
a) Slip   b) Rotor copper loss   c) hp output
d) line current   e) Efficiency   f) Rotor frequency
Assume full load power factor = 0.85 lag.

8)

A) What is the necessity of a starter? With a neat sketch draw and explain the 3 point starter for a DC machine. (6)

B) The rotor resistance and reactance per phase of a 4 pole, 50 Hz, 3 phase induction motor are 0.25 Ω and 1 Ω respectively. (6)

Find the value of external resistance to get a) 50% of maximum torque at starting b) Maximum torque at starting.

C)   Draw and explain the phasor diagram of a transformer supplying   (8)
a) a lagging PF load   b) Leading PF load

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