SR ENGINEERING COLLEGE

(Autonomous institution)

Hand Book

II-B.Tech I-Sem

Electronics and Communication Engineering

RA-15 Regulation

Course Accredited by NBA, Accredited by NAAC with 'A' Grade, Approved by AICTE, Affiliated to JNTU, Hyderabad

Ananthasagar, Warangal, Telangana – 506 371

I Semester: 12-06-2017 to 13-10-2017

SR Educational Group

The thirst for knowledge and the enthusiasm to go beyond and think 'out of the box' is something that S R group encourages, nurtures and supports among our students.

S R Engineering College, Warangal was established in 2002 by S R Educational Society. It is located on Warangal-Karimnagar highway at about 15 KM away from Warangal City. The college is affiliated to JNTU, Hyderabad. It is running 5 undergraduate (B.Tech) and 7 postgraduate (M.Tech) engineering programs besides, Master of Business Administration (MBA). Three undergraduate engineering programs are accredited by the National Board of Accreditation (NBA) within a short span of six years of its establishment. The college was recently sanctioned with two new integrated programs; a 5-year dual degree program in Management (BBA+MAM) and a 5½ year dual degree program in engineering (B.Tech+MTM). The college is granted Autonomous Status by University Grants Commission (UGC) in 2014.

S R Engineering College (SREC) is an autonomous and accredited institution valuing and encouraging creativity and quality in teaching and research. The staff and the students take on new and interesting activities to acquire ability to think uniquely and independently. The college is in a position to attract and develop outstanding faculty to actively participate and interactively support an open academic climate in the campus. It adopts innovative approaches for continuous improvement by strategic planning, benchmarking and performance monitoring. The policy is to establish a system of quality assurance of its graduates by continuously assessing and upgrading teaching and learning practices.

Through active industry cooperation, SREC has established centers like CISCO Networking Academy, Microsoft Innovation Centre, IBM Centre of Excellence and NEN Centre for Entrepreneurship Development for nurturing specific skill sets for employability. To shape and transform the graduates to meet challenging and complex engineering tasks globally, the college has built and fostered relationship with reputed universities like University of Massachusetts, Saint Louis University, University of Missouri and Wright State University. To align with ABET system of outcome based curriculum, many reforms have been implemented in the course structure with due stress on basic sciences and humanities, interdisciplinary and core engineering including projects and seminars in line with AICTE guidelines.

The college is striving to create and support academic and research activities in thrust areas like energy and environment. The institute has reliable, flexible and scalable technology infrastructure for networking and web services which provides crucial support for improved functioning and timely service to students and faculty. The centre for student services and placements (CSSP) actively pursues training and campus placements by keeping in touch with industry for internships and employment. The faculty is highly motivated to advance their knowledge and qualifications through sponsored research. The digital library provides the necessary resources and e-learning services. Regular seminars, webinars, workshops and conferences and faculty development programs are conducted to encourage participation from students and faculty from neighboring colleges.

S R Engineering College is implementing a strategic action plan with specific focus on:

1. Novel technology enabled teaching and learning techniques,
2. Strengthen existing PG programs through modernization of laboratories and training of faculty and staff,
3. Identify and start new PG programs in current areas of research with immediate relevance to the state and the country,
4. Attract funding for sponsored research from DST, MNRE, AICTE and UGC,
5. Strengthen functional areas like governance and administration, infrastructure, finance etc.,
6. Network with industry and institutes of repute through academic partnership for expanding avenues for internships and research.

VISION

To be among the Top 20 Private Engineering Institutes in India by 2020

MISSION

- Design and implement curriculum that equips students with professional and life skills
- Recruit, develop and retain outstanding faculty to achieve academic excellence
- Promote and undertake quality research in thrust areas of science and Technology
- Collaborate with industry and academia to meet the changing needs of society
- Foster innovation and cultivate the spirit of entrepreneurship among students

About The Department

The Department of ECE is one of the biggest department in the college with highly experienced, qualified, dedicated, and trained faculty with deep sense of commitment towards the Students and Institution. The department has 56 staff members, 5 of whom are Doctorates and 12 faculties are pursuing their higher qualifications from various universities besides this most of the faculty were executing research projects from various funding agencies like AICTE,DST and UGC The main research of the department is in the area of VLSI, Embedded Systems and Communications. The department has four major projects from Department of Science and Technology and one minor project from UGC. The department of ECE has well equipped and state of the art laboratories for both UG & PG programs. To cater the needs of the students several technical talks, workshops, personality development programs, soft skills and entrepreneurial activities are regularly conducted under professional societies besides the curriculum. The Department has an Active IEEE student branch and IETE Student forum.

The department has its own Vision and Mission at par with the Vision and Mission of the Institute.

VISION

To be the leading Electronics and Communication Engineering Department in promoting quality education, research and consultancy

MISSION

- Design curriculum that provides effective engineering education by promoting innovating teaching-learning practices
- Establish centers of excellence in core areas and take up consultancy and research
- Interact and work closely with industries, research organizations to accomplish technology transfer
- Impart necessary skills and promote professional practices to enhance placement and entrepreneurship

Program Educational Objectives (PEOs)

PEOs (Program Educational Objectives) relate to the career and professional accomplishments of students after they graduate from the program. Consequently, assessment and evaluation of the objectives requires assessment tools that can be applied after graduation.

I. Enhance the skill set of students by providing strong foundation in basic sciences, mathematics, engineering and use necessary tools to solve engineering problems..
II. Equip students with ethical, professional behavior and mould them to become successful qualified engineers.
III. Inculcate necessary aptitude and ability to equip students to use their knowledge as a foundation for lifelong learning.
IV. Build team work skills and develop abilities to communicate and deal with different professionals both nationally and globally.

Program Outcomes (POs):

Engineering Graduates will be able to:

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/Development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern Tools usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life Long Learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Academic Calendar for II - IV B. Tech. I & II Semester

Academic Year 2017 – 18

I Semester

S. No.	Description	Schedule	Duration
1	**Commencement of Class work**	**12.06.2017**	--
2	1st Spell of Instruction	12.06.2017 to 05.08.2017	8 Weeks
3	1st Mid Examinations *Timings:* FN: 10.00 am to 11.30 am : AN:2.00 pm to 3.30 pm	08.08.2017 to 10.08.2017	3 Days
4	2nd Spell of Instruction (Includes Dasara Holidays)	11.08.2017 to 11.10.2017	9 Weeks
6	2nd Mid Examinations *Timings:* FN: 10.00 am to 11.30 am **:** AN:2.00 pm to 3.30 pm	12.10.2017 to 16.10.2017	3 Days
7	End Semester Regular Examinations / Supplementary Examinations (Theory & Practical)	17.10.2017 to 02.12.2017	7 Weeks
8	Commencement of Class work for **II, III, IV B.Tech. II Sem**. for the academic year 2016-2017	**04.12.2017**	--

COUSE STRUCTURE

II Year I Semester

S. No.	Course Code	Course	Hours / Week			
			L	T	P/D	C
1	BS109	Mathematics – II	3	-	-	3
2	EE135	Network Analysis	4	1	-	4
3	EC103	Electronic Circuit Analysis	4	-	-	4
4	EC104	Probability Theory and Stochastic Processes	3	-	-	3
5	EC105	Signals and Systems	4	-	-	4
6	BS111	Computational Mathematics Lab	-	-	3	2
7	ES120	Basic Simulation Lab	-	-	3	2
8	EC109	Electronic Devices and Circuit Analysis Lab	-	-	3	2
9	MC102	Gender Sensitization	-	-	2	-
Total						**24**

TIME TABLE

Department of Electronics and Communication Engineering

SR Engineering College

Academic Year 2017-18

Class: II-ECE-A **Room No: 2216** **w.e.f. 12-06-2017**

Day	9:30-10:20	10:20-11:10	11:10-11:20	11:20-12:10	12:10-1:00	1:00-1:40	1:40-2:30	2:30-3:15	3:15-4:00
	I	II	BREAK	III	IV		V	VI	VII
MON	ECA	BS/EDC Lab				LUNCH BREAK	PTSP	M-II	NA
TUE	NA	S&S	BREAK	T & P			ECA	S&S	Library
WED	M-II	S&S		PTSP	ECA		NA	CED	
THU	PTSP	CM LAB					BS/EDC Lab		
FRI	S&S	ECA	BREAK	PTSP	NA		M-II	Gender Sensitization	
SAT	Media Project			S&S	M-II		NA	ECA	Sports/ Library

Class Teacher : Mr. G. Mahesh Kumar

<u>Subjects:</u>

ECA(EC103) :Electronic Circuit Analysis: Mr. G.Mahesh Kumar

PTSP (EC104):Probability Theory and Stochastic Processes : Ms. Ch. Sridevi

S& S (ES105) : Signals and Systems: Mr. Leo Joseph

NA (EE135) : Network Analysis: Mr. PraveenKumar

M-II(BS109) :Mathematics II : Mr. Balaram

GS (MC102): Gender Sensitization :Ms.Kafila

Media project:

CED:Center for Enterpreurship Development:(Drawing hall block-I) Dr. N. Suman Kumar/Mr. G.Sathish Raj

T& P : : Mr. Syam B.Koleti

<u>Labs:</u>

BS (ES120) :Basic Simulation: Mr. Leo Joseph / Ms. D. Rajitha

EDCA (EC109):Electronic Devices & Circuit Analysis : Mr. G.Mahesh Kumar/ Ms. Ch. Sudharani

CM (BS111) : Computational Mathematics: Mr. Rajbir Singh

TIME TABLE

Department of Electronics and Communication Engineering

SR Engineering College

Academic Year 2017-18

Class: II-ECE-B **Room No: 2217** **w.e.f.12-06-2017**

Day	9:30-10:20	10:20-11:10	11:10-11:20	11:20-12:10	12:10-1:00	1:00-1:40	1:40-2:30	2:30-3:15	3:15-4:00
	I	II	BREAK	III	IV	LUNCH BREAK	V	VI	VII
MON	ECA	PTSP		M-II	S&S		BS/EDC Lab		
TUE	S&S	CM LAB					NA	ECA	
WED	PTSP	ECA	BREAK	S&S	NA		M-II	CED	
THU	M-II	S&S		NA	ECA		T & P	Sports/Library	
FRI	NA	BS/EDC Lab					PTSP	Gender Sensitization	
SAT	ECA	S&S	BREAK	M-II	PTSP		Media Project	Sports/Library	

Class Teacher : Ms. P. Anuradha

Subjects:

ECA(EC103) :Electronic Circuit Analysis: Mr. S.Umamaheswar

PTSP (EC104) : Probability Theory and Stochastic Processes : Dr.Tarun Kumar

S& S (ES105) : Signals and Systems: Ms.P.Anuradha

NA (EE135) : Network Analysis: Mr.Raj Kumar

M-II(BS109) :Mathematics II : Ms. Anusha

GS (MC102): Gender Sensitization: Ms.G.Rajyalaxmi

Media project:

CED:Center for Enterpreurship Development:(Drawing hall block-I) Dr. N. Suman Kumar/Mr. G.Sathish Raj

T& P : : Mr. Syam B.Koleti

Labs:

BS (ES120) :Basic Simulation: Ms.P.Anuradha/Mr. P. Krishna

EDCA (EC109):Electronic Devices & Circuit Analysis : Mr. S.Umamaheswar/Ms. Ch. Sudharani

CM (BS111) : Computational Mathematics: Mr. Rajbir Singh

TIME TABLE

Department of Electronics and Communication Engineering

SR Engineering College

Academic Year 2017-18

Class: II-ECE-C **Room No: 2218** **w.e.f.12-06-2017**

Day	9:30-10:20	10:20-11:10	11:10-11:20	11:20-12:10	12:10-1:00	1:00-1:40	1:40-2:30	2:30-3:15	3:15-4:00
	I	II		III	IV		V	VI	VII
MON	PTSP	M-II	BREAK	S&S	ECA	LUNCH BREAK	NA	Gender Sensitization	
TUE	ECA	S&S		NA	M-II		BS/EDC Lab		
WED	S&S			ECA	NA		PTSP	CED	
THU	PTSP	BS/EDC Lab					CM LAB		
FRI	M-II	S&S	BREAK	PTSP	NA		M-II	ECA	Sports/ Library
SAT	NA	ECA		Media Project			T & P	Sports/Library	

Class Teacher : Mr. S. Umamaheshwar

Subjects:

ECA(EC103) :Electronic Circuit Analysis: Mr. S.Umamaheswar

PTSP (EC104) : Probability Theory and Stochastic Processes :: Mr.S.Srinivas

S& S (ES105) : Signals and Systems: Dr. Shankaranand Jha

NA (EE135) : Network Analysis: Ms.B.Satyavani

M-II(BS109) :Mathematics II : Ms. Rashmi Agarwal

GS (MC102): Gender Sensitization:Ms.G.Rajyalaxmi

Media project:

CED:Center for Enterpreurship Development:(Drawing hall block-I) Dr. N. Suman Kumar/Mr. G.Sathish Raj

T& P : : Mr. Syam B.Koleti

Labs:

BS (ES120) :Basic Simulation: Dr. Shankaranand Jha/ Ms. K. Hemalatha

EDCA (EC109):Electronic Devices & Circuit Analysis : Ms. Ch. Sudharani /Ms. G. Samatha

CM (BS111) : Computational Mathematics: Mr. Rajbir Singh

(BS109) MATHEMATICS-II

Year	Semester	Hours / Week			C	Marks		
		L	T	P/D		CIE	SEE	Total
II	I	3	-	-	3	30	70	100

COURSE DESCRIPTION:
The course is intended to cover topics in integral transforms, complex variables and vector calculus. The topics included are those required for concurrent or subsequent courses in signals and systems, electro-magnetic theory, control engineering, communication engineering, system modeling, optics and quantum physics. This course mainly focused on the applications of mathematical concepts in various engineering problems related to electrical and electronics circuit analysis, digital signal processing, vibration analysis, walled shell theory, wave propagation and spectral analysis. Complex integration and power series expansions are also presented with applications.

PREREQUISITES:
Requires basic knowledge of mathematical concepts

COURSE OBJECTIVES:
Student will be able to
1. Identify Laplace and inverse Laplace transforms with applications.
2. Illustrate Fourier series expansion
3. Compute vector differentiation and integration
4. Evaluate complex integration and applications
5. Calculate residues and contour integration

COURSE OUTCOMES:
At the end of the course, students will develop ability to
1. Explain Laplace transforms to solve differential equations
2. Decide Laplace transform technique to engineering problems
3. Recommend vector calculus to different engineering problems
4. Discuss analytical functions apply to velocity potentials, stream functions and orthogonal trajectories
5. Create complex integration to solve real improper integrals
6. Apply Fourier series to engineering problems
7. Analyze vector integral theorems
8. Judge in evaluation of contour integration

Unit-I : Laplace Transforms
Definition – Existence – Laplace transforms of standard functions – First & Second Shifting theorems – Change of scale property – Laplace transform of Derivatives – Integrals-functions multiplied by t – divided by t – Laplace Transform of Periodic functions. Inverse Laplace transforms – Inverse Laplace transforms by partial fractions – Inverse Laplace transforms of Derivatives – Integrals – functions multiplied by s – divided by s – Convolution theorem – Applications of Laplace transforms to Ordinary Differential Equations.

Unit-II: Fourier Series
Definition of Fourier series – Dirichlet conditions – Fourier series of functions defined in [0, 2π] – Fourier series of Even and Odd functions – Half range Fourier sine and cosine series – Fourier series in arbitrary intervals.

Unit-III : Vector Calculus
Vector Differentiation: Introduction to vectors - Ordinary and Partial derivatives of a vector valued function – Gradient of a scalar function – Divergence and Curl of a vector function – vector Identities (without proofs).
Vector Integration: Integral of a vector valued function – Line integrals – Surface integrals – Volume integrals – Vector Integral Theorems – Green's theorem-Stokes theorem – Gauss Divergence theorems (statements without proofs) – verification & Applications.

Unit-IV: Complex Analysis - 1
Functions of Complex Variables: Analyticity-properties-Cauchy-Riemann conditions-harmonic and conjugate harmonic functions.
Complex Integration and Power Series: Line integral – evaluation along a path and by indefinite integration – Cauchy's integral theorem – Cauchy's integral formula – Generalized integral formula – applications. Radius of convergence - Expansion in Taylor's series – Maclaurin's series – Laurent series – applications. Definitions - Singular point – Isolated singular point – pole of order m – essential singularity

Unit-V: Complex Analysis - 2
Contour Integration: Residues – Evaluation of residues by formulae – Residue theorem (proof) – Evaluation of integrals of the type

a) $\int_{-\infty}^{\infty} f(x)dx$ b) $\int_{c}^{c+2\pi} f(\cos\theta, \sin\theta)d\theta$ c) $\int_{-\infty}^{\infty} e^{imx} f(x)dx$

TEXTBOOKS:
1. Erwin kreyszig, "Advanced Engineering Mathematics", John wiley and sons, 605 Third Evenue, New York.
2. Peter V. O'Neil, "Advanced Engineering Mathematics", Cl-Engineering, March 2006.

REFERENCE BOOKS:
1. R. K. Jain, S.R.K. Iyengar, "Advanced Engineering Mathematics", Narosa publishing house, New Delhi.
2. B. S. Grewal, "Higher Engineering Mathematics", Khanna publishers, Delhi.
3. Sri Ramachary S.K, "Engineering Mathematics-II", BSP.
4. Ramana B.V, Engineering Mathamatics", Tata McGraw Hill.

Content Beyond Syllabus:
Applications of Fourier series analysis to second order partial differential equations.

LECTURE PLAN

S. No.	Topics in syllabus	Modules and sub modules	Lecture No.	Suggested book (Adv. Engg. Math. By Erwin Kreyszig) with page numbers
Unit-I Laplace Transforms (No. of Lectures: 19)				
1	Introduction	Definition and Laplace transforms of standard functions	L1	251
2	Problems	Finding Laplace Transform of given functions	L2	257
3	First & Second Shifting theorems in Laplace transform	First & Second Shifting theorems in Laplace transform	L3	253, 265
4	Change of scale property in Laplace transform	Change of scale property in Laplace transform	L4	266
5	Laplace transform of Derivatives & Integrals	Laplace transform of Derivatives & Integrals	L5 L6	258, 262
6	Laplace transform of functions multiplied by t & divided by t	Laplace transform of functions multiplied by t & divided by t	L7 L8	275, 276
7	Laplace transform of Periodic functions	Laplace transform of Periodic functions	L9	265
8	Introduction to inverse Laplace transform & problems	Introduction to inverse Laplace transform & problems	L10	251, 257
9	First & Second Shifting theorems in inverse Laplace transform	First & Second Shifting theorems in inverse Laplace transform	L11	253, 265
10	Change of scale property in inverse Laplace transform	Change of scale property in inverse Laplace transform	L12	267
11	Inverse Laplace transforms of Derivatives & Integrals	Inverse Laplace transforms of Derivatives & Integrals	L13 L14	275, 276
12	Inverse Laplace transforms of functions multiplied by s & divided by s	Inverse Laplace transforms of functions multiplied by s & divided by s	L15 L16	258, 262
13	Convolution theorem (with out proof)	Convolution theorem (with out proof)	L17	279
14	Applications of Laplace transforms to Ordinary Differential Equations	Applications of Laplace transforms to Ordinary Differential	L18 L19	260

		Equations		
Unit-II Fourier Series (No. of Lectures: 10)				
15	Definition of Fourier series and Dirichlet conditions	Definition of Fourier series and Dirichlet conditions	L20	529
16	Fourier series of functions defined in [C, C+2π]	Fourier series of functions defined in [C, C+2π]	L21 L22	532
17	Fourier series of even and odd functions	Fourier series of even and odd functions	L23 L24	541
18	Half range Fourier Sine and Cosine series	Half range Fourier Sine and Cosine series	L25 L26	544
19	Fourier series in arbitrary intervals [C, C+2L]	Fourier series in arbitrary intervals [C, C+2L]	L27	537
20	Fourier series of even and odd functions in [0, 2L]	Fourier series of even and odd functions in [0, 2L]	L28	541
21	Half range Fourier – Sine and Cosine series in [0,L]	Half range Fourier – Sine and Cosine series in [0,L]	L29	544
Unit-III Vector Calculus (No. of Lectures: 15)				
	Vector Differentiation			
21	Introduction to vector differentiation	Introduction to vector differentiation	L30	423
22	Gradient of a scalar function	Gradient of a scalar function	L31	446
23	Divergence of vector function	Divergence of vector function	L32	453
24	Curl of a vector function	Curl of a vector function	L33	457
25	Vector identities (without proofs)	Vector identities (without proofs)	L34	463
	Vector Integration			
26	Introduction to Vector Integration	Introduction to Vector Integration	L35	464
27	Line integrals	Line integrals	L36	464
28	Surface integrals	Surface integrals	L37	496
29	Volume integrals	Volume integrals	L38	505
30	Vector Integral Theorems – Green's theorem and problems	Vector Integral Theorems – Green's theorem and problems	L39 L40	485
31	Stokes theorem and problems	Stokes theorem and problems	L41 L42	516
32	Gauss Divergence theorem	Gauss Divergence	L43	506

	and problems	theorem and problems	L44	
UNIT-IV Complex Analysis – I (No. of Lectures: 17)				
	Functions of Complex Variables			
33	Continuity, Differentiability	Continuity, Differentiability	L45	665, 666
34	Analytic function – properties	Analytic function – properties	L46	667
35	Cauchy – Riemann conditions, problems	Cauchy – Riemann conditions, problems	L47	669, 671
36	Max.Min principle	Max.Min principle	L48	673
37	Harmonic function – conjugate	Harmonic function – conjugate	L49	672
38	Milne – Thompson method	Milne – Thompson method	L50	674
	Complex Integration and Power Series			
39	Line integral	Line integral	L51	704
40	Cauchy integral theorem and problems	Cauchy integral theorem and problems	L52 L53	713, 714
41	Cauchy integral formula, generalization, problems	Cauchy integral formula, generalization, problems	L54 L55	722, 723
42	Radius of convergence, Taylor's, Maclaurin's series expansion	Radius of convergence, Taylor's, Maclaurin's series expansion	L56 L57	743, 751
43	Laurent series, problems	Laurent series, problems	L58 L59	770, 775
44	Types of singularities, problems	Types of singularities, problems	L60 L61	776, 780
UNIT – V Complex Analysis – II (No. of Lectures: 06)				
45	Residue – Evaluation	Residue – Evaluation	L62 L63	781, 786
46	Residue Theorem – problems	Residue Theorem – problems	L64 L65	784, 786
47	Evaluations of improper real integrals (4 types)	Evaluations of improper real integrals (4 types)	L66 L67	787

Review Questions

1.1 Find the Laplace transform of Sin2t Cos3t and e^{-3t} Cos4t.

1.2 Find the Laplace transforms of $t^2 + at + b$

1.3 Find the Laplace transforms of $\cos(\omega t+\theta)$

1.4 Find the Laplace transforms of $\sin^2 t$.

1.5 Find the Laplace transforms of

f(x) = 1, 0<t<2

= 2, 2<t<4

= 3, 4<t<6

= 0, t>6

1.6 Find L $[t^2 e^{-2t} S\text{int}]$

1.7 Find L $[te^{3t} Sin2t]$

1.8 Show that $L\{t^n f(t)\}=(-1)^n \frac{d^n}{do^n} \bar{f}(s)$ where n=1, 43……..

1.9 Show that $L\left\{\frac{1}{t} f(t)\right\} = \int_0^a \bar{f}(0)ds$.

1.10 Find $L\{t^2 e^{-2t}\}$

1.11 Find $L\{e^{at} \sin h\ bt\}$

1.12 Find $L\{e^{at} \cos h\ bt\}$

1.13 Find $L\{e^{-at} \sin h\ bt\}$

1.14 Find L {e-4t $\int_0^t t \sin 3t\, dt$ }

1.15 Find the Laplace Transform of the function: t e^{-t} sin2t.

1.16 Find the Laplace transform of $e^{2t} + 4t^3 - 2 \sin 3t + 3\cos 3t$.

1.17 Evaluate $L\{e^t (\cos 2t + 1/2 \sinh 2t)\}$

1.18 Find Laplace transform of sin(at+b).

1.19 Find LT of $f(t) = \begin{cases} \cos t, & 0 < t < \pi \\ \sin t, & t > \pi \end{cases}$

1.20 Find LT of $te^{-4t} \sin 3t$.

1.21 Solve the differential equation: $y'' - 4y' + 3y = 4e^{3x}$, y (0) = - 1, y′(0) = 3

1.22 Find inverse Laplace transform of $\frac{1}{(s-1)(s+2)}$

1.23 Find inverse Laplace transform of $\frac{1}{s(s^2-a^2)}$ by convolution theorem.

1.24 Find the inverse Laplace transforms of $\frac{4}{(s+1)(s+2)}$

1.25 Find L^{-1} $[\frac{s+3}{(s^2+6n+13)^2}]$

1.26 Find L^{-1} $[\frac{s+3}{s^2+10n+29}]$

1.27 Find $L^{-1}\left\{\frac{1}{s^2(s+2)}\right\}$

1.28 Find $L^{-1}\left[\frac{s^3-3s^2+6-4}{(s^2-2s+2)^2}\right]$

1.29 Find Inverse Laplace Transform of $\frac{2s+1}{(s-1)^2(s+2)^2}$

1.30 Find Inverse Laplace Transform of $\frac{2s}{4+s^4}$

1.31 Find the inverse Laplace transforms of $\frac{1}{(s^2+25)}$

1.32 Solve the differential equation $\frac{d^2y}{dt^2}+2\frac{dy}{dt}+5y=e^{-t}\sin t$ where $y(0) = 0$, $y^1(0) = 1$ by using Laplace transform.

1.33 Solve the following initial value problem by using Laplace transform : $4y'' + \pi^2 y = 0$, $y(0)=2$, $y'(0)=0$.

1.34 Using Laplace transform, solve $y''+2y'+5y = e^{-t}\sin(t)$, given that $y(0) = 0$, $y'(0) = 1$.

1.35 Solve $\left(D^4+2D^2+1\right)y=0, y=0, y'=1, y''=2, y'''=-3$ at t=0.

2.1 Find the value of function in the Fourier series for $f(x) = e^{-ax}$ in $(-\pi, \pi)$.

2.2 Express $f(x) = x^2$ in $(0, \pi)$ as half range cosine series.

2.3 Find the half range sine series for

$$f(x)=\begin{cases}\sin x, & 0\le x\le \frac{\pi}{4}\\ \cos x, & \frac{\pi}{4}\le x\le \frac{\pi}{2}\end{cases}$$

2.4 Find 'a_0' term in the Fourier expansion of the function $f(x)=\frac{1}{12}\left(3x^2-6x\pi+2\pi^2\right)$.

2.5 Write the Dirichelet conditions of Fourier series.

2.6 Express $f(x) = x^2$ as a Fourier series in $[-l, l]$.

2.7 Obtain a half range cosine series for

$$f(x)=\begin{cases}k\,x & 0\le x\le \frac{L}{2}\\ k(L-x) & \frac{L}{2}\le x\le L\end{cases}$$

Deduce the sum of the series $\frac{1}{1^2}+\frac{1}{3^2}+\frac{1}{5^2}+\ldots\ldots..$

2.8 Expand the function $f(x) = x\sin x$ as a Fourier series in the interval $-\pi\le x\le\pi$.

2.9 Expand the function $f(x) = x\cos x$ as a Fourier series in the interval $-\pi\le x\le\pi$.

2.10 Find half range sine series for $f(x)= x^2$ in $(0,\pi)$

2.11 Obtain Fourier series expansion $f(x) = x\cos\frac{\Pi x}{L}$ in the interval $-L \le x \le L$.

3.1 Find the directional derivative of the scalar point function $\varphi(x, y, z) = 4xy^2 + 2x^2yz$ at the point A(1, 2, 3) in the direction of the line AB where B = (5,0,4).

3.2 If $\phi_1 = x^2 y$ and $\phi_2 = xz - y^2$ find $\nabla \times (\nabla\phi_1 \times \nabla\phi_2)$

3.3 Find constants a, b, c so that the vector A =(x+2y+az) i +(b x–3y–z)j+(4x+cy+2z)k is irrotational. Also find ϕ such that $A = \nabla\varphi$.

3.4 Find a and b such that the surfaces $ax^2 - b\,y\,z=(a + 2)x$ and $4ax^2y + z^3=4$ cut orthogonally at (1, -1, 2).

3.5 Show that $F = (2xy + z^3)\,i + x^2\,j + 3\,x\,z^2\,k$ is a conservative force field. Find the scalar potential and the work done by F in moving an object in this field from (1, –2, 1) to (3, 1, 4).

3.6 For any vector A, find div curl A.

3.7 Evaluate $\iint_s A.n ds$ where $A=z\,i + x\,j - 3y^2 z\,k$ and S is the surface of the cylinder $x^2 + y^2 = 16$ included in the first octant between z=0 and z=5.

3.8 If $\varphi = 2xy^2z + x^2y$, evaluate $\int_c \phi\, dr$ where C consists of the straight lines from (0, 0, 0) to (1, 0, 0) then to (1, 1, 0) and then to (1, 1, 1).

3.9 Evaluate $\nabla^2 \log r$ *where* $r = \sqrt{x^2 + y^2 + z^2}$

3.10 If $\bar{F} = (x^2 - 27)\,i - 6yzj + 8xz^2k$ evaluate $\int_c \bar{F}.d\bar{r}$ from the point (0,0,0) to the point (1,1,1) along the straight line from (0,0,0) to (1,0,1), (1,0,0) to (1,1,0) and (1,1,0) to (1,1,1).

3.11 If A is irrotational vector, evaluate div(A x r) where r = x i +y j +z k.

3.12 If F= x y i – z j + x2k and c is the curve $x = t^2$, y = 2t, z = t3 from t=0 to t=1. Evaluate $\int_c F\,.\,dr$.

3.13 Find the directional derivative of $\varphi(x, y, z) = x^2yz + 4xz^2$ at the point (1, -2, -1) in the direction of the normal to the surface $f(x, y, z) = x \log z - y^2$ at (-1, 2,-1).

3.14 Find the work done in moving a particle in the force field $F=3x^2i + j + z\,k$ along the straight line from (0, 0, 0) to (2, 1, 3).

3.15 Find the work done by F = (2x−y − z) i + (x +y − z) j + (3x −2y −5z) k along a curve C in the xy plane given by $x^2 + y^2 = 9$, z = 0.

3. 16 Find the angle between the surfaces $x^2+y^2+z^2=9$ and $z=x^2 + y^2 - 3$ at the point (2, -1, 2)

3.17 Evaluate $\int_c F.dr$ where F=(x-3y)i+(y-2x)j and c is the closed curve in the xy-plane, x=2cost,y=3sint , from t=0 to t=2π.

3.18 Find the work done in moving a particle in the force field $F=3x^2i + j + z\,k$ along the straight line from (0, 0, 0) to (2, 1, 3).

3.19 For any vector A, find div curl A.

3.20 Evaluate $\iint_s A.n\, ds$ where $A=z\,i + x\,j - 3y^2z\,k$ and s is the surface of the cylinder $x^2 + y^2 = 16$ included in the first octant between z=0 and z=5.

3.21 Find the work done in moving a particle in the force field $F=3x^2i + (2xz - y)j + z\,k$ along the straight line from (0, 0, 0) to (2, 1, 3).

3.22 Find the angle between the surfaces $x^2+y^2+z^2=9$ and $z=x^2 + y^2 - 3$ at the point (2, -1, 2)

3.23 Show that $F=(2xy + z^3)i+x^2j + 3xz^2k$ is a conservative force field. Find the scalar potential. Find the work done in moving an object in this field from (1, -2, 1) to (3, 1, 4).

3.25 Find the work done in moving a particle in the force field $\overline{F} = 3x^2\, i + (2xz - y)\, j + z\, k$ along the curve $x^2 = 4y$, $3x^3 = 8z$ from x = 0 to x = 2.

3.26 Evaluate $\iint_s A.n\, ds$ where A=18zi-12j+3yk and s is that part of the plane 2x+3y +6z=12 which is located in the first octant.

3.27 Find the directional derivative of $\varphi = x^2yz+4xz^2$ at (1, -2, -1) in the direction 2i–j-2k.

3.28 Find the work done in moving a particle in the force field $F=3x^2i + (2xz\ ¡\ y)j + z\ k$ along the space curve $x = 2t^2$; $y = t$; $z = 4t^2 - t$ from t=0 to t=1.

3.29 Find grad ϕ where $\phi = (x^2 + y^2 + z^2)\, e^{-\sqrt{x^2+y^2+z^2}}$

3.30 Find the angle between the surfaces $x^2+y^2+ z^2= 4$, $z =x^2 + y^2 + 3$ at the point (2, -1, 1).

3.31 Find $\overline{A}.\nabla\, \phi$ at (1, -1, 1) if $\overline{A} = 3xyz^2 i + 2xy^3 j - x^2 yzk$ and $\phi = 3x^2 - yz$

3.32 Show that F= $(2xy + z^3)i + x^2 j + 3xz^2 k$ is a conservative force field. Find the scalar potential. Find the work done in moving an object in this field from (1,-2,1) to (3,1,4).

3.33 Find a unit normal vector to the surface $x^3 + y^3 + 3xyz = 3$ at the point (1, -2, -1)

3.34 In what direction from (3,1,-2) is the directional derivative of $f = x^2y^2z^4$ maximum ? Find also the magnitude of maximum.

3.35 Find constants a & b so that surface $ax^2 - b\,y\,z = (a+2)x$ will be orthogonal to the surface $4x^2y+z^3 = 4$ at the point (1,-1,2).

3.36 If F = (x-y)i + (x+y)j evaluate line integral of F. dr around curve c consisting of $y =x^2$ and $y^2 = x$

3.37 Evaluate $\iint e^x\, dy\, dz - y\, e^x\, dz\, dx - 3z dx dy$ over the surface of the cylinder $x^2 + y^2 = c^2$, $0 \le z \le b$

3.38 Find the directional derivative of $xy^2 + yz^3$ at the points (2,-1,1) in the direction of vector i+2j+2k

3.39 Find angle between $x^2+y^2+z^2=4$ and $z=x^2+y^2+3$ at (2, -1, 1)

3.40 Find the work done by moving a particle in the force field. $E= 3x^2i+(2xz-y)j+ z\,k$ along the curve $x=2t^2$, $y=t$, $z=4t^2-t$ from t=0 to t=1

3.41 Find the directional derivative of $\phi = x^2yz + 4xz^2$ at (1,-2, -1) in the direction of 2i-j-2k

3.42 Find the directional derivative of xyz at (1,1,1) in the direction of the vector i+j+k.

3.43 If $\bar{f} = e^{x+y+z}(\bar{i} + \bar{j} + \bar{k})$ .find curl $\bar{f}$.

3.44 $\overline{F} = y\bar{i} + z\bar{j} + x\bar{k}$ find the circulation of $\overline{F}$ round the curve c ,where c is the circle $x^2 + y^2 = 1, z = 0$

3.45 If $\overline{F}$ = 2xyi+yzj+xzk find the surface integral over the parallelopiped x=0, y=0, z=0, x=2, y=1, z=3.

3.46 Evaluate $\int_v \overline{F} dv$ when $\overline{F} = x\overline{i} + y\overline{j} + z\overline{k}$ and V is the region bounded by x=0,y=0.z=4,z= x^2

3.47 Using Divergence theorem, evaluate $\iint_S (xdydz + ydzdx + zdxdy)$,where, S is the sphere $x^2 + y^2 + z^2 = a^2$.

3.48 Verify divergence theorem for f = $4xi - 2y^2j + z^2k$ the region bound by $x^2 + y^2 = 4$, z= 0 and z =1

3.49 Verify Gauss divergence theorem for the function $\overline{F} = y\,\overline{i} + x\,\overline{j} + z^2\,\overline{k}$ over the cylindrical region bounded by $x^2 + y^2 = 9$, Z = 0, Z = 2.

3.50 If $\overline{A} = 2x^2\overline{i} - 3yz\overline{j} + xz^2\overline{k}$ and f = $2z - x^3y$ then find $A.\nabla f$ at (1, -1, 1).

3.51 Evaluate line integral $\int_C (y^2dx - x^2dy)$ about the triangle whose vertices are (1, 0), (0,1) and (-1, 0).

3.52 Find the work done in moving a particle in the Force field $\overline{F} = 3x^2\overline{i} + \overline{j} + 2k$ along the straight line from (0, 0, 0) to (2, 1, 1).

3.53 Verify Green's theorem in the plane for $\int_c (x^2 - xy^3)dx + (y^2 - 2xy)dy$. Where c is a square with vertices (0, 0), (2, 0), (2, 2), (0, 2).

3.54 Verify divergence theorem for $\overline{F} = 4xi - 2y^2j + z^2k$ taken over the region bounded by the cylinder $x^2 + y^2 = 4, z = 0 \quad and \quad z = 3$

3.55 State Green's theorem in plane.

3.56 State Gauss divergence theorem.

3.57 State Stokes' divergence theorem

3.58 Verify divergence theorem for $\overline{F} = 4xi - 2y^2j + z^2k$ taken over the region bounded by the cylinder $x^2 + y^2 = 4, z = 0 \quad and \quad z = 3$

3.59 If $\overline{A} = (x - y)\overline{c} + (x + y)\overline{j}$ Evaluate $\oint_C \overline{A}.d\overline{r}$ around the curve C consisting of $y = x^2$ and $y^2 = x$.

3.60 Verify Green's theorem in plane for $\int_c (x^2 - 2xy)dx + (x^2y + 3)dy$ where C is the boundary of the region defined by $y^2=8x$ and x=2.

4.1 Write down the CR-equations in polar form.

4.2 Evaluate $\oint_C \frac{dz}{z}$ where C:|Z|=1.

4.3 Expand sinz as Taylor's series about Z = $\pi/4$ upto the first three terms.

4.4 If $f(z)$ is a regular function of z then show that $\left(\frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2}\right)|f(z)|^2 = 4|f'(z)|^2$.

4.5 Define Harmonic function.

4.6 Show that z^3 is analytic for all z.

4.7 State Cauchy's integral theorem.

4.8 What is the nature of singular point in $f(z) = \frac{\sin z}{z}$.

4.9 State Taylor's theorem.

4.10 State Laurent's theorem.

4.11 Obtain the Taylor's expansion of e^{1+z} in powers of (z-1).

4.12 Evaluate $\oint_C \frac{2z^2+3}{z^3} dz$ over c: |z|=1.

4.13 Show that the function $f(z) = \bar{z}$ is continuous over C.

4.14 Show that xy^2 cannot be the real part of an analytic function.

4.15 Define a singular point and an isolated singular point with an example of each.

4.16 Show that $f(z) = |z|$ is not differentiable anywhere.

4.17 Determine constants a and b such that $u = ax^3 + by^3$ is harmonic function.

4.18 Find $\int_c \frac{\log z}{(z-2)^2} dz$, where C is $|z| = \frac{1}{2}$.

4.19 Find the singular point(s) of the function $f(z) = z^2 \, e^{1/z}$

4.20 Find Taylor expansion of f(z) = 1/z about z = 1.

4.21 Determine the analytic function whose real part is e^{2x}(xcos2y – ysin2y).

4.22 Prove that the function f(z) = sinhz is analytic.

4.23 Evaluate $\oint_C \frac{dz}{(z^2+1)(z^2-4)}$, C:|Z|=1.5 using Cauchy's integral formula.

4.24 Explain f(z) = $\frac{1}{(1-z)(2-z)}$ in a Laurent series valid for 0 < |z – 2| < 1.

4.25 If $u = e^x$(cosy - siny) where $w = u + iv$ is an analytic function, find the function w.

4.26 Show that the real part of analytic function f(z) is Harmonic, if f(z) = $u + iv$ is an analytic function, show that $\left(\frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2}\right)|\text{Re}\,al\, f(z)|^2 = 2|f'(z)|^2$.

4.27 Verify Cauchy's integral theorem for f(z) = z^2 for a curve OAB where OA is given by y = 0, AB is given by x + y = 1 and BO is given by x = 0.

4.28 Evaluate $\int_C (y - x - 3x^2 i) dz$ where C consists of the line segments from $z = 0$ to $z = i$ and the other from $z = i$ to $z = 1 + i$.

4.29 Find an analytic function whose real part $\dfrac{Sin2x}{Cosh2y - Cos2x}$.

4.30 Evaluate $\int_C \dfrac{e^{2z}}{(z+1)^4}dz$, C : | z-1 | = 3.

4.31 Integrate $f(z) = x^2 + i\,x\,y$ from *A(1, 1)* to *B(2, 8)* along the (a) the straight line *AB*, (b) the curve C: $x = t,\ y = t^3$.

4.32 Give two Laurent's series expansion in power of z for $f(z) = \dfrac{1}{z^2(1-z)}$ and specify the regions in which these expansions are valid.

5.1 Find the residue for $f(z) = \dfrac{\sin z}{(z-1)^2}$ at z = 1.

5.2. Evaluate the residue of $f(z) = \dfrac{z^3}{(z^2-1)}$.

5.3 Define the terms residue and improper integrals with suitable examples.

5.4 Determine the poles of the function $f(z) = \dfrac{z^2}{(z-1)^2(z+2)}$ and the residues at each pole.

5.5 Determine the poles of the function $f(z) = \dfrac{\sin\left(\frac{\pi z}{2}\right)}{(z+1)^2(z^2+1)}$ and the residue at each pole.

5.6 Evaluate $\int_{-\infty}^{\infty} \dfrac{dx}{1+x^4}$ by using Residue theorem.

5.7 Determine the poles of the function $f(z) = \dfrac{\sin\left(\frac{\pi z}{2}\right)}{(z+1)^2(z^2+1)}$ and the residue at each pole.

5.8 Find the residue at z = 1 of the function $f(z) = \dfrac{3z^2-1}{(z-1)^2(z^2+1)}$.

5.9 Evaluate $\int_0^{\pi} \dfrac{d\theta}{2+3\cos\theta}$.

5.10 Evaluate $\int_0^{2\pi} \dfrac{d\theta}{a+b\cos\theta}$, $(0<b<a)$ using complex integration.

(EE135) NETWORK ANALYSIS

Year	Semester	Hours / Week			C	Marks		
		L	T	P/D		CIE	SEE	Total
II	I	4	1	-	4	30	70	100

Course Description:-

The goal of this course is to explain in various concepts of the analysis of DC circuits as well as the basic concepts of the AC circuit.

In this course emphasis will be given to the concept of voltage, current, power and energy. You will be learn the voltage current relationship of the basic circuit elements like resistor, inductor and capacitor, dependent and independent sources, apply Kirchhoff's current and voltage law to the circuit in order to determine voltage, current, power in any branches of the circuit excited by DC voltage and current sources. Apply simplifying techniques like star delta transformation, nodal analysis mesh analysis and theorems to solve circuits easily.

The goal also included the transient response of the circuit to sinusoidal excitation in time domain, application of phase to circuit analysis, detailed study of graph theory, magnetic coupled circuits where you will be familiar with mutual induction, resonance, bandwidth, quality factor, resonance frequency.

COURSE OBJECTIVES:

Student will be able to

1. Learn the passive components and their V-I relations.
2. Learn electric circuit laws and network theorems with D.C. and A.C. excitations and solve electric circuits.
3. Calculate A.C. quantities and draw phasor diagrams.
4. Understand the concepts of transient response and solve problems.
5. Learn basic theorems, two port network and apply them.

COURSE OUTCOMES:

At the end of the course, the student will develop ability to

1. Solve electric network with passive elements
2. Represent the network solution in a graphical form by means of phasor and locus diagrams
3. Analysis transient response of different circuit and two port network
4. Apply network theorem to different electric network.
5. Solve a complex circuit by applying reduction technique like star-delta, theorems etc.
6. Understand the concept of resonance, band width and quality factor.
7. Find average and RMS value for the different periodic signals.
8. Solve first and second order differential equation related problem using Laplace transform.

UNIT – I

Introduction to Electrical Circuits : Circuit Concept – R-L-C Parameters- Voltage and Current sources – Independent and dependent sources – Source transformation – Voltage – Current relationship for passive. Kirchhoff's laws – network reduction techniques – series, parallel, star-to-delta or delta-to-star transformation. Nodal analysis Mesh analysis Super node and Super mesh for DC excitations.

UNIT – II

Single Phase AC Circuits: Single Phase A.C Circuits: R.M.S and Average values and form factor for different periodic wave forms, Steady state analysis of R, L and C (in series, parallel and series parallel combinations) with sinusoidal excitation – Concept of Reactance, Impedance, Susceptance and Admittance – Phase and Phase difference – concept of power factor, Real and Reactive powers, Complex power. **:** Resonance – series, parallel circuits, concept of band width and Q factor.

UNIT – III

Network Theorems with DC and AC Excitations: Superposition, Reciprocity, Thevenin's, Norton's, Maximum Power Transfer and Compensation theorems for dc and ac excitations.

UNIT – IV

Transient Analysis: Transient Response of RL, RC Series, RLC Circuits (First and Second Order Circuits), for DC Excitations, Initial conditions, Solution Using Differential Equations Approach and Laplace Transform Method.

UNIT – V

Two Port Networks: Impedance Parameters, Admittance Parameters, Hybrid Parameters, Transmission (ABCD) Parameters, Conversion of one parameter to another, Conditions for reciprocity and symmetry, Interconnection of Two Port Networks in Series, Parallel and Cascaded Configurations, Image Parameters, Illustrative Problems

TEXT BOOKS:

1. William Hayt and Jack E. Kimmerly, "Engineering Circuit Analysis", McGraw Hill Company, 6th Edition.
2. A. Chakrabarthi, "Circuit Theory: Analysis and Synthesis", Dhanpat Rai and Co., 6th Edition.

REFERENCE BOOKS:

1. Vanvalkenburg, "Network Analysis", PHI.
2. N C Jagan and C. Lakshminarayana, "Network Theory", B.S Publications.

LECTURE PLAN

Sl. No.	Topics in syllabus	Modules and Sub modules	Lecture No.	Suggested books with Page Nos. (A. Chakrabarthi, "Circuit Theory: Analysis and Synthesis",)
UNIT – I (No. of Lectures – 15)				
1	Introduction to electrical circuits	Circuits concepts	L1	1
2	R-L-C parameters	Properties of R-L-C parameters	L2 L3	5,6,7
3	Voltage and current sources	Voltage-current relationship for passive elements	L4	5,6,7
4	Energy sources	Dependent &independent sources	L5 L6	9,10,11
5	Kirchhoff's current law definition	Problems	L7	16,17,18
6	Kirchhoff's voltage law definition	Problems	L8	11,12,13
7	Nodal analysis& super node analysis	problems.	L9 L10	76,77,78,81,82
8	Mesh analysis &super mesh analysis	Problems	L11 L12	68,69,70,74,75
9	Network Reduction techniques	Series-parallel ,star to delta and delta to star transformation problems	L13 L14	REFER CHAKRABARTI 4,8,9,10,20,21,22,23, 24
10	Source transformation techniques	Problems	L15	83,84,85
UNIT –II (No. of Lectures – 13)				
11	Introduction to single phase voltage source	Difference b/w A.C and D.C	L16	169,171
12	R.M.S and Average values Form factor	Problems on different periodic waveforms	L17 L18	172,173,174,175 upto 186
13	Steady state analysis of R-L-C	Series, parallel and series parallel combinations with sinusoidal excitation	L19 L20	Refer chakrabarthi 201-246
14	Concept of reactance impedance s	Susceptance ,admittance	L21	Refer sudhkar shamohan 192,193,upto 205

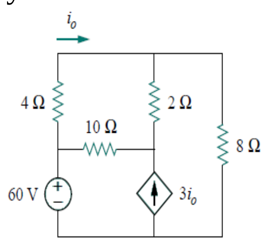
15	Concept of power factor, Real and reactive powers, complex power	problems	L22	Refer Chakrabarti 305-329
16	Definition of Resonance	Problems on Series, parallel circuits	L23 L24	Refer Chakrabarthi 247-248
17	Concept of band width and Q factor	Problems	L25 L26	Refer Chakrabarti 249-250
18	problems	Of all topics	L27 L28	Refer both books
UNIT –III (No. of Lectures – 13)				
19	Introduction to network theorems	Classification of network theorems	L29	Refer chakrabarti 99
20	Thevenins theorem	Problems on Thevenins theorem with DC and AC exitation	L30 L31	99-200
21	Superposition theorem	Problems on Superposition theorem with DC and AC exitation	L32 L33	121
22	Nortons theorem	Problems on Nortons theorem with DC and AC exitation	L34 L35	111
23	Reciprocity theorem	Problems on Reciprocity theorem with DC and AC exitation	L36 L37	133
24	Maximum power theorem	Problems on Maximum power theorem with DC and AC exitation	L38 L39	127
25	problems	Of all topics	L40 L41	Refer both books
UNIT-IV **(No. of Lectures – 11)**				
26	Introduction to Transient analysis	Classification of transient analysis	L42	Refer chakrabarti 331
27	Transient response of RL circuit	Problems on RL circuit first& second order system for DC excitations	L43 L44	333
28	Transient response of RC circuit	Problems on RC circuit first& second order system for DC excitations	L45 L46	339
29	Transient response of RLC circuit	Problems on RLC circuit first& second order system for DC excitations	L47 L48	349
30	Solution using Differential equation approach method	problems	L49	Refer van valkenburg
31	Solution using Laplace Transform approach method	problems	L50 L51 L52	377-430

UNIT –V (No. of Lectures – 14)				
35	Introduction to two port networks	Classification of two port networks	L53	Refer chakrabarti 485
36	Impedance parameters	Problems on impedance parameters	L54 L55	492
37	Admittance parameters	Problems on admittance parameters	L56 L57	500
38	Hybrid parameters	Problems on hybrid parameters	L58 L59	504
39	ABCD or Transmission parameters	Problems on ABCD parameters	L60 L61	507
40	Conversion of one parameter to anther parameter	Interconnection of Two port networks in series ,parallel and cascaded configurations	L62 L63	517-525
41	Image parameters	Illustrative problems condition for reciprocity and symmetry	L64 L65 L66	508

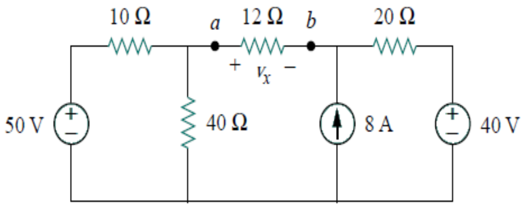
Review Questions

UNIT I

1. Calculate i_o using super mesh analysis.



2. Find Vx using source transformation theorem.



3. (a) How basic elements are classified in electrical engineering? write about properties of any two passive elements.

(b) For the circuit shown in fig.1, find power delivered by the source.

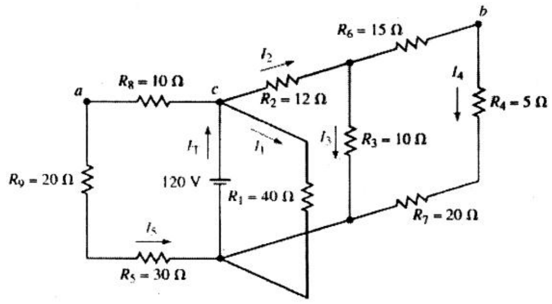


Fig.1

4. (a) Derive an expression for equivalent capacitance for two capacitors connected in series.

(b) Using nodal analysis find power loss in all resistors shown in fig. 2

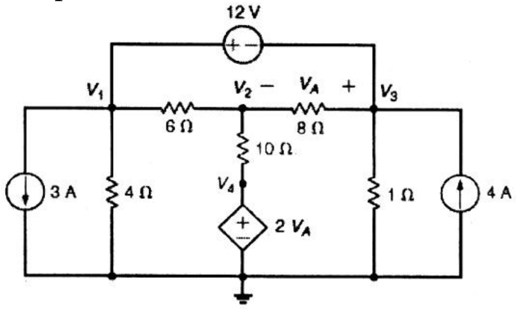


Fig.2

5. For the circuit shown in fig.3, using star- delta reduction method, find power delivered by the

Source.

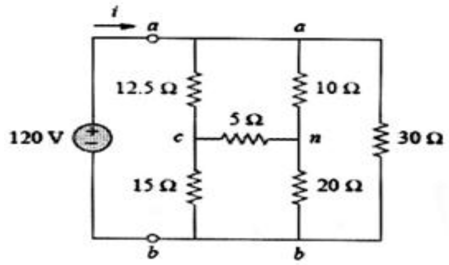


fig 3

6 (a) Derive an expression for energy stored in capacitor when applied with voltage of V volts.

(b) Explain the types of dependent and independent source with neat diagram.

7. Determine the resistance between the terminals A&B and hence find the current through the voltage source. Refer figure 4

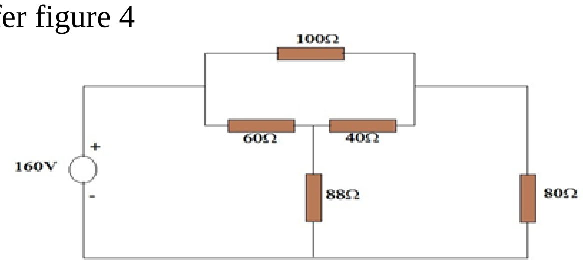
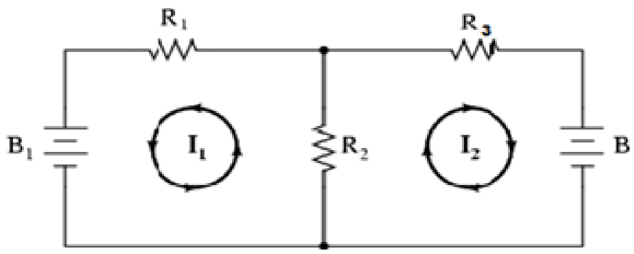


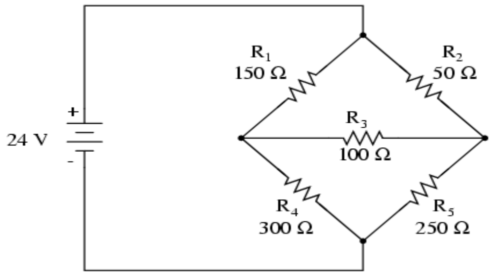
Figure 4

8. Determine the current I_1 *and* I_2 the following circuits with reference to the indicated

Direction, also calculate voltage drops across R_2. Where $R_1 = 10\,\Omega$, $R_2 = 20\Omega$ and R_3=10Ω $B_1 = 20V$ and B_2= 40V.

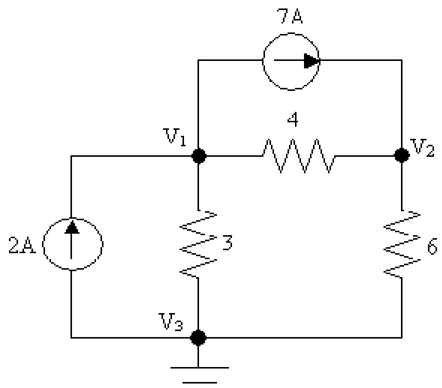


9. Calculate the amount of current flowing through voltage source and voltage drop across 100Ω resistance using mesh analysis.

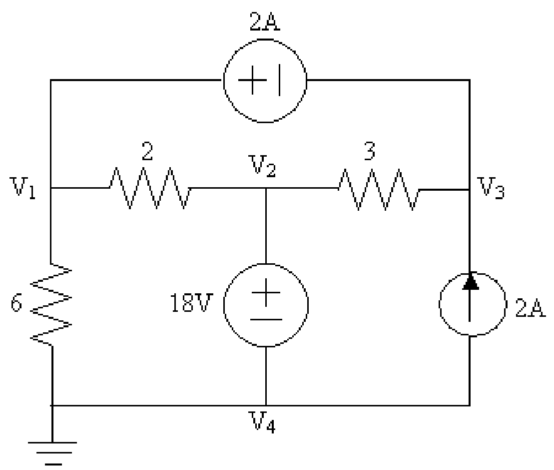


10.(a) Calculate the voltage V_1 and V_2 using nodal analysis technique, also calculate the amount

Of current flowing through 4 ohm resistance.

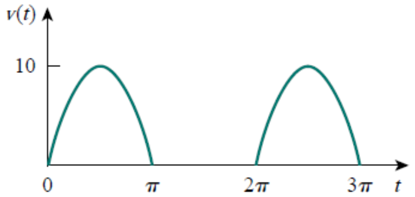


(b) Calculate the nodal voltage V_1, V_2, and V_3 using node analysis method



UNIT II

11. Define peak to peak value and RMS value of an alternating wave.
12. Calculate average and rms values of the following waveform.



13. For the waveform shown in fig.5 find r.m.s and average values.

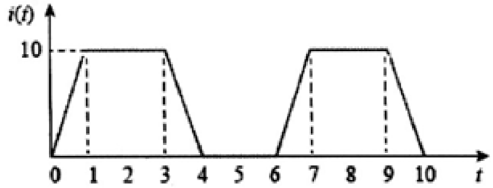


Fig. 5

14. A certain electrical circuit results a passing current of $i = 6.1 \sin(377t+30^0)$A when it is Applied with voltage of $v=340 \cos(377t-50^0)$V. Find the circuit elements and real and Reactive power.

15. Find the value of unknown resistance (R_c) value that the circuit in fig.6 gets resonance Condition.

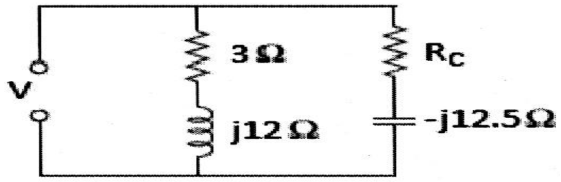


Fig.6

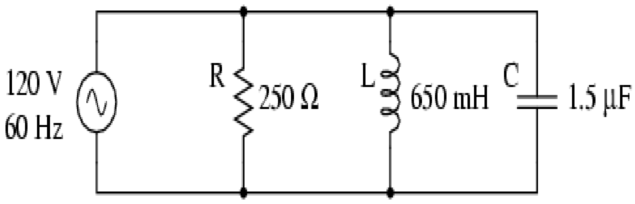
16. A parallel resonance network consisting of a resistor of 60Ω, a capacitor of 120uF and an Inductor of 200mH is connected across a sinusoidal supply voltage which has a constant output
Of 100 volts at all Frequencies. Calculate, the resonant frequency, the quality factor and the Bandwidth of the circuit, and the circuit current at resonance.

17. A parallel AC circuit draws 8 amps of current through a purely resistive branch and 14 amps
Of current through a purely inductive branch, Calculate the total current and the angle Θ of the
Total current, explaining your trigonometric method(s) of solution.

18. A parallel AC circuit draws 100 mA of current through a purely resistive branch and 85 mA
Of current through a purely capacitive branch, Calculate the total current and the angle Θ of the
Total current, explaining your trigonometric method(s) of solution.

19. (a) If a sinusoidal voltage is applied to an impedance with a phase angle of 90^0 , draw the Resulting voltage and current waveforms.
(b) Define reactive power, in contrast to “true” or “apparent” power.

20. Find the value total current is flowing through the source, also find the current flowing Through inductor, capacitor, and resistor individually.



UNIT III

21. For circuit shown in fig.7 find the value of load impedance for maximum power transfer.

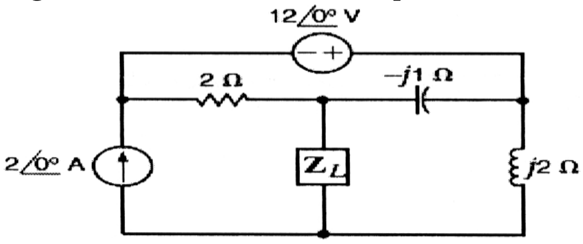
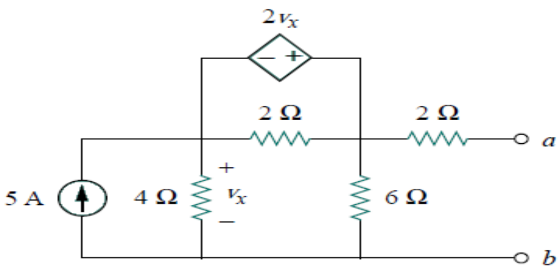
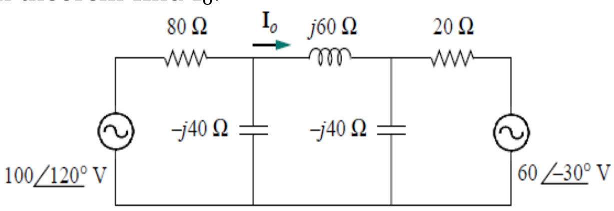


Fig.7

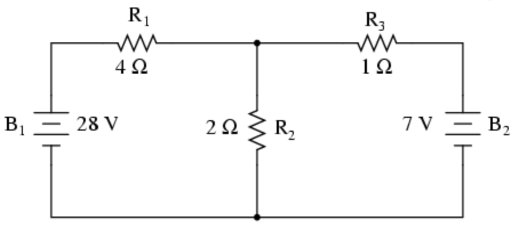
22. Obtain the Thevenin’s equivalent of the following circuit.



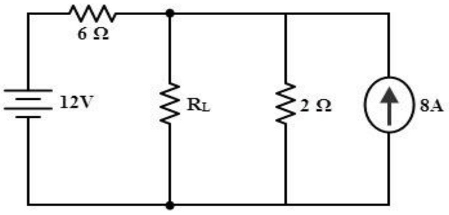
23. Using superposition theorem find I_o.



24. Using superposition theorem find the value of current flowing through 2 ohm resistance.



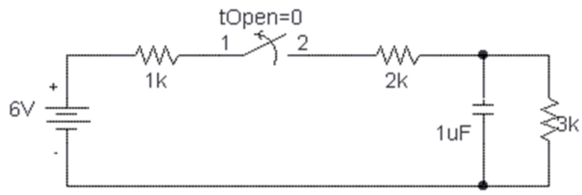
25. Using maximum power theorems find the power absorb by load resistance.



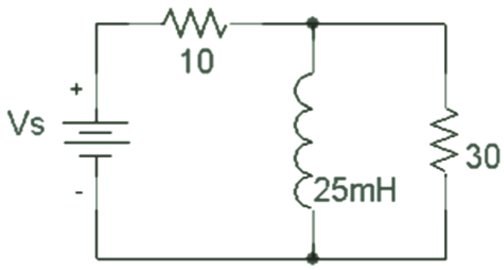
26. What do you mean by compensation theorem, explain with an example.
27. Write down the procedure to solve thevenin's theorem for both dependent and independent
Source, explain with suitable examples.
28. Prove that the efficiency is 50 % during maximum power transfer theorem.

UNIT IV

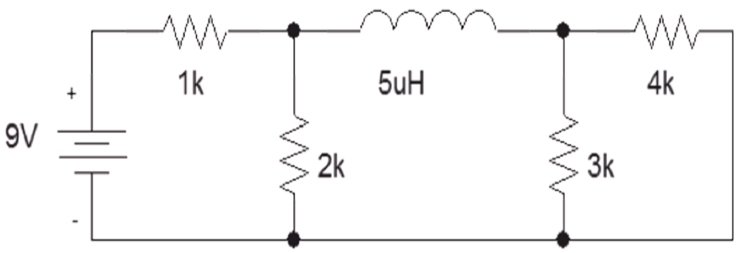
29. Find the voltage, Vc(t), over the capacitor for all time t>0



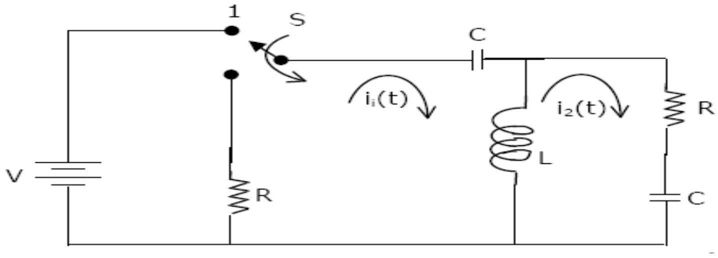
30. The voltage source Vs in the circuit shown below is nominally 5V. A power surge At Time t=0 causes it to instantaneously jump to 10V, and then at time t=5ms, it Instantaneously drops back to 5V. Express the current flowing down through the 30 Ohm resistor (as a function of time)



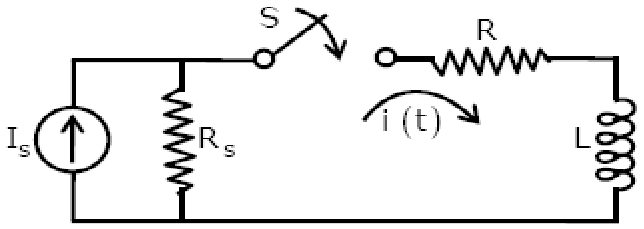
31. The voltage supply in the circuit shown below is switched on at time 0. Compute the voltage over the 3K ohm resistor for all time.



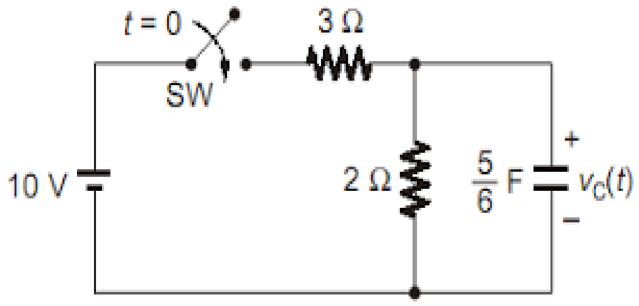
32. Assume that the switch S is in position 1 for a long time and thrown to position 2 at t=0. At t = 0^+, find the value of current i_1.



33. In the following circuit, the switch S is closed at t = 0. The rate of change of current $di(0^+)/dt$ is ?.



34. In the circuit shown, switch SW is closed at t =0. Assuming zero initial conditions, the value of $V_c(t)$ (in volts) at t = 1 sec is ?



35. Find the time domain current i(t) if its Laplace transform is

$$\mathbf{I(S)} = \frac{S-10}{S^4+S^2}$$

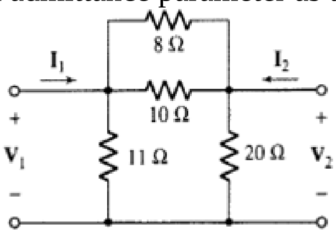
36. Find the Laplace transform of $e^{-at}\cos wt$ where a is constant.

37. Find the inverse Laplace of the following function.

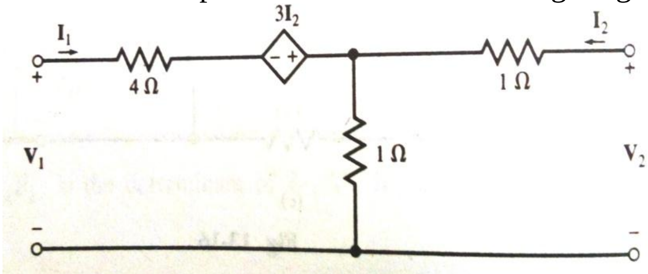
(a) $\frac{S}{(S+2)(S+1)}$ (b) $\frac{S+5}{S^2+2S+5}$

UNIT V

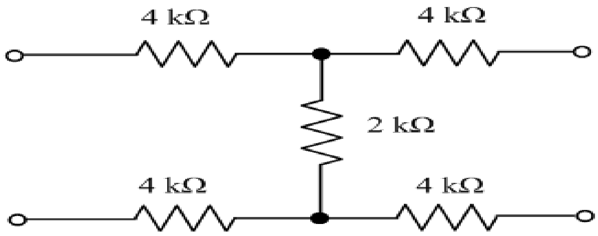
38. Determine the impedance and admittance parameter as the circuit given below.



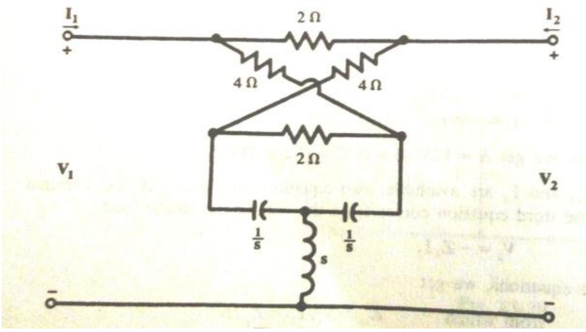
39. Find the Z parameters of the two port network as shown in figure given below.



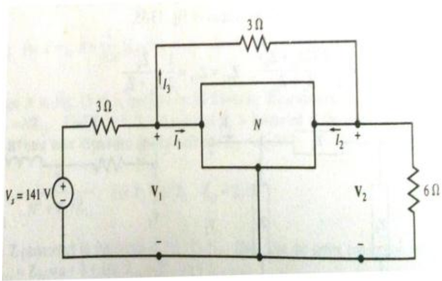
40. Transform Z-parameters in terms of ABCD and Y- parameters.
41. What do you mean by interconnection of two port network, derive the expression for Cascaded And parallel connection.
42. Find the Y-parameters and ABCD parameters of the two-port network as shown in figure Given below



43. Transform h-parameters in terms of ABCD, admittance and impedance parameters, write Down the symmetrical and reciprocal condition of ABCD and h-parameters.
44. Find the Z-parameter in the circuit given below.



45. Two port network N as shown in figure is specified by $Z_{11} = 2, Z_{12} = Z_{21} = 1 \; and \; Z_{22} = 4$ Find I_1, $I_2$and I_3.

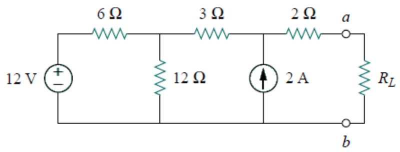


46. Express reciprocity and symmetry criteria for impedance, admittance, hybrid and Transmission line parameters, also explain why Z parameters is called as open circuit and Y-Parameters are called as short circuit parameters.
47. Derive the expression of interconnected two port network of series connections.

Short Questions (NA)

1. Three resistors of 1Ω each are connected in star form. Find equivalent resistance in delta connection.
2. What is meant by a periodic waveform? Draw any two shapes.
3. A voltage of 100V dc is applied across two series connected capacitors of 100 μF and 25 μF. Find voltage drop across each capacitor?
4. A 750Ω resistor is in series with a 0.1 μF capacitor. Find the frequency, if the total impedance of the circuit is 1000Ω If a voltage of V=80Sin $(314t+60^0)$ V is applied to a load of Z= (43+j25) Ω find power factor.
5. Two coils of inductance s 2H and 1H with flux aiding are connected in series. The mutual inductance is 0.5H find total inductance of the combination.
6. What is the power factor a series **RLC** circuit operating at resonance condition?
7. For a certain network have seven node and five independent loops. Find the number of branches.
8. State Norton's theorem
9 . Draw the symbols of dependent sources.

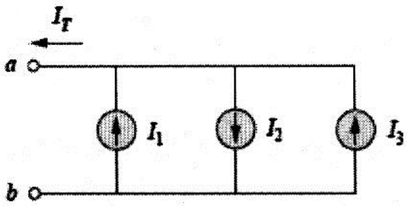
10 .Define form factor and crest factor.
11. Derive the expression for resonant frequency of a RLC series circuit
12. For what value of R_L maximum power will be transferred?



13. State reciprocity theorem

19.

14. A battery provides 6 V on open circuit and it provides 5.4 V when delivering 6 A. Find the internal resistance of the battery?
15. Five inductors are connected in series with lowest value is 5H. if the value of each inductor is twice that of preceding one and if the inductors are connected in order ascending value. Find the total inductance.
16. For the circuit shown below if I_1 = 5A, I_2= 15A and I_3=7A find I_T.



17. A 750 □ resistor is in series with a 0.01 □F capacitor. Find the frequency does the total impedance have a magnitude of 1000 □.
18. If a voltage of V=80 Sin$(314t+60^0)$ is applied to a load of Z=(43+j25)□ find apparent power.
19. Define reciprocity theorem.
20 Define form factor.
21. Define RESONANCE,BANDWIDTH& Q-FACTOR.
22 Write the time period relations for RL &RC transient anylasis.
23 define two port network
24 define Laplace transform
25. define symmetry and reciprocity in two port network

26 write symmetry and reciprocity conditions for all two port networks
27 write the relations for all parameters for two port network.
28 write some applications for Laplace transform
29 draw and write relations for star and delta connection
30 define resistance, conductance ,resistivity & conductivity.
31 draw the symbols for voltage and current sources.
32 define linear and nonlinear circuit.
33 define filter
34 define attenuator.

(EC103) ELECTRONIC CIRCUIT ANALYSIS

Year	Semester	Hours / Week			C	Marks		
		L	T	P/D		CIE	SEE	Total
II	I	4	-	-	4	30	70	100

Course Description

The course is designed to provide students with fundamental principles of electronic circuit design and analysis. Students are engaged in the study of basic concepts of BJT & its design, analysis of MOS amplifier, feedback amplifiers, oscillators, power and tuned amplifiers and their applications. This course also helps students to develop the skills to analyze and design electronic circuits that utilize the devices. This course includes Circuit models for electronic devices such as BJT, FET as amplifiers, dc and ac circuit models for the design and analysis of electronic circuits and also analysis and design of Single-stage and multistage amplifier circuits, low-frequency and high-frequency response of amplifiers.

Prerequisites

Requires the knowledge of Electronic Devices and Circuits.

COURSE OBJECTIVES:

Students will be able to

1. Design RC coupled amplifier and analyze its performance using simplified hybrid model.
2. Illustrate the effect of coupling and by-pass capacitors at low frequencies and stray capacitances at high frequencies.
3. Describe the effect of negative feedback on amplifier characteristics and to analyze the feedback amplifiers (voltage series, voltage shunt, current series and current shunt).
4. Discuss the concept of positive feedback and explain RC and LC oscillators
5. Evaluate the efficiency of power amplifiers (class A and B) and explain tuned amplifiers (single, double and staggered).

COURSE OUTCOMES:

At the end of the course, the student will develop ability to

1. Design RC coupled amplifier for the given specifications and analyze its performance.
2. Explain MOSFET amplifiers.
3. Discuss the frequency response of a given amplifier.
4. Explain the effect of negative feedback on amplifiers.
5. Illustrate the generation of sinusoidal signals at audio and radio frequencies using oscillators.
6. Evaluate the efficiency of a given power amplifier.
7. Explain the concept of tuned amplifiers.
8. Compare small signal and large signal amplifiers.

UNIT – I

Single Stage and Multi Stage Amplifiers: Classification of Amplifiers – Analysis of CE, CC, and CB Configurations with simplified Hybrid Model, Analysis of CE amplifier with Emitter Resistance, Emitter follower, Miller's Theorem and its dual, design of single stage

RC coupled amplifier using BJT.
Different coupling schemes used in amplifiers – RC coupled amplifier, Transformer coupled amplifier, direct coupled amplifier, Analysis of Cascaded RC coupled BJT amplifiers, Cascode amplifier, Darlington pair, Distortion in Amplifiers

UNIT – II
BJT and MOS Amplifiers – Frequency Response: Logarithms, Decibles, frequency response of BJT amplifier, analysis at low and high frequencies, effect of coupling and bypass capacitors, the hybrid-pi common emitter transistor model, CE short circuit current gain, single stage CE Transistor Amplifier Response, gain-bandwidth product.
Basic concepts, MOS Small signal model, common source amplifier with resistive load, diode connected load and current source load, source follower, common gate stage cascade amplifier and their frequency response.

UNIT – III
Feedback Amplifiers: Concepts of feedback, classification of feedback amplifiers, general characteristics of negative feedback amplifiers, effect of feedback on amplifier characteristics, voltage series, voltage shunt, current series and current shunt feedback configurations, illustrative problems.

UNIT – IV
Oscillators: Classification of oscillators, conditions for oscillation, RC phase shift oscillator, generalized analysis of LC oscillators, hartely, and colpitts oscillators, wien-bridge and crystal oscillators, stability of oscillators

UNIT – V
Large Signal and Tuned Amplifiers: Classification. Class A Large signal amplifiers, Transformer coupled class A audio power amplifier, efficiency of class A amplifier, class B amplifier, efficiency of class B amplifier, class-B Push-pull amplifier, Complementary symmetry class B Push-pull amplifier, distortion in power amplifiers, thermal stability and heat sinks.
Introduction, Q-Factor, small signal tuned amplifiers, effect of cascading single tuned amplifiers on bandwidth, stagger tuned amplifiers, stability of tuned amplifiers.

TEXT BOOKS:

1. Jacob Millman and Christos C Halkias, “Integrated Electronics”, TMH, 2008.
2. S. Salivahanan, N. Suresh Kumar and A Vallavaraj, “Electronic Devices and Circuits”, 2nd Edition, TMH, 2009.

REFERENCE BOOKS:

1. Robert L. Boylestad and Louis Nashelsky, “Electronic Devices and Circuits Theory”, 9th Edition, Pearson Education, 2008.
2. K Lal Kishore, “Electronic Circuit Analysis”, BSP, 2004.
3. Niamen, Donalda, “Electronic Circuits Analysis and Design”, TMH, 2012.
4. Millman Jacob, “Electronic Devices and Circuits”, 2nd Edition, TMH, New Delhi, 2009.

WEBSITES

1. www.cc.ee.ntu.edu.tw/~lhlu/eecourses/Electronics1/Electronics_Ch4.pdf
2. www.techpowerup.com/articles/overclocking/voltmods/21

3. www.pa.msu.edu/courses/2014spring/PHY252/Lab4.pd
4. www.iet.ntnu.no/courses/ttt4100/oppg1_eng.pdf
5. www.te.kmutnb.ac.th/~msn/225301reports156-2.**pdf**
6. http://www.unix.eng.ua.edu/~huddl/mystuff/ECE333/ISM
7. Electronic%20Circuit%20Analysis%20and%20Design.pdf

CONTENT BEYOND SYLLABUS:

Phase lead phase lag networks, LC coupled amplifier, Class AB and Class C power amplifiers.

LECTURE PLAN

Sl. No.	Topics in syllabus	Modules and Sub modules	Lecture No.	Suggested books with Page Nos.
UNIT – I Single Stage and Multi Stage Amplifiers: (No. of Lectures – 16)				
1	Classification of Amplifiers	Categorization of amplifiers with Examples	L1	TB1, 372-373
2	Distortion in Amplifiers	Amplitude, Frequency and Phase distortions	L2	TB1, 373-374
3	Analysis of Transistor in C.B Configuration using Simplified Hybrid Model Analysis of Transistor in C.E Configuration using Simplified Hybrid Model Analysis of CE amplifier with Emitter Resistance using Simplified Hybrid Model Analysis of Transistor in C.C Configuration & Emitter Follower using Simplified Hybrid Model	Expression for voltage gain, current gain, input impedance and output impedance	L3 L4 L5 L6	TB2, 6.25-6.26 B2, 6.15-6.18 TB2, 6.20-6.21 TB2, 6.25-6.26
4	Miller's Theorem and it's dual	Definition & Proof	L7	TB1, 255-266
5	Design of single stage RC coupled amplifier using BJT	Design concepts and Equations for circuit components	L8 L9	TB2, 6.68-6.76
6	Different coupling schemes used in amplifiers	RC coupled amplifier, Transformer coupled amplifier and direct coupled amplifier	L10 L11	RB4, 245
7	Cascode amplifier	Explanation and Analysis	L13 L14	TB1, 560-563
8	Darlington pair	Explanation and Analysis	L15 L16	TB1, 274-279
UNIT –II BJT and MOS Amplifiers- Frequency Response (No. of Lectures – 16)				
9	Logarithm, decibels	Basic concept and Problems	L17	TB1, 388
10	Frequency Response of BJT Amplifier	Explanation of Frequency Response of RC Coupled Amplifier	L18	TB1, 389-390
11	Analysis(of frequency response) at low and high frequencies	Analysis using Low Pass and High Pass RC circuits.	L19 L20	TB1, 374-378
12	Effect of coupling and bypass capacitors	Derivation for C_E and C_C	L21 L22	TB2, 6.27-6.32
13	Hybrid-pi model for common emitter transistor	Justification of each parameter in the model & it's expressions	L23	TB2, 6.33
14	CE short circuit current gain	Concept & Derivation for CE short circuit current gain	L24	TB1, 356-359
15	CE current gain with Resistive Load	Effect of load on B.W & Derivation for CE current gain with resistive load	L25	TB1, 359-361
16	gain-bandwidth product	Concept & derivation	L26	TB1, 365-367
17	Basic concepts of MOSFET & it's Small signal model	Justification of each parameter in the model()	L27	TB1, 313-319
18	Common Source amplifier with	Explanation and Analysis (i.e expression	L28	TB1, 329-331

	resistive load, diode connected load and current source load	for voltage gain, input impedance and output impedance)	L29	
19	Source follower	Explanation and Analysis	L30	TB1, 334-335
20	Common gate amplifier	Explanation and Analysis	L31	TB1, 341-343
21	Cascode amplifier	Explanation and Analysis	L32	
UNIT –III Feedback Amplifiers (No. of Lectures – 11)				
22	Concepts of feedback	Basic concepts of feedback with block diagram & derivation for negative feedback	L33	TB2, 7.1
23	Classification and general characteristics of negative feedback amplifiers	Categorization of feedback amplifiers with Examples. Merits & Demerits	L34	TB2, 7.2-7.3
24	Effect of feedback on amplifier characteristics	Effect of negative feedback on Gain, Noise, Distortion, Input impedance, Output impedance and Bandwidth of amplifier & Problems	L35 L36 L37 L38	TB2, 7.4-7.7
25	Voltage Series, Voltage Shunt, Current Series and Current shunt feedback configurations	Analysis(i.e. Gain, Input and Output impedances) of Practical feedback amplifier circuits.	L39 L40 L41 L42	TB2, 7.7-7.9 TB2, 7.11-7.13 TB2, 7.13-7.18
26	Illustrative Problems	Problems on above topics	L43	TB2,7.4-7.6,7.9-7.10, 7.16
UNIT – IV Oscillators : (No. of Lectures – 10)				
27	Oscillators, conditions for Oscillations	Basic concepts, Derivation for positive feedback, Condition for Oscillations & Starting voltage	L44	TB2, 8.1-8.2
28	Classification of Oscillators	Categorization of Oscillators with Examples.	L45	TB2, 8.1-8.4
29	RC phase shift oscillator	Explanation & Derivations for Resonant frequency and condition for oscillations	L46 L47	TB2, 8.14-8.16
30	Wien-bridge oscillator	Explanation & Derivations for Resonant frequency and condition for oscillations	L48	TB2, 8.25-8.27
31	Generalized analysis of LC oscillators	Derivation of General Equation for LC oscillator	L49	TB2, 8.3-8.5
32	Hartley oscillator	Explanation & Derivations for Resonant frequency and condition for oscillations	L50	TB2, 8.6-8.7
33	Colpitts oscillator	Explanation & Derivations for Resonant frequency and condition for oscillations	L51	TB2, 8.9-8.10
34	Crystal oscillator	Basic concepts of Crystals & Explanation of oscillator using crystals	L52	TB2, 8.29-8.31
35	Stability of oscillators	Amplitude and frequency stability	L53	TB2, 8.34-8.35
UNIT –V Large Signal and Tuned Amplifiers : (No. of Lectures – 12)				
36	Classification of Large signal amplifiers	Basic concepts & Categorization of power amplifiers	L54	TB1, 373
37	Class A Large signal amplifiers	Explanation & Derivations of Efficiency. Problems	L55	TB1, 677-678
38	Transformer coupled class A audio power amplifier	Explanation & Derivations of Efficiency. Problems	L56	TB1, 684-687
39	class B power amplifier	Explanation & Derivations of Efficiency. Problems	L57	TB1, 692-693
40	class-B Push-pull amplifier	Explanation & Derivations of Efficiency. Problems	L58	TB1, 690-695
41	Complementary symmetry class	Explanation & Derivations of	L59	TB1, 693-695

	B Push-pull amplifier, distortion in power amplifiers	Efficiency. Problems		
42	Distortion in Power Amplifiers	Explanation and Derivations of Harmonic and Cross-over distortions	L60	TB1, 679-681, 699
43	Thermal stability and heat sinks	Thermal resistance, condition for thermal stability, types of heat sinks	L61	TB1, 5.22-5.27
44	Tuned amplifiers	Introduction, Q-Factor	L62	RB4, 399 RB5, 13.28
45	Small Signal tuned amplifiers	Expression for gain and bandwidth	L63	RB4, 400-403
46	Effect of cascading single and double tuned amplifiers on bandwidth	Expression for bandwidth	L64	RB4, 411-415
47	Stagger tuned amplifiers, Stability of tuned amplifiers	Explanation of stagger tuning & Stability of tuned amplifiers	L65	RB4, 415

REVIEW QUESTIONS
UNIT-I

1. Explain how amplifiers are classified?
2. Explain various types of distortions occur in amplifiers with neat sketches.
3. Draw a self-biased CE amplifier circuit without bypass capacitor. Also derive the expressions (using simplified hybrid model) for

   i) Current gain ii) Input impedance iii) Voltage gain and iv) Output impedance.
4. Draw the simplified hybrid model for Emitter Follower. Also derive the expressions for

   i) Current gain ii) Input impedance iii) voltage gain iv) Output impedance
5. State and prove Miller's theorem & it's dual.
6. Design Single Stage RC coupled CE amplifier(with self bias and emitter bypassed) for the given specifications.

   V_{CC}=24 V , V_{CE} =3 V , V_{RE} =5 V , R_S =600 Ω, f_1 =100 Hz , h_{fe} =100 , R_L =120 K Ω
7. Differentiate various coupling schemes used in amplifiers.
8. Draw a Two-Stage Transformer Coupled amplifier and explain its operation.

   Also list it's merits, demerits and applications.
9. Draw a Two-stage Direct Coupled amplifier using BJT and explain its frequency response with neat sketches. Also list it's merits, demerits and applications.
10. Explain Cascode amplifier in detail with a neat sketches and derive the expressions for

    i) Input impedance and ii) Voltage gain.
11. Explain Darlington Emitter follower with neat sketches. Also derive the expressions for

    i) Voltage gain ii) Current gain iii) Input impedance and iv) Output impedance.

UNIT-II

1. Explain the frequency response of RC coupled amplifier.
2. Explain in detail the reasons for fall of gain of RC coupled amplifier at both low and high frequencies.
3. Explain the effect of emitter bypass capacitor and coupling capacitor on low frequency response of single stage RC coupled amplifier. Also derive the expressions for bypass capacitor and coupling capacitor.
4. Draw the hybrid π model for a transistor in CE configuration. Also explain the significance of each component in the model.
5. Define CE short circuit current gain. Also derive its expression as a function of frequency using hybrid - π model.
6. Derive the expression for CE current gain with resistive load. Also explain the effect of load on B.W.
7. Define f_α, f_β and f_T. Also derive the relation between f_β and f_T.

8. Draw and explain the small signal MOS model at low and high frequencies.
9. Draw and explain CS amplifier with resistive load. Also derive the expressions for

   i) I/P resistance ii) O/P resistance iii) Voltage gain

10. Draw and explain CS amplifier with diode connected load. Also derive the expression for Voltage gain.
11. Draw and explain CS amplifier with current source load. Also derive the expression for Voltage gain.
12. Draw and explain source follower. Also derive the expressions for

    i) I/P resistance ii) O/P resistance iii) Voltage gain

13. Draw and explain CG amplifier. Also derive the expressions for

    i) I/P resistance ii) O/P resistance iii) Voltage gain

14. The h-parameters of a transistor at I_c= 10 mA , V_{CE} =10 V and room temp. are h_{fe}=100 , h_{ie}=500 Ω , | A_i |=10 at 10 M Hz and C_c=3 pF. Find i) $r_{b'e}$ ii) $r_{bb'}$ iii) f_T iv) f_β and v) C_e
15. The hybrid-π parameters of the transistor at room temperature with I_c= 1.3mA are g_m = 50mA/V, $r_{b'e}$= 1KΩ, $r_{bb'}$ = 100Ω, $r_{b'c}$ = 4MΩ, r_{ce} = 80KΩ,r_{ce} = 80KΩ, C_c = 3pF, C_e = 100pF. C BJT has g_m = 38millimhos; $r_{b'e}$ = 5.9Kohms, h_{ie} = 6Kohms, $r_{bb'}$ = 100 ohms, $C_{b'c}$ =12pF; $C_{b'e}$ =63pF, h_{fe} = 224 at 1KHz. Find α and β cutoff frequencies and f_T.
16. The following low-frequency parameters are known for a given transistor at I_c=10 mA, V_{ce}=10v and at room temperature.

    h_{ie}=500 Ω h_{oe}=4x10^{-5} A/v h_{fe}=100, h_{oe}=10^{-4}

    At the same operating point, f_T=50 MHZ and C_{ob}=3pf, compute the values of all the hybrid - Π parameters.
17. Three identical non interacting stages of amplifiers have the overall cutoff frequencies; f_L^* = 10KHZ and f_H^* =40 KHZ. What are the values of f_L and f_H?
18. The parameters of a two stage BJT RC coupled amplifier are h_{fe} = 50, h_{ie}= 1.1 K ohms, h_{oe} = 0 and R_L = 2 K ohms. Find the value of the Coupling capacitor to give a lower 3dB frequency of 20Hz.
19. In the three stage amplifier, the higher cutoff frequencies are: 500 kHz, 200 kHz and 100 kHz. Estimate the resulting high cutoff frequency.

UNIT-III

1. Classify the negative feedback amplifiers.
2. Explain the concept of feedback using block diagram.
3. Derive an expression for the gain of amplifier with negative feedback.
4. List out the merits & demerits of negative feedback.

5. Explain the effect of negative feedback on Gain and B.W.
6. Show that with negative feedback Gain of amplifier will be stabilized.
7. Show that with negative feedback lower cut-off frequency will be decreased and upper cut-off frequency will be increased by 1+Aβ.
8. Explain the effect of negative feedback on Noise & Distortion
9. Show that for Voltage Shunt feedback amplifier transresistance gain, R_i and R_o are decreased by a factor 1+Aβ.
10. With the help of network topology, obtain the expressions for I/P impedance and O/P impedance of Current Series feedback amplifier.
11. With the help of network topology, obtain the expressions for I/P impedance and O/P impedance of Current Shunt feedback amplifier.
12. Draw and explain practical Voltage-Series feedback amplifier circuit. Also derive the expressions for i) Voltage gain ii) I/P impedance iii) O/P impedance
13. Draw and explain practical Current-Series feedback amplifier circuit. Also derive the expressions for i) Transconductance gain ii) I/P impedance iii) O/P impedance
14. An amplifier has mid band gain of 125 and a B.W of 250 kHz.

    i) If 4% negative feedback is introduced, find new B.W and gain.

    ii) If B.W is restricted to 1 MHz , find the feedback ratio
15. The gain of an amplifier is decreased to 10000 with negative feedback from its gain of 60000. Calculate the feedback factor. Also express the amount of negative feedback n dB.
16. Calculate the Gain, I/P impedance and O/P impedance of Voltage-Series feedback amplifier having A=300 , R_i =1.5 kΩ , R_o =50 kΩ and β=1/12.
17. An amplifier has an open loop gain of 400 and a feedback ratio of 0.05. If the open loop gain changes by 20% due to temp. find the % change in closed loop gain.
18. An amplifier has voltage gain with feedback is 100. If the gain without feedback changes by 20% and gain with feedback should not vary more than 2%. Determine the values of Open loop gain (A) and feedback ratio (β)
19. An amplifier has a mid frequency gain of 800. lts upper and lower cut off frequencies are 16KHz and 40KHz respectively. What will be the band width after 2% of the signal output is given as negative feedback?

UNIT-IV

1. Derive an expression for gain of amplifier with positive feedback.
2. Draw and explain RC Phase shift Oscillator. Also derive an expression for i) f_o ii) h_{fe}
3. Draw and explain Wein Bridge Oscillator. Also derive an expression for i) f_o ii) h_{fe}
4. Derive the general expression for frequency of oscillations of an LC oscillator.
5. Draw and explain Hartley Oscillator. Also derive an expression for f_o
6. Draw and explain Colpitt's Oscillator. Also derive an expression for f_o
7. What is Piezo electric effect? What are the main substances that exhibit this property?

8. Explain the stability of oscillators?
9. A Hartley Oscillator is designed with L_1=2 mH , L_2=20 µH and a variable capacitance. Find the range of Capacitance values if the frequency of oscillations is varied between 950 kHz to 2050 kHz
10. In a Colpitt's Oscillator, the values of inductors and capacitors in the tank circuit are L= 40 mH, C_1=100 pF and C_2=500 pF. Find the frequency of oscillation.

UNIT-V

1. Differentiate small signal transistor and power transistor.
2. Differentiate small signal amplifier and power amplifier
3. Explain class A power amplifier (series fed type) with neat sketches. Also derive it's expression for maximum efficiency. List its merits and demerits.
4. Explain class A power amplifier (transformer coupled type) with neat sketches. Also derive it's expression for maximum efficiency. List its merits and demerits.
5. Explain Class-B power amplifier. Derive it's expression for the efficiency.
6. Explain class B push pull power amplifier with neat sketches. Also derive it's expressions for i) Max. efficiency ($n\%_{max}$) ii) $P_{c(dc),max}$(total)
7. Show that no even harmonics are present in a push pull complementary circuit.
8. Explain complementary symmetry class B push pull power amplifier with neat sketches. Also derive it's expression for theoretical Max. efficiency (n%)
9. Explain harmonic distortion in power amplifiers. Also derive the expression for total harmonic distortion.
10. Describe cross over distortion. How it is overcome?
11. What is thermal runaway? How does a heat sink help?
12. Explain small signal capacitive coupled single tuned amplifier. Also derive it's expressions for i) A/A_o ii) Bandwidth.
13. Explain the effect of cascading single tuned amplifiers on Bandwidth.
14. Draw the circuit of a double tuned amplifier and explain its operation.
15. Write a short notes on i) Stagger Tuning ii) stability of tuned amplifiers.
16. A class B push pull amplifier drives a load of 16 Ω connected to the secondary of Ideal transformer. The supply voltage is 25 V. If no. of primary turns is 200 and secondary turns is 50, Calculate i) Max. power o/p ii) efficiency iii) Max. power dissipation per transistor.
17. A transistor supplies 2 W ac power to a load resistor of 2 kΩ. Zero-Signal dc collector current is 30 mA and dc collector current with signal is 35 mA. Determine the Present Second Harmonic distortion.
18. A sinusoidal signal v_i=1.75 Sin 600t is fed to an amplifier. The resulting output current is of the form i_o=15Sin 600t + 1.5 Sin 1200t + 1.2 Sin 1800t + 0 .5 Sin 2400t. Calculate

    i) Second, Third and Fourth harmonic distortion

    ii) % increase in power (because of distortion)

(EC104) PROBABILITY THEORY AND STOCHASTIC PROCESS

Year	Semester	Hours / Week			C	Marks		
		L	T	P/D		CIE	SEE	Total
II	I	3	-	-	3	30	70	100

COURSE DESCRIPTION

Probability theory is the branch of mathematics concerned with probability, the analysis of random phenomena. The central objects of probability theory are random variables, stochastic processes, and events: mathematical abstractions of non-deterministic events or measured quantities that may either be single occurrences or evolve over time in an apparently random fashion.

It is not possible to predict precisely results of random events. However, if a sequence of individual events, such as coin flipping or the roll of dice, is influenced by other factors, such as friction, it will exhibit certain patterns, which can be studied and predicted Two representative mathematical results describing such patterns are the law of large numbers and the central limit theorem.

PREREQUISITES

Requires the knowledge of mathematics.

COURSE OBJECTIVES:

Students will be able to

1. Recall the concept of probability and understand the random variable.
2. Analyze the concept of operation on random variable and transformations.
3. Understand the multiple random variables and analyze the concept of operation on multiple random variables.
4. Learn the random process concept and classify the various random processes.
5. Relate power spectrum density and autocorrelation function and analyze the probabilistic situations in communication.

COURSE OUTCOMES:

At the end of the course, the student will develop ability to

1. Define random variable and understand the probability, events and random experiments.
2. Analyze the operations like expectation, variance and moments of single random variable.
3. Analyze the operations like expectation, variance and moments of multiple random variables.
4. Understand the central limit theorem.
5. Understand the stochastic process in both deterministic and non deterministic types.
6. Classify the various processes, functions and state its properties.
7. Relate power spectrum density and autocorrelation function and state its properties.
8. Analyze the power spectral density of linear systems.

UNIT – I

Probability: Concept of Probability, Random Variables, Discrete and Continuous Sample Spaces, Events, Probability Definitions and Axioms, Joint Probability, Conditional Probability, Total Probability, Bayes' Theorem. Distribution and Density functions, Properties, Binomial, Poisson, Uniform, Gaussian, Exponential, Rayleigh, Conditional Distribution.

UNIT – II
Operation on One Random Variable – Expectations: Introduction, Expected Value of a Random Variable, Function of a Random Variable, Moments about the Origin, Central Moments, Variance and Skew, Chebychev's Inequality, Characteristic Function, Moment Generating Function, Transformations of a Random Variable: Transformation of a Discrete Random Variable

UNIT – III
Multiple Random Variables: Vector Random Variables, Joint Distribution Function, Properties of Joint Distribution, Marginal Distribution Functions, Conditional Distribution and Density – Point Conditioning, Conditional Distribution and Density – Interval conditioning, Statistical Independence, Sum of Two Random Variables, Sum of Several Random Variables, Central Limit Theorem, (Proof not expected).

UNIT – IV
Stochastic Processes – Temporal Characteristics: The Stochastic Process Concept, Classification of Processes, Stationary Random Process, Ergodicity, Mean-Ergodic Processes, Correlation-Ergodic Processes, Autocorrelation Function and Its Properties, Cross-Correlation Function and Its Properties, Covariance and its properties.

UNIT – V
Stochastic Processes – Spectral Characteristics: Power Spectrum Properties, Relationship between Power Spectrum and Autocorrelation Function, Cross-Power Density Spectrum, Properties, Relationship between Cross-Power Spectrum and Cross-Correlation Function. Spectral Characteristics of system response: power density spectrum of response, cross-power spectral density of input and output of a linear system.

TEXT BOOKS:
1. Probability, Random Variables & Random Signal Principles - Peyton Z. Peebles, TMH, 4th Edition, 2001.
2. Probability, Random Variables and Stochastic Processes – Athanasios Papoulis and S. Unnikrishna Pillai, PHI, 4th Edition, 2002.

REFERENCE BOOKS:
1. Theory of probability and stochastic processes- Pradip Kunar Gosh, University press
2. Probability theory and stochastic processes-mallikarjuna reddy cengage learning
3. Probability and Random Processes with Application to Signal Processing – Henry Stark and John W. Woods, Pearson Education, 3rd Edition.

WEBSITES

1. *www.math.harvard.edu*
2. *ebooks.cambridge.org*
3. *nptel.ac.in*
4. https://www.maths.unsw.edu.au
5. *ocw.mit.edu*

CONTENT BEYOND SYLLABUS:

1. Detection of a target

LECTURE PLAN

Sl. No.	Topics in syllabus	Modules and Sub modules	Lecture No.	Suggested books with Page Nos.
UNIT – I (No. of Lectures – 14)				
1	An overview of probability	Introduction of probability and its significance	L1	3-7(A. Papoulis) 1-4(Peebles)
2	Probability definition	Introduced through sets, relative frequency	L2 L3	3(Peebles) 9-14(Peebles)
3	Experiments and sample spaces	Pack of cards, dice, tossing of coins experiments, definition of continuous and discrete sample spaces.	L4 L5 L6	9(Peebles)
4	events	Independent events, mutually exclusive events, certain events, joint events	L7	10& 20 (Peebles)
5	Joint probability	Joint probability	L9	14(Peebles)
6	conditional probability, total probability, baye's theorm	conditional probability, total probability, baye's theorm	L10	14-19(Peebles)
7	Standard distribution and density functions	Binomial, Poisson, Uniform, Gaussian, Exponential, Rayleigh, Conditional Distribution.	L11 L12 L13 L14	54-65(Peebles)
UNIT –II (No. of Lectures – 14)				
7	definition of a random variable(R.V)	definition of a random variable(R.V)	L15	41(Peebles)
8	Classification of Random variables, condition for a function to be a random variable	Continuous, discrete, Mixed random variables	L16	41-43(Peebles)
9	Distributions and density functions	Definitions, properties	L17 L18	44-50(Peebles)
10	expected value of a R.V, function of a R.V	expected value of a R.V, function of a R.V	L19	77-80(Peebles)
11	moments about the origin, central moments	Mean, mean square value, variance, skew	L20	81-83(Peebles)
12	characteristic functions, moment generating function.	characteristic functions, moment generating function.	L21 L22	84-86(Peebles)
13	Transformations of a Random Variable	Transformation of a Discrete R.V, continuous R.V	L23 L24 L25	87-92(Peebles)
14	problems	Of all topics	L26 L27 L28	32,66 & 97(Peebles)
UNIT –III (No. of Lectures – 11)				
16	Vector Random variables.	Introduction, definition	L29	108(Peebles)
19	joint distribution, density functions and its properties	joint distribution, density functions and its properties	L30 L31	109-115(Peebles)
20	conditional distribution and density	Point conditioning and interval conditioning	L32 L33	116-120(Peebles)
21	statistical independence ,problems	Statistical independence ,problems	L34 L35	121(Peebles)
22	sum of two R.V's, sum of several R.V's.	sum of two R.V's, sum of several R.V's.	L36	122-124(Peebles)

23	central limit theorem.	central limit theorem.	L37	125-128(Peebles)
24	problems	problems	L38 L39	129(Peebles)
UNIT-IV (No. of Lectures – 11)				
25	Introduction	introduction	L40	179(Peebles)
29	Classification of R.P	Continuous and disrete	L41	179-184(Peebles)
30	concept of stationary and statistical independent	first-order stationary processes, second-order and wide sense stationarity, N order and strict sense stationarity	L42	185-188(Peebles)
31	Time averages and ergodicity	Mean ergodic processes, correlation ergodic processes	L43 L44	189-193(Peebles)
32	Auto correlation and cross correlation functions and its properties	Auto correlation and cross correlation functions and its properties	L45 L46	194-198(Peebles)
33	Covariance and its properties	Covariance and its properties	L47	198(Peebles)
34	problems	problems	L48 L49 L50	169 & 208(Peebles)
UNIT –V (No. of Lectures – 10)				
35	Power Spectrum Properties	Power Spectrum Properties	L51	220-226(Peebles)
36	Relationship between power spectrum and Auto correlation function	Relationship between power spectrum and Auto correlation function	L52	227-230(Peebles)
37	The cross power density spectrum	The cross power density spectrum	L53	230(Peebles)
38	properties, problems	properties, problems	L54 L55	230-234(Peebles)
39	Relationship between cross power spectrum and cross correlation function	Relationship between cross power spectrum and cross correlation function	L56	234-237(Peebles)
40	Spectral Characteristics of system response	power density spectrum of response, cross-power spectral density of input and output of a linear system	L57	280-286(Peebles)
41	problems	problems	L58 L59 L60	256 & 329(Peebles)

REVIEW QUESTIONS
UNIT I: PROBABLITY

1. a. Find the probability of obtaining 14 with 3 dice.
   b. A class has only 3 students A, B, C who attended the class independently. The probability of their attendance on any day being 1/2, 2/3, 3/4 respectively. Find the probability that the total number of attendances in two consecutive days is exactly three.
2. a. Explain Poisson approximation to Binomial law.
   b. There are 500 misprints in book of 500 pages. What is the probability that a given page will contain at most 3 misprints?
3. a) State and prove Baye's theorem.
   b) State and prove any four properties of conditional probability.
4. a) What is the probability that a positive integer not exceeding 100 selected at random is divisible by 5 or 7?
   b) The diameter of a cable, say X, is taken to be a random variable with probability density function (pdf) $f_x(x) = 6x\,(1-x),\ 0 \leq x \leq 1$. Verify whether $f_x(x)$ is pdf.
5. a. Define joint and conditional probability.
   b. In a box there 500 coloured balls: 75 black , 150 green, 175 red, 70 white and 30 blue what are the probability of selecting a ball of each colour.
6. a. State and prove properties of probability density function.
   b. A random variable X has the distribution function

$$f_X(x) = \sum_{n=1}^{12} \frac{n^2}{650} u(x-n).$$

   Find the probabilities of P $\{-\infty < x \leq 6.5\}$.
7. a. Give the definition of probability and axioms.
   b. A book containing 100 pages is opened at random. Find the probability that on the page.
   i) A doublet is found. ii) a number whose sum of digits is 10.
8. a. State and prove the properties of cumulative distribution function.
   b. A sample space is defined by the set S = {1,2,3,4}. A random variable x is defined by $y = x(s) = s^3$. If the probability of S are P(1) = 4/24, P(2) = 3/24, P(3) = 7/24 and P(4) = 10/24. Then find the probability of random variable Y.
9. a. A missile can be accidentally launched if two relays A and B both have failed. The probabilities of A and B failing are known to be 0.01 and 0.03 respectively. It is also known that B is more likely to fail (probability 0.06) if A have failed.
   i. What is the probability of an accidental missile launch?
   ii. What is the probability that A will fail if B has failed?
   Are the events "A fails" and "B fails" statistically independent?
   b. Trains X and Y arrive at a station at random between 8 a.m. and 8.20 a.m. Train X stops for four minutes and train Y stops for five minutes. Assuming that the trains arrive independently of each other, determine
   i. The probability that the train X arrives before train Y.
   ii. The probability that the trains meet at the station.
   iii. Assuming that the trains met, determine the probability that the train X arrives before train Y.
10. a. Define a random variable. State the properties of a probability distribution function.

b. Find the value of A such that the following function is a valid probability density function.

$f_X(x) = 0 \quad X < -1$
$\quad A(1-x^2)\cos(\pi x/2) \quad -1 \le x \le 1$
$\quad 0 \quad 1 < x$

UNIT II: OPERATIONS ON ONE RANDOM VARIABLE

11. a. Derive the variance of Poisson distribution.
    b. The first, second and third moments of a probability distribution about the point 2 are 1, 16, -40 respectively. Find the mean, variance and the third central moment.
12. a) What are the effects of change of scale on moment generating function?
    b) Derive the variance of Binomial distribution.
13. a) A Random variable X has pdf $12x^2(1 - x)$ where $0 < x < 1$, compute $P(|x - \mu| \ge 2\sigma)$ and compare it with the limits given by chebycheff's inequality.
    b) X_1, X_2 and X_3 are continuous independent random variables with mean value 1, -1 and 2 respectively and variances 0.5, 2 and 0.5 respectively. If $Z = X_1 + X_2 + X_3$, write the approximate probability density function of random variable Z.
14. a. Calculate the mean of Rayliegh random variable.
    b. In an experiment when two dice are thrown simultaneously find expected value of sum of number of points on them.
15. a. Calculate the mean of Gaussian random variable.
    b. In an experiment when two dice are thrown simultaneously. Find the expected value of sum of number of points on them.
16. a. A random variable x has the density

$$f_x(x) = \frac{3}{32}(-x^2+8x-12) \quad ; 2 \le x \le 6$$
$$= 0 \quad ; \text{otherwise}$$

Find all moments about origin.
17. a. A Gaussian random variable X has a mean value 0 and variance 9. The voltage X is applied to a square law, full wave diode detector with a transfer function characteristic Y = 5X. Find the mean value of the output voltage Y.

    b. Show that the characteristic function of a random variable having binomial density function is $\square_x(\square) = [\exp(1-p+pe^{j\square})]^N$.

UNIT III: MULTIPLE RANDOM VARIABLES

18. The joint density function of two continuous random variable X and Y is given by
$f_{XY}(x, y) = 2$ for $0 < x \,\square 1, 0 < y < x$
$= 0$ otherwise
i) Find the conditional density functions $f_{X/Y}(x/y)$ and $f_{Y/X}(y/x)$.
ii) Find the marginal density functions $f_X(x)$ and $f_Y(y)$.

19. The joint probability density function of two random variables X and Y is given by

$$f_{XY}(xy) = \frac{1}{\pi\sqrt{3}} e^{-\frac{2}{3}\left(x^2 - xy + y^2\right)}$$

Determine the marginal probability density function $f_X(x)$ and $f_Y(y)$.

20. a)Random variables X and Y have a joint probability density function given by

$$f_{XY}(x,y) = \begin{cases} \frac{1}{\pi}, & for\ x^2 + y^2 \le 1 \\ 0 & otherwise \end{cases}$$

Determine whether random variables X and Y are a) Statistically independent b) Uncorrelated.

b. State and prove any four properties of joint density function of two random variables.

21. a. Find the marginal densities of X and Y using the joint density.

$$f_{XY}(x,y) = \frac{10}{4}\left\{[u(x) - u(x-4)]u(y)y^3 \exp[-(x+1)^2 y]\right\}$$

b. Explain conditional distribution and density for point conditioning and interval conditioning.

22. a. Find the mean value.

b. Variance of a random variable with

$$f_X(x) = \frac{1}{2b} e^{-|x-m|/b.}$$

Where m and b are real constants b>0 and $-\infty < m < \infty$

23. a. A random variable x ahs the probability density

$$f_x(x) = \begin{cases} \frac{\pi}{16}\cos(\frac{\pi x}{8}) & ; -4 \le x \le 4 \\ 0 & ; elsewhere \end{cases}$$

Find its mean value.

b. Its second moment and its variance.

24. a. Determine the given function is a valid probability distribution function.

$$F_X(x) = \begin{cases} 0 & x \le 0 \\ \frac{1}{3} & 0 < x \le \frac{1}{2} \\ 1 & x > \frac{1}{2} \end{cases}$$

b. For real constants b > 0, c > 0, and any a, find a condition on constant 'a' and a relationship between 'c' and 'a' (for given b) such that the function given below is a valid probability density function.

$$f(x) = \begin{cases} a[1-(x/b)] & 0 \le x \le c \\ 0 & elsewhere \end{cases}$$

25. a. $f_{xy}(x,y) = b(x+y)^2$ -2<x<2 and -3<y<3

0 Else where

Find the constant b such that this is a valid joint density function.

Determine the marginal density functions $f_X(x)$ and $f_Y(y)$.

b. Random variables X and Y have the joint density function

$f_{xy}(x,y) = (x+y)^2/40$ -1 <x< 1 and -3<y<3

0 Else where

i. Find the second order moments of X and Y.

ii. What are the variances of X and Y?

iii. What is the correlation coefficient?

UNIT IV: STOCHASTIC PROCESS – TEMPORAL CHARACTERISTICS

26. a. Let Z be a random variable with probability density $f_Z(z) = \frac{1}{2}$ in the range -1 □ Z □ Let the random variable X = Z and random variable $Y = Z^2$.
    Show that X and Y are uncorrelated.
    b. Show that if any two random variables are statistically independent, then they are also uncorrelated.
27. Explain the properties of cross correlation function of second order stationary process.
28. a) Show that if two random variables are uncorrelated and one of them has Zero mean, then they are also orthogonal.
    b) X and Y are two statistically independent random variables with values $\overline{X} = 2, \overline{Y} = 4$ respectively and second moments $E[X^2] = 8$, $E[Y^2] = 25$ respectively. Random variable W = 2X – Y. Determine variance σ_ω^2 of W.
29. List and explain the properties of auto correlation function of wide sense stationary process.
30. a. State and prove properties of stationary random process.
    b. Give that a process X(t) has the autocorrelation function.
    $R_{XX}(\tau) = A.e^{-\alpha(\tau)}\cos(w_0\tau)$
    Where A>0, $\alpha > 0$ and w_0 are real constants find the power spectrum of x(t)
31. a. Explain the concept of stationary and statistical independence.
    b. For a linear system find out autocorrelation of the output.
32. a. State and prove properties of auto correlation function.
    b. If x(t) is a stationary random process having a mean value E{x(t)} = 3, auto correlation function $R_{xx}(\tau) = 9 + 2e^{-|\tau|}$ Find the mean value.
33. a. Explain the classification of random processes.
    b. For a linear system, if input mean and variance are given, find the mean and variance of the output.
34. a. Write short notes on variance and skew.
    b. Given the random process X(t) = A sin(□□t+□) where A and $□_0$ are constants and □ is a random variable uniformly distributed on the interval (-□, □). Define a new random process $Y(t)=X^2(t)$.
    i. Find the autocorrelation function of Y(t)
    ii. Find the cross correlation function of X(t) and Y(t).
    iv. Are X(t) and Y(t) wide sense stationary?

UNIT V: STOCHASTIC PROCESS – SPECTRAL CHARACTERISTICS

35. State & prove Wiener-Khintchine relation.
36. a) Find average power of a power spectrum of a random process.

$$S_{XY}(\omega) = \begin{cases} 4 - (\frac{\omega^2}{9}), & /\omega/ \leq 6 \\ 0, & elsewhere \end{cases}$$

    b) State and prove the properties of the power density spectrum.
37. a. Given the power density spectrum of the response of a linear time invariant system having a transfer function $H(\omega)$
    b. Compare Gaussian and Poisson Random process.
38. a. Define cross power density spectrum. State the properties of cross power density spectrum.
    b. Give the spectral characteristics of a linear system for a given input.

39. Let *X(t)* and *Y(t)* be both zero-mean and WSS random processes. Consider the random process *Z(t)* defined by Z(t)=Y(t) + X(t). Determine the autocorrelation function and the power spectral density of *Z(t),* (i) if *X(t)* and *Y(t)* are jointly WSS; (ii) if *X(t)* and *Y(t)* are orthogonal.
40. Explain the relationship between Power spectrum and autocorrelation function.

Short Questions

1. Define a property of Independent event.
2. Explain in brief Binomial law.
3. A coin is flipped ten times, how many possible outcomes are exactly two heads?
4. List the properties of characteristic function.
5. What are the properties of the joint distribution function?
6. How can we say that two processes are statistically independent?
7. Define cross correlation function of two random processes.
8. Explain Mean & Mean squared value of a linear system response.
9. Give the relation between auto-correlation and cross-correlation.
10. What is Ergodicity?
11. How many ways can the letters of the word ALGORTHM be arranged in a row?
12. What is probability mass function?
13. Define Skewness.
14. List two limitations of moment generating function.
15. List the properties of Joint density function.
16. State central limit theorem.
17. How are random process classified.
18. Define auto covariance function of random process X(t).
19. What are the conditions to be satisfied by a function to be Fourier transformable?
20. Give any two examples of Poisson processes.
21. Define probability and explain its use in communication system.
22. Give the properties of probability density function.
23. Illustrate the importance of Gaussian Random variable.
24. Define moments about origin.
25. Write joint and conditional probabilities for multiple random variables.
26. Differentiate temporal and spectral characteristics.
27. Give the relation between auto correlation and power spectral density.
28. Calculate the output spectral density for a given input spectral density.

29. Explain Poisson Random process.
30. Define the set theory with reference to probability.
31. Give the relation between probability density function and cumulative distribution function.
32. Give the properties of Gaussian Random variable.
33. Define central moments of a random variable.
34. What is the cumulative distribution function of sum of two random variable.
35. What do you mean by wide sense stationary and strict sense stationary.
36. Give the relation between cross correlation and cross spectral density.
37. Calculate the cross power spectral density of input and output of a linear system.
38. Give the properties of co-variance.
39. An experiment consists of observing the sum of the dice when two fair dice are thrown. Find (a) the probability that the sum is 7 and (b) the probability that the sum is greater than 10.
40. State the similarities between probability density function and power density spectrum.
41. Define conditional probability and hence conditional distribution function.
42. Define Wide sense stationary process.
43. State the relation between power spectral density and auto correlation function.
44. Define Poisson random process.
45. Define random process and classify.
46. Define cross power density spectrum.

(EC105) SIGNALS AND SYSTEMS

Year	Semester	Hours / Week			C	Marks		
		L	T	P/D		CIE	SEE	Total
II	I	4	-	-	4	30	70	100

COURSE DESCRIPTION:

Concepts associated with Signals and Systems find wide area of application in different technological fields such as communications, circuit design, aeronautics, speech processing and so on. This course focuses on analyzing signals (sound, voltage, communication transmissions etc.) and the systems that act on them (circuits, mechanical dynamics, modulation, etc.). The course presents and integrates the basic concepts for both continuous-time and discrete-time signals and systems. Signal and system representations are developed for both time and frequency domains. Filter design and sampling are also discussed.

PREREQUISITES

Requires the knowledge of mathematics generally taught at higher secondary level.

COURSE OBJECTIVES:

Students will be able to

1. Recall the basics concepts about the elementary signals.
2. Apply fourier series, fourier transform, laplace transform and Z-transform with respect to signal processing.
3. Solve response of RLC networks using transform techniques.
4. Discuss concepts of convolution and correlation of various signal
5. Illustrate concept of sampling theorem.

COURSE OUTCOMES:

At the end of the course, the student will develop ability to

1. Retrieve the historical and natural aspects of signals and systems (remember)
2. Describe the different types of signals and systems (understand)
3. Apply the mathematical operations on signals (apply)
4. Distinguish the type of transform (fourier / laplace / *Z*) required to analyze the given signal (analyze)
5. Apply the relation between time domain and frequency domain representations of signals and their applications in filters (apply)
6. Compare the advantages and disadvantages of operating in time / frequency domain (analyze)
7. Evaluate the response of a system for a given signal (evaluate)
8. Design of RLC circuits, stable systems (create)

UNIT I

INTRODUCTION Definitions of a signal and a system, classification of signals, basic Operations on signals, elementary signals, Systems viewed as Interconnections of operations, properties of systems.

UNIT II

TIME-DOMAIN REPRESENTATIONS FOR LTI SYSTEMS: Convolution, impulse response representation, Convolution Sum and Convolution Integral, Properties of impulse response representation, Differential and difference equation Representations, Block diagram representations.

UNIT III

FOURIER SERIES: Introduction, Discrete time and continuous time Fourier series (trigonometric Fourier series representation and exponential Fourier Series representation), Properties of Fourier series (No proof), Applications of Fourier series. Sampling Theorem and Reconstruction.

UNIT IV

APPLICATIONS OF FOURIER REPRESENTATIONS: Introduction, Frequency response of LTI, Fourier transform representation of periodic signals, Fourier transform representation of discrete time signals.

LAPLACE TRANSFORMATION & APPLICATIONS: Review of Laplace transforms, waveform Synthesis, initial and final value theorems, step, ramp and impulse responses, convolution theorem, solution of simple R-L, R-C, RL-C networks.

UNIT V

Z-TRANSFORMS: Introduction, Z – transform, properties of ROC & Z – transforms Inverse Z–transforms, unilateral Z- Transform, analysis of LTI Systems and application to solve Difference equations.

TEXT BOOKS:

1. Alan V Oppenheim, Alan S, Willsky and A Hamid Nawab, "Signals and Systems" Pearson Education Asia / PHI
2. Simon Haykin and Barry Van Veen "Signals and Systems", John Wiley & Sons,

REFERENCE BOOKS:

1. B. P. Lathi, "Linear Systems and Signals", Oxford University Press, 2005
2. H. P Hsu, R. Ranjan, "Signals and Systems", Scham"s outlines, TMH, 2006

WEBSITES

1. http://nptel.ac.in/courses/117104074/
2. https://www.youtube.com/watch?v=h-CdTxDShho&list=PLC6210462711083C4
3. http://ocw.mit.edu/resources/res-6-007-signals-and-systems-spring-2011/lecture-notes/
4. http://www.tutorialspoint.com/signals_and_systems/index.htm
5. www.google.com

CONTENT BEYOND SYLLABUS:

- Applications in Communication Engineering

LECTURE PLAN

Sl. No.	Topics in syllabus	Modules and Sub modules	Lecture No.	Suggested book (Signals & Systems by Oppenheim) with Page Nos.
UNIT – I Introduction (No. of Lectures: 14)				
1	Introduction	Motivation and some historical aspects, engineering applications	L1	1
2	Definitions of a signal and a system	Definition and examples of signal and system	L2	1, 38
3	Classification of signals	Continuous-time and Discrete-time, Continuous-value and Discrete-value, Periodic and Aperiodic, Even and Odd, Energy and Power signals	L3 L4 L5	5, 11−25
4	Basic operations on signals	Time and Amplitude Scaling, Time Shifting, Time reversal, Multiple transformations, Differentiation and Integration	L6 L7 L8	8
5	Elementary signals	Sinusoidal, Real and complex Exponential, Unit Step, Impulse, Ramp, Signum, Sinc, Rectangular pulse, Triangular	L9 L10	1, 15
6	Systems viewed as Interconnections of operations	Effect of Parallel and Cascade representation of Systems	L11	41
7	Properties of systems	Homogeneity, Time Invariance, Additivity, Linearity and Superposition, Stability, Causality, Orthogonality Memory, Invertibility	L12 L13 L14	44−53
UNIT –II Time-Domain Representations for LTI Systems (No. of Lectures :10)				
1	Convolution	Need for convolution	L15	74
2	Impulse response representation	Significance of Impulse response Mathematical representation of Impulse response	L16	77, 94
3	Convolution Sum and Convolution Integral	Discrete-Time LTI Systems and Convolution Sum Continuous-Time LTI Systems and Convolution Integral	L17,L18 L19,L20	75−94
4	Properties of impulse response	Impulse response properties of LTI systems	L21	103
5	Differential and difference equation Representations	Linear Constant -Coefficient Differential Equations Linear Constant-Coefficient Difference Equations	L22 L23	116−124
6	Block diagram representations	Block Diagram Representations of First-Order Systems Described by Differential and Difference Equations	L24	124
UNIT –III Fourier Series (No. of Lectures: 13)				
1	Introduction	Introduction and Historical Perspective Response of LTI Systems to Complex Exponentials	L25 L26	177−182
2	Discrete time and continuous time Fourier series	Fourier Series Representation of Continuous-Time Periodic Signals Fourier Series Representation of Discrete-Time Periodic Signal	L27, L28 L29, L30	186−190 211−212

3	Properties of Fourier series	Properties of Continuous-Time and Discrete-Time Fourier Series: Linearity, Time Shifting, Time Reversal, Time Scaling, Multiplication, Conjugation and Conjugate Symmetry, Parseval's Relation	L31 L32 L33 L34	202−205 221−223
4	Applications of Fourier series	Application in Filters	L35	231−245
5	Sampling Theorem and Reconstruction	Representation of a Continuous-Time Signal by Its Samples Impulse-Train Sampling Reconstruction of a Signal from Its Samples	L36 L37	514
UNIT – IV Applications of Fourier Representations & Laplace Transformation (No. of Lectures: 15)				
1	Introduction	Need for Fourier transform Frequency response of LTI systems	L38	284
2	Fourier transform representation of continuous-time aperiodic signals	Fourier transform of Continuous-Time aperiodic signals Properties of the Continuous-Time Fourier Transform	L39 L40 L41	285−328
3	Fourier transform representation of discrete-time aperiodic signals	Fourier transform of discrete time aperiodic signals Properties of the discrete time Fourier Transform	L42 L43 L44	358−390
4	Review of Laplace transforms	Laplace Transform definition Region of Convergence for Laplace Transforms Inverse Laplace Transform Properties of Laplace Transform	L45 L46 L47 L48	655,662,670, 682−691
5	Initial and Final value theorems	Definitions Usefulness of these theorems	L49	690
6	Convolution theorem	Definition Application in LTI systems	L50 L51	693
7	Solution of simple R-L, R-C, RL-C networks	Network solutions using Laplace Transform	L52	700
UNIT –V *Z*-Transforms (No. of Lectures: 08)				
1	Introduction	Need for *Z*-transforms	L53	741
2	*Z* – transform and properties of ROC	Definition of *Z*-transform How to draw ROC Importance of ROC Properties of *Z*-transform	L54 L55 L56	741−774
3	Inverse *Z*–transforms	Inverse *Z*–transforms	L57	757
4	Unilateral *Z*–Transform	Unilateral *Z*- Transform	L58	789
5	Analysis of LTI Systems and application to solve Difference equations	Analysis of LTI Systems in terms of Causality, Stability Solution of Difference equations using *Z*-Transform	L59 L60	774−781

Review Questions

1.1. Give two examples for each of the following signals

a) Continuous-time and Discrete-time
b) Continuous-value and Discrete-value
c) Discrete-time discrete-value
d) Periodic and Aperiodic

e) Even and Odd
f) Energy and Power

1.2. Explain (a) Unit step function (b) Exponential function (c) Sinc function

1.3. Let $x[n]$ be a signal with $x[n] = 0$ for $n < -2$ and $n > 4$. For each signal given below, determine the values of n for which it is guaranteed to be zero
(a) $x[n-3]$ (b) $x[n+4]$ (c) $x[-n]$ (d) $x[-n+2]$ (e) $x[-n-2]$

1.4. If $g(t) = 7e^{-2t-3}$, write out and simplify the following function
(a) $g(3)$ (b) $g(2-t)$ (c) $g\left(\frac{t}{10}+4\right)$ (d) $g(\ jt)$ (e) $\frac{g((jt-3)/2)+g((-jt-3)/2)}{2}$

1.5. Determine whether or not each of the following functions is periodic. If the signal is periodic, determine its fundamental period.
(a) $x(t) = 3\cos(4t+\frac{\pi}{3})$ (b) $x(t) = [\cos(2t-\frac{\pi}{3})]^2$ (c) $x(t) = e^{j(\pi t-1)}$
(d) $x[n] = \sin(\frac{6\pi}{7}n+1)$ (e) $x[n] = \cos(\frac{n}{8}-\pi)$ (f) $\cos(\frac{\pi}{2}n)\cos(\frac{\pi}{4}n)$

1.6. Sketch the signal $x(t) = r(t+2) - r(t+1) - r(t-1) + r(t-2)$

1.7. A continuous-time signal x(t) is shown in Figure 1.1. Sketch and label carefully each of the following signals:
(a) $x(t-1)$ (b) $x(2-t)$ (c) $x(2t+1)$ (d) $x(4-\frac{t}{2})$ (e) $[x(t)+x(-t)]u(t)$
(f) $x(t)[\delta(t+\frac{3}{2})-\delta(t-\frac{3}{2})]$

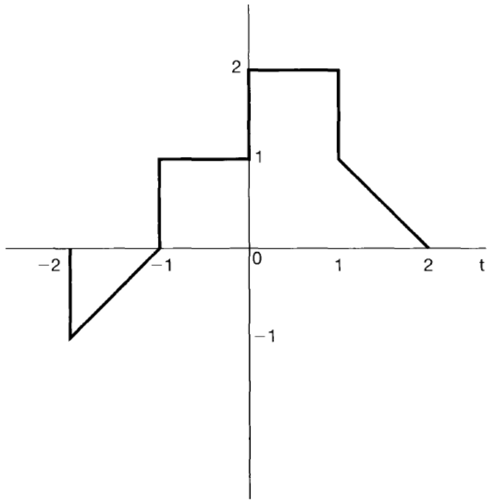


Figure 1.1

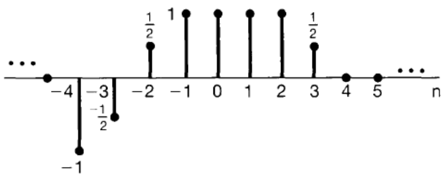


Figure 1.2

1.8. A discrete-time signal is shown in Figure 1.2. Sketch and label carefully each of the following signals:
(a) $x[n-4]$ (b) $x[3-n]$ (c) $x[3n]$ (d) $x[3n+1]$ (e) $x[n]u[3-n]$
(f) $x[n-2]\delta[n-2]$ (g) $\frac{1}{2}x[n]+\frac{1}{2}(-1)^n x[n]$ (h) $x[(n-1)^2]$

1.9. Find the even and odd parts of these functions
(a) $g(t) = 2t^2 - 3t + 6$ (b) $g(t) = \text{sinc}(t)$ (c) $g[n] = \cos(0.5\pi n)$

1.10. Explain the perseval's energy theorem.

1.11. Find the signal energy of the following signals

(a) $x(t) = 2rect(t)$ (b) $x(t) = A(u(t) - u(t-10))$ (c) $x(t) = rect(t)\cos(2\pi t)$

(d) $x[n] = A\,\delta[n]$

1.12. Find the signal power of the signals: (a) $x(t) = A$ (b) $x(t) = A\cos(2\pi ft + \theta)$

1.13. Define LTI system with examples.

1.14. Consider a continuous-time system with input x(t) and output y(t) related by

$y(t) = x(\sin(t))$

(a) Is this system causal? (b) Is this system linear?

1.15. Evaluate the following integrals

(a) $\int_0^5 \sin(2\pi\, t)\, \delta(t+3)\, dt$

(b) $\int_{-\infty}^{\infty} u(t)\cos(t)\, dt$

2.1. Let $x[n] = \delta[n] + 2\delta[n-1] - \delta[n-3]$ and $h[n] = 2\delta[n+1] + 2\delta[n-1]$

Compute and plot each of the following convolutions:

(a) $y_1[n] = x[n] * h[n]$ (b) $y_2[n] = x[n+2] * h[n]$

(c) $y_3[n] = x[n] * h[n+2]$

2.2. Consider an input $x[n]$ and a unit impulse response $h[n]$ given by

$$x[n] = \left(\frac{1}{2}\right)^{n-2} u[n-2]$$

$$h[n] = u[n+2]$$

Determine and plot the output $y[n] = x[n] * h[n]$.

2.3. Let

$$x(t) = u(t-3) - u(t-5) \quad \text{and} \quad h(t) = e^{-3t}u(t).$$

(a) Compute $y(t) = x(t) * h(t)$.

(b) Compute $g(t) = (dx(t)/dt * h(t)$.

(c) How is $g(t)$ related to $y(t)$.

2.4. For the following impulse responses determine whether each system is causal and/or stable. Justify your answers.

(a) $h[n] = \left(\frac{1}{5}\right)^n u[n]$ (b) $h[n] = (5)^n u[3-n]$

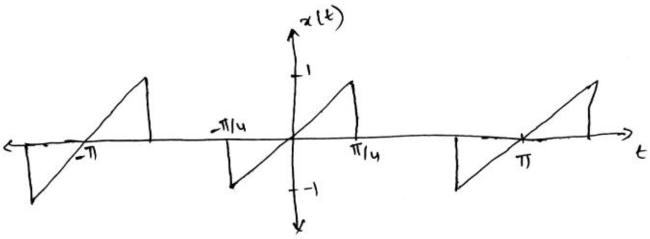
(c) $h(t) = e^{-4t}u(t-2)$ (d) $h(t) = e^{2t}u(-1-t)$

2.5. Determine whether the system is Linear Time Invariant (LTI) or not: $y(t) = \cos(x(t))$.

3.1. Find fourier-series for the following continuous-time periodic signal

$$x(t) = 2 + \cos\left(\frac{2\pi t}{3}\right) + 4\sin\left(\frac{5\pi t}{3}\right)$$

3.2. Obtain the Exponential Fourier series co-efficient and plot its magnitude, phase spectrum.



3.3. A continuous-time periodic signal $x(t)$ is real valued and has a fundamental period T = 8. The nonzero Fourier series coefficients for $x(t)$ are specified as

$$a_1 = a_{-1}^* = j, a_5 = a_{-5} = 2$$

Express $x(t)$ in the form: $x(t) = \sum_{k=0}^{\infty} A_k \cos(w_k t + \phi_k)$

3.4. Write differences between Fourier Series and Fourier Transform.

3.5. State and prove time sifting property of Fourier transform.

3.6. Find Fourier Transform of the following signals and also plot the results

(a) $e^{-2(t-1)}u(t-1)$ (b) $e^{-2|t-1|}$ (c) $\delta(t+1)+\delta(t-1)$ (d) $\sin(2\pi t + \frac{\pi}{4})$

(e) $(\frac{1}{2})^{n-1}u[n-1]$ (f) $\delta[n-1]+\delta[n-1]$

3.7. Find the signal corresponding to $X(j\omega) = \frac{2\sin[3(\omega-2\pi)]}{(\omega-2\pi)}$

3.8. State and prove the Sampling Theorem.

4.1. What is the difference between Laplace Transform and Fourier Transform?

4.2. What is the significance of Region of Convergence (ROC)?

4.3. For the following signals find the Laplace Transform and its ROC

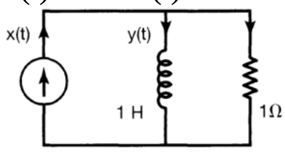
(a) $e^{-5t}u(t-1)$ (b) $\begin{cases} e^t \sin 2t, & t \le 0 \\ 0, & t > 0 \end{cases}$

4.4. Find the inverse Laplace transform of $X(s) = \frac{2(s+2)}{s^2+7s+12}, \quad \Re e\{s\} > -3.$

4.5. Determine the unilateral Laplace transform of the following signals, and specify the corresponding regions of convergence:

(a) $x(t) = e^{-2t}u(t+1)$ (b) $x(t) = \delta(t+1)+\delta(t)+e^{-2(t+3)}u(t+1)$

4.6. Determine the zero-state response of the following circuit when the input current is $x(t) = e^{-2t} u(t)$.



4.7. Consider an LTI system with input $x(t) = e^{-t} u(t)$ and impulse response $h(t) = e^{-2t} u(t)$.

(a) Determine the Laplace transforms of $x(t)$ and $h(t)$.

(b) Using the convolution property, determine the Laplace transform $Y(s)$ of the output $y(t)$.

(c) From the Laplace transform of $y(t)$ as obtained in part (b), determine $y(t)$.

(d) Verify your result in part (c) by explicitly convolving $x(t)$ and $h(t)$.

a) Compare (i.e. write differences between) Fourier Transform, Laplace Transform and *Z*-Transform.

b) Determine the *z*-transform for each of the following sequences. Sketch the pole-zero plot and indicate the region of convergence. Indicate whether or not the Fourier transform of the sequence exists.

(a) $\delta(n+5)$ (b) $\delta(n-5)$ (c) $(-1)^n u[n]$ (d) $\left(\frac{1}{4}\right)^n u[3-n]$ (e) $\left(\frac{1}{3}\right)^{n-2} u[n-2]$

c) Let $x[n]=(-1)^n u[n]+\alpha^n u[-n-n_0]$, determine the constraints on the complex number α and the integer n_0 , given that the ROC of $X(z)$ is $1<|z|<2$.

d) Find the inverse z-transform of $X(z)=\dfrac{1-\frac{1}{3}z^{-1}}{(1-z^{-1})(1+2z^{-1})}$, $|z|>2$

e) Consider the following system functions for stable LTI systems. Determine in each case whether or not the corresponding system is causal.

(a) $X(z)=\dfrac{1-\frac{4}{3}z^{-1}+\frac{1}{2}z^{-2}}{z^{-1}(1-\frac{1}{2}z^{-1})(1-\frac{1}{3}z^{-1})}$ (b) $X(z)=\dfrac{z-\frac{1}{2}}{z^2+\frac{1}{2}z-\frac{3}{16}}$

f) Derive the relation between discrete time Fourier Transform (DTFT) and Z-transform. Find the *z*-transform and ROC for $x(n) = \sin(\omega_o n)\, u(n)$.

(BS111) COMPUTATIONAL MATHEMATICS LAB

(Common to all branches)

Year	Semester	Hours / Week			C	Marks		
		L	T	P/D		CIE	SEE	Total
II	I	-	-	3	2	30	70	100
Pre-requisite	Nil							

COURSE OBJECTIVES:

Students will be able to

1. Understand the basics of spreadsheet applications to engineering problem solving
2. Use Excel and MATLAB for engineering computing and data visualization
3. Apply skills of modeling and generate engineering models
4. Illustrate scientific documentation tools
5. Apply MATLAB for solving problems in numerical methods and curve fitting

COURSE OUTCOMES:

At the end of the course, the students will develop ability to

1. Create and format spreadsheets in Excel
2. Compare different solutions to engineering problems using the scenario analysis
3. Represent program modules in terms of a flowchart and psuedocode and use MATLAB for interactive computing
4. Write and test programs in MATLAB using flow controls (if-else, for, and while)
5. Manipulate matrices and perform matrix algebra in Excel and MATLAB
6. Solve simultaneous equations in Excel and MATLAB
7. Perform numerical integration and differentiation in Excel and MATLAB
8. Construct appropriate graphs or plots in Excel and MATLAB for data analysis and prediction.

EXCEL

Week 1: Introduction to Excel: Formatting and Layout, Page orientation, Size, Breaks, Header/Footer, Headings, Font, Height and Width, Color, Lines, Alignment, Merge, Wrap, Sheets titles, Fill, Sort, Absolute and Relative referencing.
Week 2: Simple plots, Graphing with error and trend lines.
Week 3: Solving system of equations using matrix methods and the solver.
Week 4: Numerical integration and differentiation from data and from equation.
Week 5: Finding roots of a polynomial - Goal seek, Finding maximum and minimum of function - solver, Finding the results for different scenarios.

MATLAB

Week 6: Flowcharting, Pseudocode and Documentation – Basic building blocks of flowchart, Translating flowchart to pseudocode, Basics of documentation.
Week 7: Introduction to MATLAB environment, Writing simple programs with branching and loop statements.
Week 8: Creating plots with MATLAB.
Week 9: Manipulating matrices and solving system of equations using matrix methods.
Week 10: Using programmer's toolbox (input/output/plotting..) - Finding roots, Maximum and minimum values of a function.
Week 11: Numerical integration and differentiation.

TEXT BOOKS:

1. Bernard Liengme, "A Guide to Microsoft Excel 2013 for Scientists and Engineers", Elsevier.
2. Kelly Bennett, "MATLAB Applications for the Practical Engineer", InTech, (2014).

REFERENCE BOOKS:

1. John Walkenbach, "Excel 2013 Bible",Wiley.
2. E.Joseph Billo, "Excel for Scientists and Engineers - Numerical Methods", Wiley, (2007).
3. Stormy Attaway, "MATLAB: A Practical Introduction to Programming and Problem Solving", Elsevier, (2009).
4. V. Rajaraman, "Computer Oriented Numerical Methods", PHI Learning Pvt. Ltd.
5. Amos Gilat, "MATLAB: An Introduction with Applications", Wiley, (2011).

SUGGESTED READINGS:

1. Ronald Larsen, "Engineering with Excel", Pearson, (2013).
2. Thomas J Quirk, "Excel 2010 for Engineering Statistics: A Guide to Solving Practical Problems", Springer, (2014).
3. MathWorks, "MATLAB Programming Fundamentals", the math works, Inc., (2017).
4. Holly Moore, "MATLAB for Engineers", Pearson, (2012).
5. Douglas C. Giancoli, "Physics Principles with Applications", Pearson, (2005).

WEB LINKS:

1. http://www.mcrhrdi.gov.in/Downloads/04.MS%20Excel.pdf
2. http://www.breezetree.com/articles/how-to-flow-chart-in-excel.htm
3. http://cheserver.ent.ohiou.edu/matlab/H-2.pdf
4. https://in.mathworks.com/help/stateflow/ug/creating-flow-graphs-with-the-patternwizard.html

(ES120) BASIC SIMULATION LABORATORY

Year	Semester	Hours / Week			C	Marks		
		L	T	P/D		CIE	SEE	Total
II	I	-	-	3	2	30	70	100

COURSE OBJECTIVES:
Students will be able to
1. Develop vectors, matrices, variables expressions, statements in MATLAB.
2. Sketch different types of signals in MATLAB.
3. Compute convolution, correlation of signals and sequences.
4. Sketch Fourier transform to signals.
5. Sketch Laplace transform to signals and verify Gibb's phenomenon.

COURSE OUTCOMES:
At the end of the course, the student will develop ability to
1. Examine basic operations on signals.
2. Discuss various signals and sequences (periodic and aperiodic).
3. Compute operations on signals and sequences.
4. Compute even and odd parts of signals / sequence and real and imaginary parts of signal.
5. Evaluate convolution between signals and sequences.
6. Apply correlation concepts of signals and sequences in various fields.
7. Use Fourier transform, Laplace transform in analysis of signals.
8. Apply sampling theorem in various applications.

LIST OF EXPERIMENTS: (Note: Minimum of any 12 experiments to be conducted)
1. Basic Operations on Matrices.
2. Generation of various signals and sequences (periodic and aperiodic), such as unit impulse, unit step, square, saw tooth, triangular, sinusoidal, ramp, sinc.
3. Operations on signals and sequences such as addition, multiplication, scaling, shifting, folding, computation of energy and average power.
4. Finding the even and odd parts of signals / sequence and real and imaginary parts of Signal.
5. Convolution between signals and sequences.
6. Auto correlation and cross correlation between signals and sequences.
7. Verification of linearity and time invariance properties of a given continuous/ discrete systems.
8. Computation of unit sample, unit step and sinusoidal responses of the given LTI system and verifying its physical realiazability and stability properties.
9. Gibbs Phenomenon.
10. Finding the Fourier transform of a given signal and plotting its magnitude and phase spectrum.
11. Waveform synthesis using Laplace transform.
12. Locating the zeros and poles and plotting the pole-zero maps in S plane and Z plane for the given transfer function.

11\. Generation of Gaussian noise (real and complex), computation of its mean, M.S. value and its skew, kurtosis, and PSD, probability distribution function.

13\. Sampling theorem verification

14\. Removal of noise by autocorrelation / cross correlation

15\. Extraction of periodic signal masked by noise using correlation

16. Verification of Weiner-Khinchine relations
17. Checking a random process for stationarity in wide sense.

(EC109) ELECTRONIC DEVICES AND CIRCUIT ANALYSIS LABORATORY

Year	Semester	Hours / Week			C	Marks		
		L	T	P/D		CIE	SEE	Total
II	I	-	-	3	2	30	70	100
Pre-requisite		Nil						

COURSE OBJECTIVES:
Students will be able to
1. Sketch the V-I characteristics of PN Junction diode and zener diode and to calculate the static, dynamic resistance and cut-in voltage of both diodes and breakdown voltage of zener diode from the characteristics.
2. Draw the input and output characteristics of a transistor in CE and CB configurations and
3. calculate its input and output dynamic resistance.
   Sketch the characteristics of SCR and FET.
4. Draw the frequency response of single stage CE amplifiers and CS FET amplifier and to calculate its voltage gain and bandwidth.
5. Produce sinusoidal signals by simulating / constructing Hartley and Colpitt's oscillators.

COURSE OUTCOMES:
At the end of the course, the student will develop ability to
1. Explain the unidirectional conduction property of p-n junction diode.
2. Discuss the regulation property of zener diode.
3. Experimentally compare the various parameters such as i/p resistance, o/p resistance
6. current gain and voltage gain of a transistor in C.E and C.B configurations.
4. Design common emitter amplifier for the given specifications and analyze its
7. performance.
5. Describe behavior and working of SCR and FET.
6. Describe the generation of sinusoidal signals at AF and RF frequencies using oscillators.
7. Compute the efficiency of class A and class B amplifier.
8. Contract and discuss the effect of feedback on the amplifier.

LIST OF EXPERIMENTS: (12 experiments to be done)
I) Testing in the Hardware Laboratory (Any 6 Experiments)
1. Forward and reverse bias characteristics of PN junction diode.
2. Zener diode characteristics and Zener as voltage regulator.
3. Input and output characteristics of transistor in CB configuration.
4. Input and output characteristics of transistor in CE configuration.
5. FET characteristics.
6. Frequency response of CE amplifier.
7. Frequency response of common source FET amplifier.
8. SCR characteristics.
9. Hartley and Colpitt's oscillators.

II) Design and simulation in simulation laboratory using any simulation software. (Any 6 experiments)
1. Common emitter amplifier.
2. Common source amplifier.
3. Voltage series feedback amplifier (with and without feedback).

4. Hartley and Colpitt's oscillators.
5. Class A power amplifier (transformer less).
6. Class B complementary symmetry amplifier.
7. Common base (BJT)/ common gate (JFET) amplifier.
8. Single tuned voltage amplifier.

(MC102) GENDER SENSITIZATION

(Common to all branches)

Year	Semester	Hours / Week			C	Marks		
		L	T	P/D		CIE	SEE	Total
II	I	-	-	-	2	-	-	-

COURSE OBJECTIVES:

Students will be able to

1. Act sensibility to issues of gender in contemporary India.
2. Develop a critical perspective on the socialization of men and women.
3. Emphasize about biological aspects of genders.
4. Judge and reflect on gender violence.
5. Expose themselves to more egalitarian interactions between men and women.

COURSE OUTCOMES:

At the end of the course, the students will develop ability to

1. Evaluate a better understanding of issues related to gender in contemporary India.
2. Sensitize to multi dimensionalities like biological, social, psychological and legal aspects of gender.
3. Attain an insight of gender discrimination in society.
4. Acquire insight into the gendered division of labour and its relation to politics and economics.
5. Ensure and equip them for professional equivalence.
6. Respond to gender violence and empower themselves with moral values.
7. Expose themselves to debates on the politics and economics of work.
8. Equip themselves with morality and ethics.

UNIT- I: Understanding Gender

Gender: Why should we study it? (Towards a World of Equals: Unit – 1)

Socialization: Making Women, Making Men (Towards a World of Equals: Unit – 2)
Introduction. Preparing for Womanhood. Growing up Male. First lessons in Caste. Different Masculinities.

Just Relationships: Being Together as Equals (Towards a World of Equals: Unit – 12)
Mary Kom and Onler. Love and Acid just do not Mix. Love letters. Mothers and Fathers. Further Reading: Rosa
Parks. The Brave Heart.

UNIT- II: Gender Biology

Missing Women: Sex selection and its consequences (Towards a World of Equals: Unit – 4)
Declining Sex Ratio. Demographic Consequences.

Gender Spectrum: Beyond the Binary (Towards a World of Equals: Unit – 10)
Two or Many? Struggles with Discrimination.

Additional Reading: Our Bodies, Our Health (Towards a World of Equals: Unit – 13)

UNIT –III: Gender of Labour

House Work: the Invisible Labour (Towards a World of Equals: Unit – 3)
"My Mother doesn't work." Share the Load."

Women's Work: Its Politics and Economics (Towards a World of Equals: Unit – 7)
Fact and Fiction. Unrecognized and Unaccounted work. Further Reading: Wages and

Conditions of Work.

UNIT –IV : Issues of Violence
Sexual Harassment: Say No! (Towards a World of Equals: Unit – 6)
Sexual Harassment, not Eve-teasing – Coping with Everyday Harassment –Further Reading. "Chupulu".
Domestic Violence: Speaking out (Towards a World of Equals: Unit – 8)
Is Home a Safe Place? When Women unite (Film). Rebuilding Lives. Further Reading New Forums for Justice.
Thinking about Sexual Violence (Towards a World of Equals: Unit – 11)
Blaming the Victim-"I Fought for my Life…" – Further Reading; The Caste Face of Violence.

UNIT –V: Gender Studies
Knowledge: Through the lens of Gender (Towards a World of Equals: Unit-5)

TEXT BOOKS:

1. Sumeetha, Uma Bhrugubanda, Duggitala Vasanta, Rama Melkote, Vasudha Nagaraj, Asma Rasheed, Gogu Shyamala, Deepa Sreenivas and Susie Tharu, "Towards a World of Equals: A Bilingual Textbook on Gender".
2. Jayaprabha, A. "Chupulu (Stares)". Women Writing in India: 600BC to the Present. Volume it. The 20th Century Ed. Susie Tharu and K. Lalita. Delhi: Oxford University Press, 1995. 596-597.

REFERENCE BOOKS:

1. Sen, Amartya. "More than One Million Women are Missing." New York review of Books 37.20(20th December 1990). Print. 'We Were Making History….' Life stories of Women in the Telangana People's struggle. New Delhi: Kali for Women, 1989.
2. K. Satyanarayana and Susie Tharu (Ed.) Steel Nibs Are Sprouting: New Dalit Writing Form South India, Dossier 2: Telugu And Kannada http://harpercollins.co.in/BookDetail.asp?Book_Code=3732