M.E. ELECTRICAL ENGINEERING - FIRST YEAR - SECOND SEMESTER

(1st / 2nd Semester/Repeat/Supplementary/Annual/Bi-Annual)

SUBJECT: - ADVANCED ELECTRIC DRIVES

Time: Three hours

Answer any Two Questions

Full Marks 100
(50 marks for each part)

Use a separate Answer-Script for each part

No. of Questions	PART I	Marks
Q1.	a) Explain how speed control of a three phase induction motor can be achieved under V/f mode in low speed region.	6
	b) For a three phase induction motor, explain with the help of model equations how field orientation can be obtained from the stator voltage and current information in case of a stator flux oriented control scheme. Develop the block diagram for the same.	10+5
	c) How the speed sensing can be done for the above induction motor drive system?	4
Q2.	a) What are the advantages of field oriented control of a three phase induction machine? Develop the block diagram of an indirect rotor field oriented control scheme and explain the same.	5+12
	b) Explain the relative merits and demerits of indirect field oriented control scheme over direct control scheme.	8
Q3.	a) What is direct torque control (DTC) scheme of a three phase induction motor drive system? From the basic principle, develop the control block diagram for a three phase induction motor under DTC mode and explain the blocks used.	13
	b) A 415V, 6-pole 50 Hz, 2.2kW, 970 rpm star connected three phase induction motor is controlled with constant v/f technique. Assuming constant slip speed for same torque, calculate the applied voltage and frequency for the speed commands of (i) 10 rpm and (ii) 600 rpm and (iii) 1000 rpm. (Assume rated torque under all speeds and no leakage impedance drop for the machine)	12

Master of Electrical Engineering, 1st Year 2nd Semester Examination, 2019

SUBJECT: ADVANCED ELECTRIC DRIVES (MACHINES)

Time: Three Hours   Full Marks: 100

Use a separate Answer-Script for each part
PART – II   **Marks**
Answer any three questions.
Two marks are reserved for neat and well organized answer.

1. a) Explain what is constant power and constant torque drive in drive application?   6
   (b) Derive the relation between speed and torque of D.C. motor when fed from single phase half controlled rectifier. Also explain what are the advantages of semi converter over fully controlled converter in drive application?   10

2. (a) Explain how resistance drop in armature circuit in D.C motor drive is compensated without speed feedback ? Sketch and explain the principle of closed loop speed control of a D.C. motor considering armature resistance drop compensated technique.   8
   (b) Sketch and explain the principle of closed loop speed controlled of a D.C. motor using dual feedback loops with speed and current feedback.   8

3. (a) Explain what are the advantages of Sinusoidal Pulse Width Modulated inverter over stepped wave inverter fed Induction motor drive ? Also explain what is modulation index ratio ?   8
   (b) Explain how the performance of induction motor are affected when fed from non-sinusoidal voltage.   8

4. (a) Sketch and explain the principle of speed control of induction motor using speed back.   8
   (b) Prove that when induction motor is fed from non-Sinusoidal voltage , the 5th harmonic component of voltage produc negative sequence and 7th harmonic component of voltage produce a positive sequence voltage.   8

5. (a) Prove that when induction motor is fed from non-Sinusoidal voltage the slip at m th harmonic is given by
$$S=1+N/mNs.$$

The symbol bears their usual meanings.   **8**

(b) Derive the final approximated harmonic equivalent circuit of
   3 phase induction motor from the equivalent circuit for
   Fundamental voltage.   **8**