Reg. No.									

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

IV SEMESTER B.TECH (ELECTRICAL & ELECTRONICS ENGINEERING)

END SEMESTER EXAMINATIONS, APRIL / MAY 2019

ELECTRICAL MACHINERY – II [ELE 2202]

REVISED CREDIT SYSTEM

Time: 3 Hours **29, APRIL 2019** **Max. Marks: 50**

Instructions to Candidates:

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

1A. 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. Compute,

(a) The net output torque.
(b) The line current at 70% efficiency.

Assume constant rotational loss of 350W. ***(03)***

1B. Hopkinson's test was conducted on two identical DC machines. It gave the following results for full load: Line voltage is 220 V, field currents of motor & generator are 0.3 A & 0.45 A respectively. The armature currents of motor & generator are 25 A & 19.5A respectively. Calculate the efficiency of generator if the armature resistance of each machine is 0.45 Ω. ***(04)***

1C. A 240 V dc series motor takes 40 A at rated output running at 1000 rpm. Its total winding resistance is 0.3 Ω. Calculate the value of resistance which must be added in series to obtain same torque at 700 rpm. ***(03)***

2A. Explain how overload release and no-volt release are achieved in a three point starter with the help of suitable diagram. ***(03)***

2B. A 400V, 40kW, 550rpm dc shunt motor has full load efficiency of 89%. Resistance of shunt field and armature windings are 200Ω and 0.2Ω respectively. Find the speed of the motor during regenerative braking mode at which the machine develops rated electromagnetic torque. ***(03)***

2C. Two alternators *X* and *Y* with capacities 80MW and 30MW respectively operate in parallel in a power station. Full load speed regulation of *X* is 2.5% and that of *Y* is 3.2%. If no load frequency of both the machines are 50Hz, calculate the common operating frequency with a connected load of 60MW. ***(04)***

3A. Describe the operation of alternator with constant excitation and variable load with suitable phasor diagrams. What is the significance of the condition with minimum excitation? Analyze the relation between power factor and excitation with the help of suitable curve. ***(05)***

3B. What is the role of damper winding in synchronous machines? Where is it placed in the machine? ***(03)***

3C. In a star-connected alternator calculate the percentage of 5^{th} harmonics induced in the line voltage if the average flux per pole of fifth harmonic components is 1% of that of the fundamental. Neglect the pitch and distribution factors. ***(02)***

4A. A 10 kVA, 440 V, 50 Hz, 3-phase star-connected alternator has the following open circuit characteristics. With zero pf full-load applied, an excitation of 14 A produced a terminal line voltage of 500 V and an excitation of 6 A produced a voltage of 200 V. On short circuit, 4 A excitation was required to circulate the full load current. Using the Potier triangle method, determine the voltage regulation at full-load 0.6 pf lagging. Assume armature resistance of 2 Ω per phase.

Field current (A)	1	3	5	8	11	15
Terminal Line Voltage (V)	100	300	440	550	600	635

(05)

4B. A factory has an average load of 1000kW at a power factor of 0.6 lag. A synchronous motor of 86% efficiency is used later to supply an additional mechanical load of 65kW and also to improve the overall power factor to 0.92 lag. Determine the power factor at which the synchronous motor operates. Also comment on the type of excitation required for the synchronous motor for this application and draw the corresponding phasor diagram relating terminal voltage and excitation emf. ***(05)***

5A. What is the significance of reluctance power in salient pole synchronous machines? Discuss with power-angle characteristics. ***(03)***

5B. Explain the operation of PMBLDC motor. What are its drawbacks ***(03)***

5C. A 10MVA, 6-pole star-connected alternator is synchronised to 13kV bus bar supplies half load at 0.84 pf lag. Find the excitation emf and air-gap voltage. Also calculate the synchronising power developed with a displacement of 2.5 mechanical degrees. Synchronous reactance is 7Ω and leakage reactance is 1.7Ω. Neglect the armature winding resistance. ***(04)***