Registration No.: | | | | | | | | | | |

Total Number of Pages: 02

Course: B.Tech
Sub_Code:
REC4D002/REE4C003/REI4D002/REL4C003

4th Semester Back Examination: 2024-25
SUBJECT: Power Electronics
BRANCH(S): AEIE, ECE, ETC, EEE, Electrical
Time: 3 Hours
Max Marks: 100
Q.Code: S518

Answer Question No.1 (Part-1) which is compulsory, any eight from Part-II and any two from Part-III.
The figures in the right hand margin indicate marks.

Part-I

Q1 **Answer the following questions:** **(2 x 10)**

a) Find the rms value of half wave rectified symmetrical square wave current of 3 A.
b) What is a secondary breakdown of BJT?
c) Define latching and holding current as applicable to SCR.
d) What is the need of driver circuit in power switches?
e) List different types of voltage control and current control device?
f) What are the difference between freewheeling diode and feedback diode?
g) In a single phase full converter, what will be the firing angle if the output voltage has peak and average values of 325V and 133V respectively?
h) Draw the load current waveform of single phase voltage source inverter with R-L load.
i) What are the advantages of bipolar switching over unipolar switching in SPWM control strategy as applied to inverters?
j) Write the applications of dc-dc converters.

Part-II

Q2 **Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)** **(6 x 8)**

a) Explain the different turn-on methods of Thyristor.
b) Describe the resistance firing circuit used for triggering SCRs. Is it possible to get a firing angle greater than 90° with resistance firing? Illustrate your answer with appropriate waveforms.
c) Draw and explain the VI characteristics of SCR.
d) Describe gate triggering of a thyristor. Does gate current has any effect on the forward breakover voltage? Discuss
e) For a step-down dc-dc converter dc source voltage is 230 V, load resistance of 10 Ω. For a duty cycle of 0.4, find the average and rms value of output voltage. Assume the switches are ideal.

f) The single-phase full bridge inverter has a resistive load of R = 2.4 Ω and the dc input voltage is Vs = 48 V. Determine (I) the rms output voltage at the fundamental frequency (II) the output power (III) The average and peak currents of each transistor (IV) the THD (v) DF

g) A resistive load of 10 Ω is connected through a half wave SCR circuit to 220 V, 50 Hz, single phase source. Calculate the power delivered to load for a firing angle of 40°.

h) Draw the switching model for power BJT. Also explain the secondary breakdown of BJT.

i) Draw the input and output voltage wave form of a full wave converter.

j) Explain sinusoidal pulse modulation as used in PWM inverters.

k) A single-phase half wave converter is operated from a 120 V, 60 Hz supply and the load resistance is R = 10 Ω. if the average output voltage is 25 % of the maximum possible average output voltage, calculate (I) the delay angle (II) the rms and average output currents (III) the average and rms thyristor current

l) Give a brief comparison between BJT, MOSFET, IGBT, and SCR.

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four) **(16 x 2)**

Q3 What is an IGBT? Describe the working of an IGBT. Derive the approximate and exact equivalent circuit of IGBT from its structural details. Also, describe its output and transfer characteristics. **(16)**

Q4 Draw the output voltage waveform of 3-phase full bridge thyristor rectifier for a firing angle of 45° explaining the operation of the converter. **(16)**

Q5 Explain 180° conduction scheme of a three phase voltage source inverter with relevant circuit diagram and waveform. **(16)**

Q6 Describe the principle of Boost converter operation. Derive an expression for its average output voltage. **(16)**