Reg. No.									

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

A Constituent Institution of Manipal University

IV SEMESTER B.TECH (ELECTRICAL & ELECTRONICS ENGINEERING)

MAKE-UP EXAMINATIONS, JUNE 2017

SUBJECT: ELECTRICAL MACHINERY – II [ELE 2202]

REVISED CREDIT SYSTEM

Time: 3 Hours **Date: 16 June 2017** **Max. Marks: 50**

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitably assumed.
- Graph sheet may be provided.

1A. A 250 V DC shunt motor on no-load runs at 1,200 rpm and draws 5 A. The total armature and shunt field resistances are 0.2 Ω and 250 Ω respectively. Calculate the full-load speed when the motor takes 40 A. Armature reaction weakens the flux by 1 % from no-load to full-load. ***(04)***

1B. A Field's test on two mechanically coupled DC series motors gave the following data.

	Armature current	Armature voltage	Field winding voltage drop
Motor:	50 A	500 V	38 V
Generator:	38 A	400 V	36 V

Resistance of each armature is 0.2 Ω.
Calculate the efficiency of each machine at this load. ***(04)***

1C. Draw a characteristic to explain why DC series motors are never started or run under no-load condition. ***(02)***

2A. A DC shunt motor draws 22 A at rated voltage of 200 V and runs at 1,000 rpm. Its field resistance is 100 Ω and armature circuit resistance is 0.5 Ω. If the total rotational losses at this load are 350 W, compute: (i) torque developed (ii) armature and field copper losses and (iii) efficiency of operation. ***(03)***

2B. Two star-connected synchronous generators are connected in parallel to supply a balanced load of 1,500 kVA at 11 kV and 0.8 lagging power factor. The per-phase synchronous reactances of the two generators are 35 Ω and 40 Ω respectively. The prime movers of the 2 generators are adjusted so that they share the total active power equally. The phase current in one generator is 43 A at lagging power factor. Calculate:

a) Phase current of the second generator.
b) Power factors at which each generator operate.
c) Induced emf of each machine. ***(05)***

2C. What are the advantages of placing the field system of a large alternator on its rotor and the 3-phase windings on its stator? ***(02)***

3A. A 3-phase, 3,000 kVA, 6.6 kV, 50 Hz, 750 rpm, star connected synchronous generator has a synchronous reactance of 2.9 Ω per phase and a negligible resistance. It is running in parallel with infinite bus. Calculate synchronizing power and synchronizing torque per mechanical degree of displacement at full-load, 0.8 pf leading. ***(03)***

3B. A 3-phase, 50 Hz, 1000 rpm, star connected alternator has 72 armature slots with 6 conductors per slot and the coil span is 10 slots. The average airgap flux per pole is 0.26Wb. Calculate the distribution and pitch factors of the winding, number of turns per phase and line value of emf induced. ***(04)***

3C. Explain the effect of load power factor on armature reaction in alternators. ***(03)***

4A. A 30kVA, 440V 3-phase 50Hz star connected alternator gave the following test data. If the per phase resistance is 0.3 Ω, calculate the voltage regulation at full load 0.8 pf lagging by EMF method.

I_f (A)	2	4	6	8	10
OC Voltage(V_{Line})	155	287	395	475	530
S.C Current (A)	11	22	34	46	57

(04)

4B. Draw and explain the phasor diagram of salient pole alternator based on Blondel's two reaction theory. ***(03)***

4C. Why a synchronous motor is not self-starting? Explain any two methods of starting synchronous motor. ***(03)***

5A. An industrial plant is supplied with 850kVA of electrical power at 0.7pf lagging from a 3-phase 50Hz, 11kV substation. A synchronous motor of rating 110kVA operating at a leading power factor of 0.5 is added during expansion. Calculate the new kVA supplied and overall power factor of the plant. ***(05)***

5B. A 1000 kW, 3.3 kV, 24 pole, 50Hz, 3-phase star connected synchronous motor has synchronous reactance of 3.4 Ω per phase and the resistance is negligible. The motor is fed from infinite bus bar at 3.3kV. Its field excitation is adjusted to result in upf operation at rated load. Compute the maximum power and torque that the motor can deliver with its excitation remains constant at this value. ***(05)***