Reg. No.										

Manipal Institute of Technology, Manipal

(A Constituent Institute of Manipal University)

VII SEMESTER B.TECH (ELECTRICAL & ELECTRONICS ENGINEERING)

MAKE UP EXAMINATIONS, DEC 2015 / JAN 2016

SUBJECT: SOLID STATE DRIVES [ELE 403]

REVISED CREDIT SYSTEM

Time: 3 Hours 07 January 2016 MAX. MARKS: 50

Instructions to Candidates:

- Answer **ANY FIVE FULL** questions.
- Missing data may be suitably assumed.
- Sine graph sheets may be used.

1A. Illustrate the four quadrant operation of an electric drive by choosing a typical application. (04)

1B. A motor drives two loads, one has rotational motion, and is coupled to the motor through a reduction gear with gear ratio 0.1 and efficiency 90%. The load has a moment of inertia of 10 kg-m^2 and a torque of 10 Nm. Other load has translational motion and consists of 1000 Kg to be lifted up at uniform speed of 1.5 m/s. The coupling between the motor and the load has an efficiency of 85%. The motor has a moment of inertia of 0.2kg-m^2 and runs at a constant speed of 1420 rpm. Determine the equivalent inertia referred to the motor shaft and the power delivered by the motor. (06)

2A. A 220V, 1500 rpm, 11.6 A separately excited motor has La=28.36 mH and Ra=2Ω is controlled by a single phase fully controlled rectifier with a source voltage of 230V, 50 Hz, and is operating with controlled freewheeling. Identify the operating mode and determine the steady state speed of operation for $\alpha=60^0$ and $\alpha_n=0^0$, Ta=30 N-m. Also sketch the load voltage and load current waveforms. (06)

2B. What are the components of load torque? How they are modeled? (04)

3A. With relevant waveforms and triggering sequence, explain three phase fully controlled rectifier feeding a separately excited DC motor armature operating in motoring mode with continuous conduction. Derive also the expression for the average voltage developed across the armature. (05)

3B. Explain working of a class C chopper fed separately excited DC motor with the help of circuit diagram and waveforms of load voltage and current. (05)

4A. Explain the concept of field oriented control. With the help of detailed block diagram explain direct vector control scheme for variable speed Induction Motors (05)

4B. Derive the expression for the current drawn be a separately excited DC motor fed from a Class A chopper. Sketch the relevant waveforms. (05)

5A. Write short notes on

a) Effect of armature current ripple on motor performance.

b) Dual converters (04)

5B. With a neat block diagram, explain a brushless excitation scheme implemented in synchronous machines. (03)

5C. Explain Static rotor resistance control method implemented in 3 phase wound rotor induction machine (03)

6A. List and explain the power line disturbances. How are they mitigated? (04)

6B. Why does the performance of a V/f controlled induction machine drive deteriorate at very low speed. (03)

6C. Why is slip energy recovery scheme preferred for very large capacity drives (03)