RVK/KW/13/3304

Faculty of Engineering & Technology
Eighth Semester B.E. (Power Electronics) Examination
DESIGN OF POWER ELECTRONIC CIRCUITS
Sections—A & B

Time : 3 Hours]   [Maximum Marks : 80

INSTRUCTIONS TO CANDIDATES

(1) All questions carry marks as indicated.

(2) Answer **TWO** questions from Section A and **TWO** questions from Section B.

(3) Assume suitable data wherever necessary.

(4) Illustrate your answers wherever necessary with the help of neat sketches.

(5) Use of non-programmable electronic calculator is permitted.

SECTION—A

1. (a) What are the advantages and disadvantages of switch mode power supply over the conventional power supply ?   5

    (b) Design the SMPS with the following specifications :

    $V_o = 10$ V

    $I_{Lmax} = 1$ Amp

    $V_i = 20 \pm 15\%$

    $\Delta V_o = 20$ mV

    Switching frequency = 25 kHz

    Derive the design equations.   15

2. (a) Design of regulator using IC 723 for the output voltage of 5 Volts.

    What is line regulation, load regulation for the regulator circuit ?   12

    (b) Draw the circuit of 555 IC timer as a monostable multivibrator and sketch the waveforms of trigger pulse voltage and output voltage.   8

3. (a) Design Colpitt's Oscillator for an oscillating frequency of 150 kHz.

    Assume $V_{CC} = 18$ V

    Gain of an amplifier, $A_v = 10$ 8

    (b) Design a class-B audio power amplifier to deliver an output power of 5 watts to a load of 10 Ω resistance.

    Assume, $V_{CC} = 12$ V

    h_{FE} for a power transistor = 25   12

4. (a) The SCR has forward breakover voltage of 150 V when gate current of 2 mA flows in the gate circuit. When a sinusoidal voltage of

400 V rms is applied to it, find the average valu of the output voltage.

(Draw necessary waveform)   ξ

(b) Write technical notes on (any **TWO**) :—

   (i) Over voltage protection in linear regulators   6

   (ii) Emitter Follower Regulator Design.   6

   (iii) Design of LC transistorised oscillators.   6

SECTION—B

5. (a) Explain the working of multiphase chopper with waveforms.   6

(b) A highly inductive load is controlled by the chopper shown in Fig. Q. 5(b) requires an average current of 400 Amp with a peak value of 450 Amp.
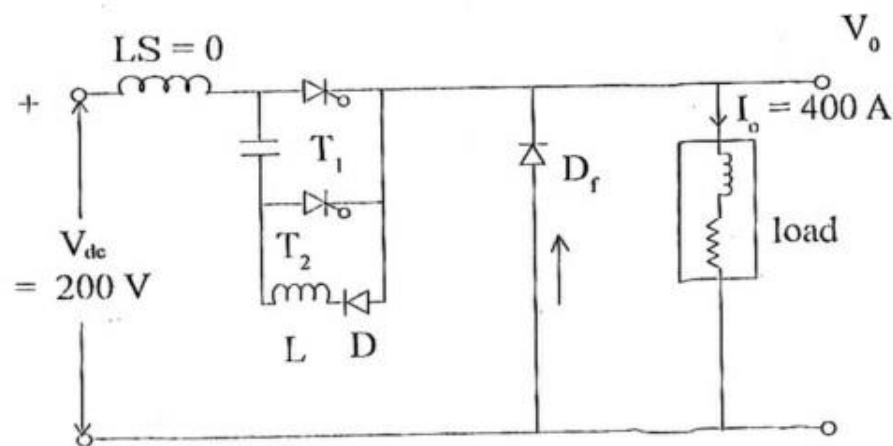

Fig. Q. 5(b)

Input dc voltage = 200 V

Chopping frequency = 500 Hz and

Turn-off time of SCR = 20 µs. If the peak current through the SCR is limited to 1.71 m, determine the sizes of L and C and also find the minimum and maximum values of output voltages.   14

6. (a) State the design criteria for designing a pulse transformer for triggering SCRs in a 1 φ converter. Discuss the conditions under which input pulse is faithfully transmitted or is transmitted in the form of exponentially delaying pulse.   12

(b) Design a UJT triggering circuit for 1 φ full wave fully controlled converter to deliver output voltage from 0—220 V. The input supply is 230 V_{rms}.   8

7. (a) A full bridge bipolar PWM inverter is operated from a 240 V battery and is driving an RL load. Find out the following if the modulation index m = 0.8 :

   (i) Total RMS output voltage

   (ii). Fundamental output voltage

   (iii) Distortion factor

   (iv) Harmonic factor

   (v) Gain of the inverter.   13

(b) A series inverter has following parameters : inductance L = 12 mH, C = 0.1 µF, load resistor R = 100 Ω and T_{off} = 0.3 ms.

Determine :—

(i) the frequency of the output voltage

(ii) the attenuation factor. 7

8. (a) Design the control circuit of a 3 ph induction motor, using volt-frequency control. 10

(b) Give the design of OTT filter for a square-wave inverter. 10