PRESIDENCY UNIVERSITY
BENGALURU

SCHOOL OF ENGINEERING

TEST1 EXAMINATION

Winter Semester: 2021 - 22

Course Code: ECE 302

Course Name: POWER ELECTRONICS

Program & Sem: B.Tech (ECE) & 6th Sem (DE – III)

Date: 26th Apr 2022

Time: 1.30 PM to 2.30 PM

Max Marks: 30

Weightage: 15 %

Instructions:
(i) Read the all questions carefully and answer accordingly.
(ii) Question paper consists of 3 parts.
(iii) Scientific and Non-programmable calculators are permitted.

Part A [Memory Recall Questions]

Answer all the Questions. Each Question carries TWO marks.   **(5Qx 2M= 10M)**

1. Thyristor is also known as   (C.O.No.1) [Knowledge]

(a) SRC   (b)SCR   (c)SSR   (d)SRR

2. The layers in Thyristor   C.O.No.1) [Knowledge]

(a) PNNP   (b) PPNN   (c) PNPN   (d) None of the above

3. Forward leakage current in an Thyristor flows from   (C.O.No.1) [Knowledge]

(a) cathode to anode due to majority carriers   (b) anode to cathode due to minority carriers

(c) cathode to anode due to minority carriers   (d) anode to cathode due to majority carriers

4. Over Drive Factor is a ratio of   (C.O.No.1) [Knowledge]

(a) $I_B/I_B(sat)$ (b) $I_B(sat)/I_B$ (c) $I_C(sat)/I_C$ (d) $I_C/I_C(sat)$

5. How do you calculate output power loss in a BJT   (C.O.No.1) [Knowledge]

(a) $V_{CE}(sat)*I_C$ (b) $V_{CE}(sat)*I_C(sat)$ (c) $V_{CE}*I_C(sat)$ (d) $V_{CE}*I_C$

Part B [Thought Provoking Questions]

Answer both the Questions. Each Question carries FIVE marks.   **(2Qx5M=10M)**

6. Two thyristors in the circuit shown in Fig. 1, each rated a continuous current of 100A sharing a load current. Current through T_2 is 40A. Determine the current through T_1?
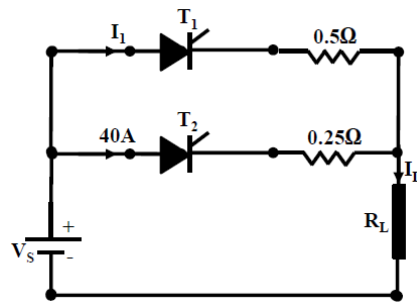
Fig. 1   (C.O.No.1) [Comprehension]

7. Why series connection of two or more SCRs is needed? What is the technical difficulty we encounter while connecting SCRs in series? How do you overcome this difficulty?

(C.O.No.1) [Comprehension]

Part C [Problem Solving Questions]

Answer the following Question. Question carries TEN marks.   (1Qx10M=10M)

8. For a power transistor typical switching parameters are given as follows: V_{CC}=100V, $V_{CE(Sat)}$=1.5V, $I_{C(Sat)}$=100A, t_d=0.5μs, t_r=10 μs, t_n=50 μs, t_s=2 μs, t_f=1 μs, t_o=30 μs, f=1KHz, I_{CEO}=1mA and duty cycle D=0.5. Find (i) Average power loss due to collector current during t_{on} (ii) Peak instantaneous power loss due to collector current during t_{on}?   (C.O.No.1) [Comprehension]

Roll No. ☐☐☐☐☐☐☐☐☐☐☐☐

PRESIDENCY UNIVERSITY
BENGALURU

SCHOOL OF ENGINEERING

TEST 2

Semester: Even Sem A.Y 2021-22   **Date**: 1ˢᵗ June 2022

Course Code: ECE 302   **Time**: 01:30 PM to 02:30 PM

Course Name: Power Electronics   **Max Marks**: 30

Program & Sem: B.Tech. & VI ECE   **Weightage**: 15%

Instructions:

(i)   Read the question properly and answer accordingly.

(ii)   Question paper consists of 3 parts.

(iii)   Scientific and Non-programmable calculators are permitted.

Part A [Memory Recall Questions]

Answer ALL the Questions. Each question carries two marks.   (5Qx2M=10M)

Q.NO.1. AC voltage controller converts   (a) Fixed DC to Variable DC   (b)Fixed AC to Variable AC (c)Variable AC to Fixed AC (d)Variable DC to Fixed DC

(C.O.No.2) [Knowledge]

Q.NO.2. In ON-OFF AC voltage controller if T1 and T2 thyristors ON for m cycles and OFF for n cycles then duty cycle is (a) m/(m+n) (b) n/(m+n) (c) (m+n)/n   (d) (m+n)/m

(C.O.No.2) [Knowledge]

Q.NO.3. Controlled rectifiers are used to control the speed of (a) AC motor (b) Stepper motor   (c) DC motor   (d) Servo motor   (C.O.No.2) [Knowledge]

Q.NO.4. Full wave controlled rectifier will be operated in (a) Iˢᵗ quadrant   (b) Iˢᵗ quadrant & IIⁿᵈ quadrant   (c) Iˢᵗ quadrant & IIIʳᵈ quadrant   (d) Iˢᵗ quadrant & IVᵗʰ quadrant

(C.O.No.2) [Knowledge]

Q.NO.5. The range of duty cycle in fixed frequency chopper is (a) 0 to 1   (b) 0 to 10   (c) 1 to 100   (d) 0 to infinity   (C.O.No.3) [Knowledge]

Part B [Thought Provoking Questions]

Answer both the Questions. Each question carries five marks.   **(2Qx5M=10M)**

Q.NO.6. A 1-Φ half wave AC voltage controller has a resistive load of R=52Ω and input voltage V$_s$=220V, 50Hz. The thyristor switch is triggered at an angle of α=π/3. Determine (i) RMS output voltage (ii) Input power factor (iii) Average input current?

(C.O.NO. 2) [Bloom's level-L2]

Q.NO.7. A 1kW heater is connected across a 1-Φ$230V,50Hz$, supply through half wave controlled rectifier using an SCR. If the delay angle $\alpha = \frac{\pi}{3}$. Calculate the power observed by the heater element?   (C.O.NO. 2) [Bloom's level-L2]

Part C [Problem Solving Questions]

Answer the Question. Each question carries ten marks.   **(1Qx10M=10M)**

Q.NO.8. A 1-Φ ON-OFF AC voltage controller has a resistive load of R=20Ω and input voltage V$_s$=220V, 50Hz. The thyristor switch is ON for 65 cycles and OFF for 35 cycles. Determine (i) RMS output voltage (ii) Input power factor (iii) Average current of thyristor (iv) RMS currents of thyristor?   (C.O.NO. 2) [Bloom's level-L2]

PRESIDENCY UNIVERSITY
BENGALURU

SCHOOL OF ENGINEERING

ENDTERM EXAMINATION

Even Semester: 2021 - 22

Course Code: ECE 302

Course Name: POWER ELECTRONICS

Program & Sem: B. Tech & VI Sem (DE-III)

Date: 30th June 2022

Time: 9:30 AM to 12:30 PM

Max Marks: 100

Weightage: 50%

Instructions:

(i)   Read the all questions carefully and answer accordingly.

(ii) Programmable calculators not allowed.

Part A [Memory Recall Questions]

Answer all the Questions. Each question carries TWO mark.   (20Qx 2M= 40M)

1. Forward break over voltage is related to (a) MOSFET (b)SCR (c) BJT (d) Diode
                                                                          (C.O.No.1)
[Knowledge]

2. The layers in SCR   (a) NPPN (b) PNPN (c) NPNP   (d) None of the above
                                                                          (C.O.No.1)
[Knowledge]

3. Technique used to increase switching speed of BJT (a) Base drive (b) Collector drive (c) Emitter drive (d) None of the above   (C.O.No.1)
[Knowledge]

4. Overdrive factor is the ratio of (a) $I_{B(sat)}/I_B$ (b) $I_B/I_{B(sat)}$ (c) $I_{C(sat)}/I_B$ (d) None of the above
                                                                          (C.O.No.1)
[Knowledge]

5. IGBT combines (a) Two BJTs   (b) Two diodes (c) BJT and MOSFET   (d) None of the above
        (C.O.No.2) [Knowledge]

6. Bi-directional ACVC consists of (a) Two thyristors   (b) Two diodes (c) One thyristor and one diode (d) None of the above   (C.O.No.2)
[Knowledge]

7. ACVC is used in (a) speed control of ac motor   (b) Speed control of dc motor   (c) speed control of servo motor   (d) None of the above   (C.O.No.2)
[Knowledge]

8. ACVC's are used to obtain (a) variable frequency   (b) variable voltage (c) both variable voltage and variable frequency (d) None of the above   (C.O.No.2)
[Knowledge]

9. Controlled rectifiers convert (a) Fixed AC to variable DC   (b) Fixed DC to variable AC (c) Fixed DC to variable DC (d) None of the above   (C.O.No.2) [Knowledge]

10. Full controlled converter consists of (a) Two thyristors (b) One thyristor (c) Four diodes (d) Four Thyristors   (C.O.No.2) [Knowledge]

11. Semi-converter operates in   (a) Two quadrant (b) One quadrant (c) Four quadrant (d) Three quadrant   (C.O.No.2) [Comprehension]

12. In fixed frequency chopper   (a) Output voltage is fixed (b) Output voltage is variable (c) Input voltage is fixed (d) None of the above   (C.O.No.3) [Knowledge]

13. In step-up chopper   (a) Output voltage is less than input voltage (b) Output voltage is greater than input voltage (c) Output voltage is equal to input voltage (d) None of the above
(C.O.No.3)

[Comprehension]

14. Regenerative breaking chopper is used to (a) Charge the Input voltage (b) Control the output voltage (c) Charge the output voltage (d) None of the above
(C.O.No.3)
[Comprehension]

15. Class A chopper operates in (a) Second quadrant (b) First quadrant (c) Third quadrant (d) None of the above   (C.O.No.3) [Knowledge]

16. Class B chopper is (a) No direction (b) Bidirectional (c) Unidirectional (d) None of the above
(C.O.No.3)

[Knowledge]

17. In class D chopper (a) Output voltage is either positive or negative (b) Output current is either positive or negative (c) Output current is always negative (d) None of the above
(C.O.No.3)

[Knowledge]

18. In half bridge inverter, the rms output voltage is (a) Equal to Vs (b) Vs/2 (c) Equal to 0 (d) None of the above   (C.O.No.4) [Knowledge]

19. The total number of MOSFETs used in full bridge inverter (a) Four (b) Two (c) Eight (d) Six
(C.O.No.4)

[Knowledge]

20. Output voltage of an ideal inverter is (a) Sine wave (b) Triangular wave (c) Step wave (d) None of the above   (C.O.No.4) [Knowledge]

Part B [Thought Provoking Questions]

Answer all the Questions. Each question carries TEN marks.
(3Qx10M=30M)

21. In the circuit of single phase bidirectional AC voltage controller, two SCRs connected in anti-parallel configuration. Can you modify the circuit to control power flow in both positive and negative half cycle using one SCR?   (C.O.No.2) [Comprehension]

22. In the circuit of single phase semi-converter controlled rectifier, out of two thyristors, what if one thyristor is replaced by a diode? Justify your answer with typical output voltage waveform across a resistive load?   (C.O.No.2)
[Knowledge]

23. What is the condition that needs to be satisfied to make power flow in both the directions in chopper? Which chopper is used to make power flow in both the directions with minimum number of controlled switching devices?   (C.O.No.3)
[Knowledge]

Part C [Problem Solving Questions]

Answer all the Questions. Each question carries TEN marks.
(3Qx10M=30M)

24. A step up chopper has an input voltage of 220V and an output voltage of 600V. if the non conducting time of the chopper is $100\mu s$. Calculate the pulse width. In case the pulse width is divided into two equal parts for constant frequency operation. Find the new output voltage.

                                                                (C.O.No.3)

[Comprehension]

25. The half wave controlled rectifier has a purely resistive load of R and the delay angle is $\alpha = \pi/6$. Determine (i) η (ii) FF (iii) RF (iv) TUF (v) PIV (C.O.No.1)
[Comprehension]

26. A transistor switch used to connect a 24V dc supply across a relay coil which has a dc resistance of 200 Ω, β=25 to 100, $V_{CE(sat)}$=0.2V, $V_{BE(sat)}$=0.7V. An input pulse of 0 to 5V with duty cycle 50% is applied to the base through R_B to turn on the transistor. Calculate (i) R_B to obtain an ODF of 5 (ii) $I_{C(sat)}$ (iii) Power loss in the transistor that occur during the saturation state.

                                                                (C.O.No.2)

[Comprehension]