

Fifth Semester B.E. Degree Examination, Feb./Mar. 2022
Power Electronics

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. With neat circuit diagram, input and output waveform, explain the different types of Power Electronics Converters. (10 Marks)
- b. With block diagram, explain the peripheral effects of power electronic equipment. (06 Marks)
- c. Compare the advantages and disadvantages of full wave bridge rectifier and full wave centre tapped transformer rectifier. (04 Marks)

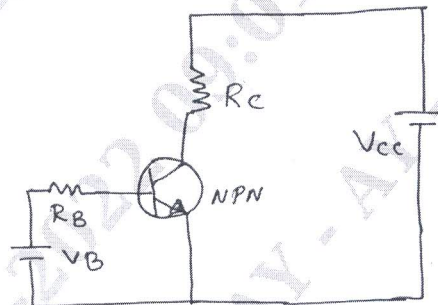
OR

- 2 a. Briefly explain the different types of Power diodes and its applications. (08 Marks)
- b. List the applications of Power Electronics. (04 Marks)
- c. With circuit diagram and waveform, explain the working of single phase full wave uncontrolled rectifier with R load. (08 Marks)

Module-2

- 3 a. Explain Switching characteristics of BJT with waveforms. (08 Marks)
- b. A power BJT is connected as a switch as in figure Q3(b) with the following data. Calculate
 - i) The value of R_B that will result in saturation with an overdrive factor of 20.
 - ii) The forced β
 - iii) Power loss in the transistor. (06 Marks)

Fig. Q3(b)



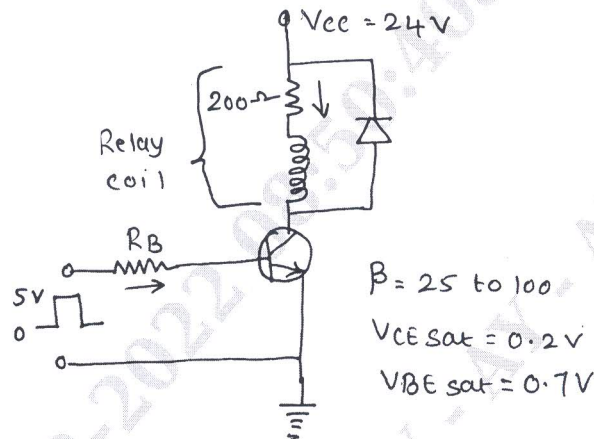
$V_{ce} = 100V$ $V_B = 8V$
 $V_{ce\ sat} = 2.5V$
 $V_{BE\ sat} = 1.75V$
 β of the transistor is varied from 10 to 60.
 $R_c = 10\ \Omega$

- c. Give a comparison between BJT and MOSFET. (06 Marks)

OR

- 4 a. Discuss the need of base drive control in a Power transistor. (08 Marks)
- b. A simple transistor switch is used to connect a 24V DC supply across a relay coil, which has a DC resistance of $200\ \Omega$. An input pulse of 0 to 5V amplitude is applied through a series base resistor R_B at the base so as to turn ON the transistor switch. Sketch the device current waveform with reference to the input pulse. Calculate :
 - i) $I_{C\ sat}$.
 - ii) Value of resistor R_B required to obtain over drive factor of 2.
 - iii) Total Power dissipation in the transistor that occurs during the saturation state. (06 Marks)

Fig. Q4(b)



- c. Explain steady state characteristics of n channel power MOSFET with necessary diagram. (06 Marks)

Module-3

- 5 a. Explain the V.I characteristics of SCR also define :
 i) Holding current ii) Latching current. (12 Marks)
- b. Explain any four method of Turn – ON used for Thyristors. (04 Marks)
- c. The latching current of an SCR used in a phase controlled circuit. Comprising an inductive load of $R = 10\Omega$ and $L = 0.1H$ is $15mA$. The input voltage is $325 \sin 314t$. Obtain the minimum gate pulse width required for reliable triggering of the SCR if gated at $\frac{\pi}{3}$ angle in every positive half cycle. (04 Marks)

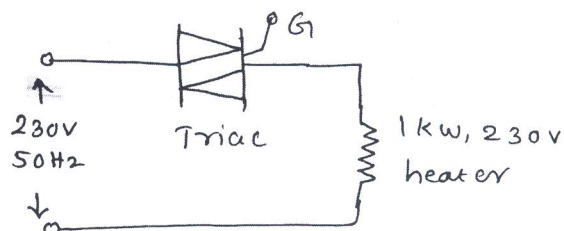
OR

- 6 a. Derive an expression for anode current using two transistor model of Thyristor. (08 Marks)
- b. A UJT is connected across a 220V DC supply. The valley and peak point voltages are 1V and 15V. The period of UJT relaxation oscillator is 20MS. Find the value of charging capacitor, if a charging resistor of $100k\Omega$ is used. (06 Marks)
- c. Explain Half wave RC firing circuit with necessary diagrams. (06 Marks)

Module-4

- 7 a. With the help of circuit diagram and waveform, explain the working of single phase full wave AC voltage controller with R load. (10 Marks)
- b. The single phase full wave AC voltage controller operates on a single phase supply voltage of 230V rms at 50Hz. If the triac is triggered at a delay angle of 45° during each half cycle of input supply. i) RMS value of output voltage ii) RMS value of current through heater
 iii) Average value of triac current iv) RMS value of triac current
 v) Input power factor. (10 Marks)

Fig. Q7(b)



OR

- 8 a. Explain Half wave controlled rectifier with R_L load, without freewheeling diode. Draw necessary diagrams. (10 Marks)
- b. A single phase half wave converter is operated from a 120V, 50Hz supply and the load resistance $R = 10\Omega$. If the average output voltage is 25% of the maximum possible average output voltage calculate : i) Delay angle α ii) The rms and average output currents
iii) The average and rms thyristor currents iv) The input power factor. (10 Marks)

Module-5

- 9 a. A Chopper circuit drives an Inductive load from 200V DC supply. Given the load resistance as 4Ω , the average load current as 30A and operating frequency is 400Hz. Compute the ON period and OFF period of the Chopper. Also determine the duty cycle of the Chopper. (06 Marks)
- b. With the help of circuit and waveforms, explain the operation of step up Chopper. (08 Marks)
- c. Explain Performance Parameters of Chopper. (06 Marks)

OR

- 10 a. Explain Single Phase full bridge Inverter operation with R load. Draw necessary diagrams. (10 Marks)
- b. Draw and explain Single Phase Transistorised Current Source Inverter. (10 Marks)
