

International Islamic University Chittagong
Department of Electrical and Electronic Engineering

Final Examination Autumn-2018

Course Code: EEE 4705

Time: 2 hours 30 minutes

Program: B.Sc. Engg. (EEE)

Course Title: Power Electronics

Full Marks: 50

Part A

[Answer any two questions from the followings; figures in the right margin indicate full marks.]

- 1(a). Explain the operation of three phase semiconverter with circuit diagram and necessary waveforms, when $\alpha=90^\circ$. 06
- 1(b). Consider a 3- Φ full wave converter (controlled) is operated from a 3- Φ Y-connected 208V, 60 Hz supply and the load resistance is $R=15\Omega$. If it is required to obtain an average output voltage of 50% of the maximum possible output voltage, Calculate- (a) the R.M.S and average output currents (b) the rectification efficiency and (c) the input power factor PF. 04
- 2(a). Explain the operation of step up chopper with suitable circuit diagram. Also write down - what will happen if duty cycle K tends to 1? 05
- 2(b). A step-down chopper is feeding an R-L load with $V_s = 220V$, $R=5\Omega$, $L=7.5mH$, $f=1KHz$, $k=0.5$ and $E=0V$. Calculate (a) the minimum instantaneous load current I_1 , (b) the peak instantaneous load Current I_2 , (c) the maximum peak to peak load ripple current, (d) the average value of load Current I_a and (e) the effective input resistance R_i seen by the source. 05
- 3(a). Explain the operation of three phase half wave converter with circuit diagram and necessary waveforms. 05
- 3(b). Explain the operation of buck-boost regulator with necessary circuit diagram and waveforms. 05

Part B

[Answer any three questions from the followings; figures in the right margin indicate full marks.]

- 4(a). Explain the operation of three phase bridge Inverter (180° conduction) with suitable circuit diagram and waveforms. (04 modes) 06
- 4(b). A Single Phase full-bridge inverter has a resistive load of $R=10\Omega$ and the dc input voltage is $V_s = 220V$. Determine (a) the rms output voltage at the fundamental frequency V_1 , (b) the output power P_o , (c) the average and peak currents of each transistor, (d) the peak reverse blocking voltage V_{BR} of each transistor. 04

- 5(a). Explain the operation of Single Phase Bidirectional controllers with circuit diagram and waveforms. 06
- 5(b). A single Phase Unidirectional AC voltage controller has a resistive load of $R=10\Omega$ and the input voltage is $V_s = 120V, 60Hz$. The delay angle of thyristor T_1 is $\alpha = \pi/2$. Determine (a) the rms value of output voltage V_o , (b) the input power factor PF, and (c) the average input current. 04
- 6(a). How can you control the speed of a separately excited dc motor by single phase Half-wave converter? Briefly explain with suitable circuit diagram and necessary equation. 05
- 6(b). The speed of a separately excited motor is controlled by a single phase semiconverter. The field current, which is also controlled by a semiconverter, is set to the maximum possible value. The AC supply voltage to the armature and field converter is one-phase, 208 V, 60 Hz. The armature resistance is $R_a = 0.25\Omega$, and the field resistance is $R_f = 147\Omega$ and the motor voltage constant is $K_v = 0.7032 V/A\text{- rad/s}$. The load torque is $T_L = 45 N.m$ at 1000 rpm. The viscous friction and no load losses are negligible. The inductance of the armature and field circuits is sufficient enough to make the armature and field currents continuous and ripple free. Determine (a) The field current I_f and (b) The average armature current I_a . 05
- 7(a). What is cycloconverter? Classify it. 02
- 7(b). How many types of cycloconverters are normally used for AC voltage control? Explain one of them with circuit diagram and necessary waveforms. 02
- 7(c). Which of the parameters of a separately excited dc motor should be varied to vary its speed? 02