Reg. No.									

INTERNATIONAL CENTRE FOR APPLIED SCIENCES

(Manipal University)

IV SEMESTER B.S. DEGREE EXAMINATION – APRIL / MAY 2017

SUBJECT: ANALYSIS & CONTROL OF ELECTROMAGNETIC DEVICES (EE 242)

(BRANCH: E & E, MECH, IP)

Saturday, 29 April 2017

Time: 3 Hours **Max. Marks: 100**

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

1A. Mention the properties of an ideal transformer

1B. Obtain the condition for zero voltage regulation of a transformer.

1C. 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. **(4+4+12)**

2A. Draw and explain the torque / slip characteristics of a 3 Phase induction motor.

2B. Obtain the condition for maximum torque and the maximum torque.

2C. A 3 phase, 4 pole, 50 Hz, star connected 220 V induction motor has rotor resistance of 0.2 Ω and rotor reactance of 1 Ω. The ratio of stator to rotor turns is 2. Find the torque developed at 4 % slip and 20 % slip. **(6+6+8)**

3A. Distinguish between squirrel cage rotor and slip ring rotor.

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

3C. 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 . **(4+6+10)**

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

4B. With sketches prove that the speed of the rotating field is inversely proportional to number of poles.

4C. A 15 kVA transformer is loaded as follows

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. **(4+6+10)**

5A. 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 %.

5B. Determine the iron loss and full load copper loss of a 1 kVA, 50 Hz, 200/400 V transformer.

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. **(10+10)**

6A. Explain the significance of O.C & S.C tests on a transformer.

6B. 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.

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.

6C. Find the line current of a 3 phase, 50 Hz, Δ connected 20 hp, 400 V induction motor stated using Y/Δ starter. Full load efficiency =0.8, Full load PF=0.85.

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. **(3+10+7)**

7A. 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.

7B. 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

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. **(10+10)**

8A. A 4 kVA, 200/400V, 50 Hz transformer has an impedance of (1+j3)Ω referred to secondary, Find the % regulation at full load and the following power factors.

a) 0.8 PF lag b) 0.8 PF lead c) unity PF.

Comment on results.

8B. 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.

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

8C. Draw and explain the phasor diagram of a transformer supplying

a) a lagging PF load b) Leading PF load **(6+6+8)**