APJ ABDULKALAM TECHNOLOGICAL UNIVERSITY

08 PALAKKAD CLUSTER
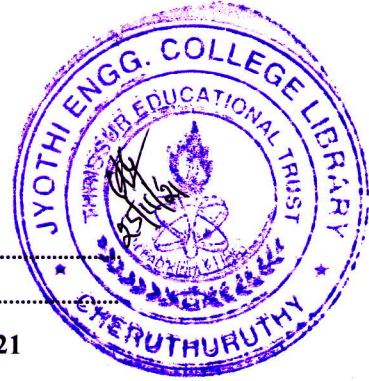
Name: ....

Reg. No : ....

Q. P. Code : **PE0821222-I**   (Pages: 2)

SECOND SEMESTER M.TECH. DEGREE EXAMINATION JULY 2021

Branch: Electrical and Electronics Engineering   Specialization: Power Electronics

08EE6222 SWITCHED MODE POWER CONVERTERS

(Common to PE)

Time: 2 hour 15 minutes   Max. Marks: 60

Answer all six questions.

Modules 1 to 6: Part 'a' of each question is compulsory and answer either part 'b' or part 'c' of each question.

(For all questions, relevant waveforms, circuits and derivation of mathematical equations are expected, to establish the answer)

Q.no.	Module 1	Marks
1.a	Analyse a buck converter for its ripple voltage with the help of a relevant expression, operating in continuous conduction mode.	3
	Answer b or c	
b	Analyse the operation of a push pull converter. Plot the load current, switch voltages current, and flux waveforms. What should be the primary and secondary side switch ratings of the converter, when the input voltage is V_d. Assume the transformer turns ratio as Np : Ns =1 : n.	6
c	Analyse the operation of a forward converter with relevant waveforms. Derive an expression for the duty ratio. What are the merits and demerits? In a practical forward converter, what is the maximum value of duty ratio possible? Explain with relevant expressions.	6

Q.no.	Module 2	Marks
2.a	Explain the method of voltage control in a Full bridge converter with relevant diagrams and waveforms.	3
	Answer b or c	
b	With circuit diagram and waveforms, explain the principle of operation of a Full bridge converter. Derive the expression for duty ratio. Compare with an half bridge converter.	6
c	A flyback converter supplies a load of 0.8 ohm at a voltage of 24 V. the duty ratio is 0.5 and switching frequency is 1 kHZ. The transformer has a turns ratio of N2/ N1 = 0.25. Determine the (a) average switch and input currents, (b) switch current & voltage ratings.	6

Q.no.	Module 3	Marks
3.a	Compare, current and voltage mode controls of converters.	3

Answer b or c

b	When a type 2 error amplifier is required to stabilise a feedback loop of a dc-dc converter? How will you shape the frequency characteristics of a type 2 error amplifier to stabilize the loop?	6
c	With relevant circuits and waveforms explain current mode control of converters. Show that problems of current mode control can be solved by proper modification.	6

Q.no.	Module 4	Marks
4.a	Derive the DC model of a buck boost converter operating in continuous conduction mode.	3

Answer b or c

b	Obtain the basic ac model of a forward converter operating in continuous conduction mode. Assume the turns ratio as $1 : n$ and on state resistance as R_{on}.	6
c	Obtain the ac model of a flyback converter. Assume the turns ratio as $1 : n$ and on state resistance as R_{on}.	6

Q.no.	Module 5	Marks
5.a	Analyse the term canonical model of DC-DC converters.	4

Answer b or c

b	For the process of controlling a nonideal buck boost converter, obtain its model, using state space averaging technique.	8
c	A mathematical model of a SEPIC converter is required. Obtain the same using circuit averaging technique..	8

Q.no.	Module 6	Marks
6.a	You are requested to choose a converter for a given application between swiched mode and resonant converters. What are the parameters to be considered to choose the best one for the same?	4

Answer b or c

b	Analyse the operation of a series loaded half bridge resonant converter operating in discontinuous conduction mode with relevant circuits, expressions and waveforms. State the assumptions you may make.	8
c	Analyse the operation of a **ZVS** resonant buck converter with relevant circuits, expressions and waveforms. What is the peak switch current value? How the output voltage is controlled?	8