

SET-2 (Only for those students whose ID is Odd number)

International Islamic University Chittagong
Department of Electrical and Electronic Engineering

Final Examination Autumn-2020

Course Code: EEE-4705

Time: 5 hours (Writing -4 hours 30 minutes + 30 minutes submission time)

Program: B.Sc. Engg. (EEE)

Course Title: Power Electronics

Full Marks: 50 (Written 30 + Viva -20)

[Answer **each of the** questions from the followings; Figures in the right margin indicate full marks. **Answer script must be submitted through online method within 5 hours from starting time**]

SET-2

- 1(a). Design and explain (with the help of input and output waveforms) the operation of a semiconverter circuit whose firing angle is 90° . **CO1 C,U 03**
- 1(b). A three phase full converter in fig-1 is operated from a three phase Y connected 240V, 60 Hz supply and a 230V dc motor is connected as a load of that converter. Motor load resistance is $R = 10 \Omega$. What will be the range of angle at which that motor will be damaged? **CO2 E 02**

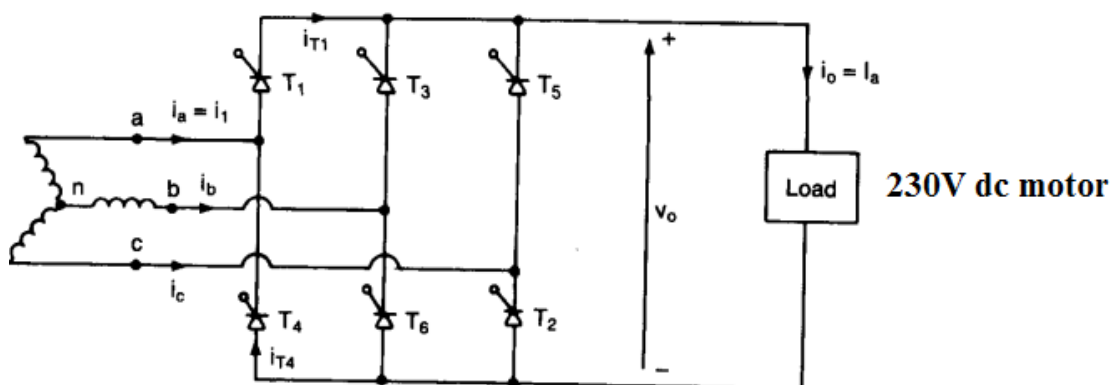


Fig-1

- 1(c). Why do thyristors are fired beyond $\pi/6$ for a three-phase converter? **CO1 U 01**
- 2(a). A step-down chopper is feeding an R-L load with $V_s = 250V$, $R=10\Omega$, $L=10mH$, $f=4.5KHz$, $k=0.4$ and $E=2V$. 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. **CO2 E 03**
- 2(b). "A chopper can be used to step up a dc voltage source"- justify it with suitable circuit diagram. **CO1 E 03**
3. Design a three phase bridge Inverter with resistive load (120° conduction) and explain the operation with the help of gating signals, calculation and output waveform.(serially from 2nd to 6th mode) **CO3 C 06**
- 4(a). Explain the operation of a three phase bidirectional controller with circuit diagram and necessary wave forms (Input , gating signal and output wave forms), when $\alpha = 45^\circ$. **CO1 U 03**

- 4(b).** A single Phase full-wave AC voltage controller in fig-4(b) has a resistive load of $R=10\Omega$ and the input voltage is $V_s = 230V, 60Hz$. What will be the delay angle (firing angle) α of thyristor T_1 and T_2 , if we want to get 10V (ac) output. **CO2 E 01**

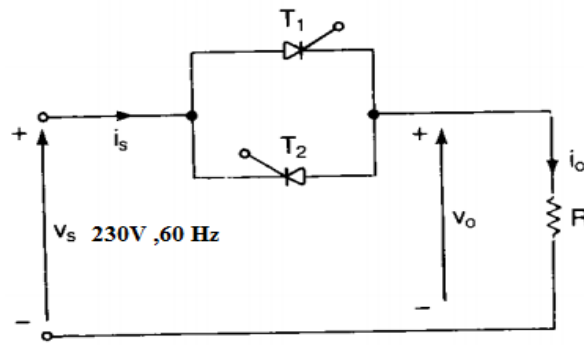


Fig-4(b)

- 4(c).** Design a single phase cycloconverter circuit whose output frequency will be 12Hz. Also modify it to get output frequency 20Hz.[Consider that supply frequency is 60Hz] **CO3 C 02**
- 5(a).** The speed of a separately excited motor is controlled by a single phase full-wave converter. The field current, which is also controlled by a full converter, is set to the maximum possible value. The AC supply voltage to the armature and field converter is one-phase, 250 V, 60 Hz. The armature resistance is $R_a = 0.9\Omega$, and the field resistance is $R_f = 70\Omega$ and the motor voltage constant is $K_v = 0.7032 \text{ V/A- rad/s}$. The load torque is $T_L = 20 \text{ N.m}$ 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 delay angle of the converter in the armature circuit, α_a . **CO2 E 03**
- 5(b).** Design a speed control circuit (using single phase full converter) with necessary output wave form of a separately excited dc motor. Also show that this motor can be stopped, rotated in forward direction and rotated in reverse direction by varying the firing angle. **CO3 E 03**
- 6.** Viva/Viva-Quiz: The time of viva/viva-quiz will be declared in google classroom. **CO1 U 20**