Registration No.:

Total Number of Pages: 02

Integrated Dual Degree (B.Tech and M.Tech)
REL4C003/REC4D002/REE4C003/REI4D002

4ᵗʰSemester Regular/Back Examination: 2023-24
SUBJECT: Power Electronics
BRANCH(S): ELECTRICAL, ECE, ETC, EE, ECE, EEE, AEIE, EIE
Time: 3 Hour
Max Marks: 100
Q.Code: P410
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) Write the advantages of freewheeling diode.
b) Write the drawbacks of resistant triggering method.
c) Explain blanking time.
d) What is the rms value of fundamental component of single phase bridge inverter if the input voltage is V.
e) Explain why an anti-parallel diode is connected across each MOSFET in inverter.
f) How is light triggering of a thyristor different from gate triggering?
g) Why freewheeling diode is not required in a semi converter?
h) What are the advantages of bipolar switching overunipolar switching in SPWM controlstrategy as applied to inverters?
i) What is secondary breakdown of BJT?
j) What is the importance of snubber circuit?

Part-II

Q2 **Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)** **(6 × 8)**
a) A single-phase full wave rectifier with R-L-E load has L = 6.5mH, R = 2.5Ω, and E = 10V. The input voltage is V_s = 120Vat 60Hz. Determine (I) the steady state load current at wt = 0, (II) the average diode current (III) the rms diode current (IV) the rms output current.
b) The parameters of UJT are V_s = 30 v, ɳ =0.51, I_P = 10µA,V_V = 3.5V, and I_v = 10mA.The frequency of oscillation is f = 60Hz,and the width of triggering pulse is tg = 50µs. Assume V_D = 0.5. Design the triggering circuit.
c) Explain with neat sketch the protection circuit of SCR.
d) Describe the principle of step up chopper. Derive an expression for the average output voltage in terms of input voltage and duty cycle.
e) Draw and explain the structure and characteristics power MOSFET and explain how it is different from BJT.

f) A single-phase Semi converter feed power to RLE load. For discontinuous load current, draw the output voltage, loadcurrent, source current and freewheeling diode current waveforms as a function of time when

(I) Extinction angle $\beta > \Pi$ (II) $\beta < \Pi$ with $V_m \sin \beta < E$

g) Draw and explain the dynamic characteristics of SCR during ON and OFF.

h) For a step-down chopper, input dc voltage is 230V, load resistance=10Ω. For the duty cycle of 0.5, Calculate I) the average and the rms values of output voltage and (II) Chopper frequency.

i) Explain IGBT with its circuit symbol and switching characteristics.

j) The input voltage to an SCR connected with snubber circuit is Vs=200V. The load and stray inductances are negligible and the thyristor is operated at a frequency of fs=2KHz. If the required (dv/dt) = 100 V/µs,and the discharge current is to be limited to 100A, determine the value of RC Snubber circuit.

k) A number of SCRs, each with rating of 2000V and 50A, are to be used in series-parallel combination in a circuit to handle 11KV and 400A. For a derating factor of 0.15, calculate the number of SCRs in series and parallel units. The maximum difference in their reverse recovery charge is 20 microcoulombs. Calculate (I) the value of dynamic equalizing capacitance and (II) the voltage across each of the slow thyristor in case one series connected SCR is fast.

l) For a buck boost converter, the input dc voltage is 14V. The duty cycle is 0.6 with switching frequency of 25KHz.The inductance L = 180µH and filter capacitance C = 220 µF. If the average load current is 1.5A, Compute

(i) The average output voltage

(ii) Peak to peak output voltage ripple

(iii) Peak to peak current in the inductor

(iv)The peak current of the device

Part-III
Only Long Answer Type Questions (Answer Any Two out of Four)

Q3   Explain 180° conduction scheme of a three-phase voltage source inverter with relevant circuit diagram and waveform.   **(16)**

Q4   With neat sketch explain the operation of three phase full wave ac to dc converter for R load with firing angle 15°.   **(16)**

Q5   Write short notes on   **(8x2)**
(I) Sinusoidal PWM
(II) Buck Converter

Q6   Explain the operations of four quadrant chopper.   **(16)**