BOARD OF STUDIES MEETING – 2020-21

K.S.R.M COLLEGE OF ENGINEERING

AUTONOMOUS

Minutes of the Meeting

Date	**23.09.2020**	**Day**	**Wednesday**
Time	**5.00 PM**	**Venue**	**Virtual meeting: https://meet.google.com/pei-fvec-pxd**
Dept./SS	**ECE**	**Convener**	**Dr. G. Hemalatha**

MembersPresent:11

S.No	Name	Designation	Signature
1.	Prof. G. Hemalatha	Prof., & HOD ECE, KSRMCE	
2.	Prof. K. Rama Naidu	University nominee Professor in ECE, JNTUA Ananthapuramu	
3.	Prof. M. Rama Subba Reddy	Subject Expert Professor in ECE IIT Madras	
4.	Dr. V. Anil Kumar	Subject Expert Asso.Prof.in ECE IIIT, Huderabad	
5.	Dr. M. Venkatanarayana	Prof., KSRMCE	M.V.N

Members Absent: 01

S.No	Name	Designation
1	Sri M. Nagendra Kumar	Alumni Member Research Staff CRL, BEL

6.	Sri R.V. Sreehari	Asso. Prof., in ECE KSRMCE		
7.	Dr. S. L. Prathapa Reddy	Asso. Prof., in ECE KSRMCE		
8.	Dr. S. Zahiruddin	Asso. Prof., in ECE KSRMCE		
9.	Sri A. Valli Bhasha	Asso. Prof., in ECE KSRMCE		
10.	Sri Md. Mahaboob Pasha	Asso. Prof., in ECE KSRMCE		
11	Sri B. Prabhakar	Industry S. V. P. Networks Bangalore		

Dr .G Hemalatha, welcomed all the members to the meeting and presented the agenda of the meeting.
The resolutions are:

	To do item	**Discussion**	**Resolution**	**Coordinator/in-charge**

1	To finalize the Minor Degree Course Structure & Syllabus	The Head of the Department has presented the syllabus designed, Including New Courses recommended Based on the Feedback given by the Stack holders and Action taken Reports and comparing with premier institute syllabus.	The committee has approved the course structure and syllabus for B. Tech (R20) I sem& II sem. With little modifications as To modify the syllabus for "Biomedical Signal Processing". To modify the syllabus of "Information theory and coding" so that to eliminate the repetitions as compared with Digital Communication Course in Major degree. To include Stephen J. Chapman, "MATLAB Programming for Engineers", Thomson learning, 4th edition in the text books for "Scientific Computing using MATLAB". To replace the "Spread Spectrum Communication" in Honors with "MIMO /OFDM Wireless communication".	Dr. G. Hemalatha
2	To finalize the Honors Degree Course Structure & Syllabus .	The Head of the Department has presented the syllabus designed, Including New Courses recommended Based on the Feedback given by the Stack holders and Action taken Reports and comparing with premier institute syllabus.	The committee suggested to reform the courses in Minor degree so that they are in the introductory level or skill oriented. To introduce "Industrial electronics" in the minor degree courses.	Sri R. V. Sreehari

3.	Other Points		To evaluate the Mini Project under Minor Degree course for 100 Marks by Internal Committee Members (HoD, Two Senior Faculty Members) and Concerned Guide by conducting Three Reviews and Final Project Viva-voce.	DR. S. L. Prathapa Reddy

The Head of the Department have proposed the Vote of thanks and concluded the meeting.

Convener

Professor & H.O.D.
Department of E.C.E.
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KSRM College of Engineering (Autonomous) Kadapa

R 20 I & II Semesters Curriculum and syllabus

DEPARTMENT OF ECE

I Semester

S.No	Course code	Category	Course Name	L	T	P	IM	EM	CR
1.	2021101	BSC	Linear Algebra and Calculus	3	0	0	40	60	3
2.	20AP102	BSC	Applied Physics	3	0	0	40	60	3
3.	2024103	HS	Communicative English	3	0	0	40	60	3
4.	2002104	ESC	Fundamentals of Electrical Engineering	3	0	0	40	60	3
5.	2003105	ESC	Engineering Drawing	1	0	2	40	60	2
6.	2003106	ESC	Engineering Drawing Lab	0	0	2	40	60	1
7.	20AP107	BSC	Applied Physics Lab	0	0	3	40	60	1.5
8.	2024108	HS	Communicative English Lab	0	0	3	40	60	1.5
9.	2002109	ESC	Fundamentals of Electrical Engineering Lab	0	0	3	40	60	1.5
									19.5

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II Semester

S. No	Course code	Category	Course Name	L	T	P	IM	EM	CR
1.	2021201	BSC	Differential Equations and Vector Calculus	3	0	0	40	60	3
2.	2023202	BSC	Chemistry	3	0	0	40	60	3
3.	2005203	ESC	C-Programming & Data Structures	3	0	0	40	60	3
4.	2004204	ESC	Electronic Devices & Circuits	3	0	0	40	60	3
5.	20EW205	LC	Engineering Workshop	0	0	3	40	60	1.5
6.	2005206	LC	IT Workshop	0	0	3	40	60	1.5
7.	2023207	BSC	Chemistry Lab	0	0	3	40	60	1.5
8.	2005208	ESC	C-Programming & Data Structures Lab	0	0	3	40	60	1.5
9.	2004209	ESC	Electronic Devices & Circuits Lab	0	0	3	40	60	1.5
10.	20MC210	MC	Environmental Science	3	0	0	30	0	0.0
									19.5

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Course Title	LINEAR ALGEBRA & CALCULUS (R20)				B. Tech. I Sem (Common to All Branches)		
Course Code	Category	Hours/Week		Credits	Maximum Marks		
2021101	BS	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	--	3	40	60	100
Mid Exam Duration: 2Hours					End Exam Duration: 3Hours		

Course Objectives:

- This course will illuminate the students in the concepts of calculus and linear algebra.
- To equip the students with standard concepts and tools at an intermediate to advanced level mathematics to develop the confidence and ability among the students to handle various real world problems and their applications.

Course Outcomes : On successful completion of this course, the students will be able to

CO 1	Develop the use of matrix algebra techniques that is needed by engineers for practical applications.
CO 2	Utilize mean value theorems to real life problems.
CO 3	Classify the functions of several variables which is useful in optimization techniques.
CO 4	Evaluate multiple integrals.
CO 5	Define Beta and Gamma functions.

Bridge Course: Limits, continuity, Types of matrices

UNIT I: Matrices (12 Hours)

Rank of a matrix by Echelon form, Normal form. Solving system of homogeneous and non-homogeneous linear equations. Eigen values and Eigen vectors for real matrices – Cayley-Hamilton theorem (without proof), finding inverse and power of a matrix by Cayley–Hamilton theorem. Diagonalization by orthogonal transformation.

Learning Outcomes:

At the end of this unit, the student will be able to

- solve systems of linear equations, using technology to facilitate row reduction determine the rank, eigen values and eigen vectors (L3).
- identify special properties of a matrix and use this information to facilitate the calculation of matrix characteristics (L3)

UNIT II: Mean Value Theorems (08 Hours)

Rolle's theorem, Lagrange's mean value theorem, Cauchy's mean value theorem, Taylor's and Maclaurin's theorems with remainders (without proof), related problems.

Learning Outcomes:

At the end of this unit, the student will be able to

- translate the given function as series of Taylor's and Maclaurin's with remainders (L3)
- analyze the behaviour of functions by using mean value theorems (L3)

UNIT III: Multivariable Calculus (10 Hours)
Partial derivatives, total derivative, chain rule, change of variables, Jacobians, Maxima and minima of functions of two variables – Lagrange's method of undetermined multipliers.

Learning Outcomes:
At the end of this unit, the student will be able to

- find partial derivatives numerically and symbolically and use them to analyze and interpret the way a function varies. (L3)
- acquire the Knowledge maxima and minima of functions of several variable (L1)
- utilize Jacobian of a coordinate transformation to deal with the problems in change of variables (L3).

UNIT IV: Multiple Integrals (10 Hours)
Evaluation of double integrals in Cartesian coordinates and polar coordinates – Change of variables in double integrals – Change the order of integration in double integrals – Evaluation of triple integrals in Cartesian and polar coordinates – Change of variables between cartesian, cylindrical and spherical polar coordinates.

Learning Outcomes:
At the end of this unit, the student will be able to

- evaluate double integrals of functions of several variables in two dimensions using cartesian and polar coordinates (L5)
- evaluate multiple integrals in Cartesian, cylindrical and spherical geometries (L5)

UNIT V: Beta and Gamma functions (08 Hours)
Beta and Gamma functions and their properties,relation between Beta and Gamma functions, evaluation of definite integrals using Beta and Gamma functions.

Learning Outcomes:
At the end of this unit, the student will be able to

- understand beta and gamma functions and its relations (L2)
- conclude the use of special function in evaluating definite integrals (L4)

Text Books:

1. Dr. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers-43 edition 2014.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley Publications, 9th edition-2013.
3. Kolman, Bernard Hill, David R, " Introductory Linear Algebra with applications".
4. Hoffman Kennethkunze Ray, "Linear Algebra".

Reference Books:

1. B.V. Ramana, "Higher Engineering Mathematics", Mc. Graw Hill Education (India) Pvt. Ltd, New Delhi, 11th Edition, Reprint 2010.
2. D Poole, "Linear Algebra: A Modern Introduction", 2nd Edition, Brooks/Cole, 2005.
3. N.P. Bali and Manish Goyal, "A Text Book of Engineering Mathematics", Lakshmi Publications, Reprint 2008
4. Gilbert Strang, "Linear Algebra and its applications".

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Course Title	APPLIED PHYSICS				B. Tech. I – Sem (EEE, ECE) & II - Sem (CSE, AI&ML)		
Course Code	Category	Hours/Week		Credits	Maximum Marks		
20AP102/ 20AP202	BSC	L	T	P	C	Continuous Internal Assessment	End lab Exams	Total
		3	0	0	3	40	60	100
					End Exam Duration: 3Hrs		

Course Objectives:

- To make a bridge between the physics in school and engineering courses.
- To identify the importance of the optical phenomenon i.e. interference, diffraction related to its Engineering applications.
- To understand the mechanisms of emission of light, the use of lasers as light sources for low and high energy applications, along with engineering applications.
- To explain the significant concepts of dielectric and magnetic materials that leads to potential applications in the emerging micro devices.
- To enlighten the concepts of Quantum Mechanics and to provide fundamentals of de-Broglie waves, quantum mechanical wave equation and its applications, the importance of free electron theory and band theory of solids.
- Evolution of band theory to distinguish materials, basic concepts and transport phenomenon of charge carriers in semiconductors. To give an impetus on the subtle mechanism of superconductors using the concept of BCS theory and their fascinating applications.

Course Outcomes:

CO1	**Analyze** the differences between interference and diffraction with applications
CO2	**Identifies** the Engineering applications of lasers and the applications of optical fibers in various fields.
CO3	**Understands** the response of dielectric and magnetic materials to the applied electric and magnetic fields.
CO4	**Interpret** the concepts of classical and quantum free electron theories
CO5	**Elaborate** the physical properties exhibited by materials through the understanding of properties of semiconductors and superconductors.

UNIT-I: Wave Optics(10hrs)

Interference- Principle of superposition – Interference of light – Conditions for sustained interference - Interference in thin films (Reflection Geometry) – Colors in thin films – Newton's Rings – Determination of wavelength and refractive index.

Diffraction- Introduction – Fresnel and Fraunhofer diffraction – Fraunhofer diffraction due to single slit, double slit and N-slits (qualitative) – Grating spectrum.

Unit Outcomes:

The students will be able to

- Explain the need of coherent sources and the conditions for sustained interference.
- Identify engineering applications of interference.
- Analyze the differences between interference and diffraction with applications.

UNIT-II: Lasers and Fiber optics (8hrs)

Lasers-Introduction – Characteristics of laser – Spontaneous and Stimulated emission of radiation – Einstein's coefficients – Population inversion – Lasing action – Pumping mechanisms – Nd-YAG laser – He-Ne laser – Semiconductor diode laser- Applications of lasers.

Fiber optics-Introduction – Principle of optical fiber – Acceptance Angle – Numerical Aperture – Classification of optical fibers based on refractive index profile and modes – Block diagram of Optical fiber Communication system – Propagation Losses (qualitative) – Applications.

Unit Outcomes:

The students will be able to

- Understand the basic concepts of LASER light Sources.
- Apply the concepts to learn the types of lasers.
- Identifies the Engineering applications of lasers.
- Explain the working principle of optical fibers.
- Classify optical fibers based on refractive index profile and mode of propagation.
- Identify the applications of optical fibers in various fields.

UNIT-III: Dielectric and Magnetic Materials (8hrs)

Dielectric Materials-Introduction – Dielectric polarization – Dielectric polarizability, Susceptibility and Dielectric constant – Types of polarizations: Electronic, Ionic and Orientation polarizations (Qualitative) – Lorentz internal field – Clausius-Mossotti equation.

Magnetic Materials-Introduction to magnetic materials (Origin of magnetic moment of an atom and Classification of magnetic materials) –Weiss theory of ferromagnetism-soft ferrites and hard ferrites- Hysteresis – Soft and Hard magnetic materials- Applications magnetic materials.

Unit Outcomes:

The students will be able to

- Explain the concept of dielectric constant and polarization in dielectric materials.
- Summarize various types of polarization of dielectrics.
- Interpret Lorentz field and Claussius-Mosotti relation in dielectrics.
- Classify the magnetic materials based on susceptibility and their temperature dependence.
- Explain the applications of dielectric and magnetic materials.
- Apply the concept of magnetism to magnetic devices.

UNIT- IV: Quantum Mechanics, Free Electron Theory(10hrs)

Quantum Mechanics- Dual nature of matter – Schrodinger's time independent and dependent wave equation – Significance of wave function – Particle in a one-dimensional infinite potential well.

Free Electron Theory-Classical free electron theory (Merits and demerits only) – Quantum free electron theory – Equation for electrical conductivity based on quantum free electron theory – Fermi-Dirac distribution – Density of states – Fermi energy.

Unit Outcomes:

The students will be able to

- Explain the concept of dual nature of matter.
- Understand the significance of wave function.
- Interpret the concepts of classical and quantum free electron theories.

- Explain the importance of K-P model
- Classify the materials based on band theory.
- Apply the concept of effective mass of electron.

UNIT – V: Semiconductors and Superconductors (10hrs)

Semiconductors- Introduction – Intrinsic semiconductors – Electrical conductivity – Fermi level – Extrinsic semiconductors –Dependence of Fermi energy on carrier concentration and temperature – Drift and diffusion currents – Einstein's equation – Direct and indirect band gap semiconductors – Hall effect – Hall coefficient – Applications of Hall effect.

Superconductors- Introduction – Properties of superconductors – Meissner effect – Type I and Type II superconductors – BCS theory – Josephson effects (AC and DC) –High T_c superconductors – Applications of superconductors.

Unit Outcomes:

The students will be able to

- Classify the energy bands of semiconductors.
- Interpret the direct and indirect band gap semiconductors.
- Identify the type of semiconductor using Hall effect.
- Identify applications of semiconductors in electronic devices.
- Explain how electrical resistivity of solids changes with temperature.
- Classify superconductors based on Meissner's effect.
- Explain Meissner's effect, BCS theory & Josephson effect in superconductors.

Text books:

1. Dr. M.N. Avadhanulu& Dr. P.G. Krishnasagar, "Engineering Physics", S. Chand and Company.
2. AjoyGhatak, "Optics", McGraw Hill Publishers, 6th edition,1stJanuary,2018.
3. Halliday, Resnick and Walker, "Fundamental of Physics", Wiley publications.
4. Hall H E, "Solid State Physics", paramount Publications

Reference Books:

1. K.Thyagarajan, "Engineering Physics", McGraw Hill Publishers.
2. S.M.Sze, "Semiconductor Devices", Wiley Publications.
3. Nelkon M parker P Arnold, "Lasers & Non-linear Optics", Heinemann Publications.
4. Donald A, Neamen, "Semiconductor physics and devices- Basic principle", McGraw Hill.

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Course Title	COMMUNICATIVE ENGLISH (Common to all branches)				B. Tech. C.E, E.E.E & E.C.E (I Sem) M,E& C.S.E (II Sem)			
Course Code	Category	Hours/Week			Credits	Maximum Marks		
2024103 (I Sem) 2024203 (II Sem)	HUM	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	1	0	3	40	60	100
Mid Exam Duration: 2Hrs					End Exam Duration: 3Hrs			

COURSE OBJECTIVES	
•	Facilitate effective listening skills for better comprehension of academic lectures and English spoken by native speakers
•	Focus on appropriate reading strategies for comprehension of various academic texts and authentic materials
•	Help improve speaking skills through participation in activities such as role plays, discussions and structured talks/oral presentations
•	Impart effective strategies for good writing and demonstrate the same in summarizing, writing well organized essays, record and report useful information
•	Provide knowledge of grammatical structures and vocabulary and encourage their appropriate use in speech and writing
COURSE OUTCOMES	
CO1	**Describe** the classification of words, sentences and their usage in sentences.
CO2	**Understand** the difference between spoken and written English
CO3	**Analyze** the rules in language for changing the form of sentences
CO4	**Illustrate** the factors that influence grammar and vocabulary in speaking and writing
CO5	**Classify** the parts of speech, tenses and sentence structures.

UNIT-I

Lesson: On the Conduct of Life: William Hazlitt

Listening: Identifying the topic, the context and specific pieces of information by listening to short audio texts and answering a series of questions. **Speaking:** Asking and answering general questions on familiar topics such as home, family, work, studies and interests; introducing oneself and others. **Reading:** Skimming to get the main idea of a text; scanning to look for specific pieces of information. **Writing: Beginnings** and endings of paragraphs - introducing the topic, summarizing the main idea and/or providing a transition to the next paragraph.

Grammar and Vocabulary: Parts of Speech; Word formation, synonyms and antonyms; Idioms and Phrases; phrasal verbs.

Learning Outcomes
At the end of the module, the learners will be able to

- Understand social or transactional dialogues spoken by native speakers of English and identify the context, topic, and pieces of specific information
- Ask and answer general questions on familiar topics and introduce oneself/others
- Employ suitable strategies for skimming and scanning to get the general idea of a text and locate specific information
- Recognize paragraph structure and be able to match beginnings/endings/headings with paragraphs
- Form sentences using proper grammatical structures and correct word forms

UNIT-II
Lesson: The Brook: Alfred Tennyson

Listening: Answering a series of questions about main idea and supporting ideas after listening to audio texts. **Speaking:** Discussion in pairs/small groups on specific topics followed by short structured talks. **Reading:** Identifying sequence of ideas; recognizing verbal techniques that help to link the ideas in a paragraph together. **Writing:** Paragraph writing (specific topics) using suitable cohesive devices; mechanics of writing - punctuation, capital letters.
Grammar and Vocabulary: Sentence structure; articles; Tenses; Prepositions.
Learning Outcomes
At the end of the module, the learners will be able to

- Comprehend short talks on general topics
- Participate in informal discussions and speak clearly on a specific topic using suitable discourse markers
- Understand the use of cohesive devices for better reading comprehension
- Write well structured paragraphs on specific topics
- Identify basic errors of grammar/ usage and make necessary corrections in short texts

UNIT-III
Lesson: A City Night Peace - Oliver Goldsmith
Listening: Listening for global comprehension and summarizing what is listened to. **Speaking:** Discussing specific topics in pairs or small groups and reporting what is discussed **Reading:**Reading a text in detail by making basic inferences -recognizing and interpreting specific context clues; strategies to use text clues for comprehension.**Writing:** Summarizing, Paragraph Writing **Grammar and Vocabulary:** Voice; Reported Speech; Degrees of Comparison, Subject with agreement.

Learning Outcomes
At the end of the module, the learners will be able to

- Comprehend short talks and summarize the content with clarity and precision
- Participate in informal discussions and report what is discussed
- Infer meanings of unfamiliar words using contextual clues

- Write summaries based on global comprehension of reading/listening texts
- Use correct tense forms, appropriate structures and a range of reporting verbs in speech and writing

UNIT-IV

Lesson: Being Rich, Being Good - Chetan Bhagat

: Official Letters/Report Writing

Grammar and Vocabulary: Information Transfer; Simple, Compound and Complex sentences; Question Tags**Listening:** Making predictions while listening to conversations/ transactional dialogues without video; listening with video. **Speaking:** Role plays for practice of conversational English in academic contexts (formal and informal) - asking for and giving information/directions. **Reading:** Studying the use of graphic elements in texts to convey information, reveal trends/patterns/relationships, communicate processes or display complicated data. **Writing:** Letter Writing

Learning Outcomes

At the end of the module, the learners will be able to

- Infer and predict about content of spoken discourse
- Understand verbal and non-verbal features of communication and hold formal/informal conversations
- Interpret graphic elements used in academic texts
- Produce a coherent paragraph interpreting a figure/graph/chart/table
- Use language appropriate for description and interpretation of graphical elements

UNIT-V

Lesson: Politics and the English Language: George Orwell

Listening: Identifying key terms, understanding concepts and answering a series of relevant questions that test comprehension. Speaking: Formal oral presentations on topics from academic contexts - without the use of PPT slides. Reading: Reading for comprehension. **Writing:** Writing structured essays on specific topics using suitable claims and evidences.

Grammar and Vocabulary: Reading Comprehension; Dialogue Writing; Common Errors.

Learning Outcomes

At the end of the module, the learners will be able to

- Take notes while listening to a talk/lecture and make use of them to answer questions
- Make formal oral presentations using effective strategies
- Comprehend, discuss and respond to academic texts orally and in writing
- Produce a well-organized essay with adequate support and detail
- Edit short texts by correcting common errors

Prescribed Text:

- Language and Life: A Skills Approach- I Edition 2019, Orient Black Swan

Reference Books

- Bailey, Stephen. Academic writing: A handbook for international students. Routledge, 2014.
- Chase, Becky Tarver. Pathways: Listening, Speaking and Critical Thinking. Heinley ELT; 2nd Edition, 2018.
- Raymond Murphy's English Grammar in Use Fourth Edition (2012) E-book
- Hewings, Martin. Cambridge Academic English (B2). CUP, 2012.
- Oxford Learners Dictionary, 12th Edition, 2011
- Norman Lewis Word Power Made Easy- The Complete Handbook for Building a Superior Vocabulary (2014)
- Speed Reading with the Right Brain: Learn to Read Ideas Instead of Just Words by David Butler

Web links

www.englishclub.com
www.easyworldofenglish.com
www.languageguide.org/english/
www.bbc.co.uk/learningenglish
www.eslpod.com/index.html
www.myenglishpages.com

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Course Title	FUNDAMENTALS OF ELECTRICAL ENGINEERING					B. Tech. I Semester		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
2002104	ESC	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	0	3	40	60	100
Mid Exam Duration : 2Hrs						End Exam Duration : 3Hrs		

Course Objectives:

- The objective of the course is to determine active, reactive, apparent power for single phase and three phase AC circuits, Principle and operation of transformers and performance characteristics of DC and AC machines, verification of Kirchhoff's laws andnetwork theorems for DC and AC excitation.

Course Outcomes: On successful completion of this course, the students will be able to,

CO 1	Understand the basic fundamentals of DC & AC circuits, network reduction techniques, network theorems, principle of DC and AC machines.
CO 2	Determine the currents, voltages using mesh and nodal analysis, Average and RMS values for different waveforms.
CO 3	Evaluate the active and reactive powers, voltage and currents for balanced and unbalanced networks.
CO 4	Obtain the EMF equation and characteristics of dc machines, Induction motor and synchronous machine.
CO 5	Evaluate the equivalent circuit and to calculate losses of single phase transformer.

UNIT I

DC Circuits: Ohm's Law and Kirchhoff's Laws, Analysis of series, parallel and series-parallel circuits excited by independent voltage sources; Power and energy; simple numerical problems. Faradays Laws, Lenz's Law, Fleming's Rules, Statically and dynamically induced EMF; Concepts of self-inductance, mutual inductance and coefficient of coupling; Energy stored in magnetic fields, simple numerical problems.

UNIT-II

AC Circuits: Definition of average value, root mean square value, form factor and peak factor of sinusoidal voltage and current and phasor representation of alternating quantities; Analysis with phasor diagrams of R, L,C, RL, RC and RLC circuits; Real power, reactive power, apparentpower and power factor, simple numerical problems.

Three Phase Systems: Definition of Phase sequence, balanced supply and balanced load, Relationship between line and phase values of balanced star and delta connections, Power in balanced three phase circuits, simple numerical problems.

UNIT-III

Network Theorems: Superposition and Reciprocity Theorems, Thevenin"s, Norton"s, MaximumPower Transfer, Millman"s Theorems, Compensation Theorem.

Transformers: Principle of operation and construction of single phase transformers (core and shell types). EMF equation, losses, efficiency and voltage regulation, OC and SC Tests.

UNIT IV

DC Generators: Constructional Features, E.M.F Equation, Types of Generators, OCC, Internal & External Characteristics of Generators, Applications.

D.C Motors: Back E.M.F, Torque Equation, Characteristics and Applications, Speed Control (Shunt Motor)– field and armature. Three Point Starter, Losses, Calculation of Efficiency,Swinburne"s Test.

UNIT V

Three phase Induction motor: Revolving magnetic field theory, Principle of operation, Torque equation, and Torque –speed characteristics.

Three phase Synchronous Machines: Principle and Constructional Features of Salient Pole and Round Rotor Machines, E.M.F Equation, Voltage Regulation by Synchronous Impedance Method, Theory of Operation of Synchronous Motor.

Text Books:

1. D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
2. D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2009.
3. L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, 2011.
4. E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.

References:

1. V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989.
2. V.K. Mehta, Rohit Mehta, "Principles of Electrical Engineering",S.Chand, 2005.
3. http://www.nptelvideos.in/2012/11/basic-electrical-technology.html
4. Ashfaq Husain and Harroon Ashfaq, "Fundamentals Of Electrical Engineering", Dhanpat Rai & Co. (P) Limited; Fourth edition.

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Course Title	ENGINEERING DRAWING				B. Tech. I Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
2003105	ESC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		1	0	2	2	40	60	100
Mid Exam Duration: 2Hrs					End Exam Duration: 3Hrs		

Course Objectives:

- Bring awareness that Engineering Drawing is the Language of Engineers.
- Familiarize how industry communicates technical information.
- Teach the practices for accuracy and clarity in presenting the technical information.
- Develop the engineering imagination essential for successful design.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Draw various curves applied in engineering.
CO 2	Show projections of solids and sections graphically.
CO 3	Draw the development of surfaces of solids.
Co4	Know draw orthographic and isometric projections
CO5	Evaluate different methods of perspective view.

UNIT-I

Introduction to Engineering Drawing: Principles of Engineering Drawing and its Significance-Conventions in drawing-lettering - BIS conventions.

a)Conic sections including the rectangular hyperbola- general method only,

b) Cycloid, epicycloids and hypocycloid c) Involutes

UNIT-II

Projection of points, lines and planes: Projection of points in any quadrant, lines inclined to one or both planes, finding true lengths, angle made by line. Projections of regular plane surfaces.

Projections of solids: Projections of regular solids inclined to one or both planes by rotational or auxiliary views method.

UNIT-III

Sections of solids: Section planes and sectional view of right regular solids- prism, cylinder, pyramid and cone. True shapes of the sections.

Development of surfaces: Development of surfaces of right regular solids-prism, cylinder, pyramid, cone and their sectional parts.

UNIT-IV

Orthographic Projections: Systems of projections, conventions and application to orthographic projections - simple objects.

Isometric Projections: Principles of isometric projection- Isometric scale; Isometric views: lines, planes, simple solids.

UNIT-V

Perspective projection –applications of perspective view –terminology of perspective view- methods of drawing perspective view-simple problems.

Text Books:

1. K L. Narayana & P. Kannaiah, Engineering Drawing, 3/e, Scitech Publishers,Chennai, 2012.
2. N. D. Bhatt, Engineering Drawing, 53/e, Charotar Publishers, 2016.
3. Colin simmons, Denis Maguire and NeilPhelps, "Manual of Engineering Drawing: British and International Standards", Buffer Worth_ HeinemanmInc, Fifth Edition.
4. Thomas E French, Charless John Vierck, Robert J. Foster, "Engineering Drawing and Graphic Technology", Mc Graw- Hill International Edition.

Reference Books:

1. Dhanajay A Jolhe, Engineering Drawing, Tata McGraw-Hill, Copy Right,2009
2. Venugopal, Engineering Drawing and Graphics, 3/e, New Age Publishers,2000
3. Shah and Rana, Engineering Drawing, 2/e, Pearson Education,2009
4. K.C.John, Engineering Graphics, 2/e, PHI,2013

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Course Title	ENGINEERING DRAWING LAB				B. Tech. I Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
2003106	ESC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		0	0	2	1	40	60	100
						End Exam Duration: 3Hrs		

Course Objectives:

- Familiarize how industry communicates technical information.
- Teach the practices for accuracy and clarity in presenting the technical information.
- Develop the engineering imagination essential for successful design.
- Bring awareness that Engineering Drawing is the Language of Engineers.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Use computers as a drafting tool.
CO 2	Draw isometric drawings using CAD packages.
CO 3	Analyze orthographic drawings using CAD packages

- Instruct the utility of drafting & modeling packages in orthographic andisometric drawings.
- Train the usage of 2D and 3Dmodeling.
- Instruct graphical representation of machine components.

Computer Aided Drafting:

Introduction to AutoCAD: Basic drawing and editing commands: line, circle, rectangle, erase, view, undo, redo, snap, object editing, moving, copying, rotating, scaling, mirroring, layers, templates, polylines, trimming, extending, stretching, fillets, arrays, dimensions. Dimensioning principles and conventional representations.

Orthographic Projections: Systems of projections, conventions and application toorthographic projections - simple objects.

Isometric Projections: Principles of isometric projection- Isometric scale; Isometricviews: lines, planes, simple solids.

Text Books:

1. K. Venugopal, V.Prabhu Raja, Engineering Drawing + Auto Cad, New AgeInternational Publishers.
2. Kulkarni D.M, AP Rastogi and AK Sarkar, Engineering Graphics with AutoCad, PHI Learning, Eastern Economy editions.

Reference Books:

1. T. Jayapoovan, Engineering Graphics using Auto Cad, Vikas Publishing House
2. K.L.Narayana & P.Kannaiah, Engineering Drawing, 3/e, Scitech Publishers,Chennai, 2012.
3. Linkan Sagar, BPB Publications, Auto Cad 2018 Training Guide.
4. K.C.John, Engineering Graphics, 2/e, PHI,2013
5. Basant Agarwal & C.M.Agarwal, Engineering Drawing, Tata McGraw-Hill,Copy Right, 2008.

Additional Sources

1. Youtube: http-sewor,Carleton.cag, kardos/88403/drawings.html conic sections-online, redwoods.edu

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Course Title	APPLIED PHYSICS LAB				B. Tech. I – Sem (EEE, ECE) & II - Sem (CSE, AI&ML)		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
20AP107/ 20AP207	BSC				C	Continuous Internal Assessment	End lab Exams	Total
					1.5	40	60	00
					3Hrs	End Exam Duration:		

Course Objectives:

- **Understand** the role of Optical fiber parameters in engineering applications
- **Identify** the generation of magnetic field through current carrying conductor.
- **Recognize** the importance of interference and diffraction.
- **Illustrates** the magnetic and dielectric materials applications.
- **Apply** the principles of semiconductors in various electronic devices.

Course Outcomes:

CO1	**Operate** various optical and electronic instruments.
CO2	**Apply** the concepts of interference and diffraction to determine various parameters
CO3	**Estimate** wavelength of laser and particles size using laser.
CO4	**Evaluate** the acceptance angle of an optical fiber and numerical aperture.
CO5	**Plots** the intensity of the magnetic field of circular coil carrying current with distance

Note: In the following list, out of 12 experiments, any 8 experiments must be performed in a semester

List of Experiments:

1. Determine the thickness of the wire using wedge shape method
   Experimental outcomes:
   Operates optical instrument like travelling microscope.
   Estimate the thickness of the wire using wedge shape method
   Identifies the formation of interference fringes due to reflected light from non-uniform thin film.
2. Determination of the radius of curvature of the lens by Newton's ring method
   Experimental outcomes:
   Operates optical instrument like travelling microscope.
   Estimate the radius of curvature of the lens
   Identifies the formation of interference fringes due to reflected light from non-uniform thin film.
   Plots the square of the diameter of a ring with no. of rings

3. Determination of wavelength by plane diffraction grating method
   Experimental outcomes:
   Operates optical instrument like spectrometer.
   Estimate the wavelength of the given source
   Identifies the formation of grating spectrum due diffraction.
4. Determination of dispersive power of prism.
   Experimental outcomes:
   Operates optical instrument like spectrometer.
   Estimate the refractive index and dispersive power of the given prism
   Identifies the formation of spectrum due to dispersion.
5. Determination of wavelength of LASER light using diffraction grating.
   Experimental outcomes:
   Operates various instrument
   Estimate the wavelength of laser source
   Identifies the formation of grating spectrum due diffraction.
6. Determination of particle size using LASER.
   Experimental outcomes:
   Operates various instrument
   Estimate the Particles size using laser
   Identifies the application of laser
7. To determine the numerical aperture of a given optical fiber and hence to find its acceptance angle
   Experimental outcomes:
   Operates various instruments and connect them as per the circuit.
   Estimate the numerical aperture and acceptance angle of a given optical fiber.
   Identifies the significance of numerical aperture and acceptance angle of an optical fiber in various engineering applications.
8. Determination of dielectric constant by charging and discharging method.
   Experimental outcomes:
   Operates various instruments and connect them as per the circuit.
   Estimate the dielectric constant of the given substance.
   Identifies the significance of dielectric constant in various devices.
9. Magnetic field along the axis of a circular coil carrying current –Stewart Gee's method.
   Experimental outcomes:
   Operates various instruments and connect them as per the circuit.
   Estimate the magnetic field along the axis of a circular coil carrying current.
   Plots the intensity of the magnetic field of circular coil carrying current with distance (L3)
10. Study the variation of B versus H by magnetizing the magnetic material (B-H curve)
    Experimental outcomes:
    Operates various instruments and connect them as per the circuit.
    Estimate the hysteresis loss, coactivity and retentivity of the ferromagnetic material.
    Classifies the soft and hard magnetic material based on B-H curve.
    Plots the magnetic field H and flux density B
11. To determine the resistivity of semiconductor by Four probe method
    Experimental outcomes:

Operates various instruments and connect them as per the circuit.
Estimate the resistivity of a semiconductor.
Identifies the importance of four probe method in finding the resistivity of semiconductor.

12. To determine the energy gap of a semiconductor

Experimental outcomes:
Operates various instruments and connect them as per the circuit.
Estimate the energy gap of a semiconductor.
Illustrates the engineering applications of energy gap.
Plots1/T with log R.

Text books:

1. S.Balasubramanian, M.N.Srinivasan "A Text book of Practical Physics"- S Chand Publishers, 2017.
2.Physics Laboratory Manual by Loyd D H, Cengage learning, 4Th International Edition 2014.
3. Et.Al. Engineering Physics Lab Manual by MadhusudhanaRao, SCITECH PUBLICATIONS (INDIA) PVT.LTD, 2015.
4.Practical Physics by K.Venugopalan (Author), VimalSaraswat (Author), Himanshu Publications (1 January 2018)

References:

1. Physics Laboratory Experiments, by Jerry Wilson (Author), Cecilia A. Hernandez-Hall (Author), Brooks/cole; 7th edition (11 June 2009)
2. Lab manual Physics, R Rangarajan, R P Manchanda, R K Gupta, Rajesh Kumar NeenaSinha-NewSaraswati House
3. Practical Physics by Kumar P. R. Sasi, Prentice-Hall of India Pvt.Ltd

Weblink:
1. http://vlab.amrita.edu/index.php - Virtual Labs, Amrita University.

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Course Title	COMMUNICATIVE ENGLISH LAB (Common to all branches)				B. Tech. I sem			
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
2024108	**HUM**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End lab Exams**	**Total**
		0	0	3	1.5	40	60	100
					End Exam Duration: 3Hrs			

Course Objectives

- Students will be exposed to a variety of self instructional, learner friendly modes of language learning
- Students will learn better pronunciation through stress, intonation and rhythm
- Students will be trained to use language effectively to face interviews, group discussions, public speaking
- Students will be initiated into greater use of the computer in resume preparation, report writing, format making etc

Course Outcomes:

CO1	**Describe** objects, places and persons
CO2	**Understand** the listening process and answer the questions related to it.
CO3	**Analyze** phonetics with examples
CO4	**Illustrate** different modes of communication skills
CO5	**Classify** LSRW Skills

UNIT-I

- Listening Skills
- Phonetics
- Introducing oneself

Learning Outcomes

At the end of the module, the learners will be able to

- understand different accents spoken by native speakers of English
- learn different professional registers and specific vocabulary to describe different persons, places and objects

UNIT-II

- Describing objects
- JAM / Interpretation of Hypothetical Situations
- Role play

Learning Outcomes
At the end of the module, the learners will be able to

- produce a structured talk extemporarily
- comprehend and produce short talks on general topics

UNIT-III

- Hypothetical situations (If…….. were)
- Elocution
- TED talks videos

Learning Outcomes
At the end of the module, the learners will be able to

- Learn different ways of greeting and introducing oneself/others
- summarize the content with clarity and precision and take notes while listening to a talk/lecture and make use of them to answer questions

UNIT-IV

- Visual Description
- Situational conversations

Learning Outcomes
At the end of the module, the learners will be able to

- Learn different ways of asking information and giving directions
- understand non-verbal features of communication

UNIT-V

- Oral Presentations
- PowerPoint presentations

Learning Outcomes
At the end of the module, the learners will be able to

- Make formal oral presentations using effective strategies
- Help in overcoming the fear of facing people.

Suggested Software

- Orell
- Walden Infotech
- Young India Films
- K-Van solutions

Reference Books

1. Bailey, Stephen. Academic writing: A handbook for international students. Routledge, 2014.
2. Chase, Becky Tarver. Pathways: Listening, Speaking and Critical Thinking. Heinley ELT; 2nd Edition, 2018.
3. Skillful Level 2 Reading & Writing Student's Book Pack (B1) Macmillan Educational.
4. Hewings, Martin. Cambridge Academic English (B2). CUP, 2012.
5. A Textbook of English Phonetics for Indian Students by T.Balasubramanyam

Web Links
www.esl-lab.com
www.englishmedialab.com
www.englishinteractive.net

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Course Title	Fundamentals of Electrical Engineering Lab				B. Tech. I Semester (ECE)		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
2002109	ESC	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		0	0	2	1.5	40	60	100
						End Exam Duration : 3Hrs		

Course Objectives:

- The objective of the course is to learn basics of DC and AC circuits,Electrical Machines, Transformers.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand the Kirchhoff"s laws, network theorem theoretically and practically for any given circuit.
CO 2	Evaluate the characteristics and efficiency of Induction Motor.
CO 3	Determine the speed, torque and efficiency of electrical machines..
CO 4	Determine the regulation of alternator.
CO 5	Obtain the efficiency and regulation for single phase transformer

List of Experiments (Any 10 experiments 5 from each stream)

Electric Circuits:

1. Verification of Kirchhoff"s laws
2. Verification of Superposition Theorem
3. Verification of Thevenin"s Theorem
4. Verification of Norton"s Theorems
5. Verification of Maximum Power Transfer Theorem
6. Verification of Compensation Theorem

Electrical Machines:

1. Magnetization characteristics of a separately excited DC generator
2. Load characteristics of DC shunt generator
3. Swinburne"s test
4. Brake test on 3-phase Induction motor
5. OC & SC tests on a 1-ϕ transformer
6. Predetermination of regulation of alternator by Synchronous impedance method

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Course Title	Differential Equations and Vector Calculus (R20)				B. Tech. II Sem (Common to All Branches)		
Course Code	Category	Hours/Week		Credits	Maximum Marks		
2021201	BS	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	--	3	40	60	100
Mid Exam Duration: 2Hours					End Exam Duration: 3Hours		

Course Objectives:

- To enlighten the learners in the concept of differential equations.
- To furnish the learners with basic concepts and techniques at plus two level to lead them into advanced level by handling various real world applications

Course Outcomes : On successful completion of this course, the students will be able to

CO 1	Classify second and higher order liner D.E's with constant coefficients.
CO 2	Solve partial differential equations.
CO 3	Analyze the applications of partial differential equations.
CO 4	Understand vector differentiation concepts.
CO 5	Apply vector integration concepts.

UNIT I:

Linear differential equations of higher order (constant coefficients) (10 Hours)

Definitions, homogeneous and non- homogeneous, complimentary function, general solution, particular integral, Wronskian, Method of variation of parameters.

Learning Outcomes:

At the end of this unit, the student will be able to

- identify the essential characteristics of linear differential equations with constant coefficients (L3)
- solve the linear differential equations with constant coefficients by appropriate method (L3)
- classify and interpret the solutions of linear differential equations (L3)

UNIT II: **Partial Differential Equations (10 Hours)**

Introduction and formation of Partial Differential Equations by elimination of arbitrary constants and arbitrary functions, solutions of first order equations using Lagrange's method.

Learning Outcomes:

At the end of this unit, the student will be able to

- apply a range of techniques to find solutions of standard PDEs (L3)
- outline the basic properties of standard PDEs (L2)

UNIT III: Applications of Partial Differential Equations (10 Hours)

Classification of PDE, method of separation of variables for second order equations. Applications of Partial Differential Equations: One dimensional Wave equation.

Learning Outcomes:

At the end of this unit, the student will be able to

- classify the PDE (L3)
- learn the applications of PDEs (L2)

UNIT IV: Vector differentiation (08 Hours)

Scalar and vector point functions, vector operator del, del applies to scalar point functions-Gradient, del applied to vector point functions-Divergence and Curl, vector identities.

Learning Outcomes:

At the end of this unit, the student will be able to

- apply del to scalar and vector point functions (L3)
- illustrate the physical interpretation of Gradient, Divergence and Curl (L3)

UNIT V:Vector integration (08 Hours)

Line integral-circulation-work done, surface integral-flux, Green's theorem in the plane (without proof), Stoke's theorem (without proof), volume integral, Divergence theorem (without proof) and applications of these theorems.

Learning Outcomes:

At the end of this unit, the student will be able to

- find the work done in moving a particle along the path over a force field (L4)
- evaluate the rates of fluid flow along and across curves (L4)
- apply Green's, Stokes and Divergence theorem in evaluation of double and triple integrals (L3)

Text Books:

1. Higher Engineering Mathematics, Dr. B.S. Grewal, Khanna Publishers-43 edition 2014.
2. Advanced Engineering Mathematics, Erwin Kreyszig, Wiley Publications, 9th edition-2013
3. Calculus and Analytic geometry, G.B. Thomas and R.L. Finney, Pearson, 9th Edition, Reprint, 2002.
4. Advanced Engineering Mathematics, Greenberg Michael D, Cengage Publishers.

Reference Books:

1. Higher Engineering Mathematics, B.V. Ramana, Mc. Graw Hill Education (India) Pvt. Ltd, New Delhi, 11th Edition, Reprint 2010.
2. A Text Book of Engineering Mathematics, N.P. Bali and Manish Goyal, Lakshmi Publications, Reprint 2008.
3. Applied Calculus, Hegarty John C
4. Advanced Calculus, Widder V David, Pearson Publishers

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Course Title	CHEMISTRY					B. Tech. CSE (I Sem) EEE & ECE (II Sem)		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
2023102 (I Sem) 2023202 (II Sem)	BSC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	1	0	3	40	60	100
Mid Exam Duration: 2Hrs					End Exam Duration: 3Hrs			

Course Objectives:

- To familiarize engineering chemistry and its applications.
- To train the students on the principles and applications of electrochemistry and polymers.
- To introduce instrumental methods, molecular machines and switches.

Course Outcomes: On successful completion of this course, the students will be able to

CO.1	**Understand** the basic quantum approach of Molecular orbital theory and calculation of bond order
CO.2	**Remember** the principle of Band diagrams in application of conductors and semiconductors.
CO.3	**Compare** the materials of construction for battery and electrochemical cells.
CO.4	**Explain**the preparation, properties, and applications of thermoplastics & thermosetting, Elastomers & conducting polymers
CO.5	**Analyze** the principles of spectroscopy and different application of analytical instruments.

UNIT-I : Structure and Bonding Models: (10 hrs)

Planck's quantum theory, dual nature of matter, Schrodinger equation, significance of Ψ and Ψ^2, applications to hydrogen, molecular orbital theory – bonding in homo- and heteronuclear diatomic molecules – energy level diagrams of O_2, NO and CO, etc., calculation of bond order.

Learning Outcomes:

At the end of this unit, the students will be able to

- apply Schrodinger wave equation to hydrogen atom.
- illustrate the molecular orbital energy level diagram of different molecular species.
- explain the calculation of bond order of O_2, NO and CO molecules.
- discussthe basic concept of molecular orbital theory

UNIT-II : Modern Engineering materials: (10 hrs)

i).Understanding of materials: Crystal field theory – salient features – splitting in octahedral, tetrahedral and square planar geometry. Properties of coordination compounds-Oxidation state, coordination, magnetic properties and colour.

ii). Semiconductor materials, super conductors- basic concept, band diagrams for conductors, semiconductors and insulators, Effect of doping on band structures.

iii). Nanochemistry: Introduction, classification of nano materials, properties and applications of Fullerenes, carbonnano tubes and Graphines nanoparticles.

Learning Outcomes:

At the end of this unit, the students will be able to

- Explain splitting in octahedral and tetrahedral geometryof complexes.
- Discuss the magnetic behavior and colour of coordination compounds.
- Explain the band theory of solids for conductors, semiconductors and insulators
- Demonstrate the application of Fullerenes, carbon Nano tubes and Graphines nanoparticles.

UNIT-III : Electrochemistry and Applications: (10 hrs)

Introduction to Electrodes – concepts, reference electrodes (Calomel electrode, Ag/AgCl electrode and glass electrode); Electrochemical cell, Nernst equation, cell potential calculations and numerical problems, Potentiometry- Potentiometry titrations (redox titrations), concept of conductivity, conductivity cell, conductometric titrations (acid-base titrations), pH metric concepts.Primary cells – Zinc-air battery, Secondary cells – Nickel-Cadmium (NiCad),and lithium ion batteries- working of the batteries including cell reactions; Fuel cells, hydrogen-oxygen, methanol fuel cells – working of the cells.

Learning Outcomes:

At the end of this unit, the students will be able to

- Apply Nernst equation for calculating electrode and cell potentials
- Differentiate between ph metry, Potentiometry and conductometric titrations
- Explain the theory of construction of battery and fuel cells
- Solve problems based on cell potential

UNIT-IV : Polymer Chemistry: (10 hrs)

Introduction to polymers, functionality of monomers, chain growth and step growth polymerization, coordination polymerization, copolymerization (stereospecific polymerization) with specific examples and mechanisms of polymer formation.

Plastics - Thermoplastics and Thermosettings, Preparation, properties and applications of – PVC, Teflon, Bakelite, Nylon-6,6.

Elastomers–Buna-S, Buna-N–preparation, properties and applications.

Conducting polymers – polyacetylenes,– mechanism of conduction and applications.

Learning Outcomes:
At the end of this unit, the students will be able to

- explain the different types of polymers and their applications
- explain the preparation, properties and applications of Bakelite, Nylon-6,6,
- describe the mechanism of conduction in conducting polymers
- discussBuna-S and Buna-N elastomers and their applications

UNIT-V : Instrumental Methods and Applications (10 hrs)
Electromagnetic spectrum. Absorption of radiation: Beer-Lambert's law. Regions of Electromagnetic radiation. UV-Visible, IR Spectroscopes'- (selection rules, principles and applications). Solid-Liquid Chromatography–TLC, retardation factor.

Learning outcomes:
After completion of Unit V, students will be able to:

- Explain the different types of spectral series in electromagnetic spectrum
- Understand the principles of different analytical instruments
- Explainthe different applications of analytical instruments

Text Books:

1. A textbook of Engineering chemistry by Shashi Chawla, Dhanpat Rai & Co publications
2. Atkins' Physical Chemistry, Peter Atkins, Julio de Paula and James Keeler, Oxford University Press, 2010.
3. Textbook of Polymer Science, Third Edition, Fred W. Billi Meyer, TR, A Wiley-Inter Science Publications
4. An Introduction to Electrochemistry, Glasstone, Arihant Publications.

Reference Books:

1. Textbook of Engineering Chemistry, Jain and Jain, DhanpatRai& Co publications, 2013
2. New Concise Inorganic Chemistry, 5th Edition, J. D. Lee, Oxford University Press, 2008.
3. Principles of Instrumental Analysis,6th edition, Douglas A. Skoog, Cengage Publications.
4. Advanced Inorganic Chemistry, Cotton F Albert, Wilkinson Geoffrey, Prism Publications

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Course Title	C PROGRAMMING & DATA STRUCTURES				B.Tech II Sem (ECE)		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
2005203	ESC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2 Hours					End Exam Duration: 3Hrs		

Course Objectives:

- The course aims to provide exposure to problem-solving through programming
- It aims to train the student to the basic concepts of the C programming language
- Gain knowledge of data structures and their applications

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Formulate simple algorithms for arithmetic and logical problems and to translate the algorithms to programs (in C Language).
CO 2	Choose the loops and decision-making statements to solve the problem
CO 3	Implement different Operations on arrays
CO 4	Use functions to solve the given problem
CO 5	Understand structures, unions and pointers
CO 6	Understand need of data structures in real time situations

UNIT I:

Introduction to C programming: - C language elements, variable declarations and data types, operators and expressions, decision statements - If and switch statements, loop control statements - while, for, do-while statements. **Jumping statements:** break, continue and goto statements

UNIT II:

Arrays: Introduction, Declaration and initialization of 1D and 2D arrays, **Functions:** Introduction, Category of functions, parameter passing methods, Storage Classes, Recursive functions. **Strings:** String I/O functions, string handling functions, array of strings

UNIT III:

Pointers: Introduction to pointers, declaring and initialization of pointer variable, accessing

the address of variables, accessing a variable through its pointer, chain of pointers. **Structures and unions:** Introduction, defining a structure, declaring structure variable, structure initialization, accessing members of structure, copying and comparing structure variables, structures within structures, array of structures, and introduction of union.

UNIT IV:

Data Structures: Overview on data structures, stack,basic operations on stack, Applications of stacks; Queues -various classification of queues,basic operations on queues.**Searching and sorting:** linear search, binary search, bubble sort, selection sort, insertion sort.

UNIT V:

Linked Lists – Single linked list, Operations on Single Linked List: insertion, deletion and searching operations, doubly linked lists and its operations, circular linked lists and its operations. **Trees** - Tree terminology, representation, Binary trees, representation, binary tree traversals. Binary tree operations.

TEXT BOOKS

1. E. Balagurusamy, C Programming and Data structures,Fourth Edition, McGrawHill.
2. Rema Theraja, Programming in C, second edition,Oxford.
3. Fundamentals of Data Structures in C, Ellis Horowitz, SartajSahni, Susan Anderson-Freed, Computer Science Press.
4. Programming in C and Data Structures, J.R.Hanly, Ashok N. Kamthane and A.AnandaRao, Pearson Education

REFERENCE TEXT BOOKS

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, PrenticeHall of India
2. R.G. Dromey, How to solve it by Computer,Pearson.
3. YashavantKanetkar, Let us C, 15th edition, BPBPublications.
4. Dr. P. ChennaReddy, Computer Fundamentals and C Programming, SecondEdition.

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Course Title	ELECTRONIC DEVICES AND CIRCUITS				B. Tech. ECE II Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
2004204	ESC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2Hrs					End Exam Duration: 3Hrs		

Course Objectives:

- To understand the basic principles of all semiconductor devices.
- To be able to solve problems related to diode circuits, and amplifier circuits.
- To analyze diode circuits, various biasing and small signal equivalent circuits of amplifiers.
- To be able to compare the performance of BJTs and MOSFETs
- To design rectifier circuits and various amplifier circuits using BJTs and MOSFETs.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand principle of operation, characteristics and applications of Semiconductor diodes, Bipolar Junction Transistor and MOSFETs.
CO 2	Applying the basic principles solving the problems related to Semiconductor diodes, BJTs, and MOSFETs.
CO 3	Analyze diode circuits for different applications such as rectifiers, clippers and clampers also analyze biasing circuits of BJTs, and MOSFETs.
CO 4	Design of diode circuits and amplifiers using BJTs, and MOSFETs.
CO 5	Compare the performance of various semiconductor devices.

UNIT-I

Review of Semiconductors: Intrinsic semiconductors, Doped Semiconductors, Current Flow in Semiconductors, PN Junction with Open Circuit, PN Junction with Applied Voltage, Capacitive Effects in PN Junction.

Diodes: Introduction, The Ideal Diode – current voltage characteristic, rectifier, diode logic gates, Terminal Characteristics of Junction Diodes– forward bias, reverse bias, and breakdown regions, Modeling the Diode Forward Characteristics- exponential model, graphical analysis and Iterative analysis using the exponential model, constant voltage drop model, the small signal model.

UNIT-II

Zener Diodes– Zener diode Characteristics, Voltage shunt regulator, Temperature Effects, Rectifier Circuits– half-wave, full-wave and bridge rectifier circuits, rectifier with a filter capacitor, C-L-C filter, Clipping and Clamping Circuits– limiter circuit, the clamped capacitor, voltage doubler, Special Diode Types– UJT, Schottky barrier diode, Varactor diode, photo diode,light emitting diode(LED), Problem Solving.

Bipolar Junction Transistors(BJTs): Physical Operation - simplified structure and modes of operation, Operation of the npn, and pnp transistors: cutoff, active, and saturation modes, V-I Characteristics- of different configurations - graphical representation of transistor characteristics, dependence of collector current on collector voltage, the Early Effect.

UNIT-III

BJT circuits at DC, Applying the BJT in Amplifier Design- Voltage Amplifier, Voltage Transfer Characteristic (VTC), Small-Signal Voltage Gain, determining the VTC by Graphical Analysis, Q-point, Small-signal operation and models- the transconductance, input resistance at the base, input resistance at the emitter, Voltage gain, separating the Signal and the DC Quantities, The Hybrid-π Model, the T Model, Basic BJT Amplifier Configurations - Common-Emitter (CE) amplifier without and with emitter resistance, Common-Base (CB) amplifier, Common-Collector (CC) amplifier or Emitter Follower, Biasing in BJT Amplifier Circuits- Fixed bias, Self bias, voltage divider bias circuits, biasing using a Constant-Current Source, CE amplifier – Small signal analysis and design, Transistor breakdown and Temperature Effects, Problem solving.

UNIT-IV

MOS Field-Effect Transistors (MOSFETs): Introduction, Device Structure and Physical Operation – device structure, operation with zero gate voltage, creating a channel for current flow, operation for different drain to source voltages, the P-channel MOSFET,CMOS, V-Icharacteristics–i_D - v_{DS} characteristics, i_D – v_{GS} characteristics, finite output resistance in saturation, characteristics of the p-Channel MOSFET, MOSFET Circuits at DC, Applying the MOSFET in Amplifier Design – voltage transfer characteristics, biasing the MOSFET to obtain linear amplification, the small signal voltage gain, graphical analysis, the Q-point. Problem solving.

UNIT-V

MOSFET Small Signal Operation Models– the dc bias, separating the DC analysis and the signalanalysis, Small signal equivalent circuit models, the transconductance, the T equivalent circuit model, Basic MOSFET Amplifier Configurations– three basic configurations, characterizing amplifiers, common source(CS) amplifier without and with source resistance, common gate (CG) amplifier, source follower, the amplifier frequency response, Biasing in MOSFET Amplifier Circuits– biasing by fixing V_{GS} with and without source resistance, biasing using drain to gate feedback resistor, biasing using constant current source, Common Source Amplifier using MOSFETs – Small signal analysis and design, Body Effect, Problem Solving.

Text Books:

1. Adel S. Sedra and KennethC. Smith, "Microelectronic Circuits – Theory and Applications", 6th Edition, Oxford Press, 2013.
2. Donald A Neamen, "Electronic Circuits – analysis and design", 3rdEdition, McGraw Hill(India), 2019.
3. J. Milliman and C Halkias, "Integrated electronics", 2nd Edition, Tata McGraw Hill, 1991.
4. Behzad Razavi, "Microelectronics", Second edition, Wiley, 2013.

References:

1. R.L. Boylestad and Louis Nashelsky, "Electronic Devices and Circuits," 9th Edition, Pearson, 2006.
2. Jimmie J Cathey, "Electronic Devices and Circuits," Schaum"s outlines series, 3rd edition, McGraw-Hill (India), 2010.
3. Anil K. Maini, Varsha Agrawal, "Electronic Devices and Circuits", John Wiely, 2nd edition.
4. David A. Bell, "Electronic Devices and Circuits", Oxford; Fifth edition.

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PRINCIPAL
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Course Title	ENGINEERING WORKSHOP				B.Tech. II sem		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**	
20EW205	**LC**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
		0	0	3	1.5	40	60	100
Mid Exam Duration: 2Hrs					**End Exam Duration: 3Hrs**		

Course Objectives: To familiarize students with

- sheet metal operations,
- fitting ,
- electrical house wiring skills
- wood working,

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Apply wood working skills in real world applications
CO 2	Build different objects with metal sheets in real world applications
CO 3	Apply fitting operations in various applications.
CO 4	Apply different types of basic electric circuit connections
CO5	Use soldering and brazing techniques

Wood Working:

Familiarity with different types of woods and tools used in wood working and make followingjoints

Half – Lapjoint

Mortise and

Tenonjoint

Corner Dovetail joint or Bridlejoint

Sheet Metal Working:

Familiarity with different types of tools used in sheet metal working, Developments of followingsheet metal job from GI sheets

a) Taperedtray
b) Conicalfunnel
c) Elbowpipe
d) Brazing

Fitting:

Familiarity with different types of tools used in fitting and do the following fitting exercises

a) V-fit b)Dovetail fit c) Semi-circular fit d) square fitting

Electrical Wiring:

Familiarities with different types of basic electrical circuits and make the following connections

a) Parallelandseries b) Twowayswitch c)Godownlighting d) Tubelight

e) Threephasemotor f) Soldering ofwires

Note: In each section a minimum of three exercises are to be carried out.

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Course Title	IT WORKSHOP				B.Tech II Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
2005206	LC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		0	0	3	1.5	40	60	100
					End Exam Duration: 3Hrs		

Course Objectives:

- To make the students know about the internal parts of a computer, assembling and dissembling a computer from the parts, preparing a computer for use by installing the operating system.
- To provide Technical training to the students on Productivity tools like Word processors, Spreadsheets, Presentations and LAteX.
- To learn about Networking of computers and use Internet facility for Browsing and Searching.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Disassemble and Assemble a Personal Computer and prepare the computer ready to use.
CO 2	Prepare the Documents using Word processors and Prepare spread sheets for calculations .using excel and also the documents using LAteX.
CO 3	Prepare Slide presentations using the presentation tool.
CO 4	Interconnect two or more computers for information sharing.
CO 5	Access the Internet and Browse it to obtain the required information.

Preparing your Computer

Task 1:

Learn about Computer: Identify the internal parts of a computer, and its peripherals. Representthe same in the form of diagrams including Block diagram of a computer. Write specifications for each part of a computer including peripherals and specification of Desktop computer. Submit it in the form of a report.

Task 2:

Assembling a Computer: Disassemble and assemble the PC back to working condition. Students should be able to trouble shoot the computer and identify working and non-working parts. Student should identify the problem correctly by various methods.

Task 3:

Install Operating system: Student should install Linux on the computer. Student may install another operating system (including proprietary software) and make the system dual boot or multi boot. Students should record the entire installation process.

Task 4:
Operating system features: Students should record the various features that are supported by the operating system(s) installed. They have to submit a report on it. Students should be able to access CD/DVD drives, write CD/DVDs, access pen drives, print files, etc. Students should install new application software and record the installation process.

Networking and InternetTask 5:
Networking: Students should connect two computers directly using a cable or wireless connectivity and share information. Students should connect two or more computers using switch/hub and share information. Crimpling activity, logical configuration etc. should be done by the student. The entire process has to be documented.

Task 6:
Browsing Internet: Student should access the Internet for Browsing. Students should search the Internet for required information. Students should be able to create e-mail account and send email.
They should get acquaintance with applications like Facebook, skype etc. If Intranet mailing facility is available in the organization, then students should share the information using it. If the operating system supports sending messages to multiple users (LINUX supports it) in the same network, then it should be done by the student. Students are expected to submit the information about different browsers available, their features, and search process using different natural languages, and creating email account.
Task 7:
Antivirus: Students should download freely available Antivirus software, install it and use it to check for threats to the computer being used. Students should submit information about the features of the antivirus used, installation process, about virus definitions, virus engine etc.
Task8
Productivity tools
Word Processor: Students should be able to create documents using the word processor tool. Some of the tasks that are to be performed are inserting and deleting the characters, words and lines, Alignment of the lines, Inserting header and Footer, changing the font, changing the colour, including images and tables in the word file, making page setup, copy and paste block of text, images, tables, linking the images which are present in other directory, formatting paragraphs, spell checking, etc. Students should be able to prepare project cover pages, content sheet and chapter pages at the end of the task using the features studied. Students should submit auser manual of the word processor considered,
Image Manipulation tools.

Task 9:
Presentations: creating, opening, saving and running the presentations, selecting the style for slides, formatting the slides with different fonts, colours, creating charts and tables, inserting and deleting text, graphics and animations, bulleting and numbering, hyper linking, running the slide show, setting the timing for slide show.

Task 10:

Spreadsheet: Students should be able to create, open, save the application documents and format them as per the requirement. Some of the tasks that may be practiced are Managing the worksheet environment, creating cell data, inserting and deleting cell data, format cells, adjust the cell size, applying formulas and functions, preparing charts, sorting cells. Students should submit a user manual of the Spreadsheet.

Task 11:

LateX: Introduction to Latex and its installation and different IDEs. Creating first document using Latex, using content into sections using article and book class of LaTeX. Styling Pages: reviewing and customizing different paper sizes and formats. Formatting text (styles, size, alignment, colors and adding bullets and numbered items, inserting mathematical symbols, and images, etc.). Creating basic tables, adding simple and dashed borders, merging rows and columns. Referencing and Indexing: cross-referencing (refer to sections, table, images), bibliography (references).

References:

1. Introduction to Computers, Peter Norton, McGraw Hill
2. MOS study guide for word, Excel, PowerPoint & Outlook Exams, Joan Lambert, Joyce Cox,PHI.
3. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education.
4. Networking your computers and devices, Rusen, PHI
5. Trouble shooting, Maintaining & Repairing PCs, Bigelows, TMH
6. Lamport L. LATEX: a document preparation system: user's guide and reference manual.Addison-wesley; 1994.

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Course Title	CHEMISTRY LAB				B. Tech. (II Sem)		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
2023207	BSC	L	T	P	C	Continuous Internal Assessment	End lab Exams	Total
		0	0	3	1.5	40	60	100
						End Exam Duration: 3Hrs		

Course Objectives:

- To verify the fundamental concepts with experiments.

Course Outcomes: At the end of the course, the students will be able to

CO 1	**Determine** the cell constant and conductance of solutions.
CO 2	**Synthesis** of advanced polymer Bakelite.
CO 3	**Calculate** the strength of an acid present in secondary batteries.
CO 4	**Illustrate** the IR of some organic compounds
CO 5	**Explain** acid-base titrations using pH metry.

List of Experiments:

1. Conductometric titration of strong acid vs. strong base.
2. Conductometric titration of weak acid vs.
strong base3.pH metric titration of strong acid
vs. strong base.
4. pH metric titration of weak acid vs. strong base
5. Determination of cell constant and conductance of solutions
6. Potentiometry - determination of redox potentials and emfs
7. Determination of Strength of an acid in Pb-Acid battery
8. Preparation of Bakelite.
9. Verify Lambert-Beer"s law
10. Thin layer chromatography
11. Identification of simple organic compounds by IR.
12. Preparation of nanomaterials by precipitation
13. Estimation of Ferrous Iron by Dichrometry.

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Course Title	C Programming & Data Structures Lab				B.Tech II Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
2005208	ESC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		0	0	3	1.5	40	60	100
					End Exam Duration: 3Hrs		

Course Objectives:

- know how to write and debug programs
- know the principles of designing structured programs
- Write basic C programs using, Selection statements, Repetitive statements,
- Functions, Pointers, Arrays, Strings and structures
- To apply suitable data structure to solve real world problems

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Formulate the algorithms for simple problems.
CO 2	Translate given algorithms to a working and correct program
CO 3	Correct syntax errors as reported by the compilers
CO 4	Identify and correct logical errors encountered at runtime
CO 5	Write iterative as well as recursive programs
CO 6	Represent data in arrays, strings and structures and manipulate them through a program
C O7	Write programs on data structures like stack, queue, liked list, trees etc

1. Ramesh. s basic salary is input through the keyboard. His dearness allowance is 40% of basic salary and house rent allowance is 20% of basic salary. Write a C program to calculate his grosssalary.
2. Write a program to take input of name, roll no and marks obtained by a student in 5 subjects each have its 100 full marks and display the name, roll no with percentage score secured.
3. a) Write a C program to find out whether a given number is even number oroddnumber.b) Write a C program to check whether a given year is leap year ornot.
4. Design and develop an algorithm that takes three coefficients (***a***, ***b***, and ***c***) of a

Quadratic equation ($ax^2+bx+c=0$) as input and compute all possible roots. Implement a C program for the developed algorithm and execute the same to output the possible roots for a given set of coefficients with appropriatemessages.

5. If the ages of the Ramesh, Suresh and Mahesh are input through the keyboard, writea C program to determine youngest of the three.
6. A character is entered through keyboard. Write a C program to determine whetherthe character entered is a capital letter, a small case letter, a digit or a special symbol using if-else and switch case. The following table shows the range of ASCII values for various characters.

Characters	ASCIIvalues
A–Z	65 – 90
a– z	97 – 122
0 – 9	48 – 57
Specialsymbols	0 – 47, 58 – 64, 91 – 96, 123 – 127.

7. Write a C program which takes two integer operands and one operator from the user, performs the operation and then prints the result. (Consider the operators +, -, *, /, % and use switchstatement).

8. Design and develop an algorithm to find whether a given number is Armstrongnumber or not. Implement a C program for the developedalgorithm.
9. Design and develop an algorithm to check whether a given number is palindrome ornot. Implement a C program for thesame.
10. Write a C program to generate all the prime numbers between 1 and n, where n is a value supplied by theuser.
11. Write a C program to generate the first N terms of Fibonacci sequence.
12. Write a C program to find the smallest and largest number in a givenarray.
13. Write a C program to find the frequency of a particular number in a list ofintegers.
14. Write a C program to sort the list of elementsusing
    a) BubbleSort b) Selectionsort.
15. Write a C program to search for an element in a list of elementsusing
    a) Linear search b) Binary search
16. Write a C program to read two matrices and perform the following operations
    a) Addition of two matrices
    b) Multiplication of two matrices

17. **Partitioning an array**

    Given a randomly ordered array of n elements, write a C program to partition the elements into two subsets such that elements $\leq X$ are in one subset and elements $\geq X$

are in another subset.

18. Write a C program to rearrange the elements in an array so that they appear in reverse order.
19. If a string and its reversed string are same then the string is called as palindrome string. Design and develop an algorithm to check whether a given string is a palindrome or not and implement a C program for the same.
20. Write a C program to read two strings and perform the following operationswithout using built string library functions.
    i) String length ii) String reversing
    iii) Comparison of two strings iv) Concatenation of two strings

21. Write a C program to count the number of vowels, consonants, digits, blank spacesand special characters in a given string.
22. Write a C program to swap the contents of two variables using
    a) Call byvalue
    b) Call byreference.
23. Write a C program using recursionto
    a) Find the factorial of a givennumber
    b) Print the Fibonacci series up to a given number.
    c) Find the GCD of twointegers.

24. Write a C program to define a structure with the followingmembers.
    Roll No., Name, marks in Sub1, Sub2, Sub3. Read the n students records and findthe total marks of each student and print the result in the following format.

Roll No	Name	Sub1	Sub2	Sub3	Total marks	result
189Y1A0501	Kavya	80	70	75	225	Distinction

25. Write C programs that implement stack (its operations) using
    i) Arrays
    ii) Pointers
26. Write C programs that implement Queue (its operations) using
    i) Arrays
    ii) Pointers
27. Write a C program that uses Stack operations to perform the following:
    i) Converting infix expression into postfix expression
    ii) Evaluating the postfix expression

28. Write a C program that uses functions to perform the following operations on singlelinked list.

i) Creation ii) Insertion iii) Deletion iv) Traversal

29. Write a C program that uses functions to perform the following operations on Doublelinked list.

i) Creation ii) Insertion iii) Deletion iv) Traversal

30. Write a C program that uses functions to perform the following:

Creating a Binary Tree of integers

i) Traversing the above binary tree in preorder, inorder and postorder.

TEXT BOOKS

1. Programming in C and Data Structures, J.R.Hanly, Ashok N. Kamthane and A. AnandaRao, Pearson Education.
2. B.A.Forouzon and R.F. Gilberg, "COMPUTER SCIENCE: A Structured ProgrammingApproach Using C", Third edition, CENGAGE Learning, 2016.
3. Richard F. Gilberg& Behrouz A. Forouzan, "Data Structures: A Pseudocode Approachwith C", Second Edition, CENGAGE Learning, 2011
4. E. Balagurusamy, Programming in ANSI C, Fifth Edition, McGrawHill.

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Course Title	ELECTRONIC DEVICES AND CIRCUITS LAB				B. Tech. ECE IISem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
2004209	ESC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		0	0	3	1.5	40	60	100
						End Exam Duration: 3Hrs		

Course Objectives:

- To verify the theoretical concepts practically from all the experiments.
- To analyze the characteristics of Diodes, BJT, MOSFET, UJT.
- To design the amplifier circuits from the given specifications.
- To Model the electronic circuits using tools such as PSPICE/Multisim

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand the basic characteristics and applications of basic electronic devices.
CO 2	Observe the characteristics of electronic devices by plotting graphs.
CO 3	Analyze the Characteristics of UJT, BJT, MOSFET
CO 4	Design MOSFET / BJT based amplifiers for the given specifications.
CO 5	Simulate all circuits in PSPICE /Multisim.

LIST OF EXPERIMENTS: (Execute any 12 experiments).

Note: All the experiments shall be implemented using both Hardware and Software.

1. Verification of Volt- Ampere characteristics of a PN junction diode and find static, dynamic and reverse resistances of the diode from the graphs obtained.
2. Design a full wave rectifier for the given specifications with and without filters, and verify the given specifications experimentally. Vary the load and find ripple factor. Draw suitable graphs.
3. Verify various clipping and clamper circuits using PN junction diode and draw the suitable graphs.
4. Design a Zener diode-based ***voltage regulator*** against variations of supply and load. Verify the same from the experiment.
5. Study and draw the ***output*** and ***transfer*** characteristics of MOSFET (Enhance mode) in Common Source Configuration experimentally. Find ***Threshold voltage (V_T), g_m, & K*** from the graphs.
6. Study and draw the ***output*** and ***transfer*** characteristics of MOSFET (Depletion mode) or JFET in Common Source Configuration experimentally. Find ***I_{DSS}, g_m, & V_P*** from the graphs.
7. Verification of the input and output characteristics of BJT in **Common Emitter** configuration experimentally and find required ***h – parameters*** from the graphs.
8. Study and draw the input and output characteristics of BJT in **Common Base** configuration experimentally, and determine required ***h – parameters*** from the graphs.

9. Study and draw the Volt Ampere characteristics of UJT and determine η, I_P, I_v, V_P,&Vv from the experiment.
10. Design and analysis of voltage- divider bias/self-bias circuit using BJT.
11. Design and analysis of voltage- divider bias/self-bias circuit using JFET.
12. Design and analysis of self-bias circuit using MOSFET.
13. Design a suitable circuit for switch using CMOSFET/JFET/BJT.
14. Design a small signal amplifier using MOSFET (common source) for the givenspecifications. Draw the frequency response and find the bandwidth.
15. Design a small signal amplifier using BJT(common emitter) for the givenspecifications. Draw the frequency response and find the bandwidth.

Tools / Equipment Required: Software Toollike Multisim/ Pspice or Equivalent, DC Power supplies, Multi meters, DC Ammeters, DC Voltmeters, AC Voltmeters, CROs, allthe required active devices.

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Course Title	ENVIRONMENTAL SCIENCE				B. Tech. II Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
20MC210	MC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	0	30	0	30
Mid Exam Duration: 2Hrs								

Course Objectives:

- To make the students to get awareness on environment.
- To understand the importance of protecting natural resources, ecosystems for future generations and pollution causes due to the day to day activities of human life.
- To save earth from the inventions by the engineers.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	**Explain** multidisciplinary nature of environmental studies and various Renewable and Nonrenewable resources.
CO 2	**Understand** Energy flow, bio-geo chemical cycles and ecological pyramids
CO 3	**Illustrate** various causes of pollution and related preventive measures.
CO 4	**Summarize** Solid waste management, Social issues related to environment and their protection acts.
CO 5	**Evaluate** Causes of population explosion, value education and welfare programmes.

UNIT – I

Multidisciplinary Nature Of Environmental Studies: –Scope and Importance – Need for Public Awareness.
Natural Resources: Renewable and non-renewable resources – Natural resources and associatedproblems
Forest resources: deforestation, case studies – Mining, dams and other effects on forest and tribal people
Water resources: Use and over utilization of surface and ground water conflicts over water. **Food resources:** World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
Energy resources: Renewable &Non-Renewable.

UNIT – II

Ecosystems: Concept of an ecosystem. – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Food chains, food web-

Ecological succession and ecological pyramids – Introduction, types, characteristic features,structure and function of the following ecosystem:

a Forest ecosystem.
b Desert ecosystem
c Aquatic ecosystems (lakes, rivers and oceans)

Biodiversity And Its Conservation : Introduction, Definition: genetic, species and ecosystem diversity – Bio-geographical classification of India – Value of biodiversity: consumptive use, Productive use, social, ethical, aesthetic and option values – Biodiversity at global levels – India as a mega-diversity nation – Hot-spots of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT – III

Environmental Pollution: Definition, Cause, effects and control measures of:

a. Air Pollution.
b. Water pollution
c. Soil pollution
d. Marine pollution
e. Noise pollution
f. Thermal pollution
g. Nuclear hazards

Solid Waste Management: Causes, effects and control measures of urban and industrial wastes
– Role of an individual in prevention of pollution – Pollution case studies – Disaster management: floods, earthquake, cyclone and landslides.

UNIT – IV

Social Issues And The Environment: From Unsustainable to Sustainable development – Urban problems related to energy – Water conservation, rain water harvesting, its problems and concerns. Case studies – Environmental ethics: Issues and possible solutions – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents.
Environment Protection Act. – Air (Prevention and Control of Pollution) Act. – Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act.

UNIT – V

Human Population And The Environment: Population growth, variation among nations. Population explosion – Family Welfare Programmes. – Environment and human health – Human Rights – Value Education – HIV/AIDS – Women and Child Welfare – Role of information Technology in Environment and human health.

Field Work: Visit to a local area to document environmental assets River/forest grassland/hill/mountain – Visit to a local polluted site-Urban/Rural/Industrial/Agricultural Study of common plants, insects, and birds – river, hill slopes, etc.

TEXT BOOKS:

1. Text book of Environmental Studies for Undergraduate Courses Erach Bharucha forUniversity Grants Commission, Universities Press.
2. Palaniswamy, "Environmental Studies", Pearson education
3. S.Azeem Unnisa, "Environmental Studies" Academic Publishing Company
4. K.Raghavan Nambiar, "Text book of Environmental Studies for Undergraduate Coursesas per UGC model syllabus", Scitech Publications (India), Pvt. Ltd.

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Structure and Syllabus for Minor degree

S. No.	Subject code	Subject	L	T	P	IM	EM	Credits
1	1892401	Scientific Computing using MATLAB	3	0	0	30	70	3
2	1891402	Digital Circuits	3	0	0	30	70	3
3	1891403	Signals and systems	3	0	0	30	70	3
4	1891404	Probability Theory and Stochastic Processes	3	0	0	30	70	3
5	1891405	Network theory	3	0	0	30	70	3
6	1891406	Microprocessors & Microcontrollers	3	0	0	30	70	2
7	1891407	Principles of communication systems	3	0	0	30	70	3
8	1891408	Analog and digital IC applications	3	0	0	30	70	3
9	1891409	Industrial electronics	3	0	0	30	70	3
10	1891410	Digital signal processing.	3	0	0	30	70	3
11	1891411	Embedded system design	3	0	0	30	70	3
12	1891412	Electronic Instrumentation and measurements	3	0	0	30	70	3
13	1891413	VLSI Design	3	0	0	30	70	3
14	1891414	Digital Image Processing	3	0	0	30	70	3
15	1891415	Biomedical Instrumentation	3	0	0	30	70	3
16	1891416	Mini Project	0	0	6	100	0	2

Minor Degree subjects

Course Title	Scientific Computing using MATLAB				Minor degree		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
1892401	EC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	-	--	3	30	70	100
Mid Exam Duration: 2Hrs					End Exam Duration: 3Hrs		

Course Objectives:

- To understand various command in MATLAB and to Solve algebraic equations using MATLAB.
- To Write the programs for curve fitting, roots of equations, Numerical Differentiation and integration.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand various commands in MATLAB
CO 2	Solve algebraic equations using MATLAB
CO 3	Write the programs for curve fitting and roots of equations.
CO 4	Write the programs for Numerical Differentiation and integration.
CO 5	Solve optimization and Eigen value problems.

Unit- I

Introduction to MATLAB: Introduction to MATLAB, Data Types and Variables, Arrays, Cells, Strings, Operators, Flow Control, Loops, Functions, Input/output, Array Manipulation, Plotting.

Systems of Linear Algebraic Equations: Introduction, Gauss Elimination Method, LU Decomposition Methods, Symmetric and Banded Coefficient Matrices, Pivoting, Matrix Inversion, Iterative Methods-Gauss–Seidel Method, Conjugate Gradient Method.

Unit -II

Interpolation and Curve Fitting: Introduction, Polynomial Interpolation-Lagrange's Method, Newton's Method, Neville's Method, Limitations of Polynomial Interpolation, Interpolation with Cubic Spline, Least-Squares Fit.

Roots of Equations: Introduction, Incremental Search Method, Method of Bisection, Brent's Method, Newton–Raphson Method, Systems of Equations, Zeros of Polynomials.

Unit- III

Numerical Differentiation: Introduction, Finite Difference Approximations, Richardson Extrapolation, Derivatives by Interpolation.

Numerical Integration: Introduction, Newton–Cotes Formulas, Romberg Integration, Gaussian Integration, Multiple Integrals.

Unit -IV

Initial Value Problems: Introduction, Taylor Series Method, Runge–Kutta Methods, Stability and Stiffness, Adaptive Runge–Kutta Method, Bulirsch–Stoer Method.

Two-Point Boundary Value Problems: Introduction, Shooting Method, Finite Difference Method.

Unit -V

Symmetric Matrix Eigenvalue Problems: Introduction, Jacobi Method, Inverse Power and Power Methods, Householder Reduction to Tridiagonal Form, Eigenvalues of Symmetric Tridiagonal Matrices.

Introduction to Optimization: Introduction, Minimization Along a Line, Conjugate Gradient Methods.

Text Books:

1. Jaan Kiusalaas, "NUMERICAL METHODS IN ENGINEERING WITH MATLAB", Cambridge University press, 2005.
2. Stephen J. Chapman, "MATLAB Programming for Engineers", Thomson learning, 4th edition.

Reference Books:

1. Ian Gladwell, Warren Ferguson Jr., James G. Nagy, "Introduction to Scientific Computing Using MATLAB", Lulu Publishing, 2011.
2. Alfio Quarteroni, Fausto Saleri, Paola Gervasio, "Scientific Computing with MATLAB and Octave", Springer International Publishing, 4 th edition, 2014.

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Course Title	Digital Circuits					Minor Degree		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
1891402	EC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	-	--	3	30	70	100
Mid Exam Duration: 2Hrs						End Exam Duration: 3Hrs		

Course Objectives:

- To provide fundamentals of number systems and Boolean Algebra.
- To learn the design of combinational and sequential circuits.
- To teach various memories and PLDs.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand various number systems and binary codes.
CO 2	Understand the postulates, theorems and properties of Boolean algebra.
CO 3	Describe the correlation between the Boolean expression and their corresponding logic diagram.
CO 4	Analyze Combinational & sequential logic circuits.
CO 5	Solve Switching functions using Programmable Logic Devices.

UNIT-I

Number Systems & Codes: Overview of number systems –complement representation of negative numbers- binary arithmetic, binary codes, code conversion, error detecting & error correcting codes – Hamming codes.

UNIT-II

Boolean Algebra and Minimization of Switching Functions: Fundamental postulates of Boolean Algebra - Basic theorems and properties –Canonical and Standard forms- Minimal SOP and POS forms ,Algebraic simplification, digital logic gates –universal gates-Multilevel NAND/NOR realizations. The K- map method, tabulation method.

UNIT-III

Combinational Logic Design: Design using conventional logic gates, Half and Full Adders, Sub tractors, Serial and Parallel Adders, Encoder, Decoder, Multiplexer, De-Multiplexer, Realization of switching functions using multiplexer, Parity bit generator, Code-converters, Hazards and hazard free realizations.

UNIT-IV

Sequential Logic Design: Synchronous and Asynchronous sequential circuits, Flip-flops- Triggering and excitation tables, Flip flop conversions, shift registers, Design of Synchronous and Asynchronous counters, Ring and Johnson counters. Finite state machines (Mealy Model, Moore Model) and their representation, Designing synchronous Sequential circuits like Serial Binary adder, Sequence detector.

UNIT-V

Semiconductor Memories and Programmable Logic Devices: ROM- Internal structure, Static RAM and Dynamic RAM. Basic PLD"s-ROM, PROM, PLA, and PAL, Realization of Switching functions using basic PLD"s. Concept of PLD"s like CPLDs and FPGAs.

Text Books:

1. ZVI Kohavi, Switching & Finite Automata theory –, TMH, 2nd Edition.
2. Morris Mano, "Digital Design", PHI, 3rd Edition, 2006.
3. A. Anand Kumar, "Switching Theory & Logic Design", 2008, PHI

Reference Books:

1. R.P. Jain, "Modern digital Electronics", Tata McGraw Hill, 4th edition, 2009.
2. W.H. Gothmann, "Digital Electronics- An introduction to theory and practice", PHI, 2nd edition, 2006.
3. D.V. Hall, "Digital Circuits and Systems", Tata McGraw Hill, 1989
4. William I. Fletcher, "An Engineering Approach to Digital Design", PHI.
5. Charles H. Roth, "Fundamentals of Logic Design", Thomson Publications, 5th Edition, 2004.
6. John M. Yarbrough, "Digital Logic Applications and Design", Thomson Publications,

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Course Title	Signals and systems				Minor Degree		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
1891403	EC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	-	--	3	30	70	100
Mid Exam Duration: 2Hrs					End Exam Duration: 3Hrs		

Course Objectives:

- To introduce terminology of signals and systems.
- To present Fourier tools through the analogy between vectors and signals.
- To teach concept of sampling and reconstruction of signals.
- To present linear systems in time and frequency domains.
- To teach Laplace and z-transform as mathematical tool to analyze continuous and discrete-time signals and systems.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand the various signals and operations on signals.
CO 2	Describe the spectral characteristics of signals
CO 3	Illustrate signal sampling and its reconstruction
CO 4	Apply convolution and correlation in signal processing.
CO 5	Analyze continuous and discrete time systems.

UNIT-I

Introduction: Definition and Classification of Signals, Elementary signals, Basic operations on signals.

Fourier series representation of periodic signals: Analogy between vectors and signals, orthogonal signal space, Signal approximation using orthogonal functions, Mean square error, closed or complete set of orthogonal functions, Orthogonality in complex functions. Representation of function by a set of mutually orthogonal functions, Dirichlet"s conditions, Trigonometric Fourier series and Exponential Fourier series, Spectrum and its significance, Amplitude and Phase spectra, bandwidth of a signal.

UNIT-II

Fourier transforms: Fourier transform, Fourier transform of standard signals, properties of Fourier transforms, Fourier transforms involving impulse function, Fourier transform of periodic signals.

UNIT-III

Discrete Time Signals: Sampling of continuous time signals, Sampling theorem, Reconstruction of signal from its samples, effect of under sampling – Aliasing. Elementary sequences- Unit impulse, step, ramp, and exponential sequences, Periodicity of Discrete-time signals, Operations on Discrete-time signals.

Signal transmission through LTI systems: Systems, Classification of Systems, Linear time invariant (LTI) system, Transmission of signals through LTI systems, Transfer function of a LTI system, Causality & Stability. Distortion less transmission through LTI system, Bandwidth of systems, relation between bandwidth and rise time.

UNIT-IV

Discrete Time Systems: Definition, classification, Linear Shift Invariant(LSI) system, Stability, Causality, Linear constant coefficient difference equation, Impulse response, Discrete time Fourier transform, Properties, Transfer function, System analysis using DTFT.

Convolution and correlation: Graphical method of convolution, auto correlation and Cross correlation of functions, properties of correlation function, Energy density spectrum, Power density spectrum, Relation between convolution and correlation, Applications of convolution and correlation.

UNIT-V

Laplace Transform: Definition , ROC , Properties , Inverse Laplace transform , The S-plane and BIBO stability , Transfer functions , System response to standard signals.

Z–Transforms: Definition, ROC and its properties, analysis of LTI system using Z-transform, The Inverse Z-transform using, Z-transform properties, Unilateral Z- Transform, solution of linear constant coefficient difference equations using Z-transforms.

Text Books:

1. Simon Haykin, Van Veen, and Wiley, "Signals & Systems", 2nd Edition, 2003.
2. Oppenheim AV and Willisky, "Signals and Systems", 2nd Edition, Pearson Ed, 1997.
3. B.P. Lathi, "Principles of Linear systems and signals," Oxford Univ. Press, Second Edition International version, 2009.

Reference Books:

1. Simon Haykin, "Communication Systems", 2nd Edition, Wiley-Eastern, 2003.
2. Luis F. Chaparro, "Signals and Systems using MATLAB," Academic Press, 2011.
3. P. Ramesh Babu, R. Ananda Natarajan, "Signals and Systems", 2nd edition, SciTech Publications, 2006.
4. John G. Proakis, Dimitris G. Manolakis, Digital Signal Processing, Principles, Algorithms, and Applications, 4 th Edition, PHI, 2007.

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Course Title	Probability Theory and Stochastic Processes				Minor Degree		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
1891404	EC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	-	--	3	30	70	100
Mid Exam Duration: 2Hrs					End Exam Duration: 3Hrs			

Course Objectives:

- The Objective of this course is to provide the students with knowledge about the random variable, random process.
- To model the random processes in the communication system such as receiver performance, interference, thermal noise, and multipath phenomenon.
- The Objective of this course is to provide the students with knowledge about the random variable, random process.
- To model the random processes in the communication system such as receiver performance, interference, thermal noise, and multipath phenomenon.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand probability by modeling sample spaces.
CO 2	Apply various random processes like Gaussian, Exponential, Uniform and Poisson processes experimentally.
CO 3	Compute PSD of Random process.
CO 4	Solve complex engineering problems involving random processes

UNIT-I

Probability: Probability definition, Event, Sample space, Axioms, Joint and conditional probability, Independent events, Total probability theorem, Baye's theorem, Bernoulli trials.

Random Variable: Concept, Distribution function, Density function, Conditional distribution and density functions.

UNIT –II

Operations on Single random variables: Expectation, Conditional expected value, Moments, Chebyshev, Markov"s and Chernoff"s inequalities, Characteristics and moment generating functions, Transformation of continuous and discrete random variable.

UNIT-III

Multiple Random Variables: Vector random variables, Joint distribution & Density functions , Conditional density & Distribution functions, Statistical independence, pdf and cdf for sum of random variables, Central limit theorem, Operations on multiple random variables, Expected value of function of random variables, Joint characteristic function, Joint by Gaussian random variables, Transformations of multiple random variables.

UNIT – IV

Random Processes : Concept, Stationarity, Independence, Time averages, Ergodicity, Correlation functions and its properties, Gaussian, Poisson, and Markov processes, Power spectral density and its properties, Relation between power spectral density and auto- correlation, Cross power spectral density and its properties, Power spectrum for discrete time processes and sequences, Definition of white and colored noise.

UNIT-V

Linear Systems with Random Inputs: Random signal response of linear system, System evaluation using random noise, Spectral characteristics of system response, Noise bandwidth, Band pass, Band limited, and Narrow band processes, Properties of band limited processes.

Text Books:

1. P.Z. Peebles Jr., "Probability Random Variables and Random Signal Principles", Tata McGraw-Hill, 4th Edition, 2001.
2. A. Papoulis and S. Unnikrishna Pillai, "Probability Random Variables and Stochastic Processes", 4th Edition, PHI, 2007
3. B.P. Lathi, " Modern Digital and Analog Communication Systems," Third Edition, OXFORD University press, 1998.

Reference Books:

1. S.P. Eugene Xavier, "Statistical Theory of Communication", New Age Publications, 2003.
2. G.R. Babu and K. Pushpa, "Probability Theory and Stochastic Processes", Premier Publishing House.
3. D. G. Childer, "Probability and Random Processes", McGraw Hill, 1997.
4. Hwei P. Hsu, Ph.D., "Theory and Problems of Probability, Random Variables, and Random Processes", Schaum's Outline Series, McGraw Hill, New York, 1968.

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Course Title	Network theory				Minor Degree		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
1891405	EC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	-	--	3	30	70	100
Mid Exam Duration: 2Hrs					End Exam Duration: 3Hrs			

Course Objectives:

- To Understand the basic concepts of magnetic circuits, resonance and network functions.
- To Solve DC and AC circuits by using various theorems.
- To Analyze RL,RC and RLC for DC and AC transient response.
- To Analyze two port networks for Z,Y,ABCD,H parameters and its relationship between them

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand the basic concepts of magnetic circuits, resonance and network functions.
CO 2	Solve DC and AC circuits by using various theorems.
CO 3	Analyze RL,RC and RLC for DC and AC transient response.
CO 4	Analyze two port networks for Z,Y,ABCD,H parameters and its relationship between them

UNIT - I

Network Theorems: Superposition theorem, Thevenin & Norton theorems, Maximum power transfer theorem, Reciprocity, Millman's and Compensation Theorems applied to DC and sinusoidal excitations.

UNIT – II

DC Transient Analysis: Determination of initial conditions – transient response of R-L, R-C & R-L- C circuits for dc–solution method using differential equation and Laplace transforms.

AC Transient Analysis: Transient response of R-L, R-C and R-L-C series circuits for sinusoidal excitations, solution method using differential equation and Laplace transforms

UNIT – III

Resonance: Series, parallel circuits, concept of half power frequencies, bandwidth and Q factor. Simple problems.

Magnetic Circuits: Concept of self and mutual inductances, dot conventions, coefficient of coupling, series and parallel magnetic circuits, composite magnetic circuits.

UNIT – IV

Single port and multiport networks, immittance functions of two port parameters, necessary conditions for driving point and transfer functions, complex frequencies, poles and zeros, time domain response from pole zero plots, restrictions from pole zero locations.

UNIT – V

Two port Networks: Two port networks, impedance parameters, admittance parameters, transmission parameters, hybrid and inverse hybrid parameters, relationship between parameters, conditions for symmetry and reciprocity, interconnected two port networks, terminated two port parameters and image parameters.

Text Books

1. Hayt and Kimmerly, "Engineering circuit analysis",7th edition
2. Van Valkenburg, "Network Analysis", 3rd edition, PHI.
3. A.Chakrabarti, "Circuit Theory", Dhanapat Rai & Co publications.
4. N.Sreenivasulu, "Electrical Circuits", Reem publications.

Reference Books

1. A. Sudhakar, Shayammohan, S. Pillai, "Circuits & Networks", 4th Edition –. TMH
2. D. Roy Chowdari, "Networks and Systems", New Age International
3. Stanely, "Network Analysis with applications",Pearson education 4th edition
4. G.K.Mittal, "Network Analysis by", Khanna Publishers.

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Course Title	Microprocessors & Microcontrollers				Minor Degree		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
1891406	EC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	-	--	3	30	70	100
Mid Exam Duration: 2Hrs					End Exam Duration: 3Hrs			

Course Objectives:

- To Understand various components and list out various features of microprocessor, microcontroller and peripherals.
- To Describe the internal block diagram of microprocessor, microcontroller and peripherals, addressing modes, instruction set and data transfer schemes.
- To Develop algorithm and assembly language programs to solve problems.
- To Design the microprocessor or microcontroller based system to solve real time problems.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Define various components and list out various features of microprocessor, microcontroller and peripherals.
CO 2	Describe the internal block diagram of microprocessor, microcontroller and peripherals, addressing modes, instruction set and data transfer schemes.
CO 3	Develop algorithm and assembly language programs to solve problems.
CO 4	Apply an appropriate algorithm, program and peripheral for the application.
CO 5	Design the microprocessor or microcontroller based system to solve real time problems.

UNIT I

Introduction to 8085 Microprocessors: Review on Number systems, Digital logic circuits, Basic Computer Organization, Basic concepts of 8085 Microprocessor, Architecture of 8085 Microprocessor, Pin Diagram of 8085 microprocessor, Instruction Set of 8085 microprocessor, Addressing modes, Timing diagrams, Delay generation, Interrupts, Serial I/O.

UNIT II

Introduction to 8051 Microcontrollers: Block diagram of microcontrollers, Features of 8051 microcontroller, Architecture of 8051 microcontroller, Memory organization, pin diagram of 8051 microcontroller, External memory Interfacing, Addressing modes, Instruction Set of 8051microcontroller, Delay Generation, Programming 8051 Timers/Counters, Interrupts, Serial Communication, Simple Programs.

UNIT III

Introduction to ARM: Introduction, features, Architecture history, ARM 7 block diagram, Registers, Program Status Register, Instruction pipeline, Modes of operation, Interrupts and vector table, Instruction Set- Data Processing Instructions, Branch, Load-Store, Software interrupt, PSR instructions, Conditional instructions, Thumb instruction Set: Register Usage, Other Branch instructions, Data processing Instructions, Single-Register and Multi Register Load-Store Instructions, Stack, Software Interrupt Instructions.

UNIT IV

The PIC microcontroller: PIC18F Introduction, Features, Memory, I/O Ports, MCU support devices, Programming model, Instructions, Instruction Description, Simple program.

The AVR microcontroller: Architecture, memory architecture, instruction architecture,

Addressing modes, Timer/counter, Interrupts, Watchdog timer.

UNIT V

Peripheral Interfacing with 8051 microcontroller: 8255 PPI and its interfacing, Interfacing Keypad, Interfacing 7-Segment LED, LCD Interfacing, ADC and DAC Interfacing.

Introduction to 8086 Microprocessor - Architecture, Instruction set, Addressing modes, Interrupt system, Pin diagram.

Text Books:

1. Ramesh S. Gaonkar, "Microprocessor architecture, programming and its applications with 8085", Penram International Publications, 4th Edition.
2. A. K. Ray and K.M. Bhurchandi, "Advanced Microprocessors and Peripherals", TMH.
3. Mazidi Muhammad Ali, Mazidi Janice Gillespie & McKinlay Rolin D, "The 8051Microcontroller and Embedded Systems", 2nd Edition, Pearson Education, 2008.
4. Kenneth J Ayala, "The 8051 microcontroller: Architecture, Programming & Applications", penram publications, 2nd edition.
5. Andrew N.Sloss, Dominic Symes, Chris Wright, "ARM System Developer's Guide-Designing And Optimizing system software", Elsevier, 2008.

Reference Books:

1. Douglas V. Hall, "Microprocessors and Interfacing: Programming and Hardware", 2nd Edition, Tata McGraw-Hill.
2. Barry B. Brey, "The Intel Microprocessors-Architecture, Programming and Interfacing", 8th Edition, PHI.
3. Y. Liu and Glenn A. Gibson, "Microcomputer Systems: 8086/8088 Family Architecture, Programming and Design", 2nd Edition, PHI.
4. Microcontrollers Architecture, Programming, Interfacing and System Design – Raj Kamal, Pearson Education, 2005.
5. Steve Furbur, ARM System on-chip Architecture, 2nd Edition, Addison Wesley,2000

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Course Title	Principles of communication systems					Minor Degree		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
1891407	EC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	-	--	3	30	70	100
Mid Exam Duration: 2Hrs					End Exam Duration: 3Hrs			

Course Objectives:

- To Understand the fundamental concepts of Telecommunication Engineering.
- To Understand use of different modulation techniques used in Analog and Digital Communication.
- To Understand different Telecommunication systems like Satellite communication, Optical Fiber communication, Wireless communication, Mobile communication etc. and its applications.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand the fundamental concepts of Telecommunication Engineering.
CO 2	Understand use of different modulation techniques used in Analog and Digital Communication.
CO 3	Understand different Telecommunication systems like Satellite communication, Optical Fiber communication, Wireless communication, Mobile communication etc. and its applications.
CO 4	Compare and contrast advantages and limitations of various Telecommunication systems.

Unit I

Basics of Telecommunication Engineering: Definition of Telecommunication, Examples of telecommunications and evolution, various types of telecommunication systems such as telephone network, Radio broadcasting system, Computer networks, Internet.

Unit II

Basic Elements of Telecommunication systems General Block schematic of communication system, Communication channels, Analog versus digital communication systems, Need of modulation, Types of analog modulation such as AM and FM, Types of digital modulation such as Pulse code modulation, delta modulation, Continuous wave modulation such as ASK, FSK, PSK.

Unit III

Introduction to Optical Fiber Communication: Use of optical fiber in communication, Principle and working of OFC system, Block diagram, Types of optical fibers, various elements required in designing OFC system, Applications such as long distance transmission links, Computer communication networks.

Unit IV

Introduction to Satellite Communication: Use of satellite in telecommunications, Launching of Satellite from earth station, Types of satellite orbits, Classification of satellite according to applications, Satellite communication link block diagram.

Unit V

Some concepts in Wireless communications: Wireless Standards: Overview of 2G and 3G, 4G

cellular standards, Multiple access schemes-FDMA, TDMA, CDMA and OFDM, Modulation schemes- BPSK, QPSK. GSM, Wi-Fi & Wi-Max, Bluetooth, Recent Trends/Developments.

Text Books:

1) Simon Haykin," Communication Systems", 4th Edition, John Wiley Publication.

2) George Kenndey, " Electronics Communication systems", 4th Edition

3) John G. Proakis," Digital Communication", Tata McGraw Hill

4) T . Prat, C.W. Bostian," Satellite Communication", Wielly Publication

Reference Books:

1. S. Rappaport," Wireless communication – Principles and Practice", Pearson Education.

2. John M. Senior,"Optical Fiber Communication Principles and Practice",, Pearson Education.

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Course Title	Analog and digital IC applications					Minor Degree		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
1891408	EC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	-	--	3	30	70	100
Mid Exam Duration: 2Hrs						End Exam Duration: 3Hrs		

Course Objectives:

- To Understand the operation and characteristics of OP-AMPs.
- To Understand multivibrator circuits and 555 timers using OP-AMPs.
- To Understand various digital logic families

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand the operation and characteristics of OP-AMPs.
CO 2	Analyze multivibrator circuits and 555 timers using OP-AMPs.
CO 3	Apply PLL in various Communication applications
CO 4	Compare various digital logic families.
CO 5	Simulate digital logic circuits using **Verilog** HDL.

UNIT-I

OP-AMP AND ITS CHARACTERISTICS: Integrated circuits -types, classification, package types and temperature ranges, power supplies, OP-Amp Block diagram, ideal and practical OP- Amp specifications, DC and AC characteristics, 741 OP-Amp and its features, Inverting and non-inverting amplifier.

UNIT-II

OP-AMP APPLICATIONS: Integrator and differentiator, difference amplifier, instrumentation amplifier, AC amplifier, V-I, I-V converters, comparators, Multivibrators, Triangular and square wave generators, Log and antilog amplifiers, precision rectifiers.

UNIT-III

TIMERS AND PHASE LOCKED LOOPS: Introduction to 555 Timer, functional diagram, Monostable and Astable operations, Schmitt Trigger, PLL-Introduction, Block schematic, principles and description of individual blocks,565 PLL, applications.

UNIT–IV

UNIPOLAR & BIPOLAR LOGIC FAMILIES: Introduction to logic families, CMOS logic, CMOS steady state electrical behavior, CMOS dynamic state electrical behavior, CMOS logic families, Bipolar logic, transistor logic, TTL families, CMOS/TTL interfacing, ECL, Comparison of logic families.

UNIT–V

VERILOG HDL AND DESIGN EXAMPLES: HDL based Design flow, Program Structure, Logic system, Nets, Variables and Constants,Vectors and Operators, Arrays,Logical Operators and Expressions. Structural design elements, data flow design

elements, behavioral design elements (procedural code). Design using basic gates, Decoders, Encoders, Multiplexers and Demultiplexers, Adders, Sub tractors, SSI Latches and Flip-Flops, Counters, Design of Counters and Shift Registers .**Verilog** Modules for the above ICs.

Text Books:

1. Ramakanth A. Gayakwad, "Op-Amps & Linear ICs", 4th edition, PHI, 1987.

2 John F. Wakerly, "Digital Design Principles & Practices" PHI/Pearson Education Asia, 4th Edition, 2008.

3. J. Bhasker, "A Verilog HDL Primer", Star Galaxy Publishing; 3rd edition (January 31, 2005)

References:

1. D. Roy Chowdhury, "Linear Integrated Circuits", New Age International (P) Ltd, 2nd Edition, 2003.

2. James M.Fiore, "Operational Amplifiers & Linear integrated circuits & Applications", Cengage 2009.
3. Fundamentals of Digital Logic with Verilog Design – Stephen Brown, Zvonko Vranesic, TMH, 3rd Edition, 2014

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Course Title	Industrial Electronics				Minor Degree		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
1891409	EC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	-	--	3	30	70	100
Mid Exam Duration: 2Hrs					End Exam Duration: 3Hrs		

Course Objectives:

- To Understand the basics of Power Electronics
- To learn the details of power semiconductor switches (Construction, Characteristics and operation).
- To understand the working of various types of converters.
- To learn how to analyze the converters and design the components of them, under various load types.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	To understand the basics of Power Electronics.
CO 2	To learn the details of power semiconductor switches (Construction, Characteristics and operation)
CO 3	To understand the working of various types of converters.
CO 4	To learn how to analyze the converters and design the components of them, under various load types.
CO 5	To learn about the control of various converters.

Unit-1

Power Semiconductor devices: Constructional features, Operating Principle, Characteristics and specification of power semiconductor diode, Power Bipolar Junction transistor (BJT), Thyristors and Triacs, Gate Turn off Thyristors (GTO), Metal oxide semiconductor field effect transistor (MOSFET), Insulate Gate Bipolar transistor (IGBT), Hard and soft switching of Power semiconductors.

Unit-2

AC to DC Convertors: Single Phase uncontrolled rectifier, Single Phase fully controlled rectifier, single phase half controlled bridge rectifier, Operation and analysis of three phase fully controlled bridge converter, Operation and analysis of three phase half controlled converter, Effect of source Inductance on the performance of AC to DC converters, Power factor improvement, Harmonic reduction, filter.

Unit-3

DC to DC Converters: Types of basic DC-DC converters, Analysis of Buck converter (DC-DC) circuit, Commutation of thyristor based circuits, Introduction to switched mode power supply

(SMPS) circuits, Fly-back type switched mode power supply, Forward type switched mode power supply, Design of transformer for switched mode power supply circuits.

Unit-4

AC to AC Voltage converter: Three phase AC regulators, Phase angle control in Traic based single Phase AC regulators, Introduction to cyclo converters, three phases to single phase cyclo converters, three phase to three phase cyclo converters, Control circuit for three phase to three phase converter.

Unit-5

Introduction to voltage source Inverters, Analysis of 1-Phase square wave voltage source Inverter, 3-Phase voltage source with square wave output. 3-phase pulse width modulated Inverter. Sine PWM and its realization, current source Inverter, Load commutated current source inverter.

Text Books:

1. M. D. Singh and K. B. Khanchandani," Power Electronics".
2. Ned Mohan, Tore M. Undeland, and William P. Robbins, "Power Electronics: Converters, Applications And Design, Media Enhanced (With CD)".
3. John G. Kassakian, Martin F. Schlecht, and George C. Verghese,"Principles of Power Electronics".

Reference Books:

1. G. K. Mithal , Maneesha Gupta, "Industrial and Power Electronics", Khanna Publishers,1987.
2. George M. Chute, R. D. Chute, "Electronics in Industry", McGraw-Hill School Pub Co, 5th Edition,

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Course Title	Digital Signal Processing.				Minor Degree		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
1891410	EC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	-	--	3	30	70	100
Mid Exam Duration: 2Hrs					End Exam Duration: 3Hrs		

Course Objectives:

- To Understand the properties and algorithms of DFT.
- To learn the Realization of Various Digital Filters.
- To Analyze IIR and FIR filters.
- To Design IIR filters, FIR filters Decimator and Interpolator.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand properties and algorithms of DFT.
CO 2	Realize Various Digital Filters.
CO 3	Analyze IIR and FIR filters.
CO 4	Design IIR filters, FIR filters Decimator and Interpolator.

UNIT-I

Discrete Fourier series: DFS representation of periodic sequences, Properties of discrete Fourier series, Discrete Fourier Transform (DFT), properties of DFT, linear convolution of sequences using DFT.

Fast Fourier Transforms: Efficient computation of the DFT, Decimation in time and decimation in frequency FFT algorithms, FFT algorithms for composite N.

UNIT-II

Realization of Digital Filters: Block diagram representation of linear constant-coefficient difference equations, basic structures of IIR filters- direct form I, direct form II, transposed form, cascade form, parallel forms, basic structures of FIR filters-Direct form, Cascade form, Linear phase structure, Lattice structures.

UNIT-III

IIR Digital Filters: General considerations-Causality and its implications, Characteristics of Practical Frequency-selective filters, Design of analog filters-Butterworth and chebyshev approximations, IIR filter design by backward difference, Impulse Invariance, Bilinear transformation, design examples: frequency transformations, Illustrative Problems.

UNIT-IV

FIR Digital Filters: Symmetric and Anti-symmetric FIR filters, Design of Linear Phase FIR digital filters using windows, Frequency sampling technique, comparison of IIR and FIR filters,Illustrative Problems, applications of DSP (Dual Tone Multifrequency signal detection, Spectral analysis of sinusoidal and nonstationary signals).

UNIT-V

Multirate Signal Processing: Introduction, Decimation, and interpolation, Sampling rate conversion by a rational factor, Implementation of sampling rate conversion, Multistage implementation of sampling rate conversion, Sampling rate conversion of bandpass signals, Sampling rate conversion by arbitrary factor, Applications of multirate signal processing.

Text Books:

1. A.V.Oppenheim and R.W. Schaffer, & J R Buck, "Discrete Time Signal Processing," 2nd ed., Pearson Education, 2012.
2. John G. Proakis, Dimitris G. Manolakis, "Digital signal processing, principles, Algorithms and Aapplications", Pearson Education/PHI, 4th Edition, 2007.
3. Sanjit K Mitra, "Digital signal processing", A computer base approach- Tata McGraw- Hill, 3rd Edition, 2009.

Reference Books:

1. Andreas Antoniou, Digital signal processing: Tata McGraw-Hill, 2006.
2. M H Hayes, "Digital signal processing", Schaum's Outlines, Tata McGraw-Hill, 2007.
3. A. Anand Kumar, "Digital Signal Processing," PHI Learning, 2011

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Course Title	Embedded System Design				Minor Degree		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
1891411	EC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	-	--	3	30	70	100
Mid Exam Duration: 2Hrs					End Exam Duration: 3Hrs			

Course Objectives:

- To understand features of Embedded system.
- To the architecture of MSP 430.
- To Write MSP 430 programs for interfacing.
- To Describe the timers, interrupts and serial communication in MSP 430

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand features of Embedded system.
CO 2	Understand the architecture of MSP 430.
CO 3	Write MSP 430 programs for interfacing.
CO 4	Describe the timers, interrupts and serial communication in MSP 430

UNIT I

Introduction To Embedded Systems: Introduction to Embedded Systems and Computer Systems Terminology, Modular approach to Embedded System Design using Six-Box model, Input devices, output devices, embedded computer, communication block, host and storage elements and power supply. Microcontroller Based Embedded System Design. Salient Features of Modern Microcontrollers. Elements of Microcontroller Ecosystem and their significance. Design of Power Supply for Embedded Systems. Linear Regulator Topologies. Switching Power Supply Topologies. Power Supply Design Considerations for Embedded Systems.

UNIT II

Introduction to MSP430 Microcontroller: MSP430 CPU Architecture, Programming Methods for MSP430, Introduction to Lunchbox Platform, Fundamentals of Physical Interfacing, Connecting Input Devices:Switches, Keyboard and Output devices: LEDs, Seven Segment Displays(SSD), Advanced Physical Interfacing: Driving load - high side, low side and H-bridge, Multiplexing displays including Charlieplexing, Shaft encoder.

UNIT III

Programming the MSP430: Basics of version control system - Git, Installing and using Code Composer Studio(CCS), Introduction to Embedded C.

Interfacing: Interfacing LEDs and Switches with MSP430 using Digital Input and Output, Interfacing Seven Segment Displays and Liquid Crystal Displays with MSP430, ADC operation in MSP430, Interfacing analog inputs, Generating random numbers using LFSR and other methods, Adding DAC to MSP430, Custom Waveform generation using MSP430.

UNIT IV

MSP430 Microcontroller-Interrupts and Timers: MSP430 Clock and Reset System, MSP430 Clock sources and distribution, Types of Reset sources, Handling Interrupts in MSP430, Writing efficient Interrupt Service Routine (ISR).

Low Power Modes in MSP430, Introduction to MSP430 Timer Module and it's Modes of Operation. Generating Pulse Width Modulation (PWM) using Timer Capture Mode, Timer Capture Modes, Measuring frequency and time period of external signals and events,

UNIT V

MSP430 Microcontroller- Serial Communication: Serial Communication Protocols: UART, SPI, I2C, Interfacing Universal Serial Communication Interface (USCI) Module of the MSP430 for UART Communication, Advanced Coding Exercises based on Interrupt driven Programming. Building an Electronics Project. Circuit Prototyping techniques, Designing Single Purpose Computers using Finite State Machine with Datapath (FSMD) approach, MSP430 Based Project Design and Implementation.

Text Books:

1. John Catsoulis, " Designing Embedded Hardware", Shroff Publishers and Distributors, 2nd edition.
2. Tony Givargis and Frank Vahid, "Embedded System Design: A Unified Hardware / Software Introduction" ,Wiley, ISBN-10: 812650837X.

Reference Books:

1. John H. Davies. Elsevier, "MSP430 Microcontroller Basics", ISBN-10: 9789380501857.
2. Micheal Barr, "Programming Embedded Systems in C and C++" Shroff Publishers and Distributors, ISBN-10: 817366076X

NPTEL Links:

https://onlinecourses.nptel.ac.in/noc20_ee98/preview

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Course Title	Electronic Instrumentation and Measurements				Minor Degree		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
1891412	EC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	-	--	3	30	70	100
Mid Exam Duration: 2Hrs					End Exam Duration: 3Hrs		

Course Objectives:

- To understand the performance characteristics of an instruments.
- To the principle of analog, digital voltmeters and wave analyzers
- To Use AC and DC bridges for relevant parameter measurement.
- To Apply the complete knowledge of various electronic transducers to measure the physical Quantities in the field of science and technology

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	**Understand** the performance characteristics of an instruments.
CO 2	**Understand** the principle of analog, digital voltmeters and wave analyzers
CO 3	**Explain** different types of oscilloscopes
CO 4	**Use** AC and DC bridges for relevant parameter measurement.
CO 5	**Apply** the complete knowledge of various electronic transducers to measure the physical Quantities in the field of science and technology

UNIT I

Performance characteristics of Instruments : Static characteristics, Accuracy, Resolution, Precision, Expected value, Error, Sensitivity. Errors in Measurement, Dynamic Characteristics-speed of response, Fidelity, Lag and Dynamic error.

Analog Instruments: Transistor Voltmeter, Micro Voltmeter (Chopper type) – DC Differential voltmeter – AC voltmeters – Multi meter -wave analyzers (AF & RF) – Harmonic distortion analyzer- Spectrum analyzer.

UNIT II

Digital Instruments: Digital Voltmeters (Ramp, Dual slope, stair case, successive approximation types) Digital multi meter, Universal counter, Digital tachometer, Digital Phase meter.

UNIT III

Cathode Ray Oscilloscopes: Motion of electron in electronic field and in magnetic field- Block diagram of CRO, CRT, Electrostatic deflection sensitivity – Vertical and Horizontal deflection systems – Principle of operation of dual beam, dual trace, sampling and storage CRO's-Measurements with CRO (Voltage, Current, time, frequency, Phase angle, lissajous figures)

UNIT IV

Bridges: Wheat stone bridge, Kelvin Bridge, Measurement of inductance- Maxwell's bridge, Anderson Bridge. Measurement of capacitance-Schearing Bridge, Wien Bridge Errors and precautions in using bridges- Q meter and measurement methods

UNIT V

Transducers: Active & passive transducers, Resistance, Capacitance, inductance; Strain gauges, LVDT, Piezo Electric transducers, Resistance Thermometers, Thermocouples, Thermistors, Sensistors. Measurement of physical parameters force, pressure, velocity, humidity, moisture, speed, proximity and displacement. Data acquisition systems.

Text Books:

1. H.S. Kalsi," Electronic instrumentation", second edition, Tata McGraw Hill, 2004.
2. A.D. Helfrick and W.D. Cooper,"Modern Electronic Instrumentation and Measurement Techniques",PHI, 5th Edition, 2002.

References:

1. David A. Bell, "Electronic Instrumentation & Measurements", PHI (OUP), 2nd Edition, 2003.
2. Robert A.Witte, "Electronic Test Instruments, Analog and Digital Measurements", Pearson Education, 2nd Ed., 2004.
3. K. Lal Kishore, "Electronic Measurements & Instrumentations", by Pearson Education – 2005.

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Course Title	VLSI Design				Minor Degree		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
1891413	EC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	-	--	3	30	70	100
Mid Exam Duration: 2Hrs					End Exam Duration: 3Hrs		

Course Objectives:

- To Understand the design rules and scaling concepts
- To Understand the various IC technologies and fabrication steps
- To Analyze the basic electrical properties of MOS and BICMOS logic circuits

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand the design rules and scaling concepts
CO 2	Understand the various IC technologies and fabrication steps
CO 3	Apply the basic functional modules for sub system design
CO 4	Analyze the basic electrical properties of MOS and BICMOS logic circuits
CO 5	Understand the models of integrated circuit design and testing techniques

UNIT-I

Introduction: Introduction to IC Technology – MOS, PMOS, NMOS, CMOS & Bi-CMOS technologies-Substrate preparation, Oxidation, Lithography, Diffusion, Ion implantation, Metallization, Encapsulation, Probe testing, Integrated Resistors and Capacitors.

UNIT-II

Basic Electrical Properties: Basic Electrical Properties of MOS and Bi-CMOS Circuits: $I_{ds}VsV_{ds}$ relationships, MOS transistor threshold Voltage, g_m, g_{ds}, Figure of merit, Pass transistor, NMOS Inverter, Various pull ups and Pull downs, CMOS Inverter analysis and design, Bi- CMOS Inverters.

UNIT-III

VLSI Circuit Design Processes: VLSI Design Flow, MOS Layers, Stick Diagrams, Design Rules and Layout, 2μ CMOS Design rules for wires, Contacts and transistors Layout Diagrams for NMOS and CMOS Inverters and Gates, Scaling of MOS circuits, Limitations of Scaling.

UNIT-IV

Gate Level Design: Logic Gates and Other complex gates, Switch logic, Alternate gate circuits, Basic circuit concepts, Sheet Resistance(R_S) concept and Sheet Resistance R_S in MOS, Area Capacitance Units, Calculations Delays, Driving large Capacitive Loads, Wiring Capacitances. Subsystem Design: Subsystem Design, Shifters, Adders, ALUs, Multipliers, Parity generators, Comparators, Counters, High Density Memory Elements.

UNIT-V

Semiconductor Integrated Circuit Design: PLAs, FPGAs, CPLDs, Standard Cells, Programmable Array Logic(PLA'S), Design Approach.

CMOS Testing: CMOS Testing, Need for testing, Test Principles, Design Strategies for test, Chip level
Test Techniques, System-level Test Techniques, Layout Design for improved Testability.

Text Books:

1. Kamran Eshraghian, Eshraghian Dougles and A. Pucknell, Essentials of VLSI circuits and systems,
   PHI, 2005 Edition.
2. Weste and Eshraghian, Principles of CMOS VLSI Design, Pearson Education, 1999.

Reference Books:

1. John .P. Uyemura, Introduction to VLSI Circuits and Systems, JohnWiley, 2003.
2. John M. Rabaey, Digital Integrated Circuits, PHI, EEE, 1997.
3. Wayne Wolf, Pearson Education, Modern VLSI Design, 3rd Edition, 1997.
4. S.M. SZE, VLSI Technology, 2nd Edition, TMH, 2003.

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Course Title	Digital Image Processing					Minor Degree		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
1891414	EC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	-	--	3	30	70	100
Mid Exam Duration: 2Hrs						End Exam Duration: 3Hrs		

Course Objectives:

- To Understand various image processing parameters
- To Understand image filtering, segmentation and compression
- To Compare different 2D transforms Color models and image restoration techniques

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand various image processing parameters
CO 2	Explain image filtering, segmentation and compression
CO 3	Compare different 2D transforms Color models and image restoration techniques
CO 4	Apply the concepts of image processing techniques in various applications.
CO 5	Analyze mathematical operations, coding and filtering methods in image processing.

UNIT-I

Introduction: Fields that use digital image processing, fundamental Steps in Digital Image Processing, Components of an Image processing system, elements of Visual Perception. Image sensing and Acquisition, Image formation model, Image Sampling and Quantization - Representing digital images, spatial and intensity resolution. Relationship between pixels - neighbours of a pixel, Adjacency, Connectivity, Regions and boundaries, distance measures, Mathematical tools in digital image processing – Array versus matrix operations, Linear and Nonlinear Operations, Arithmetic operations, geometrical spatial transformations and image registration.

UNIT-II

Image Transforms: General approach for operating in the linear transform domain, 2-D DFT and Properties, Walsh transform, Hadamard Transform, Discrete cosineTransform, Haar transform, Slant transform, KL Transform or Hotelling transform

UNIT-III

Image Enhancement: Image enhancement in Spatial domain - Some Basic Intensity Transformations, Histogram Processing, Enhancement, Basics of Spatial filtering, Smoothing spatial filtering, sharpening spatial filters, Combining spatial enhancement methods.

Image enhancement in the Frequency Domain –Basics of filtering in frequency domain, Image smoothing and sharpening in frequency domain, homomorphic filters. Color image processing, Color fundamentals, color models.

UNIT-IV

Image Restoration: Degradation model, Noise models, Restoration in the presence of noise only– spatial filtering, Periodic noise reduction by frequency domain filtering, Linear position- Invariant degradation, Inverse filtering, least mean square (Wiener) filters, Constrained Least Squares filtering.

Image Segmentation: Point, Line and Edge detection, Edge linking and boundary detection, Thresholding, Region based segmentation – Region growing, Region splitting and merging.

UNIT-V

Image Compression: Redundancies in images, Fidelity criteria, Image compression models, Error free compression – Variable length coding, Huffman coding, Arithmetic coding, LZW coding, Bit-plane coding, loss less and lossy predictive coding, Transform coding, Image Compression standards.

Text Books:

1. R.C. Gonzalez & R.E. Woods, "Digital Image processing", Addison Wesley/ Pearson Ed., 2nd Edition, 2002.
2. A.K.Jain, "Fundamentals of Digital Image processing", Prentice Hall of India.

Reference Books:

1. Rafael C. Gonzalez, Richard E Woods and Steven L, "Digital Image processing using MAT LAB", Edition, PEA, 2004.
2. William K. Pratt, "Digital Image Processing", John Wiley, 3rd Edition, 2004.
3. Jayaraman, S. Esakkirajan and T. Veerakumar, Digital Image Processing, Tata McGraw Hill Education, 2011.

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Course Title	Biomedical Instrumentation				Minor Degree		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
1891415	EC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	-	--	3	30	70	100
Mid Exam Duration: 2Hrs					End Exam Duration: 3Hrs		

Course Objectives:

- To Understand the functioning of Human Cell and its electrical characteristics
- To Understand the functioning of cardiovascular measurement and circulatory System of heart CO3: Describe various bioelectrodes
- To Describe Organization of cell and various potentials
- To Analyze the electrical hazards that may occur during the usage of medical instruments.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand the functioning of Human Cell and its electrical characteristics
CO 2	Understand the functioning of cardiovascular measurement and circulatory System of heart
CO 3	Describe various bioelectrodes
CO 4	Describe Organization of cell and various potentials
CO 5	Analyze the electrical hazards that may occur during the usage of medical instruments.

UNIT I

Components of Medical Instrumentation System: Bio-amplifier, Static and dynamic characteristics of medical instruments. Bio-signals and characteristics. Problems encountered with measurements from human beings.

UNIT II

Organization of cell: Derivation of Nernst equation for membrane Resting Potential Generation and Propagation of Action Potential, Conduction through nerve to neuron-muscular junction.

UNIT III

Bio Electrodes: Bio-potential Electrodes-External electrodes, Internal Electrodes. Biochemical Electrodes. Mechanical function, Electrical Conduction system of the heart, Cardiac cycle. Relation between electrical and mechanical activities of the heart. Pacemaker, Defibrillator

UNIT IV

Cardiac Instrumentation Blood pressure and Blood flow measurement: Specification of ECG machine. Einthoven triangle, Standard 12-lead configurations, Therapeutic equipment, shortwave diathermy.

Respiratory Instrumentation: Mechanism of respiration, Spirometry, Pnemuotachograph Ventilators.

UNIT V

Physiotherapy and Electrotherapy Equipment: High frequency heat therapy, Short wave Diathermy, Microwave Diathermy, Ultrasonic Therapy Unit, Electro diagnostic/ Therapeutic Apparatus, Pain relief through electrical stimulation, Diaphragm pacing by Radio-frequency for the treatment of chronic ventilator insufficiency, Bladder stimulators.

Patient electrical safety: Types of hazards, natural protective mechanism, leakage current, patient isolation, hazards in operation rooms, grounding conditions in hospital environment.

Text Books:

1. Leslie Cromwell and F.J. Weibell, "Biomedical Instrumentation and Measurements ",E.A. Pfeiffer, PHI, 2nd Ed, 1980.
2. John G. Webster, "Medical Instrumentation, Application and Design",John Wiley, 3rd Ed., 1998.

Reference Books:

1. L.A. Geoddes and L.E. Baker, " Principles of Applied Biomedical Instrumentation", John Wiley, 1975.
2. R.S. Khandpur, " Hand-book of Biomedical Instrumentation", TMH, 2nd Ed., 2003.
3. Mackay, Stuart R., "Biomedical Telemetry",–John Wiley, 1968.
4. M. Armugam, "Biomedical Instrumentation", Anuradha agencies publications.

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UG R18 Honours and Minor Degree

Structure and Syllabus

Department of Electronics and Communication Engineering

Honours degree Subjects

V SEM

- Scientific Computing using MATLAB (3 Credits)
- Computer System Architecture (3 Credits)
- Electromagnetic Interference & Compatibility (2 Credits)

VI SEM

- Analog IC Design (3 Credits)
- Digital IC Design (3 Credits)
- Biomedical Signal Processing (3 Credits)
- Embedded System Design with ARM (2 Credits)

VII SEM

- Information Theory & Coding (3 Credits)
- DSP Algorithms & Architectures (3 Credits)
- Low Power VLSI Design (3 Credits)
- RF Integrated Circuits (3 Credits)
- Principles of Signal Estimation for MIMO/ OFDM Wireless Communication (3 Credits)

VIII SEM

- Statistical Signal Processing (3 Credits)
- Op-Amp Practical Applications: Design, Simulation and Implementation
- Multirate DSP (3 Credits)
- Digital VLSI Testing (3 Credits)

S. No.	Subject Code	Subject	L	T	P	IM	EM	Credits
1	1892401	Scientific Computing using MATLAB	3	0	0	30	70	3
2	1892402	Computer System Architecture	3	0	0	30	70	3
3	1892403	Electromagnetic Interference & Compatibility	2	0	0	30	70	2
4	1892404	Analog IC Design	3	0	0	30	70	3
5	1892405	Digital IC Design	3	0	0	30	70	3
6	1892406	Biomedical Signal Processing	3	0	0	30	70	3
7	1892407	Embedded System Design with ARM	2	0	0	30	70	2
8	1892408	Information Theory &Coding	3	0	0	30	70	3
9	1892409	DSP Algorithms & Architectures	3	0	0	30	70	3
10	1892410	Low Power VLSI Design	3	0	0	30	70	3
11	1892411	RF Integrated Circuits	3	0	0	30	70	3
12	1892412	Principles of Signal Estimation for MIMO/ OFDM Wireless Communication	3	0	0	30	70	3
13	1892413	Statistical Signal Processing	3	0	0	30	70	3
14	1892414	Op-Amp Practical Applications: Design, Simulation and Implementation	3	0	0	30	70	3
15	1892415	Multirate DSP	3	0	0	30	70	3
16	1892416	Digital VLSI Testing	3	0	0	30	70	2

Course Title	Scientific Computing using MATLAB				Honours Degree		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
1892401	EC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	-	--	3	30	70	100
Mid Exam Duration: 2Hrs					End Exam Duration: 3Hrs		

Course Objectives:

- To understand various command in MATLAB and to Solve algebraic equations using MATLAB.
- To Write the programs for curve fitting, roots of equations, Numerical Differentiation and integration.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand various commands in MATLAB
CO 2	Solve algebraic equations using MATLAB
CO 3	Write the programs for curve fitting and roots of equations.
CO 4	Write the programs for Numerical Differentiation and integration.
CO 5	Solve optimization and Eigen value problems.

Unit- I

Introduction to MATLAB: Introduction to MATLAB, Data Types and Variables, Arrays, Cells, Strings, Operators, Flow Control, Loops, Functions, Input/Output, Array Manipulation, Plotting.

Systems of Linear Algebraic Equations: Introduction, Gauss Elimination Method, LU Decomposition Methods, Symmetric and Banded Coefficient Matrices, Pivoting, Matrix Inversion, Iterative Methods-Gauss–Seidel Method, Conjugate Gradient Method.

Unit -II

Interpolation and Curve Fitting: Introduction, Polynomial Interpolation-Lagrange's Method, Newton's Method, Neville's Method, Limitations of Polynomial Interpolation, Interpolation with Cubic Spline, Least-Squares Fit.

Roots of Equations: Introduction, Incremental Search Method, Method of Bisection, Brent's Method, Newton–Raphson Method, Systems of Equations, Zeros of Polynomials.

Unit- III

Numerical Differentiation: Introduction, Finite Difference Approximations, Richardson Extrapolation, Derivatives by Interpolation.

Numerical Integration: Introduction, Newton–Cotes Formulas, Romberg Integration, Gaussian Integration, Multiple Integrals.

Unit -IV

Initial Value Problems: Introduction, Taylor Series Method, Runge–Kutta Methods, Stability and Stiffness, Adaptive Runge–Kutta Method, Bulirsch–Stoer Method.

Two-Point Boundary Value Problems: Introduction, Shooting Method, Finite Difference Method.

Unit -V

Symmetric Matrix Eigenvalue Problems: Introduction, Jacobi Method, Inverse Power and Power Methods, Householder Reduction to Tridiagonal Form, Eigenvalues of Symmetric Tridiagonal Matrices.

Introduction to Optimization : Introduction, Minimization Along a Line, Conjugate Gradient Methods.

Text Books:

1. Jaan Kiusalaas, "NUMERICAL METHODS IN ENGINEERING WITH MATLAB", Cambridge university press, 2005.
2. Stephen J. Chapman, "MATLAB Programming for Engineers", Thomson learning, 4th edition.

Reference Books:

1. Ian Gladwell, Warren Ferguson Jr., James G. Nagy, "Introduction to Scientific Computing Using MATLAB", Lulu Publishing, 2011.
2. Alfio Quarteroni, Fausto Saleri, Paola Gervasio, "Scientific Computing with MATLAB and Octave", Springer International Publishing, 4 th edition, 2014.

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Course Title	Computer System Architecture					Honours Degree		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
1892402	EC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	-	--	3	30	70	100
Mid Exam Duration: 2Hrs					End Exam Duration: 3Hrs			

Course Objectives

- To Understand different parallel computer models
- To Describe the advanced processor technologies
- To Interpret memory hierarchy and mechanisms for enforcing cache coherence
- To Compare different multiprocessor system interconnecting mechanisms
- To Analyze different pipelining techniques

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand different parallel computer models
CO 2	Describe the advanced processor technologies
CO 3	Interpret memory hierarchy and mechanisms for enforcing cache coherence
CO 4	Compare different multiprocessor system interconnecting mechanisms
CO 5	Analyze different pipelining techniques

Unit- I

Introduction: Parallel computer models – Evolution of Computer Architecture, System Attributes to performance, Amdahl's law for a fixed workload. Multiprocessors and Multicomputers, Multivector and SIMD computers, Architectural development tracks, Conditions of parallelism.

Unit- II

Processors and memory hierarchy: Advanced processor technology- Design Space of processors, Instruction Set Architectures, CISC Scalar Processors, RISC Scalar Processors, Superscalar and vector processors, Memory hierarchy technology.

Unit- III

Multiprocessors system interconnects: Hierarchical bus systems, Cross bar switch and multi-port memory, Multistage and combining networks. Cache Coherence and Synchronization Mechanisms, Cache Coherence Problem, Snoopy Bus Protocol, Directory Based Protocol, Hardware Synchronization Problem

Unit-IV

Message Passing Mechanisms: Message Routing schemes, Flow control Strategies, Multicast Routing Algorithms. Pipelining and Superscalar techniques – Linear Pipeline processors and Nonlinear pipeline processors

Unit-V

Instruction pipeline design: Arithmetic pipeline deign - Super Scalar Pipeline Design. Multithreaded and data flow architectures - Latency hiding techniques, Principles of multithreading - Multithreading Issues and Solutions, Multiple context Processors, Fine- grain Multicomputer- Fine-grain Parallelism. Dataflow and hybrid architecture

Text Book:

1. K. Hwang and Naresh Jotwani, Advanced Computer Architecture, Parallelism, Scalability, Programmability, TMH, 2010.

References:

1. H P Hayes, "Computer Architecture and Organization", McGraw Hill, 1978.
2. K. Hwang & Briggs , "Computer Architecture and Parallel Processing", McGraw Hill International, 1986
3. M J Flynn, "Computer Architecture: Pipelined and Parallel Processor Design", Narosa Publishing House, 2012.
4. M Sasikumar, D Shikkare and P Raviprakash, "Introduction to Parallel Processing", PHI, 2014.
5. P M Kogge, "The Architecture of Pipelined Computer", McGraw Hill, 1981.
6. P V S Rao , Computer System Architecture, PHI, 2009.
7. Patterson D. A. and Hennessy J. L., Morgan Kaufmann , „Computer Organization and Design: The Hardware/Software Interface", Morgan Kaufmann Pub, 4/e, 2010.

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Course Title	Electromagnetic Interference & Compatibility					Honours Degree		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
1892403	EC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	-	--	3	30	70	100
Mid Exam Duration: 2Hrs						End Exam Duration: 3Hrs		

Course Objectives

- To understand the effect of EM noise in system environment and its sources.
- To Identifying of EMI hotspot and various techniques like Grounding, Filtering, Soldering, etc
- To Understanding the various aspects of shielding.
- To Designing electronic systems that function without errors or problems related to electromagnetic compatibility

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand the effect of EM noise in system environment and its sources.
CO 2	Identifying of EMI hotspot and various techniques like Grounding, Filtering, Soldering, etc.
CO 3	Understanding the various aspects of shielding.
CO 4	Designing electronic systems that function without errors or problems related to electromagnetic compatibility

Unit I

Introduction to EMC: Definition, Sources, units, Electromagnetic principles-Faraday's and Ampere's equations, Gauss's equation, boundary conditions, Uniform plane wave, Transmission lines, Dipoles. High-frequency behavior of components- Conductors, Capacitors, inductors, resistors, mechanical switches and transformers.

Unit II

Crosstalk or near-field coupling : Capacitive coupling, inductive coupling, common-impedance coupling, Crosstalk combinations ,Coupling to shielded cables, Electromagnetic coupling in the far-field, field coupling.

Unit III

EM topology & grounding and Shielding: Solutions to EMC problems - Lay out and control of interfaces, Grounding or earthing, Electromagnetic Shielding. Shielded cables Filters and Surge protectors.

Unit IV

Solutions to EMC problems: Shielded cables Filters and Surge protectors, Lightning Protection- Currents, charges and fields, Buildings, Towers, Lightning safety.

Unit V

EMC measurements and Standards: Testing and Difficulties, Intentional Electromagnetic Interference or IEMI.

Text Books:

1. Henry W. Ott, "Electromagnetic Compatibility Engineering", John Wiley & Sons, 2009
2. V.P. Kodali, "Engineering Electromagnetic Compatibility", IEEE Publication, S. Chand & Co. Ltd., New Delhi.
3. Ralph Morrison, "Grounding and Shielding: Circuits and Interference", John Wiley & Sons

Reference Books:

1. Henry W. Ott, "Electromagnetic Compatibility Engineering", Wiley, 2009.
2. Clayton R. Paul, "Introduction to Electromagnetic Compatibility", Wiley, 2006.

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Course Title	Analog IC Design				Credits	Honours Degree		
Course Code	Category	Hours/Week				Maximum Marks		
1892404	EC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	-	--	3	30	70	100
Mid Exam Duration: 2Hrs						End Exam Duration: 3Hrs		

Course Objectives

- To Understand the concepts of Analog MOS devices and current mirror circuits
- To Design different configuration of Amplifiers and feedback circuits
- To Describe the characteristics of frequency response of the amplifier and its noise
- To Analyze te stability and frequency compensation techniques of Op-Amp Circuits
- To Construct switched capacitor circuits and PLLs

Course Outcomes: On successful completion of this course, the students will be able to	
CO 1	Understand the concepts of Analog MOS devices and current mirror circuits
CO 2	Design different configuration of Amplifiers and feedback circuits
CO 3	Describe the characteristics of frequency response of the amplifier and its noise
CO 4	Analyze the stability and frequency compensation techniques of Op-Amp Circuits
CO 5	Construct switched capacitor circuits and PLLs

Unit-I

Introduction to Analog IC Design and Current Mirrors: Concepts of Analog Design – General consideration of MOS devices – MOS I/V Characteristics – Second order effects – MOS device models. Basic current mirrors- Cascode current mirrors- Active current mirrors- Large and Small signal analysis- Common mode properties.

Unit-II

Amplifiers and Feedback: Basic Concepts – Common source stage- Source follower- Common gate stage- Cascode stage. Single ended and differential operation- Basic Differential pair- Common mode response- Differential pair with MOS loads- Gilbert Cell. Feedback- General Consideration of feedback circuits- Feedback topologies- Effect of loading- Effect of feedback on Noise.

Unit-III

Frequency Response of Amplifiers and Noise: General considerations- Miller Effect and Association of Poles with Nodes, Common source stage- Source followers- Common gate stage- Cascode stage- Differential pair. Noise- Statistical characteristics of noise- Types of noise- Representation of noise in circuits- Noise in single stage amplifiers- Noise in differential pairs- Noise Bandwidth.

Unit-IV

Operational Amplifier Stability and Frequency Compensation: General Considerations- One and Two Stage Op Amps- Gain Boosting- Comparison- Common mode feedback- Input range limitations- Slew rate- Power Supply Rejection- Noise in Op Amps- General consideration of stability and frequency compensation- Multi pole system- Phase margin- Frequency compensation- Compensation of two stage op Amps- Other compensation techniques.

Unit-V

Switched Capacitor Circuits and PLLs: General Considerations- Sampling switches- Switched Capacitor Amplifiers-Switched Capacitor Integrator-Switched Capacitor Common mode feedback. Phase Locked Loops-Simple PLL-Charge pump PLLs-Non ideal Effects in PLLs- Delay locked loops- its Applications.

TEXT BOOK:

1. Behzad Razavi, Design of Analog CMOS Integrated Circuits‖, Tata McGraw Hill, 2001, 33rd Re-print, 2016.

REFERENCES:

1. Phillip Allen and Douglas Holmberg, CMOS Analog Circuit Design‖ Second Edition, Oxford University Press, 2004.
2. Paul R. Gray, Paul J. Hurst, Stephen H. Lewis, Robert G. Meyer, Analysis and Design of Analog Integrated Circuits, 5th Edition, Wiley, 2009
3. Grebene, Bipolar and MOS Analog Integrated circuit design‖, John Wiley & sons, Inc., 2003

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Course Title	Biomedical Signal Processing					Honours Degree		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
1892406	EC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	-	--	3	30	70	100
Mid Exam Duration: 2Hrs						End Exam Duration: 3Hrs		

Course Objectives

- To understand the origin, propertiesof biomedical signals like ECG, EEG, PCG, ENG, EOG signals, modern filtering techniques.
- To apply filters to remove noise, signal compression techniques & averaging technique on biomedical signals to extract the features of ECE, EEG and EMG signals.
- To analyze the nature of biomedical signals and related concepts, and event detection techniques for ECG, EEG, and EMG signals. Also compare different filtering techniques.
- To develop an interest to simulate the models and validate its functionality in real time systems.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand the origin, propertiesof biomedical signals like ECG, EEG, PCG, ENG, EOG signals, modern filtering techniques.
CO 2	Apply filters to remove noise, signal compression techniques & averaging technique on biomedical signals to extract the features of ECE, EEG and EMG signals.
CO 3	Analyze the nature of biomedical signals and related concepts, and event detection techniques for ECG, EEG, and EMG signals. Also compare different filtering techniques.
CO 4	Develop an interest to simulate the models and validate its functionality in real time systems.

Unit-I

Preliminaries: Concept of Biological signals – Electrical, Mechanical, Chemical, Magnetic, Optical etc. Origin of electrical signal from Biological cell – Structure of Biological cell, Characteristics of Cell membrane, Distribution and movement of ions across the cell membrane, Generation of Biological cell Action Potential. Concept of Electrocardiogram (ECG), Electroencephalogram (EEG), Phonocardiogram (PCG), Electromyogram (EMG), Electroneurogram (ENG), Electrooculogram (EOG), Respiratory signals etc.

Unit-II

Signal Conditioning: Band limiting of different Biological signals, Representation of biological signals in analog, discrete and digital forms.

Filtering for Removal of artifacts - Statistical Preliminaries, Time domain filtering - Synchronized Averaging, Moving Average Filter to Integration, Derivative-based operator, **Frequency Domain Filtering** – FIR and IIR methods for implementing Notch, band selective filters, Weiner, Adaptive Filtering concepts.

Unit-III

Electrocardiogram (ECG) Analysis: Concepts of morphological and rhythm analysis, Different types of arrhythmias, Derivative based Approaches for QRS Detection, Pan Tompkins Algorithm, Concepts of detecting the P, T waves, PR, ST intervals, QRS duration, etc. Heart Rate Variability (HRV) study and its importance.

Unit-IV

EEG, EMG signals Analysis: Basics of EEG and EMG signals. Signal strength, Signal entropy in time and frequency domain, Correlation coefficient, Envelop Extraction, Root Mean Square value, Zero-crossing rate, Form factor, Periodogram, Minimum phase correspondent, Power Spectral Density concepts in analyzing EEG and EMG signals.

Unit-V

Modelling of Biomedical Systems: Motor unit firing pattern, Cardiac rhythm, Formants and pitch of speech, Point process, Parametric system modelling, Autoregressive model, Autocorrelation method, Application to random signals, Computation of model parameters, Levinson-Durbin algorithm, Computation of gain factor, Covariance method, Spectral matching and parameterization, Model order selection, Relation between AR and Cepstral coefficients, ARMA model, Sequential estimation of poles and zeros.

Text Books:

1. R M Rangayyan "Biomedical Signal Analysis: A case Based Approach", IEEE Press, John Wiley & Sons. Inc, 2002.
2. Willis J. Tompkins, "Biomedical Digital Signal Processing", EEE, PHI, 2004.
3. D C Reddy "Biomedical Signal Processing: Principles and Techniques", Tata McGraw-Hill Publishing Co. Ltd, 2005.

References:

1. Suresh R Devasahayam, "Signals and Systems in Biomedical Engineering: Physiological Systems Modeling and Signal Processing", Springer, 3rd Edition, 2019.
2. J G Webster "Medical Instrumentation: Application & Design", John Wiley & Sons Inc., 2001.

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Course Title	Embedded System Design with ARM					Honours Degree		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
1892407	EC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	-	--	3	30	70	100
Mid Exam Duration: 2Hrs						End Exam Duration: 3Hrs		

Course Objectives

- To understand architectures and instruction set of ARM controller.
- To Write programs using ARM instructions.
- To Interface various sensors and actuators with ARM controller.
- To Design an Embedded system.

Course Outcomes: On successful completion of this course, the students will be able to	
CO 1	Understand architectures and instruction set of ARM controller.
CO 2	Write programs using ARM instructions.
CO 3	Interface various sensors and actuators with ARM controller.
CO 4	Design an Embedded system.

UNIT I

Introduction To Embedded Systems: Introduction, Design Considerations of Embedded Systems, Microprocessors and Microcontrollers, Architecture of ARM Microcontroller, ARM Instruction Set.

UNIT II

ARM Board: The STM32F401 Nucleo Board, PWM And Interrupt on STM32F401, Digital To Analog Conversion, Analog To Digital Conversion, Output Devices, Sensors and Actuators.

UNIT III

Interfacing-I: Microcontroller Development Boards, EMbed C Programming Environment, Interfacing With STM32F401 Board, Interfacing With Arduino Uno, Interfacing 7-Segment LED And LCD Displays, Serial Port Terminal Application.

UNIT IV

Interfacing-II: Interfacing Temperature Sensor, Interfacing LDR Light Sensor, Interfacing Speaker, Interfacing Microphone, Design of Control System, Interfacing Relay, Interfacing DC Motor, Interfacing Multiple Sensors And Relay.

UNIT V

Interfacing-III: Introduction, GSM And Bluetooth, Design of A Home Automation System, Design Of A Simple Alarm System Using Touch Sensor, Accelerometer, Interfacing Accelerometer, Interfacing Bluetooth, Interfacing Gas Sensor.

Text Books:

1. F. Vahid and T. Givargis, "Embedded System Design: A Unified Hardware/Software Introduction", Wiley India Pvt. Ltd., 2002.
2. A.N. Sloss, D. Symes and C. Wright, "ARM System Developer's Guide: Design and Optimizing System Software", Morgan Kaufman Publishers, 2004.

Reference Books:

1. W. Wolf, "Computers as Components: Principles of Embedded Computing System Design", Morgan Kaufman Publishers, 2008.
2. Steve Furber, "ARM System-on-Chip Architecture", Addison Wesley, 2nd edition.

NPTEL Links:

https://onlinecourses.nptel.ac.in/noc20_cs15/preview

https://nptel.ac.in/courses/106/105/106105193/

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Course Title	Information Theory &Coding				Honours Degree		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
1892408	EC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	-	--	3	30	70	100
Mid Exam Duration: 2Hrs					End Exam Duration: 3Hrs		

Course Objectives

- To understand various information measures
- To describe various information channels
- To use different source code algorithms
- To analyze quantization and transform coding.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand various information measures
CO 2	Describe various information channels
CO 3	Use different source code algorithms
CO 4	Analyze quantization and transform coding.

Unit-I

Information Theory: Introduction to Information Theory and Coding, Definition of Information Measure and Entropy, Extension of An Information Source and Markov Source, Adjoint of An Information Source, Joint and Conditional Information Measure, Properties of Joint and Conditional Information Measures and A Morkov Source Properties of Joint and Conditional Information measures and a Markov source.

Unit-II

Source Coding: Source coding theorem, Prefix Codes, Kraft McMillan Inequality property, Encoding of the Source Output, Shannon's Encoding Algorithm, Shannon Fano Encoding Algorithm, Huffman codes, Extended Huffman coding, Arithmetic Coding.

Unit-III

Information Channels I: Introduction to Information Channels, Equivocation and Mutual Information, Properties of Different Information Channels, Reduction of Information Channels, Properties of Mutual Information and Introduction to Channel Capacity, Calculation of Channel Capacity for Different Information Channels, Shannon's Second Theorem.

Unit-IV

Information Channels II: Error Free Communication Over Noisy Channel, Error Free Communication Over A Binary Symmetric Channel and Introduction to Continuous Sources and Channels, Differential Entropy and Evaluation of Mutual Information for Continuous Sources and Channels, Channel Capacity of A Band Limited Continuous Channel

Unit-V

Quantization: Introduction to Quantization, Lloyd-Max Quantizer, Companded Quantization, Variable Length Coding and Problem Solving in Quantizer Design, Vector Quantization, Transform Coding-Idea of Transform Coding, Choosing the weights of basis vector, forward transform, Energy preserving, Optimal bit allocation .

Text books:

1. T. M. Cover, J. A, Thomas, "Elements of information theory," Wiely Interscience, 2 nd Edition, 2006
2. R. W. Hamming, "Coding and information theory," Prentice Hall Inc., 1980.

Reference Books:

1. Bose, "Information Theory, Coding and Cryptography", Mc graw hill Education
2. S. Gravano, "Introduction to Error Control Codes", OUP Oxford (24 May 2001)
3. Robert B. Ash, "Information Theory", Dover Publications (November 1, 1990)
4. Todd k Moon, "Error Correction Coding: Mathematical Methods and Algorithms", Wiley, 2005.

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Course Title	DSP Algorithms & Architectures				Honours Degree		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
1892409	EC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	-	--	3	30	70	100
Mid Exam Duration: 2Hrs					End Exam Duration: 3Hrs		

Course Objectives

- **To u**nderstand Aspects of architectures.
- **To** understand Memory mapped accelerators
- **To** analyze DSP algorithms
- **To** map the algorithms to architectures

Course Outcomes: On successful completion of this course, the students will be able to	
CO 1	Understand Aspects of architectures.
CO 2	Understand Memory mapped accelerators
CO 3	Analyze DSP algorithms
CO 4	Map the algorithms to architectures

Unit-I

DSP System Models: Introduction- Review of digital logic, Timing and Power in digital circuits, Quality metrics and bounds - Implementation Costs and Metrics, Architecture cost components, Examples of Architectures, Multi-objective Optimization.

Number representation- Scientific notation and Floating point

FIR and IIR Implementation: FIR filter, Serial FIR filter architectures, Simple programmable architecture, Block diagrams and SFGs, Dataflow Graphs, Iteration period, FIR filter iteration period, IIR filter iteration period, Computation Model

Unit-II

Dedicated hardware and transforms – Implementation, Constraint analysis for IPB computation, Motivational examples for IPB, General IPB computation, Sample period calculation, Parallel architecture, Odd-even register reuse, Power consumption, Pipelining, Pipelining FIR filter, Time-invariant systems, Valid pipelining examples, Feed forward cutsets, Balanced pipeline, Retiming basic concept, Example and uses of retiming

Resource sharing: adder example, Changing iteration period, Hardware assumptions and constraint analysis, Mathematical formulation, Examples with formulation, Example: Biquad filter, Hardware architecture, Review biquad folding sets, Complete biquad hardware,

Unit-III

Scheduling: Obtaining a folding schedule, ASAP schedule, Utilization Efficiency, ALAP schedule, Iteration period bound and scheduling, Retiming for scheduling, Blocked schedules, Overlapped schedules, mproved blocked schedule, Allocation, Binding and Scheduling, Heuristic approaches to scheduling, Mathematical formulation, ILP formulation, List scheduling, Hardware model, Force Directed Scheduling.

Unit-IV

Programmable Sytems: Software Compilation, Optimization Examples, Loop optimizations, Software pipelining, FFT Optimization, CPUs and FPGAs, FFT on FPGA board, Understanding ELF files

Unit-V

Memory and Communication Systems: On-chip communication basics, Many-to-Many communication, AXI bus handshaking, HW accelerator for FPGA, DMA and arbitration, Network-on-chip basics, NoC - topologies and metrics, NoC– routing, NoC - switching and flow control,

Specialized Architectures: Systolic Arrays – Background, CORDIC algorithm, Parallel implementation of FIR filters, Unfolding Transformation, Look ahead Transformation, Introduction to GPUs and Matrix multiplication

Text Books:

1. KK Parhi, "VLSI Digital Signal Processing Systems: Design and Implementation", Wiley, NY, 1999.
2. Lars Wanhammar, Academic Press, 1999.

Reference Books:

1. Peter Pirsch, "Architectures for Digital Signal Processing", 2nd edition, John Weily, 2007
2. B. Venkataramani and M. Bhaskar, "Digital Signal Processors, Architecture, Programming And Applications", 2 Edition, TMH, 2004.
3. Jervis, "Digital Signal Processing- A practical approach", 4th edition, Pearson Education, 2004.

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Course Title	Low Power VLSI Design				Honours Degree		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
1892410	EC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	-	--	3	30	70	100
Mid Exam Duration: 2Hrs					End Exam Duration: 3Hrs		

Course Objectives

- To understand leakage sources and reduction techniques.
- To characterize and model power consumption & understand the basic analysis methods.
- To identify the sources of power dissipation in digital IC systems & understand the impact of power on system performance and reliability.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand leakage sources and reduction techniques.
CO 2	Characterize and model power consumption & understand the basic analysis Methods.
CO 3	Identify the sources of power dissipation in digital IC systems & understand the impact of power on system performance and reliability.

Unit -I

Technology & Circuit Design Levels: Sources of power dissipation in digital ICs, degree of freedom, recurring themes in low-power, emerging low power approaches, dynamic dissipation in CMOS, effects of Vdd & Vt on speed, constraints on Vt reduction, transistor sizing & optimal gate oxide thickness, impact of technology scaling, technology Innovations.

Unit -II

Low Power Circuit Techniques: Power consumption in circuits, flip-flops & latches, high capacitance nodes, energy recovery, reversible pipelines, high performance approaches.

Unit -II

Low Power Clock Distribution: Power dissipation in clock distribution, single driver Versus distributed buffers, buffers & device sizing under process variations, zero skew Vs. Tolerable skew, chip & package co-design of clock network.

Unit -IV

Logic Synthesis for Low Power estimation techniques: Power minimization techniques, low power arithmetic components- circuit design styles, adders, multipliers.

Unit -V

Low Power Memory Design: Sources & reduction of power dissipation in memory subsystem, sources of power dissipation in DRAM & SRAM, low power DRAM circuits, low power SRAM circuits.

Text Books:

1. P. Rashinkar, Paterson and L. Singh, "Low Power Design Methodologies", Kluwer Academic, 2002
2. Kaushik Roy, Sharat Prasad, "Low power CMOS VLSI circuit design", John Wiley sonsInc.,2000.
3. J.B.Kulo and J.H Lou, "Low voltage CMOS VLSI Circuits", Wiley, 1999.

Reference Books:

1. A.P.Chandrasekaran and R.W.Broadersen, "Low power digital CMOS design", Kluwer,1995
2. Gary Yeap, "Practical low power digital VLSI design", Kluwer, 1998.

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Course Title	RF Integrated Circuits					Honours Degree		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
1892411	EC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	-	--	3	30	70	100
Mid Exam Duration: 2Hrs						End Exam Duration: 3Hrs		

Course Objectives

- To understand different RF Components such as Passive components, Microstri Transmission Line.
- To design RF Amplifiers-High gain, Low gain Minimum Noise Amplifiers.
- To design of RF Oscillators.
- To design of RF Converters, Mixers.
- To design of Matching networks for RF Circuits.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand different RF Components such as Passive components, Microstrip Transmission Line.
CO 2	Design RF Amplifiers-High gain, Low gain Minimum Noise Amplifiers.
CO 3	Design of RF Oscillators.
CO 4	Design of RF Converters, Mixers.
CO 5	Design of Matching networks for RF Circuits.

Unit-I

RF systems: basic architectures, Transmission media and reflections, Maximum power transfer, Passive RLC Networks - Parallel RLC tank, Q, Series RLC networks, matching, Pi match, T match, Passive IC Components, Interconnects and skin Effect, Resistors, capacitors, Inductors

Unit-II

Review of MOS devices: Distributed Systems- transmission lines, reflection coefficient, The wave equation, examples, Lossy transmission lines, Smith charts – plotting gammaTime Domain Methods for Speech Processing: Time domain parameters of speech, methods for extracting the parameters: Zero crossings, Auto-correlation function, pitch estimation. Analysis and Synthesis of Pole-Zero Speech Models

Unit-III

High Frequency Amplifier Design: Bandwidth estimation using open-circuit time constants, Bandwidth estimation using short-circuit time constants, Rise time, delay and bandwidth, Zeros

to enhance bandwidth, Shunt-series amplifiers, tuned amplifiers, Cascaded amplifiers. Noise-Thermal noise, flicker noise review, Noise figure, LNA Design - Intrinsic MOS noise Parametes, Power match versus noise match, Large signal performance, design examples & Multiplier based mixers. Mixer Design – Sub sampling mixers.

Unit -IV

RF Power Amplifiers: Class A, AB, B, C Amplifiers, Class D, E, F amplifiers, RF Power amplifier design examples. Voltage controlled oscillators – Resonators, Negative resistance Oscillators.

Unit -V

Phase locked Loop: Linearized PLL models, Phase detectors, charge Pumps, Loop filters, PLL design Examples. Frequency synthesis and oscillators - Frequency division, integer-N synthesis, Fractional frequency synthesis. Phase noise - General considerations, Circuit examples. Radio architectures - GSM radio architectures, CDMA, UMTS radio architectures

Text Books:

1. Thomas H. Lee, "The Design of CMOS Radio-Frequency Integrated Circuits", Cambridge University Press, 2004.
2. Behzad Razavi, "RF Microelectronics", Prentice Hall, 1997.

Reference Books:

1. Ellinger, Frank, "Radio Frequency Integrated Circuits and Technologies", Springer, 2008.
2. Cam Nguyen, "Radio-Frequency Integrated-Circuit Engineering", John Wiley & Sons, 2015.

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Course Title	Principles of Signal Estimation for MIMO/ OFDM Wireless Communication				Honours Degree		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
1892412	EC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	-	--	3	30	70	100
Mid Exam Duration: 2Hrs					End Exam Duration: 3Hrs		

Course Objectives

- To understand MIMO Communication Systems and OFDM
- To compare MIMO Systems with Single Input Single Output (SISO) Systems
- To analyse the Information Theoretic advantages of MIMO Systems
- To analyse the spatial multiplexing properties of MIMO

Course Outcomes: On successful completion of this course, the students will be able to	
CO 1	Understand MIMO Communication Systems and OFDM
CO 2	Compare MIMO Systems with Single Input Single Output (SISO) Systems
CO 3	Analyse the Information Theoretic advantages of MIMO Systems
CO 4	Analyse the spatial multiplexing properties of MIMO

Unit-I

MIMO Introduction: Basics of Estimation, Maximum likelihood, Information Theoretic aspects of MIMO Review of SISO fading communication channels, MIMO channel models, Classical i.i.d. and extended channels, Frequency selective and correlated channel models, Capacity of MIMO channels, Ergodic and outage capacity, Capacity bounds and Influence of channel properties on the capacity.

Unit- II

MIMO Diversity: Spatial Multiplexing Sources and types of diversity, analysis under Rayleigh fading, Diversity and channel knowledge. Alamouti space time code, MIMO spatial multiplexing. Space time receivers.. ML, ZF, MMSE and Sphere decoding, BLAST receivers and Diversity multiplexing trade-off.

Unit- III

Space Time Trellis Codes: Representation of STTC, shift register, generator matrix, state-transition diagram, trellis diagram, Code construction, Delay diversity as a special case of STTC and Performance analysis.

Unit-IV

Wireless fading channel Estimation: Cramer-rao bound for Estimation, vector parameter Estimation, Properties of Estimation, Multi-antenna Wireless channel Estimation. MEMO Wireless channel Estimation, Error covariance of Estimation, Equalization for frequency selective channels.

Unit- V

OFDM Estimation: sequential estimation, Minimum Mean-square Error (MMSE), Estimate Gaussian parameter, Wireless sensor network, wireless fading channel estimation.

MMSE for MIMO Channel estimation properties of Estimation, MMSE for equalization of wireless Channel, MMSE of OFDM Channel estimation.

Text Books :

1. David Tse and Pramod Viswanath, "Fundamentals of Wireless Communication", Cambridge University Press 2005.
2. Hamid Jafarkhani, "Space-Time Coding: Theory and Practice", Cambridge University Press 2005.

Reference Books:

1. Paulraj, R. Nabar and D. Gore, " Introduction to Space-Time Wireless Communications", Cambridge University Press 2003.
2. E.G. Larsson and P. Stoica, "Space-Time Block Coding for Wireless Communications", Cambridge University Press 2008.
3. Ezio Biglieri , Robert Calderbank et al "MIMO Wireless Communications" Cambridge University Press 2007.

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Course Title	Statistical Signal Processing				Honours Degree		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
1892413	EC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	-	--	3	30	70	100
Mid Exam Duration: 2Hrs					End Exam Duration: 3Hrs		

Course Objectives

- To generalize the properties of statistical models in the analysis of signals using Stochastic Processes.
- To differentiate the prominence of various spectral estimation techniques for achieving Higher resolution in the estimation of power spectral density.
- To outline various parametric estimation methods to accomplish the signal modeling even at higher order statistics.
- To design and development of optimum filters using classical and adaptive algorithms.
- To extrapolate the importance of least squares techniques and decomposition methods in Analyzing the signal estimations.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Generalize the properties of statistical models in the analysis of signals using Stochastic Processes.
CO 2	Differentiate the prominence of various spectral estimation techniques for Achieving Higher resolution in the estimation of power spectral density.
CO 3	Outline various parametric estimation methods to accomplish the signal modeling even at higher order statistics.
CO 4	Design and development of optimum filters using classical and adaptive algorithms.
CO 5	Extrapolate the importance of least squares techniques and decomposition methods in analyzing the signal estimations.

Unit-I

Introduction: Stationary processes: Strict sense and wide sense stationarity; Correlation and Spectral analysis of discrete-time wide sense stationary processes, white noise, response of linear systems to wide-sense stationary inputs, spectral factorization.

Unit II

Parameter estimation: Properties of estimators, Minimum Variance Unbiased Estimator (MVUE Cramer Rao bound, MVUE through Sufficient Statistics, Maximum likelihood estimation- properties. Bayseaen estimation- Minimum Mean-square error (MMSE) and Maximum a Posteriori (MAP) estimation.

Unit III

Signal estimation in white Gaussian noise– MMSE, conditional expectation; Linear minimum Mean-square error (LMMSE) estimation, orthogonality principle and Wiener Hoff equation, FIR Wiener filter, linear prediction-forward and backward predictions, Levinson-Durbin Algorithm, application –linear prediction of speech, Non-causal IIR wiener filter, Causal IIR Wiener filtering.

Unit IV

Iterative and adaptive implementation of FIR Wiener filter: Steepest descent algorithm, LMS adaptive filters, convergence analysis, least-squares(LS) method, Recursive LS (RLS) adaptive filter, complexity analysis, application- neural network.

Unit V

Kalman filters: Gauss -Markov state variable models; innovation and Kalman recursion, Steady-state behavior of Kalman filters.

Text Books:

1. M. H. Hayes, "Statistical Digital Signal Processing and Modeling", John Wiley & Sons, Inc., 2002.
2. S. M. Kay, "Fundamentals of Statistical Signal Processing: Estimation Theory", Prentice Hall,1993.
3. D.G. Manolakis, V.K. Ingle and S.M. Kogon, "Statistical and Adaptive Signal Processing", McGraw Hill, 2000.

Reference Books:

1. Umberto Spagnolini, "Statistical Signal Processing in Engineering", John Wiley & Sons, 2018.
2. Robert M. Gray, Lee D. Davisson, "An Introduction to Statistical Signal Processing", Cambridge University Press, 2004.

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Course Title	Op-Amp Practical Applications: Design, Simulation and Implementation				Honours Degree			
Course Code	Category	Hours/Week			Credits	Maximum Marks		
1892414	EC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	-	--	3	30	70	100
Mid Exam Duration: 2Hrs					End Exam Duration: 3Hrs			

Course Objectives

- **To** understand the operational amplifiers with linear integrated circuits.
- **To** Identify positive feedback amplifier applications of op-amp.
- **To** Design circuits using operational amplifiers for various applications.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand the operational amplifiers with linear integrated circuits.
CO 2	Identify positive feedback amplifier applications of op-amp.
CO 3	Design circuits using operational amplifiers for various applications.

Unit-I

Introduction to Operational Amplifier: Data sheets of Operational amplifier, ideal Characteristics, effect of loading, input impedance, concept of hysteresis, need of hysteresis for switching circuits.

Unit -II

Op-amp practical applications: Analog to digital converters, Digital to analog converters, function generator capable of generating square wave and triangular wave.

Unit -III

Positive feedback amplifier op-amp applications: Window comparator, Inverting Schmitt trigger, non-inverting Schmitt trigger, Astable multivibrator, Monostable multivibrator, voltage controlled voltage source.

Unit -IV

Temperature controlled applications using op-amp: Design and development of temperature controlled circuit using op-amp for ON/OFF, Implementation of PI controller,

Unit -V

Data acquisition applications using op-amp: Signal conditioning unit for thermocouple, Introduction to ECG experiment, peak detector and thresholding for ECG signal conditioning.

TEXT BOOKS:

1. Gray, Hurst, Lewis, and Meyer, "Analysis and Design of Analog Integrated Circuits", John Wiley & Sons, 5th edition, 2009
2. Horowitz and Hill, "The Art of Electronics", Cambridge Univ. Press, 1999
3. Behzad Razavi, "Design of Analog CMOS Integrated Circuits", McGraw-Hill, 2001

REFERENCE BOOKS:

1. Phillip E. Allen and Douglas R. Holberg, "CMOS Analog Circuit Design", Oxford University Press, 2nd edition, 2002
2. Johan H. Huijsing, "Operational Amplifiers – Theory and Design", 3rd edition, Springer
3. Razavi, "Fundamentals of Microelectronics", John Wiley, 2008.

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Course Title	Multirate DSP					Honours Degree		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
1892415	EC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	-	--	3	30	70	100
Mid Exam Duration: 2Hrs						End Exam Duration: 3Hrs		

Course Objectives

- To understand the concepts of sampling rate conversions, Decimation and Interpolation as part of Signal Processing techniques.
- To describe basic sampling rate conversion algorithms.
- To design sampling rate converters.
- To analyze the interpolated FIR filters.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand the concepts of sampling rate conversions, Decimation and Interpolation as part of Signal Processing techniques.
CO 2	Describe basic sampling rate conversion algorithms.
CO 3	Design sampling rate converters.
CO 4	Analyze the interpolated FIR filters.

Unit-I

Introduction: Overview of Sampling and Reconstruction, Review of Discrete-Time Systems and Review of digital filters

Unit-II

Fundamentals of Multirate Theory: The sampling theorem – sampling at sub 30yquist rate – Basic Formulations and schemes. Basic Multirate operations- Decimation and Interpolation – Digital Filter Banks- DFT Filter Bank- representation Maximally decimated filter banks: Polyphase representation – Errors in the QMF bank- Perfect reconstruction (PR) QMF Bank – Design of an alias free QMF Bank decimator.

Unit-III

Filter Banks I: M-channel perfect reconstruction filter banks Uniform band and non uniform filter bank - tree structured filter bank- Errors created by filter bank system- Polyphase representation- perfect reconstruction systems.

Unit-IV

Filter Banks II: Perfect reconstruction (PR) filter banks Paraunitary PR Filter Banks- Filter Bank Properties induced by paraunitarity- Two channel FIR paraunitary QMF Bank- Linear phase PR Filter banks- Necessary conditions for Linear phase property- Quantization Effects: - Types of quantization effects in filter banks. - coefficient sensitivity effects, dynamic range and scaling.

Unit-V

Filter Banks III: Cosine Modulated filter banks Cosine Modulated pseudo QMF Bank- Alas cancellation- phase - Phase distortion- Closed form expression- Polyphase structure- PR Systems

Text Books

1. P.P. Vaidyanathan. "Multirate systems and filter banks." Prentice Hall. PTR. 1993.
2. N.J. Fliege. "Multirate digital signal processing ." John Wiley 1994.
3. Sanjit K. Mitra. " Digital Signal Processing: A computer based approach." McGraw Hill. 1998.

Reference Books:

1. R.E. Crochiere. L. R. "Multirate Digital Signal Processing", Prentice Hall. Inc.1983.
2. J.G. Proakis. D.G. Manolakis. "Digital Signal Processing: Principles. Algorithms and Applications", 3rd Edn. Prentice Hall India, 1999. EC6301: Random Process.

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Course Title	Digital VLSI Testing				Honours Degree		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
1892416	EC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	-	--	3	30	70	100
Mid Exam Duration: 2Hrs					End Exam Duration: 3Hrs		

Course Objectives

To understand the different types of testing and its importance
To apply design for testability and design rules.
To identify various test pattern generations
To compare the fault models and test techniques

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand the different types of testing and its importance
CO 2	Apply design for testability and design rules.
CO 3	Identify various test pattern generations
CO 4	Compare the fault models and test techniques

Unit I

Introduction to Testing: Introduction, Importance, Challenges, Levels of abstraction, Fault Models, Types of Testing, Fault Modelling: Defects, Errors and Faults, Functional Versus Structural Testing.

Unit II

Design for Testability: Introduction, Testability Analysis, DFT Basics, Scan cell design, Scan Architecture, Design for Testability: Scan design rules, Scan design flow Fault Simulation: Introduction, Simulation models

Unit III

Fault Simulation: Logic simulation, Fault simulation, Test Generation: Introduction, Exhaustive testing, Boolean difference, Basic ATPG algorithms, Test Generation: ATPG for non stuck-at faults, other issues in test generation.

Unit IV

Built-In-Self-Test: Introduction, BIST design rules, Built-In-Self-Test: Test pattern generation, Output response analysis, Logic BIST architectures. Test Compression: Introduction, Stimulus compression, Response compression.

Unit V

Memory Testing: Introduction, RAM fault models, RAM test generation, Memory Testing: Memory BIST Power and Thermal Aware Test: Importance, Power models, Low power ATPG, Power and Thermal Aware Test: Low power BIST, Thermal aware techniques.

Text Book

1. M.L. Bushnell, V. D. Agrawal, "Essentials of Electronic Testing for Digital, Memory and Mixed Signal VLSI Circuits" Kluwer Academic Publishers.
2. P. K. Lala," Digital circuit Testing and Testability", Academic Press. 1997.

Reference Books

1. M. Abramovici, M. A. Breuer and A.D Friedman, "Digital Systems and Testable Design", Jaico Publishing House.
2. N. Jha & S.D. Gupta, "Testing of Digital Systems", Cambridge, 2003.

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