Register No.: ………………………….…. Name: ……………………….……….…….……….……..

SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

SEVENTH SEMESTER B.TECH DEGREE EXAMINATION (R), DECEMBER 2023
ELECTRICAL AND ELECTRONICS ENGINEERING
(2020 SCHEME)

Course Code: **20EET493**

Course Name: **Dynamics of Power Converters**

Max. Marks: **100** **Duration: 3 Hours**

PART A

(Answer all questions. Each question carries 3 marks)

1. Obtain the expression for output voltage of a buck converter using the principle of inductor volt second balance.
2. Explain how the conduction losses in converters are modeled in steady state equivalent model?
3. Compare state-space averaging and circuit averaging techniques.
4. A pulse width modulator is constructed with input $v_c(t)$ and duty cycle d(t).Peak to peak value of triangular wave is 4V and time period is 50μs.Determine gain $d(t)/v_c(t)$ and switching frequency.
5. Discuss the features of the bode plot of $G(s) = (1 + \frac{s}{\omega_0})$.
6. Explain the measurement of transfer function of converter systems using network analyzer.
7. Describe the specifications of a regulator.
8. List out the applications of DC-DC converters.
9. Draw the averaged switch model of two switch network in DCM.
10. Transformer model of converter operating in DCM is less appropriate. Justify.

PART B

(Answer one full question from each module, each question carries 14marks)

MODULE I

11.	Construct the steady state equivalent circuit model of boost converter including ideal DC transformer and inductor winding resistance R_L and semiconductor conduction losses.	(14)
	OR	
12.	In a buck- boost converter, the inductor has the winding resistance R_L. All other losses can be ignored. Derive the expression for voltage conversion ratio V/V_g and efficiency. Also obtain the steady state equivalent circuit model.	(14)

MODULE II

13. Derive the averaged equations of a buck–boost converter operating in continuous conduction and construct the small signal ac model. (14)

OR

14. Explain the development of canonical circuit model of buck–boost converter from small signal ac model with neat sketches. (14)

MODULE III

15. Construct the transfer function and terminal impedance of buck converter by graphical approach. (14)

OR

16. Derive the converter transfer functions of ideal buck – boost converter. (14)

MODULE IV

17. Explain the design of PD compensator for a buck converter. (14)

OR

18. a) Describe the effect of negative feedback on the transfer function of a network. (9)
    b) Compare PD and PI compensators. (5)

MODULE V

19. A boost converter has parameter values R=12Ω, L =5μH, C=470 μF, f_s=100kHz. The output is regulated at 36V. Find the small signal control to output transfer function of the DCM boost converter. Also determine $G_{vd}(s)$ at the operating point where load current I= 3A and DC input voltage Vg=24V. (14)

OR

20. Obtain the transfer function of DCM boost converter. (14)

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