| | Reg. No. | | | | | | | | | |
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| Manipal Institute of Technology, Manipal (A Constituent Institute of Manipal University) | | | | | | | | | | |
| VII SEMESTER B.TECH (ELECTRICAL & ELECTRONICS ENGINEERING) | | | | | | | | | | |

END SEMESTER EXAMINATIONS, NOV/DEC 2015

SUBJECT: SOLID STATE DRIVES [ELE 403]

REVISED CREDIT SYSTEM

Time: 3 Hours

05 DECEMBER 2015

MAX. MARKS: 50

Instructions to Candidates:

- ✤ Answer ANY FIVE FULL questions.
- Missing data may be suitably assumed.
- Sine graph sheets may be used.
- **1A.** Sketch and briefly explain the block diagram of a typical electric drive system. What are the main factors which decide the choice of electrical drive.
- **1B.** With the help of neat circuit diagram explain the operation of a separately excited dc motor fed by a three phase rectifier with controlled flywheeling in motoring mode with discontinuous conduction. Draw the waweform of load voltage, load current, show the triggering sequence. Derive the output voltage and speed.
- **2A.** A 220V, 1500 rpm, 13.6A separately excited dc motor is controlled by 1- Φ fully controlled rectifier with an AC source voltage of 230V, 50 Hz. If the motor parameters L_a = 30mH and R_a = 2.5 Ω , calculate motor torque for α = 120°, and speed = -1400 rpm. Also sketch the load voltage and load current waveforms.
- 2B. A weight of 500kg is being lifted up at a uniform speed of 1.5m/sec by a winch, driven by a motor running at a speed of 1200rpm. The moment of inertia of the motor and winch are 0.6 and 1.3 kg-m² respectively. Calculate the power, motor torque and the equivalent moment of inertia referred to the motor shaft. In the absence of weight motor develops a torque of 90 N-m when running at 1200rpm.
- **2C** Sketch the speed, torque and power characteristics with respect to time of an ideal transportation drive.
- **3A.** Explain with the help of relevant wave forms, working of a two quadrant type B chopper supplying a separately excited DC motor operating in $T_p/2 < t_\alpha < T_p$.

ELE 403

(04)

(02)

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(06)

(05)

| 3B. | A 230V, 3.7KW, 1000rpm, 20Amp DC motor has an armature resistance and inductance of 1.4 Ω and 16.5mH respectively. The motor is fed by a 3- ϕ fully controlled rectifier with an AC source voltage of 170.3(line), 60Hz. Find the critical torque and motor speed. Draw the load voltage and current waveform for a firing angle of 60° when motor develops a torque of 10N-m. | (06) |
|-----|--|------|
| 4A. | For an ideal type A chopper circuit the following conditions are given dc source voltage is of 200V, Chopping frequency 500Hz duty cycle 0.45, $R = 2$ ohm, L=6mH, and back EMF 20 Volts. Calculate the following quantities (i) average output current (ii) Maximum and minimum value of steady state output current. | (05) |
| 4B. | Explain the principle of operation of a dual converter in circulating current mode, used for speed control of dc drive. | (05) |
| 5A. | With a block schematic, explain how control of field current for constant power factor, can be achieved statically in synchronous machine. | (03) |
| 5B. | Explain the concept of slip power recovery scheme of speed control of induction motor. Discuss how this scheme is implemented in static sub synchronous converter cascade. What modification is needed to achieve super-synchronous mode of operation .List advantages and disadvantages of this scheme? | (07) |
| 6A. | With the help of block schematic explain the working of on line UPS. | (02) |
| 6B. | What are the different methods used in variable frequency drives? With neat block diagram explain the basic direct torque control scheme for AC motor drives and mention its properties. | (05) |
| 6C | With the help of torque slip characteristics show that stator voltage control is best suited for pump & fan drive systems. Sketch the power circuit for a | |

reversible adjustable speed induction motor drive. (03)