CLASS: BE   SEMESTER : VII
BRANCH: EEE   SESSION : MO/18

SUBJECT: MEE1151-ADVANCED POWER ELECTRONICS

TIME: 03:00 HRS.   FULL MARKS: 60

INSTRUCTIONS:
1. **The question paper contains 7 questions each of 12 marks and total 84 marks.**
2. **Candidates may attempt any 5 questions maximum of 60 marks.**
3. **The missing data, if any, may be assumed suitably.**
4. **Before attempting the question paper, be sure that you have got the correct question paper.**
5. **Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.**

Q.1(a) Draw vertical cross sectional diagram of POWER MOSFET. Label its different layers.   [2]
   (b) Explain and Draw switching characteristics of Power MOSFET.   [4]
   (c) In the diode and LC network, the capacitor is charged to voltage Vo with upper plate positive. Switch [6]
        S is closed at t=0. Derive expressions for current through and voltage across C.
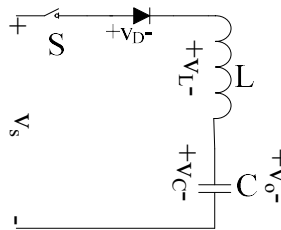
Q.2(a) List at least four differences between Flyback and Forward converter.   [2]
   (b) Establish mathematical relationship between input and output voltage of a Flyback Converter under   [4]
        discontinuous mode of operation.
   (c) A forward Converter is supplied by 600 V DC. The turn ratio of primary to tertiary winding is 1:2. Then [6]
        in order to get a DC output voltage of 60 V, what should be the minimum turn ratio of secondary to
        primary winding.

Q.3(a) List advantages of resonant pulse inverters over PWM inverters.   [2]
   (b) With the help of a circuit diagram and load current waveform explain working principle of basic Series [4]
        Resonant inverter?
   (c) A basic series resonant inverter has both inductors ($L_1=L_2=L$) of 50μH. It has a capacitor of 6μF. [6]
        Connected resistive load is of 2Ω. The DC supply voltage is 220V and the frequency of output voltage is
        7kHz. Determine (a) the maximum possible turn off time for the thyristor (b) maximum permissible
        frequency.

Q.4(a) Find out harmonic contents in a square wave AC voltage using Fourier Analysis in continuous time.   [2]
   (b) Analyse frequency response of parallel loaded resonant inverter by establishing relation between   [4]
        magnitude of gain, quality factor & frequency ratio.
   (c) A parallel resonant inverter delivers a load of 1kW at peak sinusoidal voltage of 170V at resonance   [6]
        frequency of 20 kHz. The load resistance is 10Ω. Determine (i) supply current (ii) the quality factor for
        reducing load power by 250 Watt. Assume frequency ratio to be 1.25.

Q.5(a) Distinguish between ZCS converter and ZVS converter.   [2]
   (b) Derive mathematical expression of inductor current during second mode of operation in the case of L   [4]
        type of ZCS converter.
   (c) Establish the relationship between capacitor voltage and supply voltage in the case of L-type of ZCS   [6]
        converter (During mode 2 and mode 3).

Q.6(a) Evaluate RMS output voltage of a single pulse PWM inverter in terms of DC supply voltage and pulse   [2]
        width.
   (b) Explain Space vector PWM switching scheme. Obtain and draw the instantaneous phase voltages (time   [4]
        averaging) during one switching cycle period for sector 1.
   (c) Establish the relationship between output voltage and its harmonic content of a multiple pulse width   [6]
        modulated inverters.

Q.7(a) Draw the functional block diagram of UC3843 chip.   [2]
   (b) Write short notes on IGBT gate Drive circuit.   [4]
   (c) Explain the operating principle of Flying capacitor Multilevel converter with a neat circuit diagram. [6]