

# International Islamic University Chittagong (IIUC)

Department of Electronic and Telecommunications Engineering

Final Examination, Autumn- 2018

Course Code: ETE-2425

Course Title: Electrical Machine and Industrial Electronics ✓

Full Marks: 50

Time: 2 Hours 30 Minutes

(Figures in the margin indicate full marks)

## Group-A

[Answer any two sets of the following questions]

1. (a) Write the methods of speed control of DC motor from AC supply. 2  
(b) Draw the circuit of Thyristor speed control of a series D.C motor and explain its operation. 4  
(c) The speed of a separately excited d.c. motor is controlled by a chopper. The supply voltage is 120 V, armature circuit resistance =  $0.5 \Omega$ , armature circuit inductance = 30 mH and motor constant =  $0.05 \text{ V/r.p.m.}$  the motor drives a constant load torque requiring an average current of 20 A. Assume motor current is continuous. Calculate (i) the range of speed control (ii) the range of duty cycle. 4
2. (a) What does mean by harmonics and harmonic factor. 2  
(b) Draw the single phase half wave rectifier circuit with proper wave-form for R load. 3  
(c) A single phase half wave rectifier has a purely resistive load R. Determine (i) the efficiency, (ii) the Form factor, (iii) the ripple factor, (iv) the transformer utilization factor, (v) the crest factor of the input current. 5
3. (a) What is a controlled rectifier? Why it is called controlled. 2  
(b) Draw the single phase full wave controlled rectifier with proper wave-form for RL load. 3  
(c) A single phase half wave controlled rectifier has a purely resistive load of R and delay angle is  $\alpha = \pi/2$ , determine (i) the rectification efficiency, (ii) the Form factor, (iii) the ripple factor, (iv) the transformer utilization factor, (v) the peak inverse voltage of thyristor. 5

## Group-B

[Answer any three sets of the following questions]

4. (a) Mention some application of DC-DC converter. 2  
(b) *A boost regulator provides an output voltage greater than the input voltage* Justify the above statement. 4  
(c) The dc converter has a resistive load of  $R = 10$  and the input voltage is  $V_s = 220 \text{ V}$ . When the converter switch remains on, its voltage drop is  $v_{ch} = 2 \text{ V}$  and the chopping frequency is  $f = 1 \text{ kHz}$ . If the duty cycle is 50%, determine (i) the

average output voltage  $V_a$ , (ii) the rms output voltage  $V_o$ , (iii) the converter efficiency, (iv) the effective input resistance  $R_i$  of the converter.

5. (a) What is an inverter? What is the main function of an inverter? 2
- (b) Briefly describe the operation of sinusoidal pulse width modulation of voltage control of single phase inverter with proper figure. 3
- (c) The single phase half bridge inverter has a resistive load  $R=2.4 \Omega$  and the dc input voltage is  $V_s=48 \text{ V}$ . determine (i) the rms output voltage at the fundamental frequency  $V_{o1}$ , (ii) the output power  $P_o$ , (iii) the average and peak currents of each transistor. 5
6. (a) What are the functions of reference signal in voltage in voltage control of single phase inverter? 2
- (b) Draw the basic circuit of boost regulator and briefly explain its operation with waveforms. 4
- (c) Write the method of generation of duty cycle. 4
7. (a) Classify the ac voltage control method. What is a cycloconverter? 2
- (b) Briefly explain the operation of single phase cycloconverter to get out  $f_o=2f_i$  4
- (c) A single phase ac voltage controller has a resistive load of  $R=10 \Omega$  and the input voltage is  $V_s=120 \text{ V}$ , 50 hz. The thyristors switch is on for for  $n=25$  cycles, and is off for  $m=75$  cycles. Determine (i) the rms value of output voltage, (ii) the input power factor, and (iii) the average and rms current of thyristor. 4