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	**DESIGN TECHNIQUES FOR SMPS**		
Course Code	**EE690**	**No. of Credits**	**3**
Course Code of Pre-requisite subject(s)			
Session	**July 2021**	**Section (if, applicable)**	**--**
Name of Faculty	**Dr ASHOK KUMAR**	**Department**	**ELECTRICAL AND ELECTRONICS ENGG.**
Official Email	**krashok@nitt.edu**	**Telephone No.**	**9651853535/ 7388820867**
Name of Course Coordinator(s) (if, applicable)			
Official E-mail		**Telephone No.**	
Course Type (please tick appropriately**)**	☐ **Core course**	■ **Elective course**	

Syllabus (approved in BoS)

Introduction of Available Sources & demanding loads: Sources-AC mains, Lab supplies, Batteries, Solar Cells Loads - Requirements of load, battery as load, Selection of Topology :Step-Up/Step-Down, Multiple outputs, Continuous & discontinuous modes of operation, Isolated converters, Various configurations of Converters, Selection of Components: Selection of Resistors, Chokes, Capacitors, Diodes, MoSFETs & IGBTs, Connectors, Design of Magnetics Fundamentals & ideal conditions, design of High frequency chokes & transformers, Selection of wire gauge, sealing of magnetic.

Guide to Instrumentation: Basics of measurements using DMM, Oscilloscope, Electronic loads, etc Design of Feedback circuits Basic control requirements, Current & voltage mode control fundamentals & system stability conditions Design of Control and Monitoring circuits Practical Control circuitry & Monitoring circuitry requirements.

Evaluations and Thermal management Performance evaluations of SMPS & thermal loss calculations and cooling options & packaging of converter EMI control requirements Overview of EMC, differentiating signal and noise, Layout concepts Low & High frequency filtering requirements, Optimal filter design Worst case analysis Introduction to datasheet reading, operation tuned to datasheet, typical worst-case analysis.

Standards governing the power supplies IEC standards for Electrical &Environmental testing, certification standards, Ingress protection standards Recent trend in Power supplies Recent advancements in components, Recent advancements in topologies, Digital control of power supplies, Power Integration & its Low power applications.

Analysis and Simulation using PSIM: BUCK, BOOST & BUCK, BOOST, Typical discrete power factor corrector circuit
COURSE OBJECTIVES
To give a practical step by step approach for design and assembly of Power Supplies and apply the necessary recent technology to comply the standards and certification requirements.
MAPPING OF COs with Pos

Course Outcomes	**Programme Outcomes (PO)** (Enter Numbers only)
1. Choose appropriate components and configure various converter topologies.	**1, 2, 3, 4, 6, 7, 10, 11, 12**
2. Design various control, monitoring and measurement circuitry for Switched Mode Power Supplies.	**1, 2, 3, 4, 5, 6, 7, 9, 10,12**
3. Evaluate thermal performance of SMPS units and design appropriate filters.	**1, 2, 3, 4, 5, 6, 7, 10, 11**
4. Appreciate standards and recent advancements related to SMPS.	**1, 2, 3, 4, 5, 6, 7, 10, 11, 14**
5. Analyse and simulate the various converter topologies using PSIM.	**1, 2, 3, 4, 5, 6, 7, 8, 10, 11**

COURSE PLAN – PART II

COURSE OVERVIEW

Switched Mode Power Supply (SMPS) primarily provides regulated DC ouput voltage from an unregulated DC or AC output voltage. Because of the advantages offered by them in terms of size, weight, cost, efficeicny and overall perfromance, they are widely used in many applications like motherboard of computers, mobile phone chargers, battery chargers, electric vehicles, consumer electronics, laptops, etc. This course is a complete package of all the aspects required to know for designing an SMPS. The first chapter of the syllabus focuses on the operational details of basic converters topologies employed in a typical SMPS. It also illustrates the design and selection rules of various components like resistors, inductors, capacitors, semiconductor devices, etc. Second chapter mainly tells about the controller requirements. Chapter 3 essentially explains the areas of thermal management and filter design demands of SMPS. Various IEC standards and recent advancements in the topologies are discussed in chapter 4. Finally, chapter 5 deals with analysis and simulation of basic dc-dc converter circuits like BUCK, BUCK-BOOST and BOOST along with a brief description about power factor correction structures.

COURSE TEACHING AND LEARNING ACTIVITIES

S.No.	Week/Contact Hours	Topic	Mode of Delivery
1	Week 1 2 Contact Hours 6th September to 9th September	Introduction to the course and detailing course plan	Online
2	Week 2 3 Contact Hours 13th September to 17th September	Introduction of Available Sources & demanding loads: Sources-AC mains, Lab supplies, Batteries, Solar Cells Loads - Requirements of load,	Online

		battery as load, Selection of Topology: Step-Up/Step-Down, Multiple outputs, Continuous & discontinuous modes of operation	
3	Week 3 2 Contact Hours 20th September to 24th September	Isolated converters, Various configurations of Converters, Selection of Components: Selection of Resistors, Chokes, Capacitors, Diodes, MoSFETs & IGBTs, Connectors	Online
4	Week 4 3 Contact Hours 27th September to 1st October	Design of Magnetics Fundamentals & ideal conditions, design of High frequency chokes & transformers, Selection of wire gauge, sealing of magnetic.	Online
5	Week 5 3 Contact Hours 4th October to 8th October	Guide to Instrumentation: Basics of measurements using DMM, Oscilloscope, Electronic loads, etc	Online
6	Week 6 2 Contact Hours 11th October to 14th October	Design of Feedback circuits, Basic control requirements, Current & voltage mode control	Online
7	Week 7 3 Contact Hours 18th October to 22nd October	**First assessment** Fundamentals & system stability conditions Design of Control and Monitoring circuits	Online
8	Week 8 3 Contact Hours 25th October to 29th October	Practical Control circuitry & Monitoring circuitry requirements, Evaluations and Thermal management	Online
9	Week 9 1 Contact Hours 1st November	Performance evaluations of SMPS & thermal loss calculations and cooling options & packaging of converter	Online
10	Week 10 3 Contact Hours 8th November to 12th November	EMI control requirements Overview of EMC, differentiating signal and noise, Layout concepts Low & High frequency filtering requirements, Optimal filter design	Online
11	Week 11 2 Contact Hours 15th November to 18th November	Worst case analysis Introduction to datasheet reading, operation tuned to datasheet, typical worst-case analysis.	Online
12	Week 12 3 Contact Hours 22nd November to 26th November	**Second assessment** Standards governing the power supplies IEC standards for Electrical &Environmental testing, certification standards, Ingress protection standards.	Online

13	Week 13 3 Contact Hours 29th November to 3rd December	Recent trend in Power supplies Recent advancements in components, Recent advancements in topologies	Online
14	Week 14 3 contact Hours 6th December to 10th December	Digital control of power supplies, Power Integration & its Low power applications	Online
15	Week 15 3 contact Hours 13th December to 17th December	Analysis and Simulation using PSIM: BUCK, BOOST & BUCK, BOOST, Typical discrete power factor corrector circuit **Compensation assessment**	Online

COURSE ASSESSMENT METHODS

S.No.	Mode of Assessment	Week/Date	Duration	% Weightage
1	First assessment- First class test	Week 7 18th October to 22nd October	One hour 15 minutes	20
2	Second assessment- Second class test	Week 12 22nd November to 26th November	One hour 15 minutes	20
3	Assignement/ Surprise Test/ Attendance/ Seminar	Throughout Semester		30
CPA	Compensation Assessment	Week 15 13th December to 17th December	One hour 15 minutes	20
4	Final Assessment	21st December to 30th December	One and half hour	30

ESSENTIAL READINGS: Textbooks, Refernce books, website address, journals,etc

Reference Books:

1. Ned Mohan, Undeland and Robbins, 'Power Electronics Converters, Applications and Design',2 Nd Edition,
JohnWiley&sons,1995.
2. AbrahamI Pressman, KeithBillings, TaylorMorey,'SwitchingPowerSupplyDesign',3rd Edition, McGraw-Hill 2009.
3. L.Umanand and SR Bhat, 'Design of Magnetic Components for Switched Mode Power Converters', Wiley
Eastern Limited.
4. International Standard, IEC 60571Edition2.12006-12.

COURSE EXIT SURVEY

1. Feedback from the students during class committee meetings
2. Anonymous feedback through questionnaire (Mid of the semester & End of the semester)
3. End semester feedback on course outcomes

COURSE POLICY (including compensation assessment to be specified**)**

1. Attending all the assessments mandatory for every student

2. One compensation assessment will be conducted for those students who are being physically absent for the assessment 1 and/or 2, only for the valid reason.
3. At any case CPA will not be considered as an improvement test.
4. Absolute/Relative grading will be adopted for the course.

ATTENDANCE POLICY (A uniform attendance policy as specified below shall be followed)

- At least 75% attendance in each course is mandatory.
- A maximum of 10% shall be allowed under On Duty (OD) category.
- Students with less than 65% of attendance shall be prevented from writing the final assessment and shall be awarded 'V' grade.

ACADEMIC DISHONESTY & PLAGIARISM

- Possessing a mobile phone, carrying bits of paper, talking to other students, copying from others during an assessment will be treated as punishable dishonesty.
- Zero mark to be awarded for the offenders. For copying from another student, both students get the same penalty of zero mark.
- 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.
- The above policy against academic dishonesty shall be applicable for all the programmes.

ADDITIONAL INFORMATION, IF ANY

FOR APPROVAL

Course Faculty Dr Ashok Kumar **CC- Chairperson** Dr. S. Kayalvizhi **HOD** Approved by HoD

Guidelines

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

b) Every theory 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.
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.