U.S.N.										

B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

September / October 2023 Supplementary Examinations

Programme: B.E. **Semester: V**
Branch: Electrical & Electronics Engineering **Duration: 3 hrs.**
Course Code: 22EE5PCPEN **Max Marks: 100**
Course: POWER ELECTRONICS **Date: 25.09.2023**

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

UNIT - I

1 a) What are the steps involved in designing a power electronics equipment? **04**

b) Discuss basic structure of power diode and explain the details of each of the layers. Discuss the three major categories of power diodes **10**

c) Write a short note on intelligent power modules with the help of a functional block diagram **06**

UNIT - II

2 a) With the help of relevant sketches, discuss the working of an n-channel enhancement type MOSFET **06**

b) The bipolar transistor is specified to have β_F in the range of 8 to 40. The load resistance is $R_C = 11\ \Omega$. The dc supply voltage is $V_{CC} = 200$ V and the input voltage to the base circuit is $V_B = 10$ V. If $V_{CE(sat)} = 1.0$ V and $V_{BE(sat)} = 1.5$ V, find (a) the value of R_B that results in saturation with an ODF of 5, (b) the β_{forced}, and (c) the power loss P_T in the transistor. **08**

c) What are the advantages of SiC IGBTs over normal Si based IGBTs? Justify your answer with structural diagram of SiC IGBT **06**

OR

3 a) With switching models and waveforms, explain the switching characteristics of MOSFET **10**

b) The maximum junction temperature of a transistor is $T_J = 150°C$ and the ambient temperature is $T_A = 25°C$. If the thermal impedances are $R_{JC} = 0.4°C/W$, $R_{CS} = 0.1°C/W$, and $R_{SA} = 0.5°C/W$, calculate (a) the maximum power dissipation and (b) the case temperature. **04**

c) What is the importance of a proper design of gate drive circuit for a power BJT. Discuss antisaturation control in detail **06**

UNIT - III

4 a) Draw the circuit diagram of a single-phase diode bridge rectifier that supplies a very high inductive load such as a dc motor. The turns ratio of the transformer is unity. The load is such that the motor draws a ripple-free armature current of Ia. Determine (a) the HF of input current and (b) the input PF of the rectifier. **10**

b) A step down chopper supplies power to a R-L load. express the following variables as function of input voltage Vi, output current I_0, load resistance R, load inductance L and duty cycle (i) average output voltage (ii) minimum and maximum instantaneous currents (iii) current ripple **10**

UNIT - IV

5 a) A three phase bridge inverter is fed from a 500V dc source. The inverter is operated in 180° conduction mode and is supplying a purely resistive load. Draw the waveforms of output line voltages. Determine RMS value of the output line and phase voltages. **10**

b) Compare hard switched converter with resonant converter and explain the operation of Zero Current Switching converter. **10**

OR

6 a) A single-phase half bridge inverter has a resistive load of 2.4 Ω and the d.c. input voltage of 48 V.
Determine:-
(i) RMS output voltage at the fundamental frequency
(ii) Output power P_0
(iii) Average and peak currents of each transistor
(iv) Peak blocking voltage of each transistor.
(v) Total harmonic distortion and distortion factor.
(vi) Harmonic factor and distortion factor at the lowest order harmonic.

b) Compare hard switched converter with resonant converter and explain the operation of Zero Voltage Switching converter.

UNIT - V

7 a) With circuit diagram and waveforms, explain the working of a single phase full converter feeding R-L load. Derive the expressions of average output voltage. **12**

b) Is it sufficient to consider only one mode to find output current of a full converter with R-L-E load. Obtain the expression for output current i_L of a single phase full converter as a function of time. **08**

****