QP Code: RM23MTECH133 | Reg. No | | | | | | | | | | | AY 23

GIET UNIVERSITY, GUNUPUR – 765022

M. Tech (Second Semester) Examinations, May-2024

MPEPE2031 – Switched Mode and Resonant Converters

(Power Electronics)

Time: 3 hrs | Maximum: 70 Marks

(The figures in the right hand margin indicate marks.)

PART – A **(2 x 10 = 20 Marks)**

a.	What are the implications of flux unbalancing in transformers and its significance in power electronics?	CO1	K2
b.	Can you explain the input-output voltage and current relationships as a function of duty ratio for a Buck-Boost DC-DC converter operating in continuous conduction mode?	CO1	K2
c.	What are the purposes of power conditioners in power systems?	CO2	K3
d.	Compare and contrast the L-type ZCS (Zero Current Switching) and M-type ZCS resonant converters in terms of operation and performance.	CO2	K1
e.	How do you select the appropriate inductor for a buck converter, considering factors such as input voltage and current requirements?	CO3	K1
f.	List and elaborate on the advantages of switched-mode power supplies over traditional linear power supplies.	CO3	K3
g.	What is a significant drawback of the Frequency Modulation (FM) scheme compared to the Pulse Width Modulation (PWM) scheme in power electronics?	CO4	K4
h.	Can you discuss the techniques commonly employed to reduce ripple and noise in the output voltage of a Switched Mode Power Supply (SMPS)?	CO4	K3
i.	What do ZVS and ZCS abbreviations stand for in power electronics?	CO2	K3
j.	Provide a systematic approach for selecting conventional elements to mitigate unwanted effects in power electronic circuits.	CO3	K4

PART – B **(10 x 5=50 Marks)**

Answer ***ANY FIVE*** questions

		Marks	CO#	Blooms Level
2. a.	Discuss the gain characteristics of an LC filter and an error amplifier in the design of Switched Mode Power Supplies (SMPS), emphasizing their roles in achieving stable and regulated output voltage.	5	CO1	K4
b.	Explain the principle of operation of a push-pull converter using clear diagrams and relevant waveforms.	5	CO1	K3
3.a.	Calculate the duty cycle and output voltage of a flyback converter based on specific transformer winding data and switching characteristics.	5	CO1	K2
b.	Can you illustrate the operation of a step-down converter in continuous	5	CO1	K4

	conduction mode and derive an expression for the ripple voltage?			
4. a.	Derive the small-signal AC equivalent circuit model for a non-ideal Flyback converter, considering various non-idealities.	5	CO2	K2
b.	Differentiate between unidirectional core excitation and bidirectional core excitation in the context of isolated DC-DC converters, and give one example for each.	5	CO2	K3
5.a.	Design a Buck-Boost converter circuit with the given parameters: input voltage = 48 V, duty cycle (D) = 0.5, load resistance = 5 ohms, inductance (L) = 20 micro H, capacitance (C) = 80 micro F. Determine the output voltage and average inductor current. Assume a switching frequency of 50 kHz.	5	CO2	K3
b.	Discuss the square wave switching scheme used in inverters and describe how the programmed harmonic elimination technique is achieved in square wave pulse switching.	5	CO3	K2
6. a.	Provide a comprehensive explanation and derive circuit parameter equations for the discontinuous conduction mode of a buck converter under two scenarios: (i) with a constant input voltage (ii) with a constant output voltage.	5	CO3	K4
b.	Describe the functioning and control of step-down and step-up choppers, considering different duty cycle scenarios.	5	CO3	K3
7.a.	Draw and explain the load current and load voltage waveforms of a Switched Mode Power Supply (SMPS) to demonstrate its operation.	5	CO3	K4
b.	Explain the operation of a series-loaded resonant converter when the switching frequency is less than half of the resonant frequency (fs < 0.5fo).	5	CO4	K3
8. a.	Briefly describe the design considerations for DC inductors and capacitors in power electronic circuits.	5	CO4	K3
b.	Discuss the importance of soft switching techniques in power electronics and provide an example of their application.	5	CO4	K2

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