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

COURSE PLAN – PART I			
Course Title	**NETWORKS AND LINEAR SYSTEMS**		
Course Code	**EEPC19**	**No. of Credits**	**4**
Course Code of Pre-requisite subject(s)	**MAIR32 & EEPC11**		
Session	**January 2018**	**Section**	**B**
Name of Faculty	**N. Kumaresan**	**Department**	**EEE**
Email	**nkumar@nitt.edu**	**Telephone No.**	**2503257**
Name of Course Coordinator(s) (if, applicable)			
E-mail		**Telephone No.**	
Course Type	√ **Core course**	☐ **Elective course**	

Syllabus (approved in BoS)

EEPC19 - NETWORKS AND LINEAR SYSTEMS

Course Type: Programme Core (PC) ***Pre-requisites:*** MAIR32, EEPC11
No. of Credits: 4

Course Objectives:

To emphasize the relationship between the conceptual understanding and problem-solving approach for (i) analyzing the electric circuit/system excited with non-sinusoidal and non-periodic source,(ii) one-port and two- port networks, (iii) system modeling and simplifications, (iv) transfer function, state- space analysis and z-transform analysis.

Course Content :

Frequency response - Fourier series - Harmonic analysis of simple circuits – Fourier integral - Fourier transforms – application to simple circuits.

Classification of signals – representation in terms of elementary signals - impulse functions - Time response of circuits - complex frequency - poles and zeros - frequency response from pole-zero configuration – Driving point impedances - two-port networks.

Differential equation of translational and rotational systems - transfer function modeling for simple electrical and mechanical systems-open loop and closed loop systems - block diagram representation - Block diagram algebra - signal flow graph - Mason's gain formula.

Concepts of state and state variables – state space modeling for simple electrical and mechanical systems – state transition matrix - solution of state equations.

Introduction to discrete time system – difference equations – z-transforms – inverse z-transforms for typical signals – pulse transfer function – solution of difference equation – stability analysis.

Text Books:

1. *D. Roy Choudhury, 'Networks and Systems', New Age International Publications, 1st Edition, 2013.*
2. *James W. Nilsson and Susan A. Riedel, 'Electric Circuits', Pearson Education Publications, 9th Edition, 2011.*
3. *F.F.Kuo, 'Network Analysis and Synthesis', John Wiley Inc Publications, 2nd Edition, 2010.*
4. *M.E. Van Valkenburg, 'Network Analysis', PHI Learning Publications, 3rd Edition, 2014.*

Reference Books:

1. *Cheng.D. K, 'Analysis of Linear System', Addison Wesley Publications, Revised Edition, 2009.*
2. *William D. Stanley, 'Network Analysis with Applications', Pearson Education Publication, 2009.*
3. *Hayt, W. H, Kemmerly J. E. & Durbin, 'Engineering Circuit Analysis', McGraw Hill Publications, 8th Edition, 2013.*

COURSE OBJECTIVES

To emphasize the relationship between the conceptual understanding and problem-solving approach for (i) analyzing the electric circuit / system excited with non-sinusoidal and non-periodic source, (ii) one-port and two- port networks, (iii) system modeling and simplifications, (iv) transfer function, state- space analysis and z-transform analysis.

COURSE OUTCOMES (CO)

Course Outcomes	Aligned Programme Outcomes (PO)
Upon completion of the course, the students will be able to	
1. Understand the significance of Fourier series and Fourier Transform and apply them for typical electrical systems	
2. Apply Laplace Transform for the solution of typical electric circuits and determine the two-port network parameters for typical circuits	
3. Model the systems in transfer function and state-space domain and analyze the system using these models	
4. Apply Z-transforms for the analysis of discrete time system	

COs / POs		Course outcomes(COs)			
		1	2	3	4
Programme Outcomes (POs)	1	H	H	H	H
	2	H	H	H	H
	3	NA	NA	NA	NA
	4	L	L	L	L
	5	NA	NA	NA	NA
	6	M	M	M	M
	7	M	H	H	M
	8	M	M	M	M
	9	H	H	H	H
	10	M	M	M	L
	11	M	M	M	M
	12	M	M	M	M
	13	H	H	H	H
	14	NA	NA	NA	NA

COURSE PLAN – PART II

COURSE OVERVIEW

Networks, signals and systems form the basic foundations of electrical engineering. Any electrical engineering equipment/product which handles signals using electrical networks and circuits is called as system. Having a good understanding of signals and their time/frequency domain characterization is an absolute must for any electrical engineer. The aim of this course is to provide students with an understanding of the concepts of discrete and continuous-time signals, Fourier series, Fourier transforms, Laplace transforms and application of these concepts for analyzing the electrical systems.

COURSE TEACHING AND LEARNING ACTIVITIES

S.No.	Week/Contact Hours	Topic	Mode of Delivery
1.	2nd week of Jan. 18 (8 to 12) **(4 Contact Hours)**	Discussion on course plan - Introduction to Fourier series-Fourier coefficients – waveform symmetry – Harmonics – Trigonometric form of Fourier series - Application of Fourier series to simple circuits	Lecture / Tutorial C & T using Document viewer PPT wherever needed
2.	3rd week of Jan. 18 (15 to 19) **(4 Contact Hours)**	Average power-power factor and rms value - Exponential form of the Fourier series – Fourier transform – Fourier transforms for typical signals – application to simple circuits	
3.	4th week of Jan. 18 (22 to 26) **(3 Contact Hours)** **24.01.2018 : 50 minutes (9.20 am – 10.10 am)**	application to simple circuits – contd. Review of Laplace transform – Laplace transform for typical signals **(Assessment-3 : Solving numerical examples from Unit I – 5 marks)**	
4.	Last week of January & 1st week of Feb 18 (29 Jan to 2 Feb) **(4 Contact Hours)**	Representation of signals in terms of elementary signals-complex frequency-time response - circuit elements in s-domain-circuit analysis in s-domain-transfer function-poles and zeros-application of initial and final value theorems-	

S.No.	Week/Contact Hours	Topic	Mode of Delivery
5.	2nd week of Feb. 18 (5 to 9) **(4 Contact Hours)**	frequency response from pole-zero plot-driving point impedances- Two-port networks	Lecture / Tutorial C & T using Document viewer PPT wherever needed
6.	3rd week of Feb. 18 (12 to 16) **(3 Contact Hours)** **15.02.2018 : 50 minutes (10.30 am – 11.20 am)**	Two-port networks – contd. **(Assessment-3 : Solving numerical examples from Unit II – 5 marks)**	
7.	4th week of Feb. 18 (19 to 23) **(4 Contact Hours)**	Open-loop system-closed loop system - Transfer function modeling for the simple electrical systems-Differential equation of translational and rotational mechanical systems **(Assessment - 1) - Written test**	
8.	Last week of February & 1st week of March 18 (26 Feb to 2 March) **(2 Contact Hours)**	force-voltage and force-current analogous systems-transfer function modeling of mechanical systems - Block diagram representation-Block diagram reduction technique	
9.	2nd week of March 18 (5 to 9) **(4 Contact Hours)** **08.03.2018 : 50 minutes (10.30 am – 11.20 am)**	signal flow graph-Mason's gain formula Concepts of state and state variables **(Assessment-3 : Solving numerical examples from Unit III – 5 marks)**	
10.	3rd week of March 18 (12 to 16) **(4 Contact Hours)**	state space modeling for simple electrical and mechanical systems- State transition matrix	
11.	4th week of March 18 (19 to 23) **(4 Contact Hours)** **23.03.2018 : 50 minutes (11.20 am – 12.10 am)**	solution of state equations - Solution of state equations-numerical examples **(Assessment-3 : Solving numerical examples from Unit IV – 5 marks)**	
12.	Last week of March 2018 (26 to 30) **(2 Contact Hours)**	Introduction to discrete time systems – properties – z-transform for typical signals-region of convergence **(Assessment - 2) - Written test**	
13.	1st week of April 18 (2 to 6) **(4 Contact Hours)**	Inverse z-transform-simple examples - Difference equation – solution of difference equations – pulse transfer function - stability analysis	
14.	2nd week of April 18 (9 to 13) **(3 Contact Hours)**	Numerical examples from unit V. Review of all units	
15.	3rd week of April 18 (16 to 20)	**Compensation Assessment (Written test)**	
16.	4th week of April to first week of May 2018 (23 April to 4 May)	**ASSESSMENT – 4 : Final Assessment** **(Written test)**	
	C & T : Chalk and Talk and PPT : Power Point		

COURSE ASSESSMENT METHODS

S.No.	Mode of Assessment	Week/Date	Duration	% Weightage
1	Assessment-1 : (First 2 Units) **(Written test)**	4th week of Feb. 18 (19 to 23)	60 Minutes	20
2	Assessment-2 : (3rd & 4th Units) **(Written test)**	Last week of March 18 (26 to 30)	60 Minutes	20
3	Assessment-3 : Assignments (4 Nos. each for 5 marks)	During the regular class hours – details will be informed later		20
CPA	Compensation Assessment (First 4 Units) - **(Written test)**	3rd week of April 18 (16 to 20)	60 Minutes	20
4	Assessment-4 Final Assessment - (All units) **(Written test)**	April / May 2018	120 Minutes	40

Note:

1. Exact date and time for the assessments (1,2, 4 and CPA) will be informed later.
2. Attending all the assessments (i.e., Assessment 1 to 4) are MANDATORY for every student.
3. Grading will be based on the clusters (range) of the total marks (all the assessments i.e., Assessment 1 to 4, put together for each student) scored. For grading, Gap theory or Normalized curve method will be used to decide the clusters (range) of the total marks.
4. The passing minimum shall be class mean by two or maximum by three, whichever is lower. Hence, every student is expected to score the minimum mark to pass the course. Otherwise the student would be declared fail and 'F' grade will be awarded.

COURSE EXIT SURVEY (mention the ways in which the feedback about the course shall be assessed)

Feedback from the students during class committee meetings
Anonymous feedback through questionnaire

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

MODE OF CORRESPONDENCE (email/ phone etc)

1. All the students are advised to check their NITT WEBMAIL regularly. All the correspondence (schedule of classes/ schedule of assessment/ course material/ any other information regarding this course) will be done through their webmail.
2. Queries (if required) may be emailed to me / contact me during 03.00 pm to 04.00 pm on Tuesday with prior intimation for any clarifications.

ATTENDANCE

1. Attendance will be taken by the faculty in all the contact hours. Every student should maintain minimum 75 % physical attendance in these contact hours to attend the Assessment-4 i.e., last assessment.
2. Any student, who fails to maintain 75% attendance, however, having score more than 50 % marks (i.e., more than 30 marks) in first three assessments will be eligible for attending the last assessment (Assessment-4).
3. Students having less than 75% attendance at the end of the semester and also having the score less than 50 % marks (i.e., less than 30 marks) in first three assessments will have to REDO the course and hence they are not eligible for attending the last assessment (Assessment-4). 'V' Grade will be awarded for such students.

COMPENSATION ASSESSMENT

If any student is not able to attend Assessment-1 / Assessment-2 due to genuine reason, he/she is permitted to attend the Compensation Assessment (CPA) with 20% weightage (20 marks). At any case, CPA will not be considered as an improvement test.

ACADEMIC HONESTY & PLAGIARISM

1. All the students are expected to be genuine during the course work. Taking of information by means of copying simulations, assignments, looking or attempting to look at another student's paper or bringing and using study material in any form for copying during any assessments is considered dishonest.
2. Tendering of information such as giving one's program, simulation work, assignments to another student to use or copy is also considered dishonest.
3. Preventing or hampering other students from pursuing their academic activities is also considered as academic dishonesty.
4. Any evidence of such academic dishonesty will result in the loss of marks on that assessment. Additionally, the names of those students so penalized will be reported to the class committee chairperson and HoD for necessary action.
5. Students who honestly producing ORIGINAL and OUTSTANDING WORK will be REWARDED.

ADDITIONAL INFORMATION

Following NPTEL courses will form the supplementary materials:

1. Circuit theory by Prof. S. C. Dutta Roy, Department of Electrical Engineering, Indian Institute of Technology Delhi, Hauz Khas, New Delhi -110 016. Web-site: http://nptel.ac.in/syllabus/108102042/

2. Networks and systems by Prof V G K Murti, Department of Electrical Engineering, Indian Institute of Technology, Madras. Web-site : http://nptel.ac.in/syllabus/108106075/

3. Networks and Systems by Prof. V.G.K. Murti, Prof. Andrew Thangaraj and C. S. Ramalingam, Department of Electronics & Communication Engineering, Indian Institute of Technology, Madras. Web-site : http://nptel.ac.in/syllabus/117106116/

FOR APPROVAL

Course Faculty	CC-Chairperson	HOD / EEE
	10/01/18	