ELL332 Electric Drives
Minor Test 2

Max Marks: 20

Date and Time: 22/3/2017 11:00 to 12:00 Hrs

1. State TRUE or FALSE for each of the following and Justify your answer with valid reason(s): **5 x 2=10 MARKS**
   a. A single-phase semi-controlled converter fed and a single-phase fully controlled converter fed separately excited DC motor drive are compared while operating at rated speed and 20% torque. The former one will have a better possibility of continuous conduction and it will also run at a higher speed as compared to the latter.
   b. If we arrange in the order of increasing energy efficiency the three braking schemes that can be employed to a DC shunt motor, the we can write: (i) regenerative braking (ii) Reverse current braking (iii) Rheostatic braking
   c. A series motor has a better possibility of continuous conduction because of its field inductance being lower as compared to that of separately excited DC motor.
   d. It is not possible to get the open circuit characteristics of a DC series machine because if you leave the series machine open, there cannot be any field current.
   e. The supply side power factor of 3-phase fully controlled converter fed DC motor will be better than that of a 3-phase semi-controlled converter case when the converter operates at a firing angle less than 60° and when the motor is running at 100% rated torque.

2. A separately excited DC motor of 3.7 kW, 380V, 11A, 1500 rpm rating is being fed by a 3-phase semi-controlled converter of 3-phase 280 V 50 Hz input. The resistance of the armature circuit is 2.3 Ω. Assume that the drive is working on continuous conduction with a converter firing angle of 60° with the load toque being 70%. Calculate the speed of the motor drive for this operating condition. Now, draw the waveforms of supply voltage and supply current for one phase, motor terminal voltage, back emf and armature current waveforms. Specify the devices that conduct during every interval. **7 MARKS**

3. A separately DC motor is running at its rated speed of 1200 rpm, drawing its rated current of 10A from a 220V supply. Its armature resistance is 2 Ω. Calculate the value of external resistance to be included in series with the armature circuit for limiting the armature current value to 10A (i) during dynamic braking (ii) during plugging assuming field excitation to remain as a constant. **3 MARKS**

Expressions for DC voltage in AC-DC Converters

single-phase full converter: $V_{dc(avg)} = (2V_m/\pi)\cos\alpha$ where V_m = peak of the input voltage

single-phase Semi-converter: $V_{dc(avg)} = (V_m/\pi)(1+\cos\alpha)$ where V_m = peak of input voltage

3-phase full converter: $V_{dc(avg)} = (3V_m/\pi)\cos\alpha$ where V_m = peak of the input line voltage

3-phase semi-converter: $V_{dc(avg)} = (3V_m/2\pi)(1+\cos\alpha)$
where V_m = peak of the input line voltage

(P.T.O.)