U.S.N | | | | | | | | | | |

P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belagavi)

Seventh Semester, B.E. - Electrical and Electronics Engineering

Semester End Examination; Jan. / Feb. - 2021

AC and DC Drives

Time: 3 hrs *Max. Marks: 100*

***Note**: Answer **FIVE** full questions, selecting **ONE** full question from each unit.*

UNIT - I

1 a. With the help of neat diagram and necessary equations, explain the speed torque characteristics of separately excited DC motor. 6

b. With relevant circuit and waveforms, explain the operation of single phase half controlled converter fed separately excited DC motor drive under continuous and discontinuous mode. 14

2 a. Draw the block diagram of an electric drive. State different classifications of power modulator and explain them in brief. 8

b. 220 V, 960 rpm, 12.8 A, separately excited DC motor has armature circuit resistance and inductance of 2 Ω and 150 mH respectively. It is fed from a single phase half controlled rectifier with an AC source voltage of 230 V, 50 Hz. Calculate; 12

i) Motor torque for $\alpha = 60°$ and Speed = 600 rpm

ii) Motor speed for $\alpha = 60°$ and Torque = 20 N-m

UNIT - II

3 a. With the help of circuit diagram and waveform, explain the two quadrant operation of separately excited DC motor when fed from chopper control? 10

b. The speed of a 20 hp, 300 V, 1800 rpm separately excited DC motor is controlled by a three phase full converter drive. The field current is also controlled by three-phase full converter and is set to the maximum possible value. The AC input is a three phase, Y-connected, 208 V, 60 Hz supply. The armature resistance is R_a = 0.25 Ω, the field resistance is R_f = 245 Ω, and the motor voltage constant is K_v = 1.2 V/A rad/s. The armature and field current can be assumed to be continuous and ripple free. The viscous friction is negligible. Determine; 10

i) The delay angle of the armature converter if the motor supplies the rated power at the rated speed

ii) The no-load speed, if the delay angles are same as in (i) and the armature current at no load is 10% of the rated value

iii) The speed regulation

4 a. Comparison between circulating current mode and non-circulating current mode dual converters. 6

Contd…2

b. With the help of circuit diagram and waveforms, the motoring and braking operation of a three phase fully controlled rectifier fed separately exited DC motor. 8

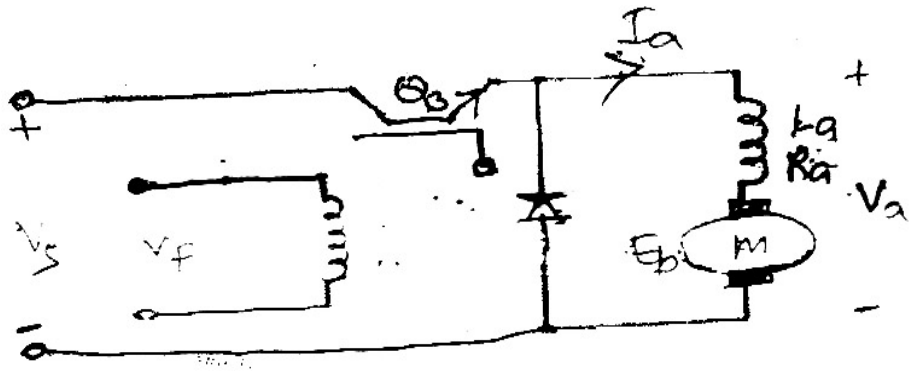
c. A DC separately excited motor is powered by a DC-DC converter as shown in Fig. 4(c) from a 600 V DC source. The armature resistance is Ra = 0.05 Ω. The back emf constant of the motor is K_v = 1.527 V/A rad/s. The average armature current is I_a = 250 A. The field current is I_f = 2.5 A. The armature current is continuous and has negligible ripple. If the duty cycle of the DC-DC converter is 60%. Determine;

i) The input power from the source

ii) The equivalent input resistance of the DC-DC converter drive

iii) The motor speed

iv) The developed torque 6



UNIT - III

5 a. Deduce the open loop transfer function of exited DC motor drive and represent the same in block diagram approach. 9

b. With a neat block diagram of a closed- loop converter-fed DC motor drive, explain the operation of closed loop converter-fed DC motor. 5

c. With a neat schematic diagram, explain the computer controlled four quadrant DC drive operation. 6

6 a. Explain the dynamic braking, counter current braking and regenerative braking of DC shunt motor. 10

b. Explain the operation of closed loop speed control of DC motor with inner current loop and field weakening. 10

UNIT - IV

7 a. Explain the speed torque characteristics of induction motor. Mention the modes of operation. 6

b. Explain the control regions of the induction motor and infer on the effects of variable parameters on its performance. 7

c. Explain the principle of variable voltage and variable frequency control of induction motor. 7

Contd…3

8 a. With the help of a neat circuit diagram, explain the VSI fed V/F control induction motor drive. 7

b. Explain the operation of static Scherbius drive. 8

c. Differentiate between VSI and CSI. 5

UNIT - V

9 a. Explain the operation of self-controlled synchronous machine. 7

b. With a neat block diagram, explain the process of cold rolling mill. 7

c. Explain the applications of industrial drive in textile industry. 6

10 a. What is load commutated inverter drive? Explain the principle and controlling operation of synchronous drive using load commutated inverter. 7

b. With the help of schematic diagram, explain the process and operation of paper mill. 6

c. With help of schematic diagram, explain the process and operation of cement mill. 7

* * *