NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE PLAN – PART I			
Name of the programme and specialization	M.Tech. Power Electronics		
Course Title	SWITCHED MODE POWER CONVERSION		
Course Code	EE652	**No. of Credits**	3
Course Code of Pre-requisite subject(s)	Power Converters/ Power Electronics		
Session	January 2021	**Section**	NA
Name of Faculty	Dr. Shelas Sathyan	**Department**	Electrical and Electronics Engineering
Official Email	shelassathyan@nitt.edu	**Telephone No.**	+91 9561450634
Name of Course Coordinator (if applicable)	----------		
Course Type	✓ **Core course**	☐ **Elective course**	☐ **Laboratory course**

SYLLABUS (approved in BoS)

Design constraints of reactive elements in Power Electronic Systems: Design of inductor, transformer and capacitors for power electronic applications, Input filter design.

Basic concepts and steady-state analysis of second and higher order Switched Mode power converters: PWM DC - DC Converters (CCM and DCM) - operating principles, constituent elements, characteristics, comparisons and selection criteria

Dynamic Modelling and control of second and higher order switched Mode power converters: analysis of converter transfer functions, Design of feedback compensators, current programmed, frequency programmed and critical conduction mode control

Soft-switching DC - DC Converters: zero-voltage-switching converters, zero-current- switching converters, Multi-resonant converters and Load resonant converters.

Pulse Width Modulated Rectifiers: Properties of ideal rectifier, realization of near ideal rectifier, control of the current waveform, single phase and three-phase converter systems incorporating ideal rectifiers and

design examples. Non-linear phenomena in switched mode power converters: Bifurcation and Chaos

Essential Readings / Reference:

1. Simon Ang, Alejandro Oliva , Taylor & Francis, 3rd Edition, 2010.
2. Robert W. Erickson, Dragan Maksimovic, Springer Science & Business Media, 2nd Edition, 2007.

COURSE OBJECTIVES	
This course aims at modeling, analysis and control of various power converter circuits.	
COURSE OUTCOMES (CO)	
Course Outcomes Upon completion of the course, the students will be able to:	**Aligned Programme Outcomes (PO)**
1. Steady-State Analysis of switched-mode dc-dc power converters	1,2,3,4,8,14
2. Design of Switched-Mode Converters, including selection of component values based on steady-state dc and ac ripple specifications.	1,2,3,4,8,14
3. Dynamic Modelling Development and Analysis for switched-mode dc-dc converters using averaging techniques, including the derivation and visualization of converter small-signal transfer functions.	1,8,4,14
4. Analysis and Design of Control Loops around switched-mode power converters using averaging small signal dynamic models and classical control theory.	1,2,3,4,8,14
5. Become proficient with simulation tools (for the analysis and design of switched mode power converters.	1,2,3,4,8,14

Course Plan – Part II

COURSE OVERVIEW

Aim of this course is to introduce various switching power converters, design of DC/DC converters, Magnetic Design and the procedure to develop closed loop controller for the converter system. Course also emphasize on the soft switching techniques for power electronics converters and design of high power factor front end topogies for utility friendly power supplies.

COURSE TEACHING AND LEARNING ACTIVITIES

S. No.	Week/ Contact Hour	Topic	Mode of Delivery
1.	3rd and 4th week of January	Basic concepts and steady-state analysis of second and higher order Switched Mode power converters: PWM DC - DC Converters (CCM and DCM) - operating principles, constituent elements, characteristics, comparisons, and selection criteria	Online lecture mode
2.	1st and 2nd week of February	Basic concepts and steady-state analysis of second and higher order Switched Mode power converters:	

		PWM DC - DC Converters (CCM and DCM) - operating principles, constituent elements, characteristics, comparisons, and selection criteria	
3.	3rd and 4th week of February	Soft-switching DC - DC Converters: zero-voltage-switching converters, zero-current- switching converters, Multi-resonant converters and Load resonant converters.	Online lecture mode
4.	1st and 2nd week of March	Design constraints of reactive elements in Power Electronic Systems: Design of inductor, transformer and capacitors for power electronic applications, Input filter design.	
5.	3rd and 4th Week of March	Dynamic Modelling and control of second and higher order switched Mode power converters: analysis of converter transfer functions, Design of feedback compensators, current programmed, frequency programmed and critical conduction mode control	
6.	1st and 2nd Week of April	Dynamic Modelling and control of second and higher order switched Mode power converters: analysis of converter transfer functions, Design of feedback compensators, current programmed, frequency programmed and critical conduction mode control	
7.	3rd and 4th Week of April	Pulse Width Modulated Rectifiers: Properties of ideal rectifier, realization of near ideal rectifier, control of the current waveform, single phase and three-phase converter systems incorporating ideal rectifiers and design examples. Non-linear phenomena in switched mode power converters: Bifurcation and Chaos	Online lecture mode

COURSE ASSESSMENT METHODS (Shall Range from 4 to 6)

S. No.	Mode of Assessment	Week/Date	Duration	% Weightage
1.	Class Test-1	4th Week of February	1 hour	25%
2.	Class Test 2	4th Week of March	1 hour	25%
3.	Miniproject	3rd week of April	-	20%
CPA	Compensation test (entire syllabus)	1st Week of May	1 hour	20%
4.	End Semester Exam (entire syllabus)	2nd Week of May	2 hours	30%

COURSE EXIT SURVEY

1. Students' feedback through class committee meetings
2. Feedback questionnaire from students – twice during the semester

3. Feedback from students on course outcomes shall be collected at the end of the semester

COURSE POLICY (preferred mode of correspondence with students, policy on attendance, compensation assessment, academic honesty and plagiarism etc.)

Mode of Correspondence

1. The faculty is available for consultation during the time intimated to the students then and there.
2. All correspondence will be sent to the NITT webmail of the students, if required.
3. The students can contact me in my office or through the email *shelassathyan@nitt.edu* for any academic related issues with respect to this course.

Compensation Assessment Policy

1. Flexibility is given to the students to fix the date for each assessment convenient to majority of the students.
2. Only one instance of absence in internal assessment is permitted. Only one compensation assessment for absentees in internal assessments will be conducted.
3. The compensation assessment (CPA) is for entire syllabus and, CPA is not considered as an improvement test.

Attendance Policy

1. All the students are expected to attend all the contact hours. Students should maintain 75% minimum physical attendance by the end of the course to attend the end semester examination.
2. Students with less than 65% of attendance shall be prevented from writing the final assessment and shall be awarded 'V' Grade. Student have to REDO the course.
3. A maximum of 10% attendance shall be allowed under On Duty (OD) category. OD is allowed only for the students having minimum attendance of 65%.

Academic Honesty & Plagiarism

1. Possessing a mobile phone, carrying bits of paper, talking to other students, copying from others during an assessment will be treated as punishable dishonesty.
2. The answer sheet of the student will not be evaluated and ZERO mark to be awarded for the offenders. For copying from another student, both students get the same penalty of zero mark.
3. The departmental disciplinary committee including the course faculty member, PAC chairperson and the HoD, as members shall verify the facts of the malpractice and award the punishment if the student is found guilty. The report shall be submitted to the Academic office.

ADDITIONAL INFORMATION

The minimum marks for passing this course and grading pattern will adhere to the regulations of the institute.

FOR APPROVAL

Dr. Shelas Sathyan, AP/EEE		Approved by Mail
Course Faculty	**CC-Chairperson**	**HoD, Dept. of EEE**

Guidelines:

a) The number of assessments for a course shall range from 4 to 6.

b) Every course shall have a final assessment on the entire syllabus with at least 30% weightage.

c) One compensation assessment for absentees in assessments (other than final assessment) is mandatory. Only genuine cases of absence shall be considered.

d) The passing minimum shall be as per the regulations.

B.Tech. Admitted in					P.G.
2019	2018	2017	2016	2015	
35% or class average/2 whichever is greater.			Peak/3 or class average/2 whichever is lower		40%

e) Attendance policy and the policy on academic dishonesty & plagiarism by students are uniform for all the courses.

f) Absolute grading policy shall be incorporated if the number of students per course is less than 10.

g) Necessary care shall be taken to ensure that the course plan is reasonable and is objective.