JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B.Tech. in ELECTRONICS AND INSTRUMENTATION ENGINEERING
COURSE STRUCTURE & SYLLABUS (R22 Regulations)
Applicable from AY 2022-23 Batch

I Year I Semester

S. No.	Course Code	Course Title	L	T	P	Credits
1.	MA101BS	Matrices and Calculus	3	1	0	4
2.	PH102BS	Applied Physics	3	1	0	4
3.	EI103ES	C Programming for Engineers	3	0	0	3
4.	ME104ES	Engineering Workshop	0	1	3	2.5
5.	EN105HS	English for Skill Enhancement	2	0	0	2
6.	EI106ES	Elements of Electronics and Instrumentation Engineering	0	0	2	1
7.	PH107BS	Applied Physics Laboratory	0	0	3	1.5
8.	EI108ES	C Programming for Engineers Laboratory	0	0	2	1
9.	EN109HS	English Language and Communication Skills Laboratory	0	0	2	1
10.	*MC110	Environmental Science	3	0	0	0
		Induction Programme				
		Total	**14**	**3**	**12**	**20**

I Year II Semester

S. No.	Course Code	Course Title	L	T	P	Credits
1.	MA201BS	Ordinary Differential Equations and Vector Calculus	3	1	0	4
2.	CH202BS	Engineering Chemistry	3	1	0	4
3.	ME203ES	Computer Aided Engineering Graphics	1	0	4	3
4.	EE204ES	Basic Electrical Engineering	2	0	0	2
5.	EC205ES	Electronic Devices and Circuits	2	0	0	2
6.	EI206ES	Applied Python Programming Laboratory	0	1	2	2
7.	CH207BS	Engineering Chemistry Laboratory	0	0	2	1
8.	EE208ES	Basic Electrical Engineering Laboratory	0	0	2	1
9.	EC209ES	Electronic Devices and Circuits Laboratory	0	0	2	1
		Total	**11**	**3**	**12**	**20**

II YEAR I SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
1	EI301PC	Analog Circuits	3	0	0	3
2	EI302PC	Network analysis and synthesis	3	0	0	3
3	EI303PC	Electronic Measurements	3	0	0	3
4	EI304PC	Signals and Systems	3	1	0	4
	EI305PC	Sensors and Signal Conditioning	3	1	0	4
5	EI306PC	Analog Circuits Laboratory	0	0	2	1
6	EI307PC	Sensors and Measurements Laboratory	0	0	2	1
7	EI308PC	Basic Simulation Laboratory	0	0	2	1
8	*MC309	Constitution of India	3	0	0	0
9		**Total Credits**	**18**	**2**	**6**	**20**

II YEAR II SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
1	EI401PC	Numerical Methods & Complex Variables	3	1	0	4
2	EI402PC	Industrial Instrumentation	2	0	0	2
3	EI403PC	Digital Logic Design	3	0	0	3
4	EI404PC	Electronic Circuit Analysis	3	0	0	3
5	EI405PC	Linear and Digital IC Applications	3	0	0	3
6	EI406PC	Electronic Circuit Analysis Laboratory	0	0	2	1
7	EI407PC	Linear and Digital IC Applications Laboratory	0	0	2	1
8	EI408PC	Industrial Instrumentation Laboratory	0	0	2	1
9	EI409PC	Real-Time Research Project/ Field-based Project	0	0	4	2
10	*MC410	Gender Sensitization Lab	0	0	2	0
		Total Credits	**14**	**1**	**12**	**20**

III YEAR I SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
1	EI501PC	Microcontrollers	3	1	0	4
2	EI502PC	Process Dynamics and Control	3	0	0	3
3	EI503PC	Control Systems	3	1	0	4
4	SM504MS	Business Economics & Financial Analysis	3	0	0	3
5		Professional Elective - I	3	0	0	3
6	EI505PC	Microcontrollers Laboratory	0	0	2	1
7	EI506PC	Process Control Laboratory	0	0	2	1
8	EN508HS	Advanced English Communication Skills Laboratory	0	0	2	1
9	*MC510	Intellectual Property Rights	3	0	0	0
		Total Credits	**18**	**2**	**6**	**20**

III YEAR II SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
1	EI601PC	Digital Signal Processing	3	0	0	3
2	EI602PC	Industrial Automation	3	0	0	3
3	EI603PC	Virtual Instrumentation	3	0	0	3
4		Professional Elective - II	3	0	0	3
5		Open Elective - I	3	0	0	3
6	EI604PC	Digital Signal Processing Laboratory	0	0	2	1
7	EI605PC	Industrial Automation Laboratory	0	0	2	1
8	EI606PC	Virtual Instrumentation Laboratory	0	0	2	1
9	EI607PC	Industry Oriented Mini Project/ Internship	0	0	4	2
10	*MC609	Environmental Science	3	0	0	0
		Total Credits	**18**	**0**	**10**	**20**

Environmental Science in III Yr II Sem Should be Registered by Lateral Entry Students Only.

IV YEAR I SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
1	EI701PC	Analytical Instrumentation	3	1	0	4
2		Professional Elective – III	3	0	0	3
3		Professional Elective – IV	3	0	0	3
4		Open Elective - II	3	0	0	3
5	EI702PC	Professional Practice, Law & Ethics	2	0	0	2
6	EI703PC	Analytical Instrumentation Laboratory	0	0	4	2
7	EI704PC	Project Stage - I	0	0	6	3
		Total Credits	**15**	**1**	**10**	**20**

IV YEAR II SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
1		Professional Elective – V	3	0	0	3
2		Professional Elective – VI	3	0	0	3
3		Open Elective - III	3	0	0	3
4		Project Stage – II including Seminar	0	0	22	11
		Total Credits	**9**	**0**	**22**	**20**

*MC – Satisfactory/Unsatisfactory

B.Tech Program Elective Courses

PE 1	PE 2	PE 3	PE 4	PE 5	PE 6
Instrumentation Practices in Industries	Optoelectronics and Laser Instrumentation	Pharmaceutical Instrumentation	Image and Video Processing	Machine Learning	Power Plant Instrumentation
Real Time Operating Systems	Industrial Data Communications	Digital Control Systems	Computer Networks	Digital Image Processing with JAVA	Biomedical Instrumentation
IoT Architectures and System Design	Embedded Systems	MEMS and its applications	Artificial Neural Networks	VLSI Design	Robotics and Automation

Open Electives

III Yr II Sem Open Elective (OE – I)	IV Yr I Sem Open Elective (OE – II)	IV Yr II Sem Open Elective (OE – III)
Basics of Sensors Technology	Fundamentals of Biomedical Instrumentation	Basics of Virtual Instrumentation
Digital Electronics for Engineering	Measuring Instruments	Electronics for Health Care

MA101BS: MATRICES AND CALCULUS

B.Tech. I Year I Sem.   **L T P C**
                                                                                    3 1 0 4

Pre-requisites: Mathematical Knowledge at pre-university level

Course Objectives: To learn
- Types of matrices and their properties.
- Concept of a rank of the matrix and applying this concept to know the consistency and solving the system of linear equations.
- Concept of eigenvalues and eigenvectors and to reduce the quadratic form to canonical form
- Geometrical approach to the mean value theorems and their application to the mathematical problems
- Evaluation of surface areas and volumes of revolutions of curves.
- Evaluation of improper integrals using Beta and Gamma functions.
- Partial differentiation, concept of total derivative
- Finding maxima and minima of function of two and three variables.
- Evaluation of multiple integrals and their applications

Course outcomes: After learning the contents of this paper the student must be able to
- Write the matrix representation of a set of linear equations and to analyse the solution of the system of equations
- Find the Eigenvalues and Eigen vectors
- Reduce the quadratic form to canonical form using orthogonal transformations.
- Solve the applications on the mean value theorems.
- Evaluate the improper integrals using Beta and Gamma functions
- Find the extreme values of functions of two variables with/ without constraints.
- Evaluate the multiple integrals and apply the concept to find areas, volumes

UNIT-I: Matrices   **10 L**
Rank of a matrix by Echelon form and Normal form, Inverse of Non-singular matrices by Gauss-Jordan method, System of linear equations: Solving system of Homogeneous and Non-Homogeneous equations by Gauss elimination method, Gauss Seidel Iteration Method.

UNIT-II: Eigen values and Eigen vectors   **10 L**
Linear Transformation and Orthogonal Transformation: Eigenvalues, Eigenvectors and their properties, Diagonalization of a matrix, Cayley-Hamilton Theorem (without proof), finding inverse and power of a matrix by Cayley-Hamilton Theorem, Quadratic forms and Nature of the Quadratic Forms, Reduction of Quadratic form to canonical forms by Orthogonal Transformation.

UNIT-III: Calculus   **10 L**
Mean value theorems: Rolle's theorem, Lagrange's Mean value theorem with their Geometrical Interpretation and applications, Cauchy's Mean value Theorem, Taylor's Series.
Applications of definite integrals to evaluate surface areas and volumes of revolutions of curves (Only in Cartesian coordinates), Definition of Improper Integral: Beta and Gamma functions and their applications.

UNIT-IV: Multivariable Calculus (Partial Differentiation and applications)   **10 L**
Definitions of Limit and continuity.
Partial Differentiation: Euler's Theorem, Total derivative, Jacobian, Functional dependence & independence. Applications: Maxima and minima of functions of two variables and three variables using method of Lagrange multipliers.

UNIT-V: Multivariable Calculus (Integration)　　　　　　　　　　　**8 L**
Evaluation of Double Integrals (Cartesian and polar coordinates), change of order of integration (only Cartesian form), Evaluation of Triple Integrals: Change of variables (Cartesian to polar) for double and (Cartesian to Spherical and Cylindrical polar coordinates) for triple integrals.
Applications: Areas (by double integrals) and volumes (by double integrals and triple integrals).

TEXT BOOKS:
1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
2. R.K. Jain and S.R.K. Iyengar, Advanced Engineering Mathematics, Narosa Publications, 5th Editon, 2016.

REFERENCE BOOKS:
1. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9thEdition,Pearson, Reprint, 2002.
3. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
4. H. K. Dass and Er. Rajnish Verma, Higher Engineering Mathematics, S Chand and Company Limited, New Delhi.

PH102BS: APPLIED PHYSICS

B.Tech. I Year I Sem.   **L   T   P   C**
                                                                                                  3   1   0   4

Pre-requisites: 10 + 2 Physics

Course Objectives: The objectives of this course for the student are to:
1. Understand the basic principles of quantum physics and band theory of solids.
2. Understand the underlying mechanism involved in construction and working principles of various semiconductor devices.
3. Study the fundamental concepts related to the dielectric, magnetic and energy materials.
4. Identify the importance of nanoscale, quantum confinement and various fabrications techniques.
5. Study the characteristics of lasers and optical fibres.

Course Outcomes: At the end of the course the student will be able to:
1. Understand physical world from fundamental point of view by the concepts of Quantum mechanics and visualize the difference between conductor, semiconductor, and an insulator by classification of solids.
2. Identify the role of semiconductor devices in science and engineering Applications.
3. Explore the fundamental properties of dielectric, magnetic materials and energy for their applications.
4. Appreciate the features and applications of Nanomaterials.
5. Understand various aspects of Lasers and Optical fiber and their applications in diverse fields.

UNIT - I: QUANTUM PHYSICS AND SOLIDS
Quantum Mechanics: Introduction to quantum physics, blackbody radiation – Stefan-Boltzmann's law, Wein's and Rayleigh-Jean's law, Planck's radiation law - photoelectric effect - Davisson and Germer experiment –Heisenberg uncertainty principle - Born interpretation of the wave function – time independent Schrodinger wave equation - particle in one dimensional potential box.
Solids: Symmetry in solids, free electron theory (Drude & Lorentz, Sommerfeld) - Fermi-Dirac distribution - Bloch's theorem -Kronig-Penney model – E-K diagram- effective mass of electron-origin of energy bands- classification of solids.

UNIT - II: SEMICONDUCTORS AND DEVICES
Intrinsic and extrinsic semiconductors – Hall effect - direct and indirect band gap semiconductors - construction, principle of operation and characteristics of P-N Junction diode, Zener diode and bipolar junction transistor (BJT)–LED, PIN diode, avalanche photo diode (APD) and solar cells, their structure, materials, working principle and characteristics.

UNIT - III: DIELECTRIC, MAGNETIC AND ENERGY MATERIALS
Dielectric Materials: Basic definitions- types of polarizations (qualitative) - ferroelectric, piezoelectric, and pyroelectric materials – applications – liquid crystal displays (LCD) and crystal oscillators.
Magnetic Materials: Hysteresis - soft and hard magnetic materials - magnetostriction, magnetoresistance - applications - bubble memory devices, magnetic field sensors and multiferroics.
Energy Materials: Conductivity of liquid and solid electrolytes- superionic conductors - materials and electrolytes for super capacitors - rechargeable ion batteries, solid fuel cells.

UNIT - IV: NANOTECHNOLOGY
Nanoscale, quantum confinement, surface to volume ratio, bottom-up fabrication: sol-gel, precipitation, combustion methods – top-down fabrication: ball milling - physical vapor deposition (PVD) - chemical vapor deposition (CVD) - characterization techniques - XRD, SEM &TEM - applications of nanomaterials.

UNIT - V: LASER AND FIBER OPTICS

Lasers: Laser beam characteristics-three quantum processes-Einstein coefficients and their relations-lasing action - pumping methods- ruby laser, He-Ne laser , CO_2 laser, Argon ion Laser, Nd:YAG laser-semiconductor laser-applications of laser.

Fiber Optics: Introduction to optical fiber- advantages of optical Fibers - total internal reflection-construction of optical fiber - acceptance angle - numerical aperture- classification of optical fibers-losses in optical fiber - optical fiber for communication system - applications.

TEXT BOOKS:

1. M. N. Avadhanulu, P.G. Kshirsagar & TVS Arun Murthy" A Text book of Engineering Physics"- S. Chand Publications, 11th Edition 2019.
2. Engineering Physics by Shatendra Sharma and Jyotsna Sharma, Pearson Publication, 2019
3. Semiconductor Physics and Devices- Basic Principle – Donald A, Neamen, Mc Graw Hill, 4th Edition, 2021.
4. B.K. Pandey and S. Chaturvedi, Engineering Physics, Cengage Learning, 2nd Edition, 2022.
5. Essentials of Nanoscience & Nanotechnology by Narasimha Reddy Katta, Typical Creatives NANO DIGEST, 1st Edition, 2021.

REFERENCE BOOKS:

1. Quantum Physics, H.C. Verma, TBS Publication, 2nd Edition 2012.
2. Fundamentals of Physics – Halliday, Resnick and Walker, John Wiley &Sons, 11th Edition, 2018.
3. Introduction to Solid State Physics, Charles Kittel, Wiley Eastern, 2019.
4. Elementary Solid State Physics, S.L. Gupta and V. Kumar, Pragathi Prakashan, 2019.
5. A.K. Bhandhopadhya - Nano Materials, New Age International, 1st Edition, 2007.
6. Energy Materials a Short Introduction to Functional Materials for Energy Conversion and Storage Aliaksandr S. Bandarenka, CRC Press Taylor & Francis Group
7. Energy Materials, Taylor & Francis Group, 1st Edition, 2022.

EI103ES: C PROGRAMMING FOR ENGINEERS

B.Tech. I Year I Sem.			L	T	P	C
			3	0	0	3

Course Objectives:
1. To learn the fundamentals of computers.
2. To understand the various steps in Program development.
3. To learn the syntax and semantics of C Programming Language.
4. To learn the usage of structured programming approach in solving problems.

Course Outcomes: Upon completing this course, the students will be able to
1. Draw flowcharts for solving arithmetic and logical problems
2. Develop modular reusable code by understanding concepts of functions.
3. Formulate algorithms and programs using arrays, pointers, strings and structures.
4. Write a programs using Searching and sorting algorithms

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	1	-	1	-	-	-	-	-	1
CO2	3	2	3	2	-	2	-	-	-	-	-	1
CO3	3	3	2	1	-	2	-	1	-	-	-	1
CO4	3	3	3	2		1	-	1				

UNIT- I
Introduction to Computer Algorithms and Programming
Components of a computer system: Memory, processor, I/O devices, storage, operating system, the concept of assembler, compiler, interpreter, loader, and linker.
From algorithm to program: Representation of an algorithm, flowchart, Pseudocode with examples, converting algorithms to programs.
Programming Basics: Structure of C program, writing and executing the first C program, Syntax and logical errors in compilation, object, and executable code. Components of C language, standard I/O in C, data types, variables and constants, memory storage, and storage classes.

UNIT – II
Expressions and Statements
Expressions and their evaluation: Operands and Operators, formation of expressions using arithmetic, relational, logical, and bitwise operators, precedence and associativity rules, mixed operands, type conversion, and evaluation of expressions.
Statements: Simple and compound statements, Conditional Branching: if and switch statements, nested if-else, dangling else problem, use of break and default with switch. Iteration and loops: use of while, do-while and for loops, nested loops, use of break and continue statements.

UNIT – III
Functions and Arrays
Designing Structured Programs: Introduction to functions, advantages of modularizing a program into functions, types of functions, passing parameters to functions: call by value, call by reference, passing arrays to functions, recursion with example programs.
Arrays: Array notation and representation, manipulating array elements, using multi-dimensional arrays, character arrays, C strings, string input/output functions, Array of strings, string manipulation functions with example programs.

UNIT – IV
Pointers and File handling

Pointers: Introduction, declaration, applications, dynamic memory allocation (malloc, calloc, realloc, free), use of pointers in self-referential structures.

File handling: File I/O functions, standard C pre-processors, defining and calling macros, command-line arguments.

UNIT – V

Derived types And Basic Algorithms:

Structures, Union, Enums and Bit-fields: Defining, declaring, and usage of structures, unions, and their arrays, passing structures, and unions to functions, introduction to enums and bit-fields.

Basic Algorithms: Searching and Sorting Algorithms (Bubble, Insertion, and Selection), finding roots of equations, notion of order of complexity through example programs.

TEXT BOOKS:
1. B. A. Forouzan and R. F. Gilberg -Programming & Data Structures, 3rd Ed., Cengage Learning`
2. Byron Gottfried – Schaum's Outline of Programming with C, McGraw-Hill

REFERENCE BOOKS:
1. Ajay Mittal – Programming in C: A practical approach, Pearson Education, 2010
2. Kernighan Brian W. and Ritchie Dennis M.- The C programming, Pearson Education.
3. J. R. Hanlyand, E. B. Koffman -Problem Solving and Program Design, 5th Ed., Pearson Education.
4. H. Cheng – C for Engineers and Scientists, McGraw-Hill International Edition
5. V. Rajaraman – Computer Basics and C Programming, PHI Learning, 2015.

ME104ES: ENGINEERING WORKSHOP

B.Tech. I Year I Sem.   L T P C
                                                                                        0 1 3 2.5

Pre-requisites: Practical skill

Course Objectives:
- To Study of different hand operated power tools, uses and their demonstration.
- To gain a good basic working knowledge required for the production of various engineering products.
- To provide hands on experience about use of different engineering materials, tools, equipments and processes those are common in the engineering field.
- To develop a right attitude, team working, precision and safety at work place.
- It explains the construction, function, use and application of different working tools, equipment and machines.
- To study commonly used carpentry joints.
- To have practical exposure to various welding and joining processes.
- Identify and use marking out tools, hand tools, measuring equipment and to work to prescribed tolerances.

Course Outcomes: At the end of the course, the student will be able to:
- CO 1: Study and practice on machine tools and their operations
- CO 2: Practice on manufacturing of components using workshop trades including pluming, fitting, carpentry, foundry, house wiring and welding.
- CO 3: Identify and apply suitable tools for different trades of Engineering processes including drilling, material removing, measuring, chiseling.
- CO 4: Apply basic electrical engineering knowledge for house wiring practice.

1. TRADES FOR EXERCISES:
At least two exercises from each trade:
    I.   Carpentry – (T-Lap Joint, Dovetail Joint, Mortise & Tenon Joint)
    II.   Fitting – (V-Fit, Dovetail Fit & Semi-circular fit)
   III.   Tin-Smithy – (Square Tin, Rectangular Tray & Conical Funnel)
   IV.   Foundry – (Preparation of Green Sand Mould using Single Piece and Split Pattern)
    V.   Welding Practice – (Arc Welding & Gas Welding)
   VI.   House-wiring – (Parallel & Series, Two-way Switch and Tube Light)
  VII.   Black Smithy – (Round to Square, Fan Hook and S-Hook)

2. TRADES FOR DEMONSTRATION & EXPOSURE:
Plumbing, Machine Shop, Metal Cutting (Water Plasma), Power tools in construction and Wood Working

TEXT BOOKS:
1. Workshop Practice /B. L. Juneja / Cengage
2. Workshop Manual / K. Venugopal / Anuradha.

REFERENCE BOOKS:
1. Work shop Manual - P. Kannaiah/ K.L. Narayana/ Scitech
2. Workshop Manual / Venkat Reddy/ BSP

EN105HS: ENGLISH FOR SKILL ENHANCEMENT

B.Tech. I Year I Sem.   **L T P C**
                                                                                    2 0 0 2

Course Objectives: This course will enable the students to:
1. Improve the language proficiency of students in English with an emphasis on Vocabulary, Grammar, Reading and Writing skills.
2. Develop study skills and communication skills in various professional situations.
3. Equip students to study engineering subjects more effectively and critically using the theoretical and practical components of the syllabus.

Course Outcomes: Students will be able to:
1. Understand the importance of vocabulary and sentence structures.
2. Choose appropriate vocabulary and sentence structures for their oral and written communication.
3. Demonstrate their understanding of the rules of functional grammar.
4. Develop comprehension skills from the known and unknown passages.
5. Take an active part in drafting paragraphs, letters, essays, abstracts, précis and reports in various contexts.
6. Acquire basic proficiency in reading and writing modules of English.

UNIT - I
Chapter entitled '*Toasted English*' by R.K.Narayan from *"English: Language, Context and Culture"* published by Orient BlackSwan, Hyderabad.

Vocabulary: The Concept of Word Formation -The Use of Prefixes and Suffixes - Acquaintance with Prefixes and Suffixes from Foreign Languages to form Derivatives - Synonyms and Antonyms

Grammar: Identifying Common Errors in Writing with Reference to Articles and Prepositions.

Reading: Reading and Its Importance- Techniques for Effective Reading.

Writing: Sentence Structures -Use of Phrases and Clauses in Sentences- Importance of Proper Punctuation- Techniques for Writing precisely – Paragraph Writing – Types, Structures and Features of a Paragraph - Creating Coherence-Organizing Principles of Paragraphs in Documents.

UNIT - II
Chapter entitled '**Appro JRD' by Sudha Murthy** from *"English: Language, Context and Culture"* **published** by Orient BlackSwan, Hyderabad.

Vocabulary: Words Often Misspelt - Homophones, Homonyms and Homographs

Grammar: Identifying Common Errors in Writing with Reference to Noun-pronoun Agreement and Subject-verb Agreement.

Reading: Sub-Skills of Reading – Skimming and Scanning – Exercises for Practice

Writing: Nature and Style of Writing- Defining /Describing People, Objects, Places and Events – Classifying- Providing Examples or Evidence.

UNIT - III
Chapter entitled '**Lessons from Online Learning' by F.Haider Alvi, Deborah Hurst et al** from *"English: Language, Context and Culture"* published by Orient BlackSwan, Hyderabad.

Vocabulary: Words Often Confused - Words from Foreign Languages and their Use in English.

Grammar: Identifying Common Errors in Writing with Reference to Misplaced Modifiers and Tenses.

Reading: Sub-Skills of Reading – Intensive Reading and Extensive Reading – Exercises for Practice.

Writing: Format of a Formal Letter-Writing Formal Letters E.g.., Letter of Complaint, Letter of Requisition, Email Etiquette, Job Application with CV/Resume.

UNIT - IV
Chapter entitled **'Art and Literature' by Abdul Kalam** from *"English: Language, Context and Culture"* published by Orient BlackSwan, Hyderabad.
Vocabulary: Standard Abbreviations in English
Grammar: Redundancies and Clichés in Oral and Written Communication.
Reading: Survey, Question, Read, Recite and Review (SQ3R Method) - Exercises for Practice
Writing: Writing Practices- Essay Writing-Writing Introduction and Conclusion -Précis Writing.

UNIT - V
Chapter entitled **'Go, Kiss the World' by Subroto Bagchi** from *"English: Language, Context and Culture"* published by Orient BlackSwan, Hyderabad.
Vocabulary: Technical Vocabulary and their Usage
Grammar: Common Errors in English (*Covering all the other aspects of grammar which were not covered in the previous units*)
Reading: Reading Comprehension-Exercises for Practice
Writing: Technical Reports- Introduction – Characteristics of a Report – Categories of Reports Formats- Structure of Reports (Manuscript Format) -Types of Reports - Writing a Report.

Note: *Listening and Speaking Skills which are given under Unit-6 in AICTE Model Curriculum are covered in the syllabus of ELCS Lab Course.*

➢ **Note: 1**. As the syllabus of English given in AICTE *Model Curriculum-2018 for B.Tech First Year is Open-ended,* besides following the prescribed textbook, it is required to prepare teaching/learning materials **by the teachers collectively** in the form of handouts based on the needs of the students in their respective colleges for effective teaching/learning in the class.

➢ **Note**: **2**.Based on the recommendations of NEP2020, teachers are requested to be flexible to adopt Blended Learning in dealing with the course contents .They are advised to teach 40 percent of each topic from the syllabus in blended mode.

TEXT BOOK:
1. "English: Language, Context and Culture" by Orient BlackSwan Pvt. Ltd, Hyderabad. 2022. Print.

REFERENCE BOOKS:
1. Effective Academic Writing by Liss and Davis (OUP)
2. Richards, Jack C. (2022) Interchange Series. Introduction, 1,2,3. Cambridge University Press
3. Wood, F.T. (2007). Remedial English Grammar. Macmillan.
4. Chaudhuri, Santanu Sinha. (2018). Learn English: A Fun Book of Functional Language, Grammar and Vocabulary. (2nd ed.,). Sage Publications India Pvt. Ltd.
5. (2019). Technical Communication. Wiley India Pvt. Ltd.
6. Vishwamohan, Aysha. (2013). English for Technical Communication for Engineering Students. Mc Graw-Hill Education India Pvt. Ltd.
7. Swan, Michael. (2016). Practical English Usage. Oxford University Press. Fourth Edition.

EI106ES: ELEMENTS OF ELECTRONICS AND INSTRUMENTATION ENGINEERING

B.Tech. I Year I Sem.

L	**T**	**P**	**C**
0	**0**	**2**	**1**

Course outcomes: Students will be able to:
1. Identify the different components used for electronics applications
2. Measure different parameters using various measuring instruments

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	1	1	1	-	-	1	-	1	1
CO2	3	2	3	2	1	2	-	-	1	-	1	1
CO3	3	3	2	1	1	2	-	-	1	-	1	1

List of Experiments:
1. Identify the different passive and active components
2. Color code of resistors, finding the types and values of capacitors
3. Measure the voltage and current using voltmeter and ammeter
4. Measure the voltage, current with Multimeter and study the other measurements using Multimeter
5. Study the CRO and measure the frequency and phase of given signal
6. Draw the various Lissajous figures using CRO
7. Study the function generator for various signal generations
8. Study of Spectrum analyzer and measure the spectrum
9. Operate Regulated power supply for different supply voltages
10. Study the various gates module and write down the truth table of them
11. Identify various Digital and Analog ICs
12. Know the available Softwares for Electronics and Instrumentation applications
13. Learn how to used analytic, biomedical Instruments

PH107BS: APPLIED PHYSICS LABORATORY

B.Tech. I Year I Sem.   L T P C
                                                                                                     0 0 3 1.5

Course Objectives: The objectives of this course for the student to
1. Capable of handling instruments related to the Hall effect and photoelectric effect experiments and their measurements.
2. Understand the characteristics of various devices such as PN junction diode, Zener diode, BJT, LED, solar cell, lasers and optical fiber and measurement of energy gap and resistivity of semiconductor materials.
3. Able to measure the characteristics of dielectric constant of a given material.
4. Study the behavior of B-H curve of ferromagnetic materials.
5. Understanding the method of least squares fitting.

Course Outcomes: The students will be able to:
1. Know the determination of the Planck's constant using Photo electric effect and identify the material whether it is n-type or p-type by Hall experiment.
2. Appreciate quantum physics in semiconductor devices and optoelectronics.
3. Gain the knowledge of applications of dielectric constant.
4. Understand the variation of magnetic field and behavior of hysteresis curve.
5. Carried out data analysis.

LIST OF EXPERIMENTS:
1. Determination of work function and Planck's constant using photoelectric effect.
2. Determination of Hall co-efficient and carrier concentration of a given semiconductor.
3. Characteristics of series and parallel LCR circuits.
4. V-I characteristics of a p-n junction diode and Zener diode
5. Input and output characteristics of BJT (CE, CB & CC configurations)
6. a) V-I and L-I characteristics of light emitting diode (LED)
    b) V-I Characteristics of solar cell
7. Determination of Energy gap of a semiconductor.
8. Determination of the resistivity of semiconductor by two probe method.
9. Study B-H curve of a magnetic material.
10. Determination of dielectric constant of a given material
11. a) Determination of the beam divergence of the given LASER beam
     b) Determination of Acceptance Angle and Numerical Apertureof an optical fiber.
12. Understanding the method of least squares – torsional pendulum as an example.

Note: Any 8 experiments are to be performed.

REFERENCE BOOK:
1. S. Balasubramanian, M.N. Srinivasan "A Text book of Practical Physics"- S Chand Publishers, 2017.

EI108ES: C PROGRAMMING FOR ENGINEERS LABORATORY

B.Tech. I Year I Sem.   **L T P C**
                                                                           0 0 2 1

Course Outcomes: Upon completing this course, the students will be able to
1. Write algorithms and to draw flowcharts for solving problems and translate the algorithms/flowcharts to programs (in C language).
2. Use functions to develop modular reusable code.
3. Use arrays, pointers, strings and structures to formulate algorithms and programs.
4. Understand Searching and sorting algorithms

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	1	1	1	-	-	1	-	1	1
CO2	3	2	3	2	1	2	-	-	1	-	1	1
CO3	3	3	2	1	1	2	-	-	1	-	1	1
CO4	3	3	3	2	1	1	-	-	1		1	

List of Experiments:
1. Write a C program to find the sum of individual digits of a positive integer.
2. Fibonacci sequence is defined as follows: the first and second terms in the sequence are 0 and 1. Subsequent terms are found by adding the preceding two terms in the sequence.
3. Write a C program to generate the first n terms of the sequence.
4. Write a C program to generate all the prime numbers between 1 and n, where n is a value supplied by the user.
5. Write a C program to find the roots of a quadratic equation.
6. Write a C program to find the factorial of a given integer.
7. Write a C program to find the GCD (greatest common divisor) of two given integers.
8. Write a C program to solve Towers of Hanoi problem.
9. 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 Switch Statement)
10. Write a C program to find both the largest and smallest number in a list of integers.
11. Write a C program that uses functions to perform the following:
    i) Addition of Two Matrices   ii) Multiplication of Two Matrices
12. Write a C program that uses functions to perform the following operations:
    i) To insert a sub-string in to a given main string from a given position.
    ii) To delete n Characters from a given position in a given string.
13. Write a C program to determine if the given string is a palindrome or not
14. Write a C program that displays the position or index in the string S where the string T begins, or – 1 if S doesn't contain T.
15. Write a C program to count the lines, words and characters in a given text.
16. Write a C program to generate Pascal's triangle.
17. Write a C program to construct a pyramid of numbers
18. Write a C program to read in two numbers, x and n, and then compute the sum of this geometric progression:
    $1+x+x^2+x^3+\ldots\ldots\ldots+x^n$
    For example: if n is 3 and x is 5, then the program computes 1+5+25+125.
    Print x, n, the sum
    Perform error checking.
    For example, the formula does not make sense for negative exponents – if n is less than 0.
    Have your program print an error message if n<0, then go back and read in the next pair of numbers of without computing the sum. Are any values of x also illegal ? If so, test for them too.

19. 2's complement of a number is obtained by scanning it from right to left and complementing all the bits after the first appearance of a 1. Thus 2's complement of 11100 is 00100. Write a C program to find the 2's complement of a binary number.
20. Write a C program to convert a Roman numeral to its decimal equivalent.

21. Write a C program that uses functions to perform the following operations:
    i)   Reading a complex number
    ii) Writing a complex number
    iii) Addition of two complex numbers
    iv) Multiplication of two complex numbers
         (Note: represent complex number using a structure.)
22.
    i.   Write a C program which copies one file to another.
    ii.   Write a C program to reverse the first n characters in a file.
    (Note: The file name and n are specified on the command line.)
23.
    i.   Write a C program to display the contents of a file.
    ii.   Write a C program to merge two files into a third file (i.e., the contents of the first file followed by those of the second are put in the third file)

24. Write a C program that implements the following sorting methods to sort a given list of integers in ascending order   i) Bubble sort   ii) Selection sort   iii)Insertion sort
25. Write C programs that use both recursive and non recursive functions to perform the following searching operations for a Key value in a given list of integers:
    i) Linear search   ii) Binary search

EN109HS: ENGLISH LANGUAGE AND COMMUNICATION SKILLS LABORATORY

B.Tech. I Year I Sem.   **L T P C**
                                                                 0 0 2 1

The **English Language and Communication Skills (ELCS) Lab** focuses on the production and practice of sounds of language and familiarizes the students with the use of English in everyday situations both in formal and informal contexts.

Course Objectives:
- ✓ To facilitate computer-assisted multi-media instruction enabling individualized and independent language learning
- ✓ To sensitize the students to the nuances of English speech sounds, word accent, intonation and rhythm
- ✓ To bring about a consistent accent and intelligibility in students' pronunciation of English by providing an opportunity for practice in speaking
- ✓ To improve the fluency of students in spoken English and neutralize the impact of dialects.
- ✓ To train students to use language appropriately for public speaking, group discussions and interviews

Course Outcomes: Students will be able to:
- ✓ Understand the nuances of English language through audio- visual experience and group activities
- ✓ Neutralise their accent for intelligibility
- ✓ Speak with clarity and confidence which in turn enhances their employability skills

Syllabus: English Language and Communication Skills Lab (ELCS) shall have two parts:
a. **Computer Assisted Language Learning (CALL) Lab**
b. **Interactive Communication Skills (ICS) Lab**

Listening Skills:
Objectives
1. To enable students develop their listening skills so that they may appreciate the role in the LSRW skills approach to language and improve their pronunciation
2. To equip students with necessary training in listening, so that they can comprehend the speech of people of different backgrounds and regions

Students should be given practice in listening to the sounds of the language, to be able to recognize them and find the distinction between different sounds, to be able to mark stress and recognize and use the right intonation in sentences.
- Listening for general content
- Listening to fill up information
- Intensive listening
- Listening for specific information

Speaking Skills:
Objectives
1. To involve students in speaking activities in various contexts
2. To enable students express themselves fluently and appropriately in social and professional contexts
- Oral practice
- Describing objects/situations/people
- Role play – Individual/Group activities

• Just A Minute (JAM) Sessions

The following course content is prescribed for the **English Language and Communication Skills Lab**.

Exercise – I
CALL Lab:
Understand: Listening Skill- Its importance – Purpose- Process- Types- Barriers- Effective Listening.
Practice: Introduction to Phonetics – Speech Sounds – Vowels and Consonants – Minimal Pairs- Consonant Clusters- Past Tense Marker and Plural Marker- *Testing Exercises*
ICS Lab:
Understand: Spoken vs. Written language- Formal and Informal English.
Practice: Ice-Breaking Activity and JAM Session- Situational Dialogues – Greetings – Taking Leave – Introducing Oneself and Others.

Exercise – II
CALL Lab:
Understand: Structure of Syllables – Word Stress– Weak Forms and Strong Forms – Stress pattern in sentences – Intonation.
Practice: Basic Rules of Word Accent - Stress Shift - Weak Forms and Strong Forms- Stress pattern in sentences – Intonation - *Testing Exercises*
ICS Lab:
Understand: Features of Good Conversation – Strategies for Effective Communication.
Practice: Situational Dialogues – Role Play- Expressions in Various Situations –Making Requests and Seeking Permissions - Telephone Etiquette.

Exercise - III
CALL Lab:
Understand: Errors in Pronunciation-Neutralising Mother Tongue Interference (MTI).
Practice: Common Indian Variants in Pronunciation – Differences between British and American Pronunciation -*Testing Exercises*
ICS Lab:
Understand: Descriptions- Narrations- Giving Directions and Guidelines – Blog Writing
Practice: Giving Instructions – Seeking Clarifications – Asking for and Giving Directions – Thanking and Responding – Agreeing and Disagreeing – Seeking and Giving Advice – Making Suggestions.

Exercise – IV
CALL Lab:
Understand: Listening for General Details.
Practice: Listening Comprehension Tests - *Testing Exercises*
ICS Lab:
Understand: Public Speaking – Exposure to Structured Talks - Non-verbal Communication-Presentation Skills.
Practice: Making a Short Speech – Extempore- Making a Presentation.

Exercise – V
CALL Lab:
Understand: Listening for Specific Details.
Practice: Listening Comprehension Tests -*Testing Exercises*
ICS Lab:
Understand: Group Discussion
Practice: Group Discussion

Minimum Requirement of infrastructural facilities for ELCS Lab:

1. **Computer Assisted Language Learning (CALL) Lab:**
The Computer Assisted Language Learning Lab has to accommodate 40 students with 40 systems, with one Master Console, LAN facility and English language learning software for self- study by students.
System Requirement (Hardware component):
Computer network with LAN facility (minimum 40 systems with multimedia) with the following specifications:
   i)   Computers with Suitable Configuration
   ii)   High Fidelity Headphones

2. **Interactive Communication Skills (ICS) Lab :**
   The Interactive Communication Skills Lab: A Spacious room with movable chairs and audio-visual aids with a Public Address System, a T. V. or LCD, a digital stereo –audio & video system and camcorder etc.
   Source of Material (Master Copy):
   • *Exercises in Spoken English. Part 1,2,3*. CIEFL and Oxford University Press

Note: Teachers are requested to make use of the master copy and get it tailor-made to suit the contents of the syllabus.

Suggested Software:
   • Cambridge Advanced Learners' English Dictionary with CD.
   • Grammar Made Easy by Darling Kindersley.
   • Punctuation Made Easy by Darling Kindersley.
   • Oxford Advanced Learner's Compass, 10th Edition.
   • English in Mind (Series 1-4), Herbert Puchta and Jeff Stranks with Meredith Levy, Cambridge.
   • English Pronunciation in Use (Elementary, Intermediate, Advanced) Cambridge University Press.
   • English Vocabulary in Use (Elementary, Intermediate, Advanced) Cambridge University Press.
   • TOEFL & GRE (KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS).
   • Digital All
   • Orell Digital Language Lab (Licensed Version)

REFERENCE BOOKS:
   1. (2022). *English Language Communication Skills – Lab Manual cum Workbook.* Cengage Learning India Pvt. Ltd.
   2. Shobha, KN & Rayen, J. Lourdes. (2019). *Communicative English – A workbook.* Cambridge University Press
   3. Kumar, Sanjay & Lata, Pushp. (2019). *Communication Skills: A Workbook.* Oxford University Press
   4. Board of Editors. (2016). *ELCS Lab Manual: A Workbook for CALL and ICS Lab Activities.* Orient Black Swan Pvt. Ltd.
   5. Mishra, Veerendra et al. (2020). *English Language Skills: A Practical Approach.* Cambridge University Press

*MC110: ENVIRONMENTAL SCIENCE

B.Tech. I Year I Sem.   **L T P C**
                                                                                                                3 0 0 0

Course Objectives:
- Understanding the importance of ecological balance for sustainable development.
- Understanding the impacts of developmental activities and mitigation measures.
- Understanding the environmental policies and regulations

Course Outcomes:
- Based on this course, the Engineering graduate will understand /evaluate / develop technologies on the basis of ecological principles and environmental regulations which in turn helps in sustainable development

UNIT - I
Ecosystems: Definition, Scope, and Importance of ecosystem. Classification, structure, and function of an ecosystem, Food chains, food webs, and ecological pyramids. Flow of energy, Biogeochemical cycles, Bioaccumulation, Biomagnification, ecosystem value, services and carrying capacity, Field visits.

UNIT - II
Natural Resources: Classification of Resources: Living and Non-Living resources, **water resources:** use and over utilization of surface and ground water, floods and droughts, Dams: benefits and problems. **Mineral resources:** use and exploitation, environmental effects of extracting and using mineral resources, **Land resources:** Forest resources, **Energy resources:** growing energy needs, renewable and non-renewable energy sources, use of alternate energy source, case studies.

UNIT - III
Biodiversity and Biotic Resources: Introduction, Definition, genetic, species and ecosystem diversity. Value of biodiversity; consumptive use, productive use, social, ethical, aesthetic and optional values. India as a mega diversity nation, Hot spots of biodiversity. Field visit. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts; conservation of biodiversity: In-Situ and Ex-situ conservation. National Biodiversity act.

UNIT - IV
Environmental Pollution and Control Technologies: Environmental Pollution: Classification of pollution, **Air Pollution:** Primary and secondary pollutants, Automobile and Industrial pollution, Ambient air quality standards. **Water pollution:** Sources and types of pollution, drinking water quality standards. **Soil Pollution:** Sources and types, Impacts of modern agriculture, degradation of soil. **Noise Pollution:** Sources and Health hazards, standards, **Solid waste:** Municipal Solid Waste management, composition and characteristics of e-Waste and its management. **Pollution control technologies:** Wastewater Treatment methods: Primary, secondary and Tertiary.
Overview of air pollution control technologies, Concepts of bioremediation. **Global Environmental Issues and Global Efforts: C**limate change and impacts on human environment. Ozone depletion and Ozone depleting substances (ODS). Deforestation and desertification. International conventions / Protocols: Earth summit, Kyoto protocol, and Montréal Protocol. NAPCC-GoI Initiatives.

UNIT - V
Environmental Policy, Legislation & EIA: Environmental Protection act, Legal aspects Air Act- 1981, Water Act, Forest Act, Wild life Act, Municipal solid waste management and handling rules, biomedical waste management and handling rules, hazardous waste management and handling rules. EIA: EIA structure, methods of baseline data acquisition. Overview on Impacts of air, water, biological and Socio-economical aspects. Strategies for risk assessment, Concepts of Environmental Management Plan

(EMP). **Towards Sustainable Future:** Concept of Sustainable Development Goals, Population and its explosion, Crazy Consumerism, Environmental Education, Urban Sprawl, Human health, Environmental Ethics, Concept of Green Building, Ecological Foot Print, Life Cycle assessment (LCA), Low carbon life style.

TEXT BOOKS:
1 Textbook of Environmental Studies for Undergraduate Courses by Erach Bharucha for University Grants Commission.
2 Environmental Studies by R. Rajagopalan, Oxford University Press.

REFERENCE BOOKS:
1. Environmental Science: towards a sustainable future by Richard T. Wright. 2008 PHL Learning Private Ltd. New Delhi.
2. Environmental Engineering and science by Gilbert M. Masters and Wendell P. Ela. 2008 PHI Learning Pvt. Ltd.
3. Environmental Science by Daniel B. Botkin & Edward A. Keller, Wiley INDIA edition.
4. Environmental Studies by Anubha Kaushik, 4th Edition, New age international publishers.
5. Text book of Environmental Science and Technology - Dr. M. Anji Reddy 2007, BS Publications.
6. Introduction to Environmental Science by Y. Anjaneyulu, BS. Publications.

MA201BS: ORDINARY DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS

B.Tech. I Year II Sem.
L T P C
3 1 0 4

Pre-requisites: Mathematical Knowledge at pre-university level

Course Objectives: To learn
- Methods of solving the differential equations of first and higher order.
- Concept, properties of Laplace transforms
- Solving ordinary differential equations using Laplace transforms techniques.
- The physical quantities involved in engineering field related to vector valued functions
- The basic properties of vector valued functions and their applications to line, surface and volume integrals

Course outcomes: After learning the contents of this paper the student must be able to
- Identify whether the given differential equation of first order is exact or not
- Solve higher differential equation and apply the concept of differential equation to real world problems.
- Use the Laplace transforms techniques for solving ODE's.
- Evaluate the line, surface and volume integrals and converting them from one to another

UNIT-I: First Order ODE   **8 L**
Exact differential equations, Equations reducible to exact differential equations, linear and Bernoulli's equations, Orthogonal Trajectories (only in Cartesian Coordinates). Applications: Newton's law of cooling, Law of natural growth and decay.

UNIT-II: Ordinary Differential Equations of Higher Order   **10 L**
Second order linear differential equations with constant coefficients: Non-Homogeneous terms of the type $e^{ax}, \sin ax, \cos ax,$ polynomials in x, $e^{ax}V(x)$ and $x V(x)$, method of variation of parameters, Equations reducible to linear ODE with constant coefficients: Legendre's equation, Cauchy-Euler equation. Applications: Electric Circuits

UNIT-III: Laplace transforms   **10 L**
Laplace Transforms: Laplace Transform of standard functions, First shifting theorem, Second shifting theorem, Unit step function, Dirac delta function, Laplace transforms of functions when they are multiplied and divided by 't', Laplace transforms of derivatives and integrals of function, Evaluation of integrals by Laplace transforms, Laplace transform of periodic functions, Inverse Laplace transform by different methods, convolution theorem (without proof). Applications: solving Initial value problems by Laplace Transform method.

UNIT-IV: Vector Differentiation   **10 L**
Vector point functions and scalar point functions, Gradient, Divergence and Curl, Directional derivatives, Tangent plane and normal line, Vector Identities, Scalar potential functions, Solenoidal and Irrotational vectors.

UNIT-V: Vector Integration   **10 L**
Line, Surface and Volume Integrals, Theorems of Green, Gauss and Stokes (without proofs) and their applications.

TEXT BOOKS:
1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010

2. R.K. Jain and S.R.K. Iyengar, Advanced Engineering Mathematics, Narosa Publications, 5th Edition, 2016.

REFERENCE BOOKS:
1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
3. H. K. Dass and Er. Rajnish Verma, Higher Engineering Mathematics, S Chand and Company Limited, New Delhi.
4. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.

CH202BS: ENGINEERING CHEMISTRY

B.Tech. I Year II Sem.   **L T P C**
                                                                               3 1 0 4

Course Objectives:
1. To bring adaptability to new developments in Engineering Chemistry and to acquire the skills required to become a perfect engineer.
2. To include the importance of water in industrial usage, fundamental aspects of battery chemistry, significance of corrosion it's control to protect the structures.
3. To imbibe the basic concepts of petroleum and its products.
4. To acquire required knowledge about engineering materials like cement, smart materials and Lubricants.

Course Outcomes:
1. Students will acquire the basic knowledge of electrochemical procedures related to corrosion and its control.
2. The students are able to understand the basic properties of water and its usage in domestic and industrial purposes.
3. They can learn the fundamentals and general properties of polymers and other engineering materials.
4. They can predict potential applications of chemistry and practical utility in order to become good engineers and entrepreneurs.

UNIT - I: Water and its treatment: [8]
Introduction to hardness of water – Estimation of hardness of water by complexometric method and related numerical problems. Potable water and its specifications - Steps involved in the treatment of potable water - Disinfection of potable water by chlorination and break - point chlorination. Defluoridation - Determination of F^- ion by ion- selective electrode method.
Boiler troubles: Sludges, Scales and Caustic embrittlement. Internal treatment of Boiler feed water - Calgon conditioning - Phosphate conditioning - Colloidal conditioning, External treatment methods - Softening of water by ion- exchange processes. Desalination of water – Reverse osmosis.

UNIT – II Battery Chemistry & Corrosion [8]
Introduction - Classification of batteries- primary, secondary and reserve batteries with examples. Basic requirements for commercial batteries. Construction, working and applications of: Zn-air and Lithium ion battery, Applications of Li-ion battery to electrical vehicles. Fuel Cells- Differences between battery and a fuel cell, Construction and applications of Methanol Oxygen fuel cell and Solid oxide fuel cell. Solar cells - Introduction and applications of Solar cells.
Corrosion: Causes and effects of corrosion – theories of chemical and electrochemical corrosion – mechanism of electrochemical corrosion, Types of corrosion: Galvanic, water-line and pitting corrosion. Factors affecting rate of corrosion, Corrosion control methods- Cathodic protection – Sacrificial anode and impressed current methods.

UNIT - III: Polymeric materials: [8]
Definition – Classification of polymers with examples – Types of polymerization –
addition (free radical addition) and condensation polymerization with examples – Nylon 6:6, Terylene
Plastics: Definition and characteristics- thermoplastic and thermosetting plastics, Preparation, Properties and engineering applications of PVC and Bakelite, Teflon, Fiber reinforced plastics (FRP).
Rubbers: Natural rubber and its vulcanization.
Elastomers: Characteristics –preparation – properties and applications of Buna-S, Butyl and Thiokol rubber.
Conducting polymers: Characteristics and Classification with examples-mechanism of conduction in trans-polyacetylene and applications of conducting polymers.

Biodegradable polymers: Concept and advantages - Polylactic acid and poly vinyl alcohol and their applications.

UNIT - IV: Energy Sources: [8]
Introduction, Calorific value of fuel – HCV, LCV- Dulongs formula. Classification- solid fuels: coal – analysis of coal – proximate and ultimate analysis and their significance. Liquid fuels – petroleum and its refining, cracking types – moving bed catalytic cracking. Knocking – octane and cetane rating, synthetic petrol - Fischer-Tropsch's process; Gaseous fuels – composition and uses of natural gas, LPG and CNG, Biodiesel – Transesterification, advantages.

UNIT - V: Engineering Materials: [8]
Cement: Portland cement, its composition, setting and hardening.
Smart materials and their engineering applications
Shape memory materials- Poly L- Lactic acid. Thermoresponse materials- Polyacryl amides, Poly vinyl amides
Lubricants: Classification of lubricants with examples-characteristics of a good lubricants - mechanism of lubrication (thick film, thin film and extreme pressure)- properties of lubricants: viscosity, cloud point, pour point, flash point and fire point.

TEXT BOOKS:
1. Engineering Chemistry by P.C. Jain and M. Jain, Dhanpatrai Publishing Company, 2010
2. Engineering Chemistry by Rama Devi, Venkata Ramana Reddy and Rath, Cengage learning, 2016
3. A text book of Engineering Chemistry by M. Thirumala Chary, E. Laxminarayana and K. Shashikala, Pearson Publications, 2021.
4. Textbook of Engineering Chemistry by Jaya Shree Anireddy, Wiley Publications.

REFERENCE BOOKS:
1. Engineering Chemistry by Shikha Agarwal, Cambridge University Press, Delhi (2015)
2. Engineering Chemistry by Shashi Chawla, Dhanpatrai and Company (P) Ltd. Delhi (2011)

ME203ES: COMPUTER AIDED ENGINEERING GRAPHICS

B.Tech. I Year II Sem.   L T P C
                                                                                                1 0 4 3

Course Objectives:
- To develop the ability of visualization of different objects through technical drawings
- To acquire computer drafting skill for communication of concepts, ideas in the design of engineering products

Course Outcomes: At the end of the course, the student will be able to:
- Apply computer aided drafting tools to create 2D and 3D objects
- sketch conics and different types of solids
- Appreciate the need of Sectional views of solids and Development of surfaces of solids
- Read and interpret engineering drawings
- Conversion of orthographic projection into isometric view and vice versa manually and by using computer aided drafting

UNIT – I:
Introduction to Engineering Graphics: Principles of Engineering Graphics and their Significance, Scales – Plain & Diagonal, Conic Sections including the Rectangular Hyperbola – General method only. Cycloid, Epicycloid and Hypocycloid, Introduction to Computer aided drafting – views, commands and conics

UNIT- II:
Orthographic Projections: Principles of Orthographic Projections – Conventions – Projections of Points and Lines, Projections of Plane regular geometric figures. Auxiliary Planes. Computer aided orthographic projections – points, lines and planes

UNIT – III:
Projections of Regular Solids – Auxiliary Views - Sections or Sectional views of Right Regular Solids – Prism, Cylinder, Pyramid, Cone – Auxiliary views, Computer aided projections of solids – sectional views

UNIT – IV:
Development of Surfaces of Right Regular Solids – Prism, Cylinder, Pyramid and Cone, Development of surfaces using computer aided drafting

UNIT – V:
Isometric Projections: Principles of Isometric Projection – Isometric Scale – Isometric Views – Conventions – Isometric Views of Lines, Plane Figures, Simple and Compound Solids – Isometric Projection of objects having non- isometric lines. Isometric Projection of Spherical Parts. Conversion of Isometric Views to Orthographic Views and Vice-versa –Conventions. Conversion of orthographic projection into isometric view using computer aided drafting.

TEXT BOOKS:
1. Engineering Drawing N.D. Bhatt / Charotar
2. Engineering Drawing and graphics Using AutoCAD Third Edition, T. Jeyapoovan, Vikas: S. Chand and company Ltd.

REFERENCE BOOKS:
1. Engineering Drawing, Basant Agrawal and C M Agrawal, Third Edition McGraw Hill
2. Engineering Graphics and Design, WILEY, Edition 2020
3. Engineering Drawing, M. B. Shah, B.C. Rane / Pearson.
4. Engineering Drawing, N. S. Parthasarathy and Vela Murali, Oxford
5. Computer Aided Engineering Drawing – K Balaveera Reddy et al – CBS Publishers

Note: - External examination is conducted in conventional mode and internal evaluation to be done by both conventional as well as using computer aided drafting.

EE204ES: BASIC ELECTRICAL ENGINEERING

B.Tech. I Year I Sem.　　　　　　　　　　　　　　　　　　　　　　**L　T　P　C**
　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　2　0　0　2

Prerequisites: Mathematics

Course Objectives:
- To understand DC and Single & Three phase AC circuits
- To study and understand the different types of DC, AC machines and Transformers.
- To import the knowledge of various electrical installations and the concept of power, power factor and its improvement.

Course Outcomes: After learning the contents of this paper the student must be able to
- Understand and analyze basic Electrical circuits
- Study the working principles of Electrical Machines and Transformers
- Introduce components of Low Voltage Electrical Installations.

Course Objectives	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
To understand DC and Single & Three phase AC circuits.	3	2	1		2	0	0	1	2	0	1	2
To study and understand the different types of DC, AC machines and Transformers.	3	2	1	1	3	0	0	0	2	0	1	1
To import the knowledge of various electrical installations and the concept of power, power factor and its improvement.	3	2	0		3	0	0	0	1	2	1	1

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Understand and analyse basic Electrical circuits	3	2	1	0	1	0	0	0	2	0	2	2
Study the working principles of Electrical Machines and Transformers	3	2	1	0	3	1	0	1	1	2	1	2
Introduce components of Low Voltage Electrical Installations.	3	2	1	1	3	2	0	0	1	0	2	2

UNIT-I:
D.C. Circuits: Electrical circuit elements (R, L and C), voltage and current sources, KVL&KCL, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems. Time-domain analysis of first-order RL and RC circuits.

UNIT - II:
A.C. Circuits: Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor, Analysis of single-phase ac circuits

consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance in series R-L-C circuit. Three-phase balanced circuits, voltage and current relations in star and delta connections.

UNIT-III:
Transformers: Ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections.

UNIT-IV:
Electrical Machines: Construction and working principle of dc machine, performance characteristics of dc shunt machine. Generation of rotating magnetic field, Construction and working of a three-phase induction motor, Significance of torque-slip characteristics. Single-phase induction motor, Construction and working. Construction and working of synchronous generator.

UNIT-V:
Electrical Installations: Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.

TEXT BOOKS:
1. D.P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 4th Edition, 2019.
2. MS Naidu and S Kamakshaiah, "Basic Electrical Engineering", Tata McGraw Hill, 2nd Edition, 2008.

REFERENCE BOOKS:
1. P. Ramana, M. Suryakalavathi, G.T. Chandrasheker, "Basic Electrical Engineering", S. Chand, 2nd Edition, 2019.
2. D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2009
3. M. S. Sukhija, T. K. Nagsarkar, "Basic Electrical and Electronics Engineering", Oxford, 1st Edition, 2012.
4. Abhijit Chakrabarthi, Sudipta Debnath, Chandan Kumar Chanda, "Basic Electrical Engineering", 2nd Edition, McGraw Hill, 2021.
5. L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, 2011.
6. E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
7. V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989.

EC205ES: ELECTRONIC DEVICES AND CIRCUITS

B.Tech. I Year I Sem.   **L   T   P   C**
                                                            2   0   0   2

Course Objectives:
1. To introduce components such as diodes, BJTs and FETs.
2. To know the applications of devices.
3. To know the switching characteristics of devices.

Course Outcomes: Upon completion of the Course, the students will be able to:
1. Acquire the knowledge of various electronic devices and their use on real life.
2. Know the applications of various devices.
3. Acquire the knowledge about the role of special purpose devices and their applications.

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	2	-	-	1	1	-	-	-	-	1
CO2	3	2	3	-	-	2	1	-	-	-	-	1
CO3	3	3	3	-	-	2	1	-	-	-	-	1

UNIT - I
Diodes: Diode - Static and Dynamic resistances, Equivalent circuit, Diffusion and Transition Capacitances, V-I Characteristics, Diode as a switch- switching times.

UNIT - II
Diode Applications: Rectifier - Half Wave Rectifier, Full Wave Rectifier, Bridge Rectifier, Rectifiers with Capacitive and Inductive Filters, Clippers-Clipping at two independent levels, Clamper-Clamping Circuit Theorem, Clamping Operation, Types of Clampers.

UNIT - III
Bipolar Junction Transistor (BJT): Principle of Operation, Common Emitter, Common Base and Common Collector Configurations, Transistor as a switch, switching times,

UNIT - IV
Junction Field Effect Transistor (FET): Construction, Principle of Operation, Pinch-Off Voltage, Volt-Ampere Characteristic, Comparison of BJT and FET, FET as Voltage Variable Resistor, MOSFET, MOSTET as a capacitor.

UNIT – V
Special Purpose Devices: Zener Diode **-** Characteristics, Zener diode as Voltage Regulator, Principle of Operation - SCR, Tunnel diode, UJT, Varactor Diode, Photo diode, Solar cell, LED, Schottky diode.

TEXT BOOKS:
1. Jacob Millman - Electronic Devices and Circuits, McGraw Hill Education
2. Robert L. Boylestead, Louis Nashelsky- Electronic Devices and Circuits theory, 11th Edition, 2009, Pearson**.**

REFERENCE BOOKS:
1. Horowitz -Electronic Devices and Circuits, David A. Bell – 5thEdition, Oxford.
2. Chinmoy Saha, Arindam Halder, Debaati Ganguly - Basic Electronics-Principles and Applications, Cambridge, 2018.

EI206ES: APPLIED PYTHON PROGRAMMING LABORATORY

I Year B.Tech. II Sem

L	**T**	**P**	**C**
0	**1**	**2**	**2**

Course Outcomes: Upon completing this course, the students will be able to
1. Build basic programs using fundamental programming constructs
2. Write and execute python codes for different applications
3. Capable to implement on hardware boards

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	1	1	1	1	-	-	1	-	1	1
CO2	2	3	2	1	1	2	-	-	1	-	1	1
CO3	2	3	2	1	1	2	-	-	1	-	1	1

LIST OF EXPERIMENTS:
Cycle - 1
1. Downloading and Installing Python and Modules
   a) Python 3 on Linux
      Follow the instructions given in the URL https://docs.python-guide.org/starting/install3/linux/
   b) Python 3 on Windows
      Follow the instructions given in the URL https://docs.python.org/3/using/windows.html
      (Please remember that Windows installation of Python is harder!)
   c) pip3 on Windows and Linux
      Install the Python package installer by following the instructions given in the URL
      https://www.activestate.com/resources/quick-reads/how-to-install-and-use-pip3/
   d) Installing numpy and scipy
      You can install any python3 package using the command pip3 install <packagename>
   e) Installing jupyterlab
      Install from pip using the command pip install jupyterlab
2. Introduction to Python3
   a) Printing your biodata on the screen
   b) Printing all the primes less than a given number
   c) Finding all the factors of a number and show whether it is a *perfect* number, i.e., the sum
      of all its factors (excluding the number itself) is equal to the number itself
3. Defining and Using Functions
   a) Write a function to read data from a file and display it on the screen
   b) Define a boolean function *is palindrome*(<input>)
   c) Write a function *collatz(x)* which does the following: if *x* is odd, *x = 3x + 1*; if *x* is even,
      then *x = x/2*. Return the number of steps it takes for *x = 1*
   d) Write a function $N(m, s) = exp(-(x-m)^2/(2s^2))/sqrt(2\pi)s$ that computes the Normal
      distribution
4. The package numpy
   a) Creating a matrix of given order *m x n* containing *random numbers* in the range 1 to
      99999
   b) Write a program that adds, subtracts and multiplies two matrices. Provide an interface
      such   that, based on the prompt, the function (addition, subtraction, multiplication)
      should be performed
   c) Write a program to solve a system of *n* linear equations in *n* variables using matrix
   inverse
5. The package scipy and pyplot
   a) Finding if two sets of data have the same *mean* value

b) Plotting data read from a file
c) Fitting a function through a set a data points using *polyfit* function
d) Plotting a histogram of a given data set
6. The strings package
    a) Read text from a file and print the number of lines, words and characters
    b) Read text from a file and return a list of all *n* letter words beginning with a vowel
    c) Finding a secret message hidden in a paragraph of text
    d) Plot a histogram of words according to their length from text read from a file

Cycle -2
7. Installing OS on Raspberry Pi
    a) Installation using PiImager
    b) Installation using image file
        - Downloading an Image
        - Writing the image to an SD card
            - using Linux
            - using Windows
        - Booting up
    Follow the instructions given in the URL
    https://www.raspberrypi.com/documentation/computers/getting-started.html
8. Accessing GPIO pins using Python
    a) Installing GPIO Zero library.
        First, update your repositories list:
        sudo apt update
        Then install the package for Python 3:
        sudo apt install python3-gpiozero
    b) Blinking an LED connected to one of the GPIO pin
    c) Adjusting the brightness of an LED
    d) Adjust the brightness of an LED (0 to 100, where 100 means maximum brightness) using the in-built PWM wavelength.
9. Collecting Sensor Data
    a) DHT Sensor interface
    ◦ Connect the terminals of DHT GPIO pins of Raspberry Pi.
    ◦ Import the DHT library using *import Adafruit_DHT*
    ◦ Read sensor data and display it on screen.

CH207BS: ENGINEERING CHEMISTRY LABORATORY

B.Tech. I Year II Sem.   **L T P C**
                                                                                        0 0 2 1

Course Objectives: The course consists of experiments related to the principles of chemistry required for engineering student. The student will learn:
- Estimation of hardness of water to check its suitability for drinking purpose.
- Students are able to perform estimations of acids and bases using conductometry, potentiometry and pH metry methods.
- Students will learn to prepare polymers such as Bakelite and nylon-6 in the laboratory.
- Students will learn skills related to the lubricant properties such as saponification value, surface tension and viscosity of oils.

Course Outcomes: The experiments will make the student gain skills on:
- Determination of parameters like hardness of water and rate of corrosion of mild steel in various conditions.
- Able to perform methods such as conductometry, potentiometry and pH metry in order to find out the concentrations or equivalence points of acids and bases.
- Students are able to prepare polymers like bakelite and nylon-6.
- Estimations saponification value, surface tension and viscosity of lubricant oils.

List of Experiments:
I. Volumetric Analysis: Estimation of Hardness of water by EDTA Complexometry method.
II. Conductometry: Estimation of the concentration of an acid by Conductometry.
III. Potentiometry: Estimation of the amount of Fe^{+2} by Potentiomentry.
IV. pH Metry: Determination of an acid concentration using pH meter.
V. Preparations:
  1. Preparation of Bakelite.
  2. Preparation Nylon – 6.
VI. Lubricants:
  1. Estimation of acid value of given lubricant oil.
  2. Estimation of Viscosity of lubricant oil using Ostwald's Viscometer.
VII. Corrosion: Determination of rate of corrosion of mild steel in the presence and absence of inhibitor.
VIII. Virtual lab experiments
  1. Construction of Fuel cell and its working.
  2. Smart materials for Biomedical applications
  3. Batteries for electrical vehicles.
  4. Functioning of solar cell and its applications.

REFERENCE BOOKS:
  1. Lab manual for Engineering chemistry by B. Ramadevi and P. Aparna, S Chand Publications, New Delhi (2022)
  2. Vogel's text book of practical organic chemistry 5th edition
  3. Inorganic Quantitative analysis by A.I. Vogel, ELBS Publications.
  4. College Practical Chemistry by V.K. Ahluwalia, Narosa Publications Ltd. New Delhi (2007).

EE208ES: BASIC ELECTRICAL ENGINEERING LABORATORY

B.Tech. I Year II Sem.
L	T	P	C
0	0	2	1

Prerequisites: Basic Electrical Engineering
Course Objectives:
- To measure the electrical parameters for different types of DC and AC circuits using conventional and theorems approach.
- To study the transient response of various R, L and C circuits using different excitations.
- To determine the performance of different types of DC, AC machines and Transformers.

Course Outcomes: After learning the contents of this paper the student must be able to
- Verify the basic Electrical circuits through different experiments.
- Evaluate the performance calculations of Electrical Machines and Transformers through various testing methods.
- Analyze the transient responses of R, L and C circuits for different input conditions.

Course Objectives	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
To measure the electrical parameters for different types of DC and AC circuits using conventional and theorems approach	3	2	1		2	0	0	1	2	0	1	2
To study the transient response of various R, L and C circuits using different excitations	3	2	1	1	3	0	0	0	2	0	1	1
To determine the performance of different types of DC, AC machines and Transformers	3	2	0		3	0	0	0	1	2	1	1

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Verify the basic Electrical circuits through different experiments	3	2	1	0	1	0	0	0	2	0	2	2
Evaluate the performance calculations of Electrical Machines and Transformers through various testing methods	3	2	1	0	3	1	0	1	1	2	1	2
Analyse the transient responses of R, L and C circuits for different input conditions	3	2	1	1	3	2	0	0	1	0	2	2

List of experiments/demonstrations:
PART-A (compulsory)
1. Verification of KVL and KCL
2. Verification of Thevenin's and Norton's theorem
3. Transient Response of Series RL and RC circuits for DC excitation
4. Resonance in series RLC circuit
5. Calculations and Verification of Impedance and Current of RL, RC and RLC series circuits
6. Measurement of Voltage, Current and Real Power in primary and Secondary Circuits of a Single-Phase Transformer
7. Performance Characteristics of a DC Shunt Motor
8. Torque-Speed Characteristics of a Three-phase Induction Motor.

PART-B (any two experiments from the given list)
1. Verification of Superposition theorem.
2. Three Phase Transformer: Verification of Relationship between Voltages and Currents (Star-Delta, Delta-Delta, Delta-star, Star-Star)
3. Load Test on Single Phase Transformer (Calculate Efficiency and Regulation)
4. Measurement of Active and Reactive Power in a balanced Three-phase circuit
5. No-Load Characteristics of a Three-phase Alternator

TEXT BOOKS:
1. D.P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 4th Edition, 2019.
2. MS Naidu and S Kamakshaiah, "Basic Electrical Engineering", Tata McGraw Hill, 2nd Edition, 2008.

REFERENCE BOOKS:
1. P. Ramana, M. Suryakalavathi, G.T.Chandrasheker,"Basic Electrical Engineering", S. Chand, 2nd Edition, 2019.
2. D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2009
3. M. S. Sukhija, T. K. Nagsarkar, "Basic Electrical and Electronics Engineering", Oxford, 1st Edition, 2012.
4. Abhijit Chakrabarthi, Sudipta Debnath, Chandan Kumar Chanda, "Basic Electrical Engineering", 2nd Edition, McGraw Hill, 2021.
5. L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, 2011.
6. E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
7. V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989.

EC209ES: ELECTRONIC DEVICES AND CIRCUITS LABORATORY

B.Tech. I Year I Sem.   **L   T   P   C**
                                                                                   0   0   2   1

Course Outcomes: Students will be able to
1. Acquire the knowledge of various semiconductor devices and their use in real life.
2. Design aspects of biasing and keep them in active region of the device for functional circuits
3. Acquire the knowledge about the role of special purpose devices and their applications.

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	-	2	-	3	-	-	3	3	-	-	1
CO2	1	-	2	-	3	-	-	3	3	-	-	1
CO3	1	-	2	-	3	-	-	3	3	-	-	1

List of Experiments (Twelve experiments to be done):
Verify any twelve experiments in H/W Laboratory
1. PN Junction diode characteristics   A) Forward bias B) Reverse bias.
2. Full Wave Rectifier with & without filters
3. Types of Clippersat different reference voltages
4. Types of Clampers at different reference voltages
5. The steady state output waveform of clampers for a square wave input
6. Input and output characteristics of BJT in CB Configuration
7. Input and output characteristics of BJT in CE Configuration
8. Input and output characteristics of BJT in CC Configuration
9. Input and output characteristics of MOS FET in CS Configuration
10. Input and output characteristics of MOS FET in CD Configuration
11. Switching characteristics of a transistor
12. Zener diode characteristics and Zener as voltage Regulator
13. SCR Characteristics.
14. UJT Characteristics and identify negative region
15. Photo diode characteristics
16. Solar cell characteristics
17. LED Characteristics
    *Design a circuit to switch on and off LED using diode/BJT/FET as a switch.

Major Equipment required for Laboratories:
1. Regulated Power Suppliers, 0-30V
2. 20 MHz, Dual Channel Cathode Ray Oscilloscopes.
3. Functions Generators-Sine and Square wave signals
4. Multimeters, voltmeters and Ammeters
5. Electronic Components and devices

EI301PC: ANALOG CIRCUITS

B.Tech. II Year I Sem.   L T P C
                                                                                  3 0 0 3

Pre-requisite: Electronic Devices and Circuits.

Course Objectives:
1. Learn the concepts of, load line analysis and biasing techniques
2. Learn the concepts of high frequency analysis of transistors.
3. To give understanding of various types of amplifier circuits
4. Learn the concepts of small signal analysis of BJT and FET
5. To familiarize the Concept of feedback in amplifiers so as to differentiate between negative and positive feedback.

Course Outcomes: Upon completing this course, the students will be able to
1. Design the amplifiers with various biasing techniques.
2. Design single stage amplifiers using BJT and FET
3. Design multistage amplifiers and understand the concepts of High Frequency Analysis of BJT.
4. Utilize the Concepts of negative feedback to improve the stability of amplifiers and positive feedback to sustained oscillations.

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	3	2	-	-	-	-	-	-	-	1
CO2	2	3	3	2	-	-	-	-	-	-	-	1
CO	2	3	3	2	-	-	-	-	-	-	-	1
CO4	2	3	3	2	-	-	-	-	-	-	-	1

UNIT - I
BJT Biasing: Transistor Biasing and Stabilization - Operating point, DC & AC load lines, Biasing - Fixed Bias, Self Bias, Bias Stability, Bias Compensation using Diode
Analysis and Design of Small Signal Low Frequency BJT Amplifiers: Transistor Hybrid model, Determination of h-parameters from transistor characteristics, Typical values of h- parameters in CE, CB and CC configurations, Transistor amplifying action, Analysis of CE, CC, CB Amplifiers and CE Amplifier with emitter resistance, low frequency response of BJT Amplifiers, effect of coupling and bypass capacitors on CE Amplifier.

UNIT - II
FET- Biasing Techniques
FET Amplifiers: Analysis of CS, CD, CG JFET Amplifiers, comparison of performance with BJT Amplifiers, Basic Concepts of MOSFET Amplifiers, MOS Small signal model, Common source amplifier with resistive, Diode connected and Current source loads, Source follower, Common Gate Stage, Cascode and Folded Cascode Amplifier – frequency response.

UNIT - III
Multistage Amplifiers: Classification of Amplifiers, Distortion in amplifiers, Different coupling schemes used in amplifiers, Frequency response and Analysis of multistage amplifiers, Cascade RC Coupled amplifiers, Cascode amplifier, Darlington pair.
Transistor at High Frequency: Hybrid -π model of Common Emitter transistor model, f_α, f_β and unity gain bandwidth, Gain-bandwidth product.

UNIT - IV

Feedback Amplifiers: Concepts of feedback – Classification of feedback amplifiers – General characteristics of Negative feedback amplifiers – Effect of Feedback on Amplifier characteristics – Voltage series, Voltage shunt, Current series and Current shunt Feedback configurations – Simple problems.

UNIT - V

Oscillators: Condition for Oscillations, RC type Oscillators-RC phase shift and Wien-bridge Oscillators, LC type Oscillators –Generalized analysis of LC Oscillators, Hartley and Colpitts Oscillators, Frequency and amplitude stability of Oscillators, Crystal Oscillator.

TEXT BOOKS:
1. Jacob Millman, Christos C Halkias -Integrated Electronics, McGraw Hill Education.
2. Robert L. Boylestead, Louis Nashelsky -Electronic Devices and Circuits theory, 11th Edition, 2009, Pearson

REFERENCE BOOKS:
1. David A. Bell – Electronic Devices and Circuits, 5th Edition, Oxford.
2. Adel S. Sedra, Kenneth C. Smith- Microelectronic Circuits- Theory and Applications, Oxford.
3. Chinmoy Saha, Arindam Halder, Debaati Ganguly -Basic Electronics-Principles and Applications, 2018, Cambridge.

EI302PC: NETWORK ANALYSIS AND SYNTHESIS

B.Tech. II Year I Sem.   **L   T   P   C**
                                                                                  3   0   0   3

Course Objectives:
1. To understand the basic concepts on RLC circuits.
2. To know the behavior of the steady state and transient states in RLC circuits.
3. To understand the two port network parameters.
4. Learn the design concepts of various filters and attenuators

Course Outcomes: Upon successful completion of the course, students will be able to:
1. Gain the knowledge on basic RLC circuits behaviour.
2. Analyse the Steady state and transient analysis of RLC Circuits.
3. Characterization of two port network parameters.
4. Analyse the Design aspect of various filters and attenuators

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	-	-	-	1	-	-	-	-	1
CO2	2	3	2	-	-	-	1	-	-	-	-	1
CO3	3	2	1	-	-	-	-	-	-	-	-	1
CO4	2	3	3	-	-	-	1	-	-	-	-	1

UNIT - I
Network Topology: Basic cutset and tie set matrices for planar networks, Magnetic Circuits, Self and Mutual inductances, dot convention, impedance, reactance concept, Impedance transformation and coupled circuits, co-efficient of coupling, equivalent T for Magnetically coupled circuits, Ideal Transformer.

UNIT - II
Transient and Steady state analysis: RC, RL and RLC Circuits, Sinusoidal, Step and Square responses. RC Circuits as integrator and differentiators. 2nd order series and parallel RLC Circuits, Root locus, damping factor, over damped, under damped, critically damped cases, quality factor and bandwidth for series and parallel resonance, resonance curves.

UNIT - III
Two port network parameters: Z, Y, ABCD, h and g parameters, Characteristic impedance, Image transfer constant, image and iterative impedance, network function, driving point and transfer functions – using transformed (S) variables, Poles and Zeros. Standard T, π, L Sections, Characteristic impedance, image transfer constants, Design of Attenuators, impedance matching network.

UNIT-IV
Filters: Classification of Filters, Filter Networks, Constant-K Filters-Low pass, high pass, Band pass, band-stop filters, M-derived Filters- T and π filters- Low pass, high pass
Attenuators: Types – T, π , L, Bridge T and lattice ,Asymmetrical Attenuators T, π , L Equalizers-Types- Series, Shunt, Constant resistance, bridge T attenuation, bridge T phase, Lattice attenuation, lattice Phase equalizers

UNIT – V
Network Synthesis: Driving point impedance and admittance, transfer impedance and admittance, network functions of Ladder and non ladder networks, Poles, Zeros analysis of network functions,

Hurwitz polynomials, Positive Real Functions, synthesis of LC, RC and RL Functions by foster and causer methods.

TEXT BOOKS:
1. Van Valkenburg -Network Analysis, 3rd Ed., Pearson, 216.
2. JD Ryder - Networks, Lines and Fields, 2nd Ed., PHI, 1999.

REFERENCE BOOKS:
1. J. Edminister and M. Nahvi - Electric Circuits, Schaum's Outlines, Mc Graw Hills Education, 1999.
2. A. Sudhakar and Shyammohan S Palli - Networks & Circuits, 4th Ed., Tata McGraw- Hill Publications
3. William Hayt and Jack E. Kimmerley - Engineering Circuit Analysis, 6th Ed., William Hayt and Jack E. Kimmerley, McGraw Hill Company

EI303PC: ELECTRONIC MEASUREMENTS

B.Tech. II Year I Sem.   L   T   P   C
                                                                                3   0   0   3

Course Objectives:
1. To understand different measurement methods and errors associated with them
2. To know the different standards and calibration methodologies adopted in the measurement systems
3. To know different AC and DC bridges for the measurement of R, L and C
4. To know different types of Oscilloscopes and Analyzers (Analog and Digital)

Course Outcomes: Upon successful completion of the course, students will be able to:
1. Use the different methods of measurement and know the error calculations
2. Do the Calibration of different instruments
3. Calculate the values of R, L and C by balancing the bridges circuits
4. Measure the waveforms in an oscilloscope and analyze any complex waveforms through analog and digital techniques

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	-	-	-	-	-	-	-	-	-	1
CO2	3	3	2	-	-	-	-	-	-	-	-	1
CO3	3	3	2	2	-	-	-	-	-	-	-	1
CO4	3	3	2	2	-	-	-	-	-	-	-	1

UNIT – I
Introduction to Measuring System: Static Characteristics, Error in measurement, Type of static errors, Dynamic characteristics, Statistical analysis, Probability of errors, Limiting errors, Standards - International standards, Primary standards, Secondary standards, Working standards.
Voltage, Current and Power Measurements: DC Ammeters and DC Voltmeters, AC voltmeter using rectifier, True RMS responding voltmeters, Electronic multimeters, Digital Voltmeters - General characteristics, Ramp type DVM, Integrating type DVM, Successive approximation type DVM, Calibration of voltmeter and ammeter, Wattmeter for power measurement, Watt-hour meter (Energy Meter), Power factor meters.

UNIT – II
Bridge Circuit and Measurements: Bridge Measurement – Wheatstone bridge, Kelvin bridge, AC bridges - Conditions for bridge balance, Maxwell's bridge, Anderson bridge, Hays bridge, Schering bridge, Wien bridge, Wagner ground connection, Q- meter, Vector impedancemeter.

UNIT – III
Frequency and Time Measurements: Digital Frequency Meter: Principle of operation, Basic circuit of digital frequency meter, frequency measurement, High frequency measurements, Digital measurement of Time-Time base selector, Period measurement, Ratio and multiple ratio measurements, Electronic Counter - Totalizing, Frequency mode, Ratio mode, Period mode, Time intervalmode.

UNIT-IV
Analyzers: Basic Wave Analyzer - Frequency selective wave analyzer and Heterodyne wave analyzer, Harmonic distortion analyzer - Tuned circuit and heterodyne, Spectrum analyzer, Logicanalyzers.

UNIT – V
Oscilloscope and Some Display Devices: Oscilloscopes: Basic CRO circuits, Lissajous patterns, Multi input oscilloscopes - Dual trace and Dual beam, Sampling oscilloscopes, Storage oscilloscope - Analog and Digital.

Display Devices: Segmental Display - 7 segment, 14 segment and Dot Matrix, LED and LCD.

TEXT BOOKS:
1. Helfrick and W.D. Cooper -Electronic Instrumentation and Measurements Techniques, PHI Publications
2. Shawney - Electrical and Electronic Measurements, Khanna Pub

REFERENCE BOOKS:
1. H. S. Kalsi - Electronic Instrumentation, Tata McGraw-Hill, 2004
2. Bernard Oliver- Electronic Measurements and Instrumentation, John Cage
3. John P. Bentley - Principles of Measurement Systems, 3rd Ed., Addison Wesley Longman, 2000
4. David A. Bell - Electronic Instrumentation and Measurements, 2nd Ed., PHI, 2003

EI304PC: SIGNALS AND SYSTEMS

B.Tech. II Year I Sem.   **L   T   P   C**
                                                                                        3   1   0   4

Course Objectives: The objectives of this subject are to:
1. Classify signals and systems and their analysis in time and frequency domains.
2. Study the concepts of distortion less transmission through LTI systems, convolution and correlation properties.
3. Understand Laplace and Z-transforms their properties for analysis of signals and systems.
4. Identify the need for sampling of CT signals, types and merits and demerits of each type.

Course Outcomes: Upon completing this course the students able to:
1. Characterize various signals, systems and their time and frequency domain analysis, using transform techniques.
2. Identify the conditions for transmission of signals through systems and c o n d i t i o n s f o r physical realization of systems.
3. Use sampling theorem for baseband and band pass signals for various types of sampling and for different duty cycles.
4. Apply the correlation and PSD functions for various applications.

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	-	-	-	-	-	-	-	-	-	1
CO2	3	3	2	-	-	-	-	-	-	-	-	1
CO3	3	3	2	2	-	-	-	-	-	-	-	1
CO4	3	3	2	2	-	-	-	-	-	-	-	1

UNIT - I
Signal Analysis: 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, Classification of Signals and systems, Exponential and Sinusoidal signals, Concepts of Impulse function, Unit Step function, Signum function.

UNIT – II
Fourier series: Representation of Fourier series, Continuous time periodic signals, Properties of Fourier Series, Dirichlet's conditions, Trigonometric Fourier Series and Exponential Fourier Series, Complex Fourier spectrum.
Fourier Transforms: Deriving Fourier Transform from Fourier series, Fourier Transform of arbitrary signal, Fourier Transform of standard signals, Fourier Transform of Periodic Signals, Properties of Fourier Transform, Fourier Transforms involving Impulse function and Signum function, Introduction to Hilbert Transform.

UNIT - III
Signal Transmission through Linear Systems: Linear System, Impulse response, Response of a Linear System, Linear Time Invariant(LTI) System, Linear Time Variant (LTV) System, Transfer function of a LTI System, Filter characteristic of Linear System, Distortion less transmission through a system, Signal bandwidth, System Bandwidth, Ideal LPF, HPF, and BPF characteristics, Causality and Paley-Wiener criterion for physical realization, Relationship between Bandwidth and rise time, Convolution and Correlation of Signals, Concept of convolution in Time domain and Frequency domain, Graphical representation of Convolution.

UNIT – IV
Laplace Transforms: Laplace Transforms (L.T), Inverse Laplace Transform, Concept of Region of Convergence (ROC) for Laplace Transforms, Properties of L.T, Relation between L.T and F.T of a signal, Laplace Transform of certain signals using waveform synthesis.

Z–Transforms: Concept of Z- Transform of a Discrete Sequence, Distinction between Laplace, Fourier and Z Transforms, Region of Convergence in Z-Transform, Constraints on ROC for various classes of signals, Inverse Z-transform, Properties of Z-transforms.

UNIT - V

Sampling theorem: Graphical and analytical proof for Band Limited Signals, Impulse Sampling, Natural and Flat top Sampling, Reconstruction of signal from its samples, Effect of under sampling – Aliasing, Introduction to Band Pass Sampling.

Correlation: Cross Correlation and Auto Correlation of Functions, Properties of Correlation Functions, Energy Density Spectrum, Parsevals Theorem, Power Density Spectrum, Relation between Autocorrelation Function and Energy/Power Spectral Density Function, Relation between Convolution and Correlation, Detection of Periodic Signals in the presence of Noise by Correlation, Extraction of Signal from Noise by Filtering.

TEXT BOOKS
1. B.P. Lathi -Signals, Systems & Communications, BSP, 2013.
2. A.V. Oppenheim, A.S. Willsky and S.H. Nawabi -Signals and Systems, 2nd Ed., Prentice Hall

REFERENCE BOOKS
1. Simon Haykin and Van Veen, A. Rama Krishna Rao, -Signals and Systems, TMH, 2008.
2. Michel J. Robert - Fundamentals of Signals and Systems, MGH International Edition, 2008.
3. C. L. Philips, J. M. Parr and Eve A. Riskin -Signals, Systems and Transforms, 3rd Ed., PE, 2004.

EI305PC: SENSORS AND SIGNAL CONDITIONING

B.Tech. II Year I Sem.   L T P C
                                                                                                         3 1 0 4

Course Prerequisites: Physics and Mathematics

Course Objectives:
1. To know the principle of sensors and transducer technology and measurementsystems
2. To provide a knowledge in Theoretical and Practical concepts of Transducers
3. To know the utilization of different sensors and their applications
4. To learn various measurement methods of physical parameters like velocity, acceleration, torque, pressure, flow, temperature etc.

Course Outcomes: Upon successful completion of the course, students will be able to:
1. Identify suitable sensors and transducers for real world applications such as level, temperature, vibration, light etc.,
2. Translate theoretical concepts into working models
3. Design the experimental applications to engineering modules and practices
4. Design engineering solution to the Industry/Society needs and develop products

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	-	-	-	-	-	-	-	-	-	1
CO2	3	3	2	-	-	-	-	-	-	-	-	1
CO3	3	3	2	2	-	-	-	-	-	-	-	1
CO4	3	3	2	2	-	-	-	-	-	-	-	1

UNIT – I
Introduction to Measurement Systems: General concepts and terminology, measurement systems, sensor classifications: Analog Input and Output, Digital Input and Output, General input-output configuration, methods of correction.

UNIT – II
Passive Sensors:
Resistive Sensors: Potentiometers, Strain Gauges, Resistive TemperatureDetectors (RTDs): Three wire and Four wire, Thermistors, Light-dependent Resistors (LDRs), Resistive Hygrometers.
Capacitive Sensors: Variable capacitor and Differential capacitor, CapacitiveTouch sensors.
Inductive Sensors: Reluctance variation sensors, Eddy current sensors, Linear Variable Differential Transformers (LVDTs), Magneto elastic sensors, Electromagnetic Sensor based on Faraday's law of Electromagnetic induction-search coil magnetometers. Introduction to proximity sensors.

UNIT – III
Self-generating Sensors:
Thermoelectric Sensors: Thermocouples-Thermo electric effects, Common thermocouples, Practical thermocouple laws, Cold junction compensation in thermocouple circuits. Thermowell.
Piezoelectric Sensors: Piezoelectric effect, piezoelectric materials, applications. Pyroelectric Sensors: Pyroelectric effect, pyroelectric materials, Radiation laws: Plank, Wein and Stefan-Boltzmann, Applications.
Photovoltaic Sensors: Photovoltaic effect, materials and applications. Hall Effect Sensors

UNIT – IV
Digital Sensors: Position Encoders, Incremental position encoders, absolute position encoders, Variable frequency sensors-Quartz digital thermometers, vibrating cylinder sensors, SAWsensors.
Introduction to Smart Sensors: Introduction to MEMS Sensors.

UNIT – V

Signal Conditioning: Voltage dividers, Wheatstone bridge, Instrumentation amplifier, Programmable gain amplifier, linearization of resistive bridge sensor, Electrostatic shield, Noise elimination using filters, Introduction to Synchros and Resolvers.

TEXT BOOKS:
1. Areny, John G. Webster, Ramon Pallas - Sensors and Signal Conditioning, 2nd Ed., Wiley
2. D. Patranabis -Sensors and Transducers, TMH, 2003

REFERENCE BOOKS:
1. Jon Wilson -Sensor Technology Hand Book, Newne 2004 Herman
2. K. P. Neubrat -Instrument   Transducers, An   Introduction to their Performance and Design, Oxford University Press
3. E. O. Doeblin -Measurement System: Applications and Design, McGraw-Hill Publications

EI306PC: ANALOG CIRCUITS LABORATORY

B.Tech. II Year I Sem.   L   T   P   C
                                                                                   0   0   2   1

Course Outcomes: Upon completing this course the students will be able to
1. Design amplifiers with required Q point and analyse amplifier characteristics
2. Examine the effect multistage amplification on frequency response
3. Investigate feedback concept in amplifiers and oscillator

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	-	2	-	3	-	-	3	3	-	-	1
CO2	1	-	2	-	3	-	-	3	3	-	-	1
CO3	1	-	2	-	3	-	-	3	3	-	-	1

List of Experiments (Twelve experiments to be done):
Verify any twelve experiments in H/W Laboratory
1. Perform an experiment to choose Q-point for a Transistor that operate in active region and observe the effect of external Load resistance on Q-point.
2. Design a Self bias Circuit and determine the Q-point of the Transistor and its Stability factor by both simulation and realization with hardware components.
3. Obtain the I/O Characteristics of CE, CB, CC amplifiers. Calculate h-parameters from the Characteristics.
4. Design and Simulate a Common Drain Amplifier with voltage divider bias and determine the Stability factor.
5. Obtain the Drain and Transfer characteristics of CD, CS amplifiers of JFET. Calculate gm, rd from the Characteristics.
6. By experiment prove that the voltage gain of Emitter Follower Circuit is one.
7. Design a Common Emitter Amplifier with a gain of 30db and Bandwidth of 10KHZ and plot the frequency response practically.
8. Design a two stage RC Coupled amplifier and prove that gain is increased and analyze the effects of coupling capacitance.
9. Practically prove that the Darlington pair has high input impedance.
10. Draw the high frequency response of common emitter transistor amplifier and calculate fα, fβ and gain bandwidth product.
11. Design a cascode amplifier for a given specifications
12. Design four topologies of feedback amplifiers and draw the frequency response of them with and without feedback.
13. Design an RC phase shift oscillator circuit and derive the gain condition for oscillations practically for given frequency.
14. Design a Colpitts oscillator circuit for the given frequency and draw the output waveform.

Major Equipment required for Laboratories:
1. Regulated Power Suppliers, 0-30V
2. 20 MHz, Dual Channel Cathode Ray Oscilloscopes.
3. Functions Generators-Sine and Square wave signals
4. Multimeters
5. Electronic devices

EI307PC: SENSORS AND MEASUREMENTS LABORATORY

B.Tech. II Year I Sem.

	L	T	P	C
	0	0	2	1

Course Outcomes: Upon completing this course the students will be able to
1. Use different sensors for applications
2. Identify the sensors required for specific application
3. Design and develop a simple measuring device employing appropriate sensors

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	-	2	-	3	-	-	3	3	-	-	1
CO2	1	-	2	-	3	-	-	3	3	-	-	1
CO3	1	-	2	-	3	-	-	3	3	-	-	1

LIST OF EXPERIMENTS:
1. Measurement of Load using Strain Gauge bridge and obtain the strain gauge characteristics.
2. Measurement of Temperature using Thermistor and RTD and obtain the temperature Vs ResistanceCharacteristics
3. Measurement of Temperature using Thermocouple and obtain the temperature Vs Voltage Characteristics.
4. Measurement of Displacement using LVDT and obtain the displacement Vs Voltage Characteristics ofLVDT.
5. Measurement of Liquid level using capacitive transducer.
6. Measurement of Resistance using Wheatstone bridge.
7. Measurement of Low Resistances using Kelvin Bridge.
8. Measurement of Capacitance using Schering Bridge.
9. Measurement of Inductance using Maxwell's Bridge.
10. Measurement of L, C and R using Q-Meter.
11. Obtain the Characteristics of Opto-Electric Transducers - Photo Transistor and Photo Diode.
12. Obtain the Characteristics of LDR.
13. Pressure measurement using Bourdon Tube and obtain the characteristics.
14. Measurement of temperature using optical Pyrometers.

EI308PC: BASIC SIMULATION LABORATORY

B.Tech. II Year I Sem.	L	T	P	C
	0	0	2	1

Course Outcomes: Upon completing this course, the students will be able to
1. Generate, analyze and perform various operations on Signals/Sequences both in time and Frequency domain
2. Analyze and Characterize Continuous and Discrete Time Systems both in Time and Frequency domain along with the concept of Sampling
3. Generate different Random Signals and capable to analyze their Characteristics

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3	3	3	2	-	-	3	1	-	1
CO2	3	2	3	3	3	2	-	-	3	1	-	1
CO3	3	2	3	3	3	2	-	-	3	1	-	1

Note:
- All the experiments are to be simulated using MATLAB or equivalent software
- Minimum of 12 experiment are to be completed

List of Experiments:
1. Basic Operations on Matrices.
2. Generation of Various Signals and Sequences (Periodic and Aperiodic), such as Unit Impulse, Unit Step, Square, Saw tooth, Triangular, Sinusoidal, Ramp, Sinc.
3. Operations on Signals and Sequences such as Addition, Multiplication, Scaling, Shifting, Folding, Computation of Energy and Average Power.
4. Finding the Even and Odd parts of Signal/Sequence and Real and Imaginary parts of Signal.
5. Convolution for Signals and sequences.
6. Auto Correlation and Cross Correlation for Signals and Sequences.
7. Verification of Linearity and Time Invariance Properties of a given Continuous/Discrete System.
8. Computation of Unit sample, Unit step and Sinusoidal responses of the given LTI system and verifying its physical realiazability and stability properties.
9. Gibbs Phenomenon Simulation.
10. Finding the Fourier Transform of a given signal and plotting its magnitude and phase spectrum.
11. Waveform Synthesis using Laplace Transform.
12. Locating the Zeros and Poles and plotting the Pole-Zero maps in S-plane and Z-Plane for the given transfer function.
13. Generation of Gaussian noise (Real and Complex), Computation of its mean, M.S. Value and its Skew, Kurtosis, and PSD, Probability Distribution Function.
14. Verification of Sampling Theorem.

*MC309: CONSTITUTION OF INDIA

B.Tech. II Year I Sem.   **L T P C**
                                                                                              3 0 0 0

Course Objectives: Students will be able to:
- Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
- To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

Course Outcomes: Students will be able to:
- Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
- Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
- Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution
- Discuss the passage of the Hindu Code Bill of 1956.

Unit - 1 History of Making of the Indian Constitution- History of Drafting Committee.

Unit - 2 Philosophy of the Indian Constitution- Preamble Salient Features

Unit - 3 Contours of Constitutional Rights & Duties - Fundamental Rights
- Right to Equality
- Right to Freedom
- Right against Exploitation
- Right to Freedom of Religion
- Cultural and Educational Rights
- Right to Constitutional Remedies
- Directive Principles of State Policy
- Fundamental Duties.

Unit - 4 Organs of Governance: Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions

Unit - 5 Local Administration: District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation. Panchayat raj: Introduction, PRI: Zila Panchayat. Elected officials and their roles, CEO ZilaPanchayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy

Unit - 6 Election Commission: Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners. State Election Commission: Role and Functioning. Institute and Bodies for the welfare of SC/ST/OBC and women.

Suggested Reading:
1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

EI401PC: NUMERICAL METHODS AND COMPLEX VARIABLES

B.Tech. II Year II Sem.   **L T P C**
                                                                                           3 1 0 4

Pre-requisites: Mathematics courses of first year of study.

Course Objectives: To learn
- Expressing periodic function by Fourier series and a non-periodic function by Fourier transforms
- Various numerical methods to find roots of polynomial and transcendental equations.
- Concept of finite differences and to estimate the value for the given data using interpolation.
- Evaluation of integrals using numerical techniques
- Solving ordinary differential equations of first order using numerical techniques.
- Differentiation and integration of complex valued functions.
- Evaluation of integrals using Cauchy's integral formula and Cauchy's residue theorem.
- Expansion of complex functions using Taylor's and Laurent's series.

Course outcomes: After learning the contents of this paper the student must be able to
- Express any periodic function in terms of sine and cosine
- Find the root of a given polynomial and transcendental equations.
- Estimate the value for the given data using interpolation
- Find the numerical solutions for a given first order ODE's
- Analyze the complex function with reference to their analyticity, integration using Cauchy's integral and residue theorems
- Taylor's and Laurent's series expansions in complex function

UNIT-I: Fourier Series & Fourier Transforms: **10 L**
Fourier series - Dirichlet's Conditions - Half-range Fourier series - Fourier Transforms: Fourier Sine and cosine transforms - Inverse Fourier transforms.

UNIT-II: Numerical Methods-I   **10 L**
Solution of polynomial and transcendental equations: Bisection method, Iteration Method, Newton-Raphson method and Regula-Falsi method. Jacobi and Gauss-Seidal iteration methods for solving linear systems of equations.
Finite differences: forward differences, backward differences, central differences, symbolic relations and separation of symbols, Interpolation using Newton's forward and backward difference formulae. Central difference interpolation: Gauss's forward and backward formulae, Lagrange's method of interpolation.

UNIT-III: Numerical Methods-II   **8 L**
Numerical integration: Trapezoidal rule and Simpson's $1/3^{rd}$ and $3/8^{th}$ rules.
Ordinary differential equations: Taylor's series, Picard's method, Euler and modified Euler's methods, Runge-Kutta method of fourth order for first order ODE

UNIT-IV: Complex Differentiation   **10 L**
Limit, Continuity and Differentiation of Complex functions. Cauchy-Riemann equations (without proof), Milne- Thomson methods, analytic functions, harmonic functions, finding harmonic conjugate, elementary analytic functions (exponential, trigonometric, logarithm) and their properties. (All theorems without Proofs), Conformal mappings, Mobius transformations.

UNIT-V: Complex Integration: **10 L**
Line integrals, Cauchy's theorem, Cauchy's Integral formula, zeros of analytic functions, singularities, Taylor's series, Laurent's series, Residues, Cauchy Residue theorem.
and their properties. (All theorems without Proofs)

TEXT BOOKS:
1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
2. S.S. Sastry, Introductory methods of numerical analysis, PHI, 4th Edition, 2005.

REFERENCE BOOKS:
1. M. K. Jain, S.R.K. Iyengar, R.K. Jain, Numerical methods for Scientific and Engineering Computations, New Age International publishers.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
3. J. W. Brown and R. V. Churchill, Complex Variables and Applications, 7th Edition, Mc-Graw Hill, 2004.

EI402PC: INDUSTRIAL INSTRUMENTATION

B.Tech. II Year II Sem.   L T P C
                                                                              2 0 0 2

Course Objectives:
1. Understand the basic knowledge of the physical parameters like Pressure, Temperature, flow, level, density and viscosity employed in different Industries.
2. Grasp sound knowledge about various techniques used for the measurement of industrial parameters.
3. Understand the construction and working of measuring instruments.
4. Analyze need and necessity of measuring instruments.

Course Outcomes: After completion of the course the student is able to:
1. Acquire adequate knowledge about process transducers.
2. Acquire adequate knowledge about the temperature standards, thermocouples and pyrometry techniques.
3. Use and calibrate flow meters, mass flow meters etc.,
4. Do the level measurements adopted in industry environment.

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	-	-	-	-	-	-	-	-	-	1
CO2	3	3	2	-	-	-	-	-	-	-	-	1
CO3	3	3	2	2	-	-	-	-	-	-	-	1
CO4	3	3	2	2	-	-	-	-	-	-	-	1

UNIT - I
Metrology: Measurement of length - Gauge blocks – Plainness – Area using Simpson's rule, Planimeter – Diameter – Roughness – Angle using Bevel protractor, sinebars and Clinometer – Mechanical, Electrical, Optical and Pneumatic Comparators. Optical Methods for length and distance measurements using Optical flats and Michelson Interferometer.
Velocity and Acceleration Measurement
Relative velocity – Translational and Rotational velocity measurements – Revolution counters and Timers - Magnetic and Photoelectric pulse counting stroboscopic methods. Accelerometers-different types, Gyroscopes-applications.

UNIT - II
Force Measurement: Force measurement – Different methods –Gyroscopic Force Measurement – Vibrating wire Force transducer.
Pressure Measurement: Basics of Pressure measurement –Manometer types – Force-Balance and Vibrating Cylinder Transducers – High- and Low-Pressure measurement – McLeod Gauge, Knudsen Gauge, Momentum Transfer Gauge, Thermal Conductivity Gauge, Ionization Gauge, Dual Gauge Techniques, Deadweight Gauges, Hydrostatic Pressure Measurement

UNIT - III
Flow Measurement and Level Measurement: Flow Meters- Head type, Area type (Rota meter), electromagnetic type, Positive displacement type, mass flow meter, ultrasonic type, vertex shedding type, Hotwire anemometer type, Laser Doppler Velocity-meter.
Basic Level measurements – Direct, Indirect, Pressure, Buoyancy, Weight, Capacitive Probe methods

UNIT - IV
Density, Viscosity and other Measurements
Density measurements – Strain Gauge load cell method – Buoyancy method - Air pressure balance

method – Gamma ray method – Vibrating probe method.
Units of Viscosity, specific gravity scales used in Petroleum Industries, Different Methods of measuring consistency and Viscosity –Two float viscorator –Industrial consistency meter. Sound-Level Meters, Microphones, Humidity Measurement

UNIT - V
Calibration and Interfacing
Calibration using Master Sensors, Interfacing of Force, Pressure, Velocity, Acceleration, Flow, Density and Viscosity Sensors, Variable Frequency Drive

TEXT BOOKS:
1. Doeblin E.O. -Measurement Systems – Applications and Design, 4th Ed., McGraw Hill international, 1990
2. Patranabis D - Principles of Industrial Instrumentation, End edition, TMH, 1997

REFERENCE BOOKS:
1. Considine D.M.- Process Instruments and Control Handbook, 4th Ed., McGraw Hill International, 1993.
2. Jain R.K.- Mechanical and Industrial Measurements, Khanna Publishers, 1986.
3. Jones E.B.- Instrument Technology, vol. I, Newens, 1981.

EI403PC: DIGITAL LOGIC DESIGN

B.Tech. II Year II Sem.   **L   T   P   C**
                                                                                    3   0   0   3

Course Objectives:
1. To understand common forms of number representation in logic circuits.
2. To learn basic techniques for the design of digital circuits and fundamental concepts used in the design of digital systems.
3. To understand the concepts of combinational logic circuits and sequential circuits.
4. To understand the Realization of Logic Gates Using Diodes & Transistors.

Course Outcomes: Upon completing this course, the students will be able to
1. Acquire the knowledge on numerical information in different forms and Boolean Algebra theorems.
2. Define Postulates of Boolean algebra and to minimize combinational functions, and design the combinational circuits.
3. Design and analyse sequential circuits for various cyclic functions.
4. Characterize logic families and analyze them for the purpose of AC and DC parameters.

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3	1	2	1	-	-	-	-	-	2
CO2	3	2	2	1	2	1	-	-	-	-	-	2
CO3	2	3	3	2	2	1	-	-	-	-	-	1
CO4	3	2	1	1	1	-	-	-	-	-	-	-

UNIT - I
Number Systems: Number systems, Complements of Numbers, Codes- Weighted and Non-weighted codes and its Properties, Parity check code and Hamming code.
Boolean algebra: Basic Theorems and Properties, Switching Functions- Canonical and Standard Form, Algebraic Simplification, Digital Logic Gates, EX-OR gates, Universal Gates, Multilevel NAND/NOR realizations.

UNIT - II
Minimization of Boolean functions: Karnaugh Map Method - Up to five Variables, Don't Care Map Entries, Tabular Method
Realization of Logic Gates Using Diodes & Transistors: AND, OR and NOT Gates using Diodes and Transistors, DCTL, RTL, DTL, TTL, CML and CMOS Logic Families and its Comparison, standard TTL NAND Gate-Analysis & characteristics, TTL open collector O/Ps, Tristate TTL, MOS & CMOS open drain and tri-state outputs,IC interfacing- TTL driving CMOS & CMOS driving TTL.

UNIT – III
Combinational Logic Circuits: Adders, Subtractors, Comparators, Multiplexers, Demultiplexers, Encoders, Decoders and Code converters, Hazards and Hazard Free Relations.
Sequential Circuits Fundamentals: Basic Architectural Distinctions between Combinational and Sequential circuits, SR Latch, Flip Flops: SR, JK, JK Master Slave, D and T Type Flip Flops, Excitation Table of all Flip Flops, Timing and Triggering Consideration, Conversion from one type of Flip-Flop to another.

UNIT - IV
Registers and Counters: Shift Registers – Left, Right and Bidirectional Shift Registers, Applications of Shift Registers - Design and Operation of Ring and Twisted Ring Counter, Operation of Asynchronous and Synchronous Counters.

Sequential Machines: Finite State Machines, Synthesis of Synchronous Sequential Circuits- Serial Binary Adder, Sequence Detector, Parity-bit Generator, Synchronous Modulo N –Counters.

UNIT – V

Finite state machine: capabilities and limitations, Mealy and Moore models, State equivalence and machine minimization, simplification of incompletely specified machines, Merger graphs. Asynchronous design-modes of operation, Hazards, synthesis of SIC fundamental mode circuits, synthesis of burst mode circuits. Introduction to ASM Charts

TEXT BOOKS
1. Zvi Kohavi &Niraj K. Jha, - Switching and Finite Automata Theory, 3rd Ed., Cambridge, 2010.
2. R. P. Jain - Modern Digital Electronics, 3rd Edition, 2007- Tata McGraw-Hill

REFERENCE BOOKS
1. Morris Mano, Fredriac J. Hill, Gerald R. Peterson - Introduction to Switching Theory and Logic Design –3rd Ed., John Wiley & Sons Inc.
2. Charles H. Roth - Fundamentals of Logic Design, 5th ED., Cengage Learning, 2004.

EI404PC: ELECTRONIC CIRCUIT ANALYSIS

B.Tech. II Year II Sem.   L T P C
                                                             3 0 0 3

Pre-requisite: Analog Circuits

Course Objectives: Upon completing this course, the student twill be able to
1. Learn the concepts of Power Amplifiers.
2. To give understanding of tuned amplifier circuits
3. Understand various multivibrators using transistors and sweep circuits.

Course Outcomes: Upon completing this course, the student will be able to
1. Design the power amplifiers
2. Design the tuned amplifiers and analyse is frequency response
3. Design Multivibrators and sweep circuits for various applications.
4. Utilize the concepts of synchronization, frequency division and sampling gates

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	1	-	3	2	-	-	-	-	1
CO2	3	3	3	1	-	2	2	-	-	-	-	1
CO3	3	3	3	1	-	2	2	-	-	-	-	1
CO4	3	3	3	1	-	3	2	-	-	-	-	1

UNIT - I
Large Signal Amplifiers: Class A Power Amplifier- Series fed and Transformer coupled, Conversion Efficiency, Class B Power Amplifier- Push Pull and Complimentary Symmetry configurations, Conversion Efficiency, Principle of operation of Class AB and Class –C and D Amplifiers.

UNIT- II
Tuned Amplifiers: Introduction, single Tuned Amplifiers – Q-factor, frequency response, Double Tuned Amplifiers – Q-factor, frequency response, Concept of stagger tuning and synchronous tuning

UNIT - III
Multivibrators: Analysis and Design of Bistable, Monostable, Astable Multivibrators and Schmitt trigger using Transistors.

UNIT - IV
Time Base Generators: General features of a Time base Signal, Methods of Generating Time Base Waveform, concepts of Transistor Miller and Bootstrap Time Base Generator, Methods of Linearity improvement.

UNIT - V
Synchronization and Frequency Division: Pulse Synchronization of Relaxation Devices, Frequency division in Sweep Circuits, Stability of Relaxation Devices, Astable Relaxation Circuits, Monostable Relaxation Circuits, Synchronization of a Sweep Circuit with Symmetrical Signals, Sine wave frequency division with a Sweep Circuit, A Sinusoidal Divider using Regeneration and Modulation.
Sampling Gates: Basic operating principles of Sampling Gates, Unidirectional and Bi-directional Sampling Gates, Four Diode Sampling Gate, Reduction of pedestal in Gate Circuits

TEXT BOOKS:
1. Jacob Millman, Christos C Halkias - Integrated Electronics, , McGraw Hill Education.
2. J. Millman, H. Taub and Mothiki S. PrakashRao - Pulse, Digital and Switching Waveforms –2nd Ed., TMH, 2008,

REFERENCE BOOKS:
1. David A. Bell - Electronic Devices and Circuits, 5th Ed., Oxford.
2. Robert L. Boylestead, Louis Nashelsky - Electronic Devices and Circuits theory, 11th Ed., Pearson, 2009
3. Ronald J. Tocci - Fundamentals of Pulse and Digital Circuits, 3rd Ed., 2008.
4. David A. Bell - Pulse, Switching and Digital Circuits, 5th Ed., Oxford, 2015.

EI405PC: LINEAR AND DIGITAL IC APPLICATIONS

	L	T	P	C
B.Tech. II Year II Sem.	3	0	0	3

Course Objectives: The main objectives of the course are:
1. To introduce the basic building blocks of linear integrated circuits.
2. To introduce the theory and applications of Analog multipliers and PLL.
3. To introduce the concept sine waveform generation and introduce some special function ICs.
4. To understand and implement the working of basic digital circuits.

Course Outcomes: Upon completing this course, the students will be able to
1. A thorough understanding of operational amplifiers with linear integrated circuits.
2. Attain the knowledge of functional diagrams and design applications of IC555 and IC565.
3. Acquire the knowledge and design the Data converters.
4. Choose the proper digital integrated circuits by knowing their characteristics.

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	1	-	-	-	-	-	-	-	-
CO2	3	3	3	1	-	-	-	-	-	-	-	-
CO3	3	3	3	1	-	-	-	-	-	-	-	-
CO4	3	3	2	1	-	-	-	-	-	-	-	-

UNIT – I
Operational Amplifier: Ideal and Practical Op-Amp, Op-Amp Characteristics, DC and AC Characteristics, Features of 741 Op-Amp, Modes of Operation-Inverting, Non-Inverting, Differential, Instrumentation Amplifier, AC Amplifier, Differentiators and Integrators, Comparators, Schmitt Trigger, Introduction to Voltage Regulators, Features of 723 Regulator, Three Terminal Voltage Regulators.

UNIT – II
Op-Amp, IC-555 & IC565 Applications: Introduction to Active Filters, Characteristics of Bandpass, Bandreject and All Pass Filters, Analysis of 1st order LPF & HPF Butterworth Filters, Waveform Generators – Triangular, Sawtooth, Square Wave, IC555 Timer-Functional Diagram, Monostable and Astable Operations, Applications, IC565 PLL-Block Schematic, principle and Applications.

UNIT – III
Data Converters: Introduction, Basic DAC techniques, Different types of DACs-Weighted resistor DAC, R-2R ladder DAC, Inverted R-2R DAC, Different Types of ADCs – Parallel Comparator Type ADC, Counter Type ADC, Successive Approximation ADC and Dual Slope ADC, DAC and ADC Specifications.

UNIT – IV
Combinational Logic Ics: Specifications and Applications of TTL-74XX & CMOS 40XX Series Ics – Code Converters, Decoders, LED & LCD Decoders with Drivers, Encoders, Priority Encoders, Multiplexers, Demultiplexers, Priority Generators/Checkers, Parallel Binary Adder/Subtractor, Magnitude Comparators.

UNIT – V
Sequential Logic IC's and Memories: Familiarity with commonly available 74XX & CMOS40XX Series Ics – All Types of Flip-flops, Synchronous Counters, Decade Counters, Shift Registers.
Memories – ROM Architecture, Types of ROMS & Applications, RAM Architecture, Static & Dynamic RAMs.

TEXT BOOKS:

1. Ramakanth A. Gayakwad – Op-Amps & Linear Ics, PHI, 2003.
2. Floydand Jain- Digital Fundamentals, 8th Ed., Pearson Education, 2005.

REFERENCE BOOKS:

1. D. Roy Chowdhury – Linear Integrated Circuits, New Age International(p) Ltd, 2nd Ed., 2003.
2. John. F. Wakerly – Digital Design Principles and Practices, 3rdEd., Pearson, ,2009.
3. Salivahana -Linear Integrated Circuits and Applications, TMH, 2008.
4. William D. Stanley- Operational Amplifiers with Linear Integrated Circuits, 4th Ed., Pearson Education India, 2009.

EI406PC: ELECTRONIC CIRCUIT ANALYSIS LABORATORY

B.Tech. II Year II Sem.   **L T P C**
                                                               0 0 2 1

Note:
- Experiments marked with * has to be designed, simulated and verified in hardware.
- Minimum of 9 experiments to be done in hardware.

Course Outcomes: Upon completing this course, the students will be able to
1. Design power amplifiers and find its efficiency
2. Design tuned amplifiers and find its Q-factor
3. Design various multivibrators and sweep circuits. Understand the necessity of linearity
4. Design sampling gates and understanding the concepts of frequency division

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	0	3	3	3	-	-	-	3	3	-	1
CO2	1	0	3	3	3	-	-	-	3	3	-	1
CO3	1	0	3	3	3	-	-	-	3	3	-	1
CO4	1	0	3	3	3	-	-	-	3	3	-	1

Hardware Testing in Laboratory:
1. Design transformer coupled class A power amplifier and draw the input and output waveforms find its efficiency
2. Design class B power amplifier and draw the input and output waveforms, find 2nd order and above harmonics.
3. Prove that the complementary symmetry pushpull amplifier eliminate cross over distortion.
4. Design class C power amplifier and draw the input and output waveforms
5. Design a single tuned amplifier and determine the Q of its tuned circuit practically.
6. Design a Bistable Multivibrator and analyze the effect of commutating capacitors and draw the wave forms at base and collector of transistors.
7. Design an Astable Multivibrator and draw the wave forms at base and collector of transistors.
8. Design a Monostable Multivibrator and draw the input and output waveforms
9. Draw the response of Schmitt trigger for gain of greater than and less than one.
10. Design a Bootstrap sweep circuit using BJT and draw its output time base waveform
11. Design a Miller sweep circuit using BJT and draw its output time base waveform.
12. Design a constant current sweep generator and draw input and output waveforms
13. Design unidirectional and bidirectional sampling gates
14. Prove practically Schmitt Trigger generates square wave
15. Frequency division with sweep circuit

Major Equipment required for Laboratories:
1. Computer System with latest specifications connected
2. Window XP or equivalent
3. Simulation software-Multisim or any equivalent simulation software
4. Regulated Power Suppliers, 0-30V
5. 20 MHz, Dual Channel Cathode Ray Oscilloscopes.
6. Functions Generators-Sine and Square wave signals
7. Multimeters
8. Electronic Components

EI407PC: LINEAR AND DIGITAL IC APPLICATIONS LABORATORY

B.Tech. II Year II Semester

L T P C
0 0 2 1

Course Outcomes: Upon completing this course, the student able to
1. Design and implementation of various analog circuits using 741 ICs.
2. Design and implementation of various Multivibrators using 555 timer.
3. Design and implement various circuits using digital ICs.
4. Design and implement ADC, DAC and voltage regulators.

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	0	3	3	3	-	-	-	3	3	-	1
CO2	1	0	3	3	3	-	-	-	3	3	-	1
CO3	1	0	3	3	3	-	-	-	3	3	-	1
CO4	1	0	3	3	3	-	-	-	3	3	-	1

Note:
- Minimum 12 experiments should be conducted.
- Verify the functionality of the IC in the given application.

Design and Implementation of:
1. Design an Inverting and Non-inverting Amplifier using Op Amp and calculate gain.
2. Design Adder and Subtractor using Op Amp and verify addition and subtraction process.
3. Design a Comparator using Op Amp and draw the comparison results of A=B, A<B, A>B.
4. Design a Integrator and Differentiator Circuits using IC741 and derive the required condition practically.
5. Design a Active LPF, HPF cutoff frequency of 2 KHZ and find the roll off of it.
6. Design a Circuit using IC741 to generate sine/square/triangular wave with period of 1 KHZ and draw the output waveform.
7. Construct Mono-stable Multivibrator using IC555 and draw its output waveform.
8. Construct Astable Multivibrator using IC555 and draw its output waveform and also find its duty cycle.
9. Design a Schmitt Trigger Circuit and find its LTP and UTP.
10. Design Frequency modulator and demodulator circuit and draw the respective waveforms.
11. Design Voltage Regulator using IC723, IC 7805/7809/7912 and find its load regulation factor.
12. Design R-2R ladder DAC and find its resolution and write a truth table with respective voltages.
13. Design Parallel comparator type/ counter type/ successive approximation ADC and find its efficiency.
14. Design a Gray code converter and verify its truth table.
15. Design an even priority encoder using IC 74xx and verify its truth table.
16. Design a 8x1 multiplexer using digital ICs.
17. Design a 4-bit Adder/Subtractor using digital ICs and Add/Sub the following bits.
   (i)1010   (ii)0101   (iii)1011
      0100   0010   1001.
18. Design a Decade counter and verify its truth table and draw respective waveforms.
19. Design a Up/down counter usingIC74163 and draw read/write waveforms.
20. Design a Universal shift register using IC 74194/195 and verify its shifting operation.
21. Design a 16x4 RAM using 74189 and draw its read/write operation.
22. Design a 8x3 encoder/3x8 decoder and verify its truth table.

Major Equipment required for Laboratories:
1. 5 V Fixed Regulated Power Supply/ 0-5V or more Regulated Power Supply; Multimeter
2. 20 MHz Oscilloscope with Dual Channel; Bread board and components/Trainer Kit;

EI408PC: INDUSTRIAL INSTRUMENTATION LABORATORY

B.Tech. II Year II Sem.	**L**	**T**	**P**	**C**
	0	**0**	**2**	**1**

Course Outcomes: After completion of the course the student is able to:
1. Measure the various parameters.
2. Design and calibrate measuring instruments
3. Analyze various Industrial Bus Protocols
4. Design a signal conditioner for various sensors

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	0	3	3	3	-	-	-	3	3	-	1
CO2	1	0	3	3	3	-	-	-	3	3	-	1
CO3	1	0	3	3	3	-	-	-	3	3	-	1
CO4	1	0	3	3	3	-	-	-	3	3	-	1

Industrial Instrumentation Experiments:
1. Calibration of Pneumatic pressure to Current (P to I) and Current to Pneumatic Pressure (I toP) Converters
2. Measurement of RPM using opto-coupler and comparing it with stroboscope
3. Measurement of precision Angular Velocity and RPM of a rotating Disk
4. Measurement of Velocity, Acceleration and Vibration using Piezo- electric transducer
5. Measurement of Humidity
6. Measurement of intensity of Light
7. Measurement of Sound Level.
8. Measurement of Viscosity of Edible Oil using Redwood Viscometer
9. Measurement of Viscosity of Crude Oil using Saybolt Viscometer
10. Measurement of Density
11. MEMS based Accelerometer
12. Design of signal conditioner for MEMS based Accelerometer
13. MEMS based Gyroscope
14. Design of signal conditioner for MEMS based Gyroscope
15. Experiments based on Industrial Bus Protocols

*MC410: GENDER SENSITIZATION LAB

B.Tech. II Year II Sem.   **L   T   P   C**
                                                                     0   0   2   0

COURSE DESCRIPTION

This course offers an introduction to Gender Studies, an interdisciplinary field that asks critical questions about the meanings of sex and gender in society. The primary goal of this course is to familiarize students with key issues, questions and debates in Gender Studies, both historical and contemporary. It draws on multiple disciplines – such as literature, history, economics, psychology, sociology, philosophy, political science, anthropology and media studies – to examine cultural assumptions about sex, gender, and sexuality.

This course integrates analysis of current events through student presentations, aiming to increase awareness of contemporary and historical experiences of women, and of the multiple ways that sex and gender interact with race, class, caste, nationality and other social identities. This course also seeks to build an understanding and initiate and strengthen programmes combating gender-based violence and discrimination. The course also features several exercises and reflective activities designed to examine the concepts of gender, gender-based violence, sexuality, and rights. It will further explore the impact of gender-based violence on education, health and development.

Objectives of the Course
- To develop students' sensibility with regard to issues of gender in contemporary India.
- To provide a critical perspective on the socialization of men and women.
- To introduce students to information about some key biological aspects of genders.
- To expose the students to debates on the politics and economics of work.
- To help students reflect critically on gender violence.
- To expose students to more egalitarian interactions between men and women.

Learning Outcomes
➢ Students will have developed a better understanding of important issues related to gender in contemporary India.
➢ Students will be sensitized to basic dimensions of the biological, sociological, psychological and legal aspects of gender. This will be achieved through discussion of materials derived from research, facts, everyday life, literature and film.
➢ Students will attain a finer grasp of how gender discrimination works in our society and how to counter it.
➢ Students will acquire insight into the gendered division of labor and its relation to politics and economics.
➢ Men and women students and professionals will be better equipped to work and live together as equals.
➢ Students will develop a sense of appreciation of women in all walks of life.
➢ Through providing accounts of studies and movements as well as the new laws that provide protection and relief to women, the textbook will empower students to understand and respond to gender violence.

Unit-I: UNDERSTANDING GENDER
Introduction: Definition of Gender-Basic Gender Concepts and Terminology-Exploring Attitudes towards Gender-Construction of Gender-Socialization: Making Women, Making Men
- Preparing for Womanhood. Growing up   Male. First   lessons in Caste.

Unit – II: GENDER ROLES AND RELATIONS

Two or Many? -Struggles with Discrimination-Gender Roles and Relations-Types of Gender Roles-Gender Roles and Relationships Matrix-Missing Women-Sex Selection and Its Consequences-Declining Sex Ratio. Demographic Consequences-Gender Spectrum: Beyond the Binary

Unit – III: GENDER AND LABOUR

Division and Valuation of Labour-Housework: The Invisible Labor- "My Mother doesn't Work." "Share the Load."-Work: Its Politics and Economics -Fact and Fiction. Unrecognized and Unaccounted work. -Gender Development Issues-Gender, Governance and Sustainable Development-Gender and Human Rights-Gender and Mainstreaming

Unit – IV: GENDER - BASED VIOLENCE

The Concept of Violence- Types of Gender-based Violence-Gender-based Violence from a Human Rights Perspective-Sexual Harassment: Say No!-Sexual Harassment, not Eve-teasing- Coping with Everyday Harassment- Further Reading: "*Chupulu".*
Domestic Violence: Speaking OutIs Home a Safe Place? -When Women Unite [Film]. Rebuilding Lives. Thinking about Sexual Violence Blaming the Victim-"I Fought for my Life…."

Unit – V: GENDER AND CULTURE

Gender and Film-Gender and Electronic Media-Gender and Advertisement-Gender and Popular Literature- Gender Development Issues-Gender Issues-Gender Sensitive Language-Gender and Popular Literature - Just Relationships: Being Together as Equals
Mary Kom and Onler. Love and Acid just do not Mix. Love Letters. Mothers and Fathers. Rosa Parks-The Brave Heart.

Note: **Since it is Interdisciplinary Course, Resource Persons can be drawn from the fields of English Literature or Sociology or Political Science or any other qualified faculty who has expertise in this field from engineering departments.**

> - *Classes will consist of a combination of activities: dialogue-based lectures, discussions, collaborative learning activities, group work and in-class assignments. Apart from the above prescribed book, Teachers can make use of any authentic materials related to the topics given in the syllabus on "Gender".*

> ☞ **ESSENTIAL READING**: The Textbook, "*Towards a World of Equals: A Bilingual Textbook on Gender"* written by A.Suneetha, Uma Bhrugubanda, DuggiralaVasanta, Rama Melkote, Vasudha Nagaraj, Asma Rasheed, Gogu Shyamala, Deepa Sreenivas and Susie Tharu **published by Telugu Akademi, Telangana Government in 2015.**

ASSESSMENT AND GRADING:
- Discussion & Classroom Participation: 20%
- Project/Assignment: 30%
- End Term Exam: 50%

EI501PC: MICROCONTROLLERS (PC-I)

B.Tech. III Year I Semester   **L   T   P   C**
                                                           3   1   0   4

Prerequisite: Nil

Course Objectives:
1. To familiarize the architecture of microprocessors and micro controllers
2. To provide the knowledge about interfacing techniques of bus & memory.
3. To understand the concepts of ARM architecture
4. To study the basic concepts of Advanced ARM processors

Course Outcomes: Upon completing this course, the student will be able to
1. Understands the internal architecture, organization and assembly language programming of 8086 processors.
2. Understands the internal architecture, organization and assembly language programming of 8051/controllers
3. Understands the interfacing techniques to 8086 and 8051 based systems.
4. Understands the internal architecture of ARM processors and basic concepts of advanced ARM processors.

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	2	2	1	-	-	-	1	1
CO2	3	3	3	2	2	2	1	-	-	-	1	1
CO3	3	3	3	2	2	2	1	-	-	-	1	1
CO4	3	3	3	2	2	2	1	-	-	-	2	2

UNIT -I:
8086 Architecture: 8086 Architecture-Functional diagram, Register Organization, Memory Segmentation, Programming Model, Memory addresses, Physical Memory Organization, Architecture of 8086, Signal descriptions of 8086, interrupts of 8086.
Instruction Set and Assembly Language Programming of 8086: Instruction formats, Addressing modes, Instruction Set, Assembler Directives, Macros, and Simple Programs involving Logical, Branch and Call Instructions, Sorting, String Manipulations.

UNIT -II:
Introduction to Microcontrollers: Overview of 8051 Microcontroller, Architecture, I/O Ports, Memory Organization, Addressing Modes and Instruction set of 8051.
8051 Real Time Control: Programming Timer Interrupts, Programming External Hardware Interrupts, Programming the Serial Communication Interrupts, Programming 8051 Timers and Counters

UNIT -III:
I/O And Memory Interface: LCD, Keyboard, External Memory RAM, ROM Interface, ADC, DAC Interface to 8051.
Serial Communication and Bus Interface: Serial Communication Standards, Serial Data Transfer Scheme, On board Communication Interfaces-I2C Bus, SPI Bus, UART; External Communication Interfaces-RS232, USB.

UNIT -IV:
ARM Architecture: ARM Processor fundamentals, ARM Architecture – Register, CPSR, Pipeline, exceptions and interrupts interrupt vector table, ARM instruction set – Data processing, Branch

instructions, load store instructions, Software interrupt instructions, Program status register instructions, loading constants, Conditional execution, Introduction to Thumb instructions.

UNIT – V:

Advanced ARM Processors: Introduction to CORTEX Processor and its architecture, OMAP Processor and its Architecture.

TEXT BOOKS:
1. A. K. Ray and K. M. Bhurchandani, Advanced Microprocessors and Peripherals –TMH, 2nd Edition 2006.
2. Andrew N SLOSS, Dominic SYMES, Chris WRIGHT, ARM System Developers guide, Elsevier, 2012

REFERENCE BOOKS:
1. Kenneth. J. Ayala, The 8051 Microcontroller, Cengage Learning, 3rd Ed, 2004.
2. D. V. Hall, Microprocessors and Interfacing, TMGH, 2nd Edition 2006.
3. K. Uma Rao, Andhe Pallavi, The 8051 Microcontrollers, Architecture and Programming and Applications - Pearson, 2009.
4. Donald Reay, Digital Signal Processing and Applications with the OMAP- L138 Experimenter, WILEY 2012.

EI502PC: PROCESS DYNAMICS AND CONTROL (PC-II)

B.Tech. III Year I Semester

	L	T	P	C
	3	0	0	3

Course Objectives: Student will be able to
1. **Identify** and monitor process parameters of various processes.
2. **Understand** the principles of controllers, degrees of freedom, and control valves.
3. **Recognize** these principles written in form of mathematical equations for various control applications.
4. **Apply** these equations to analyze problems by making good assumptions and learn systematic engineering method to solve practical process control problems.

Course Outcomes: After completion of the course the student is able to:
1. Apply fundamental knowledge of mathematics to modeling and analysis of fluid flow, level, pressure, temperature problems.
2. Conduct experiments in pipe flows and open-channel flows and interpreting data from model studies to prototype cases. Documenting them in engineering reports.
3. Understand the possible disasters caused by an in correct Design/Analysis in hydraulic, pneumatic engineering system.
4. Apply multi loop control systems in various process industries.

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	-	-	-	-	2	1	1	3
CO2	3	3	2	2	-	-	-	-	2	1	1	3
CO3	3	3	3	3	-	-	-	-	2	1	1	3
CO4	3	3	3	3	-	-	-	-	2	1	1	3

UNIT - I
Process Dynamics
Process variables – Load variables – Dynamics of simple pressure, flow, level and temperature process – interacting and non-interacting systems – continuous and batch process – self-regulation – Servo and Regulator operation - problems.

UNIT - II
Control Actions and Controllers and Types of Controllers
Basic control actions – characteristics of two position, three position, Proportional, Single speed floating, Integral and Derivative control modes – PI, PD, PID control modes – Problems -types of controllers - Pneumatic, Hydraulic and Electronic Controllers to realize various control actions.

UNIT - III
Controller Settings and Tuning of Controllers
Evaluation criteria – 1/4th decay ratio, I AE, ISE, ITSE, ITAE - determination of optimum settings for mathematically described process using time response and frequency response-tuning of controllers- process curve reaction method – continuous oscillation method – damped oscillation method – problems.

UNIT - IV
Final Control Elements and Control Valves
I/P Converter, P/I converter - pneumatic, electric and hydraulic actuators – valve Positioned Control valves – characteristic of control valves – valve body – Globe, Butterfly, diaphragm, Ball valves – Control valve sizing – Cavitations, flashing - problems.

UNIT - V
Multiloop Control System
Feed forward control – Feed Forward Feedback Controller (FFFBC) – Ratio control – Cascade control – Split range – Multivariable control and examples from distillation column, Boiler system and heat exchanger.

TEXT BOOKS
1. Eckman D.P., Wiley, Automatic Process Control – by Eastern Ltd., New Delhi, 1993.
2. Curtis. D. Johnson, Process Control Instrumentation Technology, Edition 8, PHI Publishers.

REFERENCE BOOKS
1. Stephanopoulos, Prentice Hall, Chemical Process Control: An introduction to Theory and Practice –New Delhi, 1999.
2. Liptak B.G., Process Control, Third Edition –Chilton Book Company, Pennsylvania, 1995.
3. Pollard A., Process control –Heinemann Educational Books, London, 1971.
4. Harriott P, Process Control –TMH, 1991.

EI503PC: CONTROL SYSTEMS

B.Tech. III Year I Semester

L	T	P	C
3	1	0	4

Prerequisite: Linear Algebra and Calculus, Ordinary Differential Equations and Multivariable Calculus Laplace Transforms, Numerical Methods and Complex variables.

Course objectives:
1. To understand the different ways of system representations such as Transfer function representation and state space representations and to assess the system dynamic response
2. To assess the system performance using time domain analysis and methods for improving it
3. To assess the system performance using frequency domain analysis and techniques for improving the performance
4. To design various controllers and compensators to improve system performance

Course Outcomes: At the end of this course, students will demonstrate the ability to
1. Understand the modeling of linear-time-invariant systems using transfer function and state-space representations.
2. Understand the concept of stability and its assessment for linear-time invariant systems.
3. Design simple feedback controllers.

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	-	2	1	-	-	-	-	1
CO2	3	2	3	2	-	2	1	-	-	-	-	1
CO3	3	3	3	2	-	2	1	-	-	-	-	1

UNIT - I
Introduction to Control Problem: Industrial Control examples. Mathematical models of physical systems. Control hardware and their models. Transfer function models of linear time-invariant systems. Feedback Control: Open-Loop and Closed-loop systems. Benefits of Feedback. Block diagram algebra.

UNIT - II
Time Response Analysis of Standard Test Signals: Time response of first and second order systems for standard test inputs. Application of initial and final value theorem. Design specifications for second-order systems based on the time-response. Concept of Stability. Routh-Hurwitz Criteria. Relative Stability analysis. Root-Locus technique. Construction of Root-loci.

UNIT - III
Frequency-Response Analysis: Relationship between time and frequency response, Polar plots, Bode plots. Nyquist stability criterion. Relative stability using Nyquist criterion – gain and phase margin. Closed-loop frequency response.

UNIT - IV
Introduction to Controller Design: Stability, steady-state accuracy, transient accuracy, disturbance rejection, insensitivity and robustness of control systems. Root-loci method of feedback controller design. Design specifications in frequency-domain. Frequency-domain methods of design. Application of Proportional, Integral and Derivative Controllers, Lead and Lag compensation in designs. Analog and Digital implementation of controllers.

UNIT - V
State Variable Analysis and Concepts of State Variables: State space model. Diagonalization of State Matrix. Solution of state equations. Eigen values and Stability Analysis. Concept of controllability

and observability. Pole-placement by state feedback. Discrete-time systems. Difference Equations. State-space models of linear discrete-time systems. Stability of linear discrete-time systems.

TEXT BOOKS:
1. M. Gopal, "Control Systems: Principles and Design", McGraw Hill Education, 1997.
2. B. C. Kuo, "Automatic Control System", Prentice Hall, 1995.

REFERENCE BOOKS:
1. K. Ogata, "Modern Control Engineering", Prentice Hall, 1991.
2. I. J. Nagrath and M. Gopal, "Control Systems Engineering", New Age International, 2009.

SM504MS: BUSINESS ECONOMICS AND FINANCIAL ANALYSIS

B.Tech. III Year I Semester

	L	T	P	C
	3	0	0	3

Course Objective:
1. To learn the basic business types, impact of the economy on Business and Firms specifically.
2. To analyze the Business from the Financial Perspective.

Course Outcome: The students will understand
1. The various Forms of Business and the impact of economic variables on the Business.
2. The Demand, Supply, Production, Cost, Market Structure, Pricing aspects are learnt.
3. The firm's financial position by analysing
4. The Financial Statements of a Company.

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	2	1	1	3	2	3	1
CO2	-	-	-	-	-	2	1	1	3	2	3	1
CO3	-	-	-	-	-	2	1	1	3	2	3	1
CO4	-	-	-	-	-	2	1	1	3	2	3	1

UNIT – I
Introduction to Business and Economics:
Business: Structure of Business Firm, Theory of Firm, Types of Business Entities, Limited Liability Companies, Sources of Capital for a Company, Non-Conventional Sources of Finance.
Economics: Significance of Economics, Micro and Macro Economic Concepts, Concepts and Importance of National Income, Inflation, Money Supply in Inflation, Business Cycle, Features and Phases of Business Cycle. Nature and Scope of Business Economics, Role of Business Economist, Multidisciplinary nature of Business Economics.

UNIT - II
Demand and Supply Analysis:
Elasticity of Demand: Elasticity, Types of Elasticity, Law of Demand, Measurement and Significance of Elasticity of Demand, Factors affecting Elasticity of Demand, Elasticity of Demand in decision making, Demand Forecasting: Characteristics of Good Demand Forecasting, Steps in Demand Forecasting, Methods of Demand Forecasting.
Supply Analysis: Determinants of Supply, Supply Function & Law of Supply.

UNIT - III
Production, Cost, Market Structures & Pricing:
Production Analysis: Factors of Production, Production Function, Production Function with one variable input, two variable inputs, Returns to Scale, Different Types of Production Functions.
Cost analysis: Types of Costs, Short run and Long run Cost Functions.
Market Structures: Nature of Competition, Features of Perfect competition, Monopoly, Oligopoly, Monopolistic Competition.
Pricing: Types of Pricing, Product Life Cycle based Pricing, Break Even Analysis, Cost Volume Profit Analysis.

UNIT - IV
Financial Accounting: Accounting concepts and Conventions, Accounting Equation, Double-Entry system of Accounting, Rules for maintaining Books of Accounts, Journal, Posting to Ledger, Preparation of Trial Balance, Elements of Financial Statements, Preparation of Final Accounts.

UNIT - V
Financial Analysis through Ratios: Concept of Ratio Analysis, Liquidity Ratios, Turnover Ratios, Profitability Ratios, Proprietary Ratios, Solvency, Leverage Ratios (simple problems).
Introduction to Fund Flow and Cash Flow Analysis (simple problems).

TEXT BOOKS:
1. D.D. Chaturvedi, S.L. Gupta, Business Economics - Theory and Applications, International Book House Pvt. Ltd. 2013.
2. Dhanesh K Khatri, Financial Accounting, Tata McGraw Hill, 2011.
3. Geethika Ghosh, Piyali Gosh, Purba Roy Choudhury, Managerial Economics, 2e, Tata McGraw Hill Education Pvt. Ltd. 2012.

REFERENCE BOOKS:
1. Paresh Shah, Financial Accounting for Management 2e, Oxford Press, 2015.
2. S.N. Maheshwari, Sunil K Maheshwari, Sharad K Maheshwari, Financial Accounting, 5e, Vikas Publications, 2013.

EI511PE: INSTRUMENTATION PRACTICES IN INDUSTRIES (PE – I)

B.Tech. III Year I Semester	**L**	**T**	**P**	**C**
	3	**0**	**0**	**3**

Course Objectives: Student will be able to
1. **Identify** and quantitatively estimate different materials required for the manufacturing of Cement, Pulp, Paper, food, Power and pharmacy.
2. **Understand** the principles of different manufacturing processes.
3. **Recognize** these principles written in form of mathematical & chemical equations.
4. **Apply** these equations to analyze problems by making good assumptions and learn systematic engineering method to solve practical industrial problems.

Course Outcomes: After completion of the course the student is able to:
1. **Apply** fundamental knowledge of chemistry & instrumentation to modeling and analysis of different Industrial engineering.
2. **Understand** disasters caused by an in correct analysis/design indifferent Industrial engineering system.
3. Students will **demonstrate** a working knowledge of the basic principles of measuring techniques, and demonstrate technical knowledge and skills in the calibration and use of equipment used in different industrial process measurement and control.
4. Students will **demonstrate** a working knowledge of safety practices and skills in trouble-shooting problems used in the measurement and control in industrial processes

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	3	1	1	-	-	3	1	3
CO2	3	3	3	2	3	1	1	-	-	3	1	3
CO3	3	3	3	3	3	1	1	-	-	3	1	3
CO4	3	3	3	3	3	1	1	-	-	3	2	3

UNIT - I
Cement Industries
Corrosion Analyzer Porositester Compressive strength measurement, Blast Furnace Temperature Measurement using Radiation Pyrometers.

UNIT - II
Pulp and Paper Industries
Manufacture of pulp: Raw materials, Pulping processes, Craft pulping, Soda pulping, Sulfite pulping, Semi chemical pulping, Mechanical and Thermo mechanical Pulping.
Manufacture of paper: Wet Processing, Fourdrinier Machine, Coated Papers, Special Papers.
Wet-end Instrumentation:
Pressure: Force Balanced, Bell and Limp or Slack type systems
Temperature: Liquid in Glass, Thermal bulbs, Resistance Bulbs
Liquid Density and Specific Gravity: Fixed Volume, Differential Pressure, Nuclear Radiation Level: Liquid Level- Continuous Purge Instrument, Diaphragm box, Float and Cable, Capacitive.
Solid Level- Diaphragm solids.
Flow: Tapered tube & float type meter, Cylinder & Piston type meter, Weir and Flumes Consistency: Atmospheric with Driven and Atmospheric with Stationary Sensors.
pH: pH Electrode system, types of electrodes.
Oxidation Reduction Potential (ORP): ORP Electrode system, electrode holders.
Freeness: Continuous Sample and Intermittent Sample Systems.
Dry-end Instrumentation:

Moisture: Conductivity, Resistance, Capacitance, Hygroscopic, Infrared Absorption type systems
Basis Weight: Transmission type, On-Machine type, Off-Machine type and Backscatter type systems
Caliper or Thickness: Contacting type- Electrical, Mechanical and Electro Mechanical, Non-Contacting type

UNIT - III
Petroleum Industries
Unit Operations: Distillation, Drying Separation Measurements in refineries petrochemical industries – Differential pressure transmitter, Thermocouples Infrared Pyrometer, Mass flow meters, Potentiometric level Transmitter, Vacuum Measurement, Near Infrared Analyzer, Hydro Carbon Dew point meter IR Spectrometry, Mass Spectrometry, Flame Ionization Detectors, Chromatography.

UNIT - IV
Nuclear Power Plant
Introduction, The power plant scheme, Pressure, flow and level measurement, Vibration and expansion measurements, Analysis of impurities in cooling water, Flue Gas analysis, Ultrasonic Thermometry, Radiation Pyrometry, Emittance measurement.

UNIT - V
Food Processing and Allied Industries
Chromatography, Spectrometry – Mass Spectrometer, Toxicity meter.

TEXT BOOKS
1. Austin G.T. Shreeves, Chemical Process Industries, McGraw-Hill International student edition, Singapore, 1985
2. Sankaranarayana, Pulp and Paper Industry Technology & Instrumentation, P.E., Kothari's Desk book.

REFERENCE BOOKS
1. John R Lavigne, An Introduction to Paper Industry Instrumentation, Miller Freeman Publications, California, 1985 Series.
2. Liptak B.G., Process Measurement and Analysis, Third edition, Chilton book Company, 1996.
3. Gregory K. McMillan, Doigas M. Considine.
4. Robert J. McGill, Measurement and Control in Papermaking, Adam Hilger Limited, Bristol, 1980.
5. Liptak B.G., Process/ Industrial Instruments and Controls Hand Book, Instrumentation in Process Industries, Chilton book Company, 1994.

EI512PE: REAL TIME OPERATING SYSTEMS (PE – I)

B.Tech. III Year I Semester

L	T	P	C
3	0	0	3

Prerequisite: Computer Organization and Operating System.

Course Objectives: The objectives of this course are:
1. To provide broad understanding of the requirements of Real Time Operating Systems.
2. To make the student understand, applications of these Real Time features using case studies.

Course Outcomes:
1. Be able to explain real-time concepts such as pre-emptive multitasking, task priorities, priority inversions, mutual exclusion, context switching, and synchronization, interrupt latency and response time, and semaphores.
2. Able describe how a real-time operating system kernel is implemented.
3. Explain how the real-time operating system implements time management and communication using semaphores, mailboxes, and queues.
4. Be able to work with real time operating systems like RT Linux, Vx Works, MicroC /OS-II, Tiny OS

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	1	-	-	2	-	1	3
CO2	3	3	3	3	3	1	-	-	2	-	1	3
CO3	3	3	3	3	3	1	-	-	2	-	1	3
CO4	3	3	3	3	3	1	-	-	2	-	2	3

UNIT -I
Introduction: Introduction to UNIX/LINUX, Overview of Commands, File I/O,(open, create, close, lseek, read, write), Process Control (fork, vfork, exit, wait, waitpid, exec).

UNIT -II
Real Time Operating Systems: Brief History of OS, Defining RTOS, The Scheduler, Objects, Services, Characteristics of RTOS, Defining a Task, asks States and Scheduling, Task Operations, Structure, Synchronization, Communication and Concurrency.
Defining Semaphores, Operations and Use, Defining Message Queue, States, Content, Storage, Operations and Use.
.
UNIT -III
Objects, Services and I/O: Pipes, Event Registers, Signals, Other Building Blocks, Component Configuration, Basic I/O Concepts, I/O Subsystem.

UNIT -IV
 Exceptions, Interrupts and Timers: Exceptions, Interrupts, Applications, Processing of Exceptions and Spurious Interrupts, Real Time Clocks, Programmable Timers, Timer Interrupt Service Routines (ISR), Soft Timers, Operations.

UNIT - V
Case Studies of RTOS: RT Linux, MicroC/OS-II, Vx Works, Embedded Linux, and Tiny OS.

TEXT BOOK:
1. Real Time Concepts for Embedded Systems – Qing Li, Elsevier, 2011.

REFERENCE BOOKS:

1. Embedded Systems- Architecture, Programming and Design by Rajkamal, TMH, 2007.
2. Advanced UNIX Programming, Richard Stevens.
3. Embedded Linux: Hardware, Software and Interfacing – Dr. Craig Hollabaugh.
4. Stallings, Operating Systems – Internals and Design Principles Fifth Edition–2005, Pearson Education/PHI.

EI513PE: IOT ARCHITECTURES AND SYSTEM DESIGN (PE – I)

B.Tech. III Year I Semester

	L	T	P	C
	3	0	0	3

Course Objectives: Students will be able to:
1. Know the interconnection and integration of the physical world and the cyber space.
2. Design & develop some IOT based prototypes.

Course Outcomes: Students will be able to:
1. Understand the building blocks of Internet of Things and characteristics.
2. Analyze the different communication and IOT protocols.
3. Have knowledge of programming open-source Edge devices like Arduino, Raspberry Pi.
4. Apply the knowledge of Arduino and Raspberry pi with clouds for IOT applications
5. Understand various IOT implementations in different domains.

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	2	-	-	-	2	-	1	3
CO2	3	3	3	3	2	-	-	-	2	-	1	3
CO3	3	3	3	3	2	-	-	-	2	-	1	3
CO4	3	3	3	3	2	-	-	-	2	-	2	3
CO5	3	3	3	3	2	-	-	-	2	-	2	3

UNIT- I
IoT introduction:
Introduction and definition of IoT, Evolution of IoT, IoT growth, Application areas of IoT, Characteristics of IoT, IoT stack, Enabling technologies, IoT levels, IoT sensing and actuation, Sensing types, Actuator types.

UNIT – II
IoT and M2M: M2M to IoT – A Basic Perspective– Introduction, Differences and similarities between M2M and IoT, SDN and NFV for IoT. M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT, The international driven global value chain and global information monopolies.

UNIT – III
IoT Hands-on: Introduction to Arduino Programming, Integration of Sensors and Actuators with Arduino. Introduction to Python programming, Introduction to Raspberry Pi, Interfacing Raspberry Pi with basic peripherals, Implementation of IoT with Raspberry Pi.
UNIT - IV
IoT Architecture: IoT Architecture components, Comparing IoT architectures, A simplified IoT architecture, The core IoT functional stack, IoT data management and compute stack.

UNIT – V
IoT System design: Challenges associated with IoT, Emerging pillars of IoT, Agricultural IoT, Vehicular IoT, Healthcare IoT, Smart cities, Transportation and logistics.

TEXT BOOKS:
1. Sudip Misra, Anandarup Mukherjee, Arijit Roy "Introduction to IOT", Cambridge University Press.
2. David Hanes, Gonzalosalgueiro, Patrick Grossetete, Robbarton, Jerome henry "IoT Fundamentals Networking technologies, protocols, and use cases for IoT", Cisco Press

REFERENCE BOOKS
1. Cunopfister, "Getting started with the internet of things", O Reilly Media, 2011
2. Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1 st Edition, Apress Publications.
3. "Internet of Things concepts and applications", Wiley
4. Arshdeep Bahga, Vijay Madisetti "Internet of Things A Hands-on approach", Universities Press
5. Shriram K Vasudevan, RMD Sundaram, Abhishek S Nagarajan, "Internet of things" John Wiley and Sons.

EI505PC: MICROCONTROLLERS LABORATORY

B.Tech. III Year I Semester   **L   T   P   C**
                                                                         0   0   2   1

Course Outcomes: Upon completing this course, the students will be able to:
1. Write assembly language programs and implement on 8086.
2. Write assembly language programs and implement on 8051
3. Interface the I/O devices with 8051 micro controllers
4. Perform experiments on Cortex-M3 development boards using GNU tool- chain

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	-	-	-	-	-	-	1
CO2	3	3	3	3	3	-	-	-	-	-	-	1
CO3	3	3	3	3	3	-	-	-	-	-	-	1
CO4	3	3	3	3	3	-	-	-	-	-	-	1

Cycle 1: Using 8086 Processor Kits and/or Assembler
- Assembly Language Programs to 8086 to Perform
    1. Arithmetic, Logical, String Operations on 16 Bit and 32-Bit Data.
    2. Bit level Logical Operations, Rotate, Shift, Swap and Branch Operations.

Cycle 2: Using 8051 Microcontroller Kit
- Introduction to IDE
    1. Assembly Language Programs to Perform Arithmetic (Both Signed and Unsigned) 16 Bit Data Operations, Logical Operations (Byte and Bit Level Operations), Rotate, Shift, Swap and Branch Instructions
    2. Time delay Generation Using Timers of 8051.
    3. Serial Communication from / to 8051 to / from I/O devices.
    4. Program Using Interrupts to Generate Square Wave 10 KHZ Frequency on P2.1 Using Timer 0 8051 in 8 bit Auto reload Mode and Connect a 1 HZ Pulse to INT1 pin and Display on Port 0. Assume Crystal Frequency as 11.0592 MHZ

Cycle 3: Interfacing I/O Devices to 8051
    1. 7 Segment Display to 8051.
    2. Matrix Keypad to 8051.
    3. Sequence Generator Using Serial Interface in 8051.
    4. 8-bit ADC Interface to 8051.
    5. Triangular Wave Generator through DAC interfaces to 8051.

Cycle 4: Experiments to be carried out on Cortex-M3 development boards and using GNU tool-chain
    1. Blink an LED with software delay, delay generated using the SysTick timer.
    2. System clock real time alteration using the PLL modules.
    3. Control intensity of an LED using PWM implemented in software and hardware.
    4. Control an LED using switch by polling method, by interrupt method and flash the LED once every five switch presses.

EI506PC: PROCESS CONTROL LABORATORY

B.Tech. III Year I Semester   **L   T   P   C**
                                                                   0   0   2   1

Course Objective: To provide better familiarity with the Theoretical concepts studied.

Course Outcomes: Upon completing these course students shall be able realize the process and different controls applied to each process.

Minimum Twelve experiments should be conducted.
1. Study of Electronic controllers.
2. Control valve characteristics (Different types).
3. Control of Flow process
4. Interacting and Non-interacting systems.
5. Control of Temperature process
6. Process tuning – Process reaction curve method.
7. Tuning of PID controller
8. Operation of flow loop in plant.
9. Pneumatic actuator.
10. Hydraulic actuator.
11. Multi loop control systems – Ratio Control.
12. Multi loop control systems – Cascade Control.
13. Feed-forward control.

EN508HS: ADVANCED ENGLISH COMMUNICATION SKILLS LABORATORY

B.Tech. III Year I Semester   **L T P C**
                                                                    0 0 2 1

1. Introduction

The introduction of the Advanced English Communication Skills Lab is considered essential at the B.Tech 3rd year level. At this stage, the students need to prepare themselves for their career which may require them to listen to, read, speak and write in English both for their professional and interpersonal communication in the globalised context.

The proposed course should be a laboratory course to enable students to use appropriate English and perform the following:

1. Gathering ideas and information to organise ideas relevantly and coherently.
2. Making oral presentations.
3. Writing formal letters.
4. Transferring information from non-verbal to verbal texts and vice-versa.
5. Writing project/research reports/technical reports.
6. Participating in group discussions.
7. Engaging in debates.
8. Facing interviews.
9. Taking part in social and professional communication.

2. Objectives:

This Lab focuses on using multi-media instruction for language development to meet the following targets:

- To improve the students' fluency in English, with a focus on vocabulary
- To enable them to listen to English spoken at normal conversational speed by educated English speakers
- To respond appropriately in different socio-cultural and professional contexts
- To communicate their ideas relevantly and coherently in writing
- To prepare the students for placements.

3. Syllabus:

The following course content to conduct the activities is prescribed for the Advanced English Communication Skills (AECS) Lab:

1. **Activities on Listening and Reading Comprehension:** Active Listening – Development of Listening Skills Through Audio clips - Benefits of Reading – Methods and Techniques of Reading – Basic Steps to Effective Reading – Common Obstacles – Discourse Markers or Linkers - Sub-skills of reading - Reading for facts, negative facts and Specific Details- Guessing Meanings from Context, Inferring Meaning - Critical Reading –– Reading Comprehension – Exercises for Practice.

2. **Activities on Writing Skills**: Vocabulary for Competitive Examinations - Planning for Writing – Improving Writing Skills - Structure and presentation of different types of writing – Free Writing and Structured Writing - Letter Writing –Writing a Letter of Application –Resume vs. Curriculum Vitae – Writing a Résumé **–** Styles of Résumé - e-Correspondence – Emails – Blog Writing - (N)etiquette – Report Writing – Importance of Reports – Types and Formats of Reports– Technical Report Writing– Exercises for Practice.

3. **Activities on Presentation Skills -** Starting a conversation – responding appropriately and relevantly – using the right language and body language – Role Play in different situations including Seeking Clarification, Making a Request, Asking for and Refusing Permission, Participating in a Small Talk – Oral presentations (individual and group) through JAM sessions- PPTs – Importance of Presentation Skills – Planning, Preparing, Rehearsing and Making a Presentation – Dealing with Glossophobia or Stage Fear – Understanding Nuances of Delivery - Presentations through Posters/Projects/Reports – Checklist for Making a Presentation and Rubrics of Evaluation

4. **Activities on Group Discussion (GD):** Types of GD and GD as a part of a Selection Procedure - Dynamics of Group Discussion- Myths of GD - Intervention, Summarizing - Modulation of Voice, Body Language, Relevance, Fluency and Organization of Ideas **–** Do's and Don'ts - GD Strategies – Exercises for Practice.

5. **Interview Skills**: Concept and Process - Interview Preparation Techniques - Types of Interview Questions – Pre-interview Planning, Opening Strategies, Answering Strategies - Interview Through Tele-conference & Video-conference - Mock Interviews.

4. **Minimum Requirement:**
   The Advanced English Communication Skills (AECS) Laboratory shall have the following infrastructural facilities to accommodate at least 35 students in the lab:
   - Spacious room with appropriate acoustics
   - Round Tables with movable chairs
   - Audio-visual aids
   - LCD Projector
   - Public Address system
   - One PC with latest configuration for the teacher
   - T. V, a digital stereo & Camcorder
   - Headphones of High quality

5. **Suggested Software:** The software consisting of the prescribed topics elaborated above should be procured and used.
   - **TOEFL & GRE** (KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS)
   - **Oxford Advanced Learner's Dictionary**, 10th Edition
   - **Cambridge Advanced Learner's Dictionary**
   - **DELTA's key to the Next Generation TOEFL Test: Advanced Skill Practice.**
   - **Lingua TOEFL CBT Insider**, by Dreamtech

6. **Books Recommended:**
   1. Rizvi, M. Ashraf (2018). *Effective Technical Communication*. (2nd ed.). McGraw Hill Education (India) Pvt. Ltd.
   2. Suresh Kumar, E. (2015). *Engineering English.* Orient BlackSwan Pvt. Ltd.
   3. Bailey, Stephen. (2018). Academic *Writing: A Handbook for International Students.* (5th Edition). Routledge.
   4. Koneru, Aruna. (2016). *Professional Communication*.   McGraw Hill Education (India) Pvt. Ltd.
   5. Raman, Meenakshi & Sharma, Sangeeta. (2022). *Technical Communication, Principles and Practice.* (4TH Edition) Oxford University Press.
   6. Anderson, Paul V. (2007). *Technical Communication*. Cengage Learning Pvt. Ltd. New Delhi.
   7. McCarthy, Michael; O'Dell, Felicity & Redman, Stuart. (2017). *English Vocabulary in Use* Series. Cambridge University Press
   8. Sen, Leela. (2009). *Communication Skills.* PHI Learning Pvt Ltd., New Delhi.
   9. Elbow, Peter. (1998   ). *Writing with Power.* Oxford University Press.
   10. Goleman, Daniel. (2013). *Emotional Intelligence*: *Why it can matter more than IQ.* Bloomsbury Publishing.

*MC510: INTELLECTUAL PROPERTY RIGHTS

B.Tech. III Year I Semester   L   T   P   C
                                                                            3   0   0   0

Course Objectives:
- Significance of intellectual property and its protection
- Introduce various forms of intellectual property

Course Outcomes:
- Distinguish and Explain various forms of IPRs.
- Identify criteria to fit one's own intellectual work in particular form of IPRs.
- Apply statutory provisions to protect particular form of IPRs.
- Appraise new developments in IPR laws at national and international level

UNIT – I
Introduction to Intellectual property: Introduction, types of intellectual property, international organizations, agencies and treaties, importance of intellectual property rights.

UNIT – II
Trade Marks: Purpose and function of trademarks, acquisition of trade mark rights, protectable matter, selecting, and evaluating trade mark, trade mark registration processes.

UNIT – III
Law of copyrights: Fundamental of copyright law, originality of material, rights of reproduction, rights to perform the work publicly, copyright ownership issues, copyright registration, notice of copyright, International copyright law.
Law of patents: Foundation of patent law, patent searching process, ownership rights and transfer

UNIT – IV
Trade Secrets: Trade secret law, determination of trade secret status, liability for misappropriations of trade secrets, protection for submission, trade secret litigation.
Unfair competition: Misappropriation right of publicity, false advertising.

UNIT – V
New development of intellectual property: new developments in trade mark law; copyright law, patent law, intellectual property audits.
International overview on intellectual property, international – trade mark law, copyright law, international patent law, and international development in trade secrets law.

TEXT BOOK:
1. Intellectual property right, Deborah. E. Bouchoux, Cengage learning.

REFERENCE BOOK:
1. Intellectual property right – Unleashing the knowledge economy, prabuddha ganguli, Tata McGraw Hill Publishing company ltd.

EI601PC: DIGITAL SIGNAL PROCESSING

B.Tech. III Year II Semester

	L	T	P	C
	3	0	0	3

Prerequisite: Signals and Systems.

Course Objectives:
1. To provide background and fundamental material for the analysis and processing of digital signals.
2. To understand the fast computation of DFT and appreciate the FFT processing.
3. To study the designs and structures of digital (IIR and FIR) filters and analyze and synthesize for a given specifications.
4. To acquaint in Multi-rate signal processing techniques and finite word length effects.

Course Outcomes: Upon completing this course, the student will be able to
1. Explore the LTI system characteristics and Multirate signal processing.
2. Establish the inter-relationship between DFT and various transforms.
3. Design a digital filter for a given specification.
4. Demonstrate the various filter structures and effects of round off errors.

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	3	-	1	1	-	-	-	1	1
CO2	3	3	2	3	-	1	1	-	-	-	1	1
CO3	3	3	2	3	3	1	1	-	-	-	1	1
CO4	3	3	2	3	3	1	1	-	-	-	1	1

UNIT - I
Introduction: Introduction to Digital Signal Processing: Discrete Time Signals & Sequences, conversion of continuous to discrete signal, Normalized Frequency, Linear Shift Invariant Systems, Stability, and Causality, linear differential equation to difference equation, Linear Constant Coefficient Difference Equations, Frequency Domain Representation of Discrete Time Signals and Systems
Multirate Digital Signal Processing: Introduction, Down Sampling, Decimation, Up sampling, Interpolation, Sampling Rate Conversion.

UNIT - II
Discrete Fourier series: Fourier Series, Fourier Transform, Laplace Transform and Z-Transform relation, DFS Representation of Periodic Sequences, Properties of Discrete Fourier Series, Discrete Fourier Transforms: Properties of DFT, Linear Convolution of Sequences using DFT, Computation of DFT: Over-Lap Add Method, Over-Lap Save Method, Relation between DTFT, DFS, DFT and Z-Transform.
Fast Fourier Transforms: Fast Fourier Transforms (FFT) - Radix-2 Decimation-in-Time and Decimation-in-Frequency FFT Algorithms, Inverse FFT.

UNIT - III
IIR Digital Filters: Analog filter approximations – Butterworth and Chebyshev, Design of IIR Digital Filters from Analog Filters, Step and Impulse Invariant Techniques, Bilinear Transformation Method, Spectral Transformations.

UNIT - IV
FIR Digital Filters: Characteristics of FIR Digital Filters, Frequency Response. Design of FIR Filters: Fourier Method, Digital Filters using Window Techniques, Frequency Sampling Technique, Comparison of IIR & FIR filters.

UNIT - V
Realization of Digital Filters: Applications of Z – Transforms, Solution of Difference Equations of Digital Filters, System Function, Stability Criterion, Frequency Response of Stable Systems, Realization of Digital Filters – Direct, Canonic, Cascade and Parallel Forms.
Finite Word Length Effects: Limit cycles, Overflow Oscillations, Round-off Noise in IIR Digital Filters, Computational Output Round Off Noise, Methods to Prevent Overflow, Trade Off Between Round Off and Overflow Noise, Measurement of Coefficient Quantization Effects through Pole-Zero Movement, Dead Band Effects.

TEXT BOOKS:
1. A. V. Oppenheim and R.W. Schaffer - Discrete Time Signal Processing, PHI, 2009
2. John G. Proakis, Dimitris G. Manolakis - Digital Signal Processing, Principles, Algorithms, and Applications, Pearson Education / PHI, 2007.

REFERENCE BOOKS:
1. Li Tan - Digital Signal Processing – Fundamentals and Applications, Elsevier, 2008
2. Robert J. Schilling, Sandra L. Harris - Fundamentals of Digital Signal Processing using MATLAB, Thomson, 2007
3. S. Salivahanan, A. Vallavaraj and C. Gnanapriya - Digital Signal Processing, TMH, 2009
4. Emmanuel C. Ifeachor and Barrie W. Jervis - Digital Signal Processing - A Practical approach, 2nd Edition, Pearson Education, 2009

EI602PC: INDUSTRIAL AUTOMATION

B.Tech. III Year II Semester	L	T	P	C
	3	0	0	3

Course Objectives: Student will be able to:
1. It is to **provide** and **ensure** a comprehensive understanding of using personal computers in measurement and control instrumentation.
2. **Learn** the process of collecting information/ data through PC from real world sources.
3. **Learn** remote and networked data acquisition and operating system.
4. **Learn** programmable logic controllers, and its application.

Course Outcomes: After completion of the course the student is able to:
1. Understand the main functional units in a PC and be able to explain how they interact. They should know different bus types, and on this basis be able to distinguish account for different generations of PCs.
2. Understand the basics of PLC and its programming.
3. Apply different PLC functions to applications.
4. Learn the basics of SCADA.

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	3	-	1	1	-	-	-	1	1
CO2	3	3	2	3	-	1	1	-	-	-	1	1
CO3	3	3	2	3	3	1	1	-	-	-	1	1
CO4	3	3	2	3	3	1	1	-	-	-	1	1

UNIT - I
Review of Computer Instrument Communication: Personal Computer, Overview of operating System, I/O Ports, Plug-in-slots, PCI bus, Operators Interface. Computer Interfacing for Data Acquisition and Control – Interfacing Input Signals, Output system with continuous actuators. Data Acquisition and Control using Standard Cards: PC expansion systems, Plug-in Data Acquisition Boards; Transducer to Control room, Backplane bus – VXI.

UNIT - II
Programmable logic controller (PLC) basics: Definition, Overview of PLC systems, input/output modules, Power supplies and Isolators.
Basic PLC programming: Programming On-Off inputs/ outputs. Creating Ladder diagrams, Basic PLC functions, PLC Basic Functions, register basics, timer functions, counter functions.
UNIT - III
PLC intermediate and advanced functions: Arithmetic functions, Number comparison functions, Skip and MCR functions, data move systems. Utilizing digital bits, sequencer functions, Matrix functions. PLC Advanced functions: Analog PLC operation, Networking of PLC,

UNIT - IV
Application of PLC: Controlling of Robot using PLC, PID control of continuous processes, Continuous Bottle-filling system, Batch mixing system, 3-stage air conditioning system, Automatic frequency control of Induction heating
Related Topics: Alternate programming languages. Auxiliary commands and functions. PLC installation, troubleshooting and maintenance. Field bus: Introduction, concept. HART protocol: Method of operation, structure, and applications. Smart transmitters, smart valves and smart actuators.

UNIT V
Scada Basics: Computer Process interface for Data Acquisition and control – Computer control loops.
– Supervisory Digital Control (SCADA) - introduction and brief history of SCADA – SCADA Hardware
and software – Landlines for SCADA – use of modems in SCADA – SCADA with LAN

TEXT BOOKS:
1. John. W. Webb Ronald A Reis, Programmable Logic Controllers – Principles and Applications,
   Fourth edition, Prentice Hall Inc., New Jersey, 1998.
2. M. Chidambaram, Computer Control of Processes –Narosa 2003

REFERENCE BOOKS:
1. Gary Dunning   Thomson, Introduction to Programmable Logic Controllers - Delmar Learning
   Second Edition Second reprint 2003.
2. Mike Tooley; PC Based Instrumentation and Control Third Edition by Elsevier

EI603PC: VIRTUAL INSTRUMENTATION

B.Tech. III Year II Semester

	L	T	P	C
	3	0	0	3

Course Objectives: Student will be able to:
1. Develop virtual instruments for specific application using Lab VIEW software.
2. Ease the programming required to make computer interact with real world.
3. To acquire, analyze and display the throughput of any compatible system.
4. Knowledge to connect with third party software and hardware.

Course Outcomes: After completion of the course the student is able to:
1. Create Virtual Instrument using Lab VIEW software for Control system, Signal Processing and Image processing applications.
2. Create effective Virtual Instrument that shall use minimum memory space and work effectively with any processor.
3. Interface the computer with DAQ to monitor, process and control real world applications.
4. Analyze the throughput using the tools in Lab VIEW software.

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	1	1	-	-	-	1	1
CO2	3	3	3	3	3	1	1	-	-	-	1	1
CO3	3	3	3	3	3	1	1	-	-	-	1	1
CO4	3	3	3	3	3	1	1	-	-	-	1	1

UNIT - I
Virtual Instrumentation: An Introduction, Historical perspective, advantages, blocks diagram and architecture of a virtual instrument, data-flow techniques, graphical programming in data flow, comparison with conventional programming.

UNIT - II
VI Programming Techniques: VIs and sub-VIs, loops and charts, arrays, clusters and graphs, case and sequence structures, formula nodes, local and global variables, string and file I/O, Instrument Drivers, mathscript.

UNIT - III
VI Interface Requirements: Common Instrument Interfaces: Current loop, RS 232C/ RS485, GPIB. Bus Interfaces: USB, PCMCIA, VXI, SCSI, PCI, PXI, Firewire. PXI system controllers, Ethernet control of PXI, VISA and IVI, Data Acquisition Hardware

UNIT - IV
Application of Virtual Instrumentation: Application of Virtual Instrumentation: Instrument Control using RS-232C and IEEE488, Development of Virtual Instrument using GUI, Real-time systems, Embedded Controller, OPC, Active X programming, Publishing measurement data in the web.

UNIT - V
VI toolsets: Distributed I/O modules, Control Design and Simulation, Digital Signal processing tool kit, Image acquisition and processing, Motion control.

TEXT BOOKS:
1. Gary Johnson, Lab VIEW Graphical Programming, Second edition, McGraw Hill, New York, 1997.

2. Lisa K. wells & Jeffrey Travis Prentice Hall, Lab VIEW for everyone, New Jersey, 1997.

REFERENCE BOOKS:
1. Kevin James, PC Interfacing and Data Acquisition: Techniques for Measurement, Instrumentation   and Control, Newnes, 2000.
2. Rick Bitter, Lab VIEW advanced programming technique, 2nd Edition, CRC Press, 2005
3. Jovitha Jerome, Virtual Instrumentation using Lab VIEW, 1st Edition, PHI, 2001.

EI621PE: OPTOELECTRONICS AND LASER INSTRUMENTATION (PE – II)

B.Tech. III Year II Semester

	L	T	P	C
	3	0	0	3

Course Objectives: Student will be able to:
1. Understand the principles of optics and lasing action, Design of lasers.
2. Apply the knowledge of Optics to fibers and understand the different industrial applications of Optical Fibers.
3. Learn the various applications of Lasers in Instrumentation.
4. Understand the Opto-Electronic devices and their principles of operation along with their applications.

Course Outcomes: After completion of the course the student is able to:
1. Apply fundamental knowledge of Optics and lasers to design application specific optical fiber.
2. Apply Lasers in Instrumentation for the measurement of Industrial parameters like Pressure, Temperature, and Level and find the solutions for the errors.
3. Understand the advantages of using Lasers in the measurements.
4. Understand the applications of Lasers in medicine.

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	1	-	-	-	1	-	-	1
CO2	3	2	2	2	1	-	-	-	1	-	-	1
CO3	3	2	2	2	1	-	-	-	1	-	-	1
CO4	3	2	2	2	1	-	-	-	1	-	-	1

UNIT - I
Optical Fibers and Their Properties
Introduction to optical fiber - fiber characteristics - principles of light propagation through a fiber - Different types of fibers and their properties - Losses in the optical fiber - Dispersion - advantages and disadvantages of optical fibers.

UNIT - II
Opto-Electronic Components
Optical sources: LED, LD - Optical detectors: PIN, APD - Electro-optic, Magneto optic and Acousto-optic Modulators.

UNIT - III
Industrial Applications of Optical Fibers
Interferometer method of measurement of length – Moire fringes – Measurement of pressure, Temperature, Current, Voltage, Liquid level and Strain - fiber optic Gyroscope – Polarization maintaining fibers – Applications, Bio-Medical Applications in Endoscopy.

UNIT - IV
Laser Fundamentals
Introduction to lasers - Laser characteristics – Laser configuration – Three level and four level lasers – Q-switching – Mode locking – Types of lasers: Solid lasers, Gas lasers, Liquid lasers and Semiconductor lasers.

UNIT - V
Laser instrumentation

Industrial applications of lasers – Lasers for measurement of distance, length, velocity, acceleration, current, voltage and atmospheric effect - Bio-medical applications, Holography: Principle, Methods, Holographic Interferometers and applications.

TEXT BOOKS:
1. J.M. Senior, Optical Fiber Communication – Principles and Practice', Prentice Hall of India, 1985.
2. Thyagarajan K. and Ghatak, A.K., Lasers: Theory and Applications –Plenum Press

REFERENCE BOOKS:
1. M. Arumugam, Optical Fibre Communication and Sensors ', Anuradha Agencies, 2002.
2. Jeff Hecht, Understanding Fiber Optics, 4th or 5th edition; Prentice Hall publishers
3. G. Keiser, Optical Fibre Communication ', McGraw Hill, 1995.
4. Monte Ross, Laser Applications ', McGraw Hill, 1968
5. J. Wilson and J. F. B. Hawkes, Introduction to Opto Electronics ', Prentice Hall of India, 2001.

EI622PE: INDUSTRIAL DATA COMMUNICATIONS (PE - II)

B.Tech. III Year II Semester	**L**	**T**	**P**	**C**
	3	**0**	**0**	**3**

Course Objectives:
1. To introduce the principals of analog and digital communication systems involving different modulation demodulation schemes.
2. To provide insight about networks, topologies, and the key concepts used in instrumentation industries.
3. To gain comprehensive knowledge about the layered communication architectures (OSI and TCP/IP) and its functionalities.
4. To understand the principles, key protocols, design issues, and significance of each layer in ISO and TCP/IP.
5. To know the basic concepts of network security and its various security issues related with each layer.

Course Outcomes: Upon completing this course, the student will be able to:
1. To remember and describe how the physical, data link, and network layers operate in a typical data communication system.
2. To understand the setting of network environment with all the necessary data communication components, procedure, conflicting issues and resolution techniques that make it functional.
3. To apply the operation and technique of various communication protocols such as multiple access protocols, TCP, UP, FTP, etc.
4. To analyze the services and features of the various layers of data networks
5. To evaluate communication protocols for route calculations and be able to perform such calculations of data transmission.
6. To create suitable transmission route for different internetworking devices.

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	1	-	1	-	-	-	1	3
CO2	3	3	3	3	1	-	1	-	-	-	1	3
CO3	3	3	3	3	1	-	1	-	-	-	1	3
CO4	3	3	3	3	1	-	1	-	-	-	1	3
CO5	3	3	3	3	1	-	1	-	-	-	1	3
CO6	3	3	3	3	1	-	1	-	-	-	1	3

UNIT - I
Communication Concepts: Serial and Parallel Transmission, data organization: signals, digital standard signals, data organization: communication codes, error coding, protocol concepts.
Amplitude Modulation: AM wave equation, spectrum, power relation, generation methods, high-level modulation, low level modulation, DSBSC and SSB Modulation, SSB generation methods, ISB, VSB.
Frequency Modulation: Mathematical Representation of FM, frequency spectrum of FM, generation methods of FM (Direct, Indirect Methods), effects of noise on FM, noise triangle, pre-emphasis and de-emphasis, phase modulation, compare AM, FM, PM, frequency division multiplexing.

UNIT - II
Communication Models: ISO OSI Model, mail analog, OSI model, IEEE 802 Models.
Serial Communication Standards: Basic concepts, TIA/EIA standards, interface signal functions, PC serial communication

UNIT - III
Local Area Networks: Layer 1 the physical layer, topologies, transmission media, 802 and industrial LANs, wireless LANs 802.11, Hub, bridge, Ethernet switch, router, IEEE 802.3/Ethernet: A layer 1 and layer 2 standard 10BASE5, 10BASE2, 10BASE-T, 10GbE-10 gigabit Ethernet over fiber, 10 GbE-10 gigabit Ethernet over copper
Internetworking: Layer 2 internetworking equipment, layer 3 devices, routing topologies, managed switches, gateways.
Wide Area Networks: wireless transmission, carrier concepts, wireless modems, modem types, WAN digital lines, cable modems, WANs for mobile and hinterlands.

UNIT - IV
Industrial networks and field buses: Industrial network requirements, HART, Control Net, EtherNet/IP, PROFIBUS/PROFINET, Foundation Fieldbus, Ethernet-TCP/IP, Modbus RTU protocol, IEC 61850.

UNIT - V
Cybersecurity: Overview, security vulnerabilities, methods of attack, risk analysis, IACS countermeasures, firewalls, network address translation, monitoring network traffic, hardening, internet and VPN countermeasures, network management and security, IEC/ANSI/ISA-62443 cybersecurity standards, ISA secure certification program.

TEXT BOOK:
1. Lawrence M. Thompson and Tim Shaw, "Industrial Data Communications", ISA Fifth Edition.

REFERENCE BOOKS:
1. G. Kennedy, Electronic Communication Systems, McGraw Hill, New Delhi
2. D. Roddy and J. Coolen, Electronic Communications, Prentice-Hall of India Private Limited, Third Edition, 1984
3. S. Tanennbaum, "Computer Networks", Fourth Edition, Prentice Hall of India, New Delhi, 2002.
4. W. Stallings, "Data and Computer communication, Sixth Edition, Pearson Education, New Delhi, 2001.
5. Comer, "Computer Networks and Internets", Second Edition, Pearson Education, 2001.
6. Behrouz A. Forouzen, "Data Communication and Networking" Fourth Edition, McGraw Hill Publications, 2007.

EI623PE: EMBEDDED SYSTEMS (PE - II)

B.Tech. III Year II Semester

	L	T	P	C
	3	0	0	3

Prerequisite: Microprocessors and Microcontrollers; Computer Organization and Operating Systems

Course Objectives:
1. To provide an overview of Design Principles of Embedded System.
2. To provide clear understanding about the role of firmware.
3. To understand the necessity of operating systems in correlation with hardware systems.
4. To learn the methods of interfacing and synchronization for tasking.

Course Outcomes: Upon completing this course, the student will be able to
1. Familiarize the selection procedure of Processors in the embedded domain.
2. Design Procedure for Embedded Firmware.
3. Visualize the role of Real time Operating Systems in Embedded Systems.
4. Evaluate the Correlation between task synchronization and latency issues

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	3	1	1	-	-	-	-	1
CO2	3	3	2	2	3	1	1	-	-	-	-	1
CO3	3	3	2	2	3	1	1	-	-	-	-	1
CO4	3	3	2	2	3	1	1	-	-	-	-	1

UNIT - I:
Introduction to Embedded Systems: Definition of Embedded System, Embedded Systems Vs General Computing Systems, History of Embedded Systems, Classification, Major Application Areas, Purpose of Embedded Systems, Characteristics and Quality Attributes of Embedded Systems.

UNIT - II:
Typical Embedded System: Core of the Embedded System: General Purpose and Domain Specific Processors, ASICs, PLDs, Commercial Off-The-Shelf Components (COTS), Memory: ROM, RAM, Memory according to the type of Interface, Memory Shadowing, Memory selection for Embedded Systems, Sensors and Actuators, Communication Interface: Onboard and External Communication Interfaces.

UNIT - III:
Embedded Firmware: Reset Circuit, Brown-out Protection Circuit, Oscillator Unit, Real Time Clock, Watchdog Timer, Embedded Firmware Design Approaches and Development Languages.
UNIT -IV:
RTOS Based Embedded System Design: Operating System Basics, Types of Operating Systems, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling.

UNIT - V:
Task Communication: Shared Memory, Message Passing, Remote Procedure Call and Sockets,
Task Synchronization: Task Communication/Synchronization Issues, Task Synchronization Techniques, Device Drivers, Methods to Choose an RTOS.

TEXT BOOK:
1. Shibu K.V, Introduction to Embedded Systems - Mc Graw Hill.

REFERENCE BOOKS:
1. Raj Kamal, Embedded Systems - TMH.
2. Frank Vahid, Tony Givargis, Embedded System Design - John Wiley.
3. Lyla, Embedded Systems –Pearson, 2013
4. David E. Simon, An Embedded Software Primer - Pearson Education.

EI611OE: BASICS OF SENSORS TECHNOLOGY (Open Elective – I)

B.Tech. III Year II Semester

L	T	P	C
3	0	0	3

Pre-requisites: Physics, Mathematics.

Course Objectives:
1. To provide basic knowledge in transduction principles, sensors and transducer technology and measurement systems.
2. To provide better familiarity with the Theoretical and Practical concepts of Transducers.
3. To provide familiarity with different sensors and their application in real life.
4. To provide the knowledge of various measurement methods of physical and electrical parameters

Course Outcomes: After completion of the course the student is able to:
1. Identify suitable sensors and transducers for real time applications.
2. Translate theoretical concepts into working models.
3. Design the experimental applications to engineering modules and practices.
4. Design engineering solution to the Industry/Society needs and develop products.

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	-	1	-	-	-	-	1	-	-	1
CO2	1	1	-	1	-	-	-	-	1	-	-	1
CO3	2	2	3	1	`	2	-	-	1	-	-	1
CO4	3	2	3	1	-	3	3	-	1	-	-	1

UNIT - I
Introduction to measurement systems General concepts and terminology, measurement systems, sensor classifications: Analog Input and Output, Digital Input and Output, general input-output configuration, methods of correction. Passive Sensors Resistive Sensors: Potentiometers, Strain Gages, Resistive Temperature Detectors (RTDs), Thermistors, Light-dependent Resistors (LDRs), Resistive Hygrometers. Capacitive Sensors: Variable capacitor and Differential capacitor. Inductive Sensors: Reluctance variation sensors, Eddy current sensors, Linear variable differential transformers (LVDTs), Magneto elastic sensors, Electromagnetic sensors - Sensors based on Faraday's law of Electromagnetic induction, Touch Sensors: Capacitive, Resistive, Proximity Sensors.

UNIT - II
Self-generating Sensors or active sensors Thermoelectric Sensors: Thermocouples, Thermo electric effects, Common thermocouples, Practical thermocouple laws, Cold junction compensation in thermocouples circuits. Piezoelectric Sensors: Piezoelectric effect, piezoelectric materials, applications.

UNIT - III
Velocity and Acceleration Measurement Relative velocity – Translational and Rotational velocity measurements – Revolution counters and Timers - Magnetic and Photoelectric pulse counting stroboscopic methods. Accelerometers-different types, Gyroscopes-applications. Density measurements – Strain Gauge load cell method – Buoyancy method - Air pressure balance method – Gamma ray method – Vibrating probe method.

UNIT - IV
Density, Viscosity and other Measurements Units of Viscosity, specific gravity scales used in Petroleum Industries, Different Methods of measuring consistency and Viscosity –Two float viscorator –Industrial consistency meter. Sound-Level Meters, Microphones, Humidity Measurement.

UNIT - V
CALIBRATION AND INTERFACING Calibration using Master Sensors, Interfacing of Force, Pressure, Velocity, Acceleration, Flow, Density and Viscosity Sensors, Variable Frequency Drive

TEXT BOOKS:
1. Doeblin E. O., Measurement Systems – Applications and Design – by 4/e, McGraw Hill International, 1990.
2. Patranabis D, Principles of Industrial Instrumentation –TMH. End edition 1997.

REFERENCES:
1. D. Patranabis, Sensors and Transducers, TMH 2003
2. Jon Wilson, Sensor Technology Hand Book –Newne 2004.
3. Herman K. P. Neubrat, Instrument Transducers – An Introduction to their Performance and design – Oxford University Press.
4. E. O. Doeblin, Measurement system: Applications and Design –McGraw Hill Publications.
5. H. S. Kalsi, Electronic Instrumentation.

EI612OE: DIGITAL ELECTRONICS FOR ENGINEERING (OE - I)

B.Tech. III Year II Semester	**L**	**T**	**P**	**C**
	3	**0**	**0**	**3**

Course Objectives:
1. To provide basic understanding of properties and theorems of Boolean Algebra.
2. To provide knowledge on logic gates and universal gates.
3. To teach techniques to reduce the Boolean expressions using K map.
4. To give introduction to Logic families and different types Integrated circuits.

Course Outcomes: Upon completion of this course, the students will be able to
1. Get basic knowledge on logic gates, Universal gates and their switching logics.
2. Realize Boolean expressions using NAND/NOR gates and reduce them using K map.
3. Know all types of combinational and sequential circuits.
4. Acquire knowledge on realization of logic families using diodes and transistor, and also on different types of integrated circuits.

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	2	-	-	-	-	-	1	-	-	1
CO2	2	2	3	2	-	-	-	-	1	-	-	1
CO3	1	1	2	1	-	-	-	-	1	-	-	1
CO4	1	1	1	-	-	-	-	-	1	-	-	1

UNIT - I: Number Systems: Number systems, Complements of Numbers, Codes- Weighted and Non-weighted codes and its Properties. Boolean Algebra: Basic Theorems and Properties, Switching Functions- Canonical and Standard Form, Algebraic Simplification, Digital Logic Gates, EX-OR gates, Universal Gates, Multilevel NAND/NOR realizations.

UNIT - II: Minimization of Boolean functions: Karnaugh Map Method - Up to four Variables, Don't Care Map Entries, Tabular Method, **Combinational Logic Circuits**: Adders, Subtractors, Comparators, Multiplexers, Demultiplexers, Encoders, Decoders and Code converters, Hazards and Hazard Free Relations.

UNIT - III Sequential Circuits Fundamentals: Basic Architectural Distinctions between Combinational and Sequential circuits, SR Latch, Flip Flops: SR, JK, JK Master Slave, D and T Type Flip Flops, Excitation Table of all Flip Flops, Fundamentals of shift registers, ripple and decade counters.

UNIT –IV: Realization of Logic Gates Using Diodes & Transistors: AND, OR and NOT Gates using Diodes and Transistors, DCTL, RTL, DTL, TTL, CML and CMOS Logic Families and its Comparison, standard TTL NAND Gate Analysis & characteristics, TTL open collector O/Ps, Tristate TTL, MOS & CMOS open drain and tristate outputs, CMOS transmission gate,

UNIT - V Integrated Circuits: Classification, chip size and circuit complexity, basic information of Op-amp, ideal and practical Op-amp, internal circuits, Op-amp characteristics, DC and AC Characteristics, 741 opamp and its features, modes of operation-inverting, non-inverting, differential.

TEXT BOOKS:
1. Zvi Kohavi & Niraj K.Jha, Switching and Finite Automata Theory - 3rd Edition, Cambridge, 2010.
2. R. P. Jain, Modern Digital Electronics –3rd Edition, 2007- Tata McGraw-Hill
3. D. Roy Chowdhury, Linear Integrated Circuits, New Age International (p) Ltd.
4. Ramakanth A. Gayakwad, Op-Amps & Linear ICs, PHI

REFERENCE BOOKS:
1. Morris Mano, Digital Design- PHI, 4th Edition, 2006
2. R.F. Coughlin & Fredrick F. Driscoll, Operational Amplifiers & Linear Integrated Circuits, PHI
3. Denton J. Daibey, Operational Amplifiers & Linear Integrated Circuits: Theory & Applications, TMH.

EI604PC: DIGITAL SIGNAL PROCESSING LABORATORY

B.Tech. III Year II Semester	**L**	**T**	**P**	**C**
	0	**0**	**2**	**1**

The Programs shall be implemented in Software (Using MATLAB / Lab View / C Programming/ Equivalent) and Hardware (Using TI / Analog Devices / Motorola / Equivalent DSP processors).

Note: - Minimum of 12 experiments has to be conducted.
1. Generation of Sinusoidal Waveform / Signal based on Recursive Difference Equations
2. Histogram of White Gaussian Noise and Uniformly Distributed Noise.
3. To find DFT / IDFT of given DT Signal
4. To find Frequency Response of a given System given in Transfer Function/ Differential equation form.
5. Obtain Fourier series coefficients by formula and using FET and compare for half sine wave.
6. Implementation of FFT of given Sequence
7. Determination of Power Spectrum of a given Signal(s).
8. Implementation of LP FIR Filter for a given Sequence/Signal.
9. Implementation of HP IIR Filter for a given Sequence/Signal
10. Generation of Narrow Band Signal through Filtering
11. Generation of DTMF Signals
12. Implementation of Decimation Process
13. Implementation of Interpolation Process
14. Implementation of I/D Sampling Rate Converters
15. Impulse Response of First order and Second Order Systems.

EI605PC: INDUSTRIAL AUTOMATION LABORATORY

B.Tech. III Year II Semester

L	T	P	C
0	0	2	1

Course Objectives
1. To make students **proficient** with PLC and SCADA programming
2. To make students create **interface** between PLC and SCADA
3. To make students **implement** PLC and SCADA for real time systems

Course Outcomes: After completion of the course the student is able to:
1. **Write** PLC and SCADA programs for desired application.
2. **Implement** PLC and SCADA control to real times systems.
3. **Design** and **create** seamless interface between PLC and SCADA mincing the real industrial application.

PLC: Programming and applications
1. Overview of PLC systems, input/output modules, Power supplies and Isolators
2. Simulation: Creating Ladder diagrams for arbitrary applications
3. Basic Functions: register, timer, counter
4. Interfacing PLC with at least two real time process (Pressure Level)
5. Networking of PLC
6. Process Controllers and Loop Tuning using PLC

SCADA: Programming and Applications
1. Introduction to SCADA system, Industrial Application of SCADA
2. Remote Terminal Units programming
3. SCADA programming
4. Interfacing of SCADA and PLC
5. Remote Operation Monitoring using SCADA
6. Real time implementation of SCADA System to a process (DC Motor-RPM Control; Stepper Motor-Angular Displacement and Linear Displacement through Rack Pinion)
7. Implementation of SCADA interfaced PLCs to Flow Process Station
8. Implementation of SCADA interfaced PLCs to pH control system Process Station
9. Implementation of SCADA interfaced PLCs to split control system Process Station
10. Implementation of SCADA interfaced PLCs to Temperature Process Station
11. SCADA programming to simultaneously monitor and control the pH control system process Station, the split control system process Station and Temperature process station
12. Monitoring and evaluation of PLC network using SCADA.

EI606PC: VIRTUAL INSTRUMENTATION LABORATORY

B.Tech. III Year II Semester

L	T	P	C
0	0	2	1

Course Objectives: Student will be able to
1. It provides new concepts using Data acquisition card
2. It gives knowledge about how to control an external measuring device by Interfacing a computer.
3. It gives knowledge to develop the image processing applications
4. Gives knowledge to develop the control system and signal simulation applications
5. Gives knowledge on DSP Application

Course Outcomes: On successful completion of this course, it is expected that students should be able to:
1. Design and Implement Data acquisition and control sequences using the Lab VIEW software
2. development tool
3. Perform experiments on electrical circuits to determine their frequency response and characteristics of Components etc (using NI Elvis)
4. Perform the image processing techniques on images using Vision Assistant module
5. Develop the control system and signal simulation applications using CDSM and DSP toolkit

List of experiments
1. Design of Decimal Counter Using Lab VIEW
2. Design of A function generator using Lab VIEW
3. Design of Filters Using NIELVIS.
4. Signal processing with speed 33 (speech recording and analysis)
5. Image Processing techniques with Vision Assistant
6. Image Processing application with vision assistant.
7. Image corrupted with salt and pepper noise, apply average local 3 X 3 filter, local average 5 X 5, local average
8. 7 X 7 and median filter observe the response using Vision Assistant

Control design simulation using LabVIEW
1. Building and Configuring Simulations (Control Design and Simulation Module)
2. Modularizing the Simulation Diagram (Control Design and Simulation Module)
3. Trimming and Linearizing Nonlinear Models
4. Executing Simulations in Real Time
5. Optimizing Design Parameters
6. Simulation Model Converter

Networking using LabVIEW
1. Creating a TCP Client
2. Creating a TCP Server
3. Binding Front Panel Controls to Shared Variables
4. Binding Front Panel Controls to Shared Variables in Other Projects
5. Binding Shared Variables to an Existing Source
6. Changing the Default Ports for TCP-Based NI-PSP
7. Configuring Firewalls and Network Address Translating Routers for Shared Variables

Calling Code Written in Text-Based Programming Languages
1. Building a Shared Library to Call from LabVIEW
2. Building a Function Prototype

3. Completing the .c File
4. Setting Input and Output Terminals for the CIN
5. Wiring Inputs and Outputs to the CIN
6. Creating a .c File
7. Compiling the CIN Source Code
8. Loading the CIN Object Code

Managing Performance and Memory
1. Profiling VI Execution Time and Memory Usage
2. Extending Virtual Memory Usage for 32-bit Windows

Signal Processing Using LabVIEW
1. Characteristics of an Ideal Filter
2. FIR Filters
3. IIR Filters
4. Comparing FIR and IIR Filters
5. Nonlinear Filters
6. Selecting a Digital Filter Design
7. FFT Analysis using LabVIEW
8. Design of digital filter using LabVIEW

*MC609: ENVIRONMENTAL SCIENCE

B.Tech. III Year II Semester   L T P C
                                                                                                    0 0 2 1

Course Objectives:
1. Understanding the importance of ecological balance for sustainable development.
2. Understanding the impacts of developmental activities and mitigation measures
3. Understanding the environmental policies and regulations

Course Outcomes: Based on this course, the Engineering graduate will
1. understand /evaluate / develop technologies on the basis of ecological principles and environmental regulations which in turn helps in sustainable development

UNIT - I
Ecosystems: Definition, Scope and Importance of ecosystem. Classification, structure, and function of an ecosystem, Food chains, food webs, and ecological pyramids. Flow of energy, Biogeochemical cycles, Bioaccumulation, Biomagnification, ecosystem value, services and carrying capacity, Field visits.

UNIT - II
Natural Resources: Classification of Resources: Living and Non-Living resources, **water resources:** use and over utilization of surface and ground water, floods and droughts, Dams: benefits and problems. **Mineral resources:** use and exploitation, environmental effects of extracting and using mineral resources, **Land resources:** Forest resources, **Energy resources:** growing energy needs, renewable and non renewable energy sources, use of alternate energy source, case studies.

UNIT - III
Biodiversity And Biotic Resources: Introduction, Definition, genetic, species and ecosystem diversity. Value of biodiversity; consumptive use, productive use, social, ethical, aesthetic and optional values. India as a mega diversity nation, Hot spots of biodiversity. Field visit. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts; conservation of biodiversity: In-Situ and Ex-situ conservation. National Biodiversity act.

UNIT - IV
Environmental Pollution and Control Technologies: Environmental Pollution: Classification of pollution, **Air Pollution:** Primary and secondary pollutants, Automobile and Industrial pollution, Ambient air quality standards. **Water pollution:** Sources and types of pollution, drinking water quality standards. **Soil Pollution:** Sources and types, Impacts of modern agriculture, degradation of soil. **Noise Pollution:** Sources and Health hazards, standards, **Solid waste:** Municipal Solid Waste management, composition and characteristics of e-Waste and its management. **Pollution control technologies:** Wastewater Treatment methods: Primary, secondary and Tertiary.
Overview of air pollution control technologies, Concepts of bioremediation. **Global Environmental Problems and Global Efforts: C**limate change and impacts on human environment. Ozone depletion and Ozone depleting substances (ODS). Deforestation and desertification. International conventions / Protocols: Earth summit, Kyoto protocol, and Montréal Protocol.

UNIT - V
Environmental Policy, Legislation & EIA: Environmental Protection act, Legal aspects Air Act- 1981, Water Act, Forest Act, Wild life Act, Municipal solid waste management and handling rules, biomedical waste management and handling rules, hazardous waste management and handling rules. EIA: EIA structure, methods of baseline data acquisition. Overview on Impacts of air, water, biological and Socio-

economical aspects. Strategies for risk assessment, Concepts of Environmental Management Plan (EMP). **Towards Sustainable Future:** Concept of Sustainable Development, Population and its explosion, Crazy Consumerism, Environmental Education, Urban Sprawl, Human health, Environmental Ethics, Concept of Green Building, Ecological Foot Print, Life Cycle assessment (LCA), Low carbon life style.

TEXT BOOKS:
1. Textbook of Environmental Studies for Undergraduate Courses by Erach Bharucha for University Grants Commission.
2. Environmental Studies by R. Rajagopalan, Oxford University Press.

REFERENCE BOOKS:
1. Environmental Science: towards a sustainable future by Richard T. Wright. 2008 PHL Learning Private Ltd. New Delhi.
2. Environmental Engineering and science by Gilbert M. Masters and Wendell P. Ela. 2008 PHI Learning Pvt. Ltd.
3. Environmental Science by Daniel B. Botkin & Edward A. Keller, Wiley INDIA edition.
4. Environmental Studies by Anubha Kaushik, 4th Edition, New age international publishers.
5. Text book of Environmental Science and Technology - Dr. M. Anji Reddy 2007, BS Publications.

EI701PC: ANALYTICAL INSTRUMENTATION

B.Tech. IV Year I Semester

	L	T	P	C
	3	1	0	4

Course Objectives: Student will be able to
1. Students will be introduced to a whole array of modern analytical instrumentation with the goal of providing them with the tools with which they can further their applied research.
2. The emphasis will be a "hands-on" approach with sample preparation, theory, application, method development, data analysis and interpretation being key elements.
3. Interpret data derived from any of the above-mentioned spectroscopic instruments
4. Appreciate the basic concept, principles and terms of chromatography.

Course Outcomes: After completion of the course the student is able to:
1. Understand the principles, procedures and applications of Analytical Instrument and analytical techniques
2. Use statistical method for evaluating and interpreting data
3. Appreciate the basic principles of spectroscopy and chromatography techniques.
4. Integrate different analytical techniques to solve analytical and bio-analytical problems.

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	-	-	-	-	-	1	-	-	1
CO2	3	3	2	1	-	-	-	-	1	-	-	1
CO3	3	3	2	2	-	-	-	-	1	-	-	1
CO4	3	3	1	3	-	-	-	-	1	-	-	1

UNIT - I
Electrochemical Instruments: Basic concepts of Analytical Instrumentation, Electro chemical instruments- pH meter, Conductivity meter, Dissolved oxygen analyzers, sodium analyzers, silica analyzers.

UNIT - II
Spectrophotometers-I (Absorption): Concepts of Spectrometry, Beer- Lambert's law-Derivation of Beer Lamberts Law- Problems associated with the Law. UV, VIS spectrophotometers – single beam and double beam instruments – Instrumentation associated with the above spectrophotometers – sources and detectors.
IR Spectrometers – sources and detector, Instrumentation associated with the above spectrophotometers, FTIR. Interpretation and Analysis.
Spectrophotometers-II (Emission): Flame emission and Atomic emission spectrophotometers – Sources for Flame Photometers, Online calorific value measurements.

UNIT - III
Gas and Liquid Chromatographs: Chromatography – types- Basic principles of gas chromatography, liquid chromatography (HPLC) ---- different types of columns, detectors, recorders and associated equipment for Gas and Liquid Chromatographs and their applications, Interpretation and Analysis.
Principles of Nuclear Magnetic Resonance: Instrumentation associated with NMR spectrophotometer – Introduction to mass spectrophotometers, Introduction and Working Principle of Electron Spin Resonance (ESR), Interpretation and Analysis.

UNIT - IV
Gas Analyzers-I: Analysis using Thermal conductivity principle, Katharometer – oxygen analyzers using paramagnetic principle, H_2S analyzer system.

Gas Analyzers-II: CO monitors, NO_x analyzers, Industrial analyzer circuits, Pollution Monitoring systems.

UNIT - V
Thermal Analyzers: Differential Scanning Calorimetry (DSC), Derivative Thermo Gravimetric Analyzers (DTGA).
Nuclear Radiation Detectors: Gas filled Detectors- GM counters, Scintillation counter, Ionization chamber, Proportional counter, solid state detector.

TEXT BOOKS:
1. R.S. Khandpur, Handbook of Analytical Instrumentation, TMH.
2. Willard. H. H, MerritL. L, Dean, D. Van Nostrand, Instrumental Method of Analysis- CBS publishing and Distributors, 6/e, 1995.

REFERENCE BOOKS:
1. B.G. Liptak, Process Measurement and Analysis- CRC Press
2. Skoog D.A and West D.M, Principles of Instrumental Analysis-Holt Sounder publication, Philadelphia, 1985
3. Jones B. E, Instrument Technology-Butterworth Scientific Publications, London, 1987.

EI731PE: PHARMACEUTICAL INSTRUMENTATION (PE – III)

B.Tech. IV Year I Semester   L   T   P   C
                                                                                          3   0   0   3

Course Objectives: Student will be able to
1. **Understand** the working pharmaceutical industry
2. **Understand** the necessity of a instrumentation engineer pharmaceutical industry
3. **Understand** different components and their control in pharmaceutical industry.

Course Outcomes: After completion of the course the student is able to:
1. Appreciate the concept of analytical instrumentation learned during previous semester.
2. Appreciate the necessity of homogenization of mixture and size reduction.
3. Appreciate evaporation process involved in pharma industries.
4. Appreciate distillation and filtration process involved in pharma industries.

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	1	1	-	-	-	-	1	-	-	1
CO2	3	2	1	2	-	-	-	-	1	-	-	1
CO3	3	3	2	3	-	-	-	-	1	-	-	1
CO4	3	3	3	3	-	-	-	-	1	-	-	1

UNIT - I
Introduction: Pharma Industries Basic Processors and Instrumentation Techniques, Process Analysis Technology (PAT).
Filtration: Classification of Filtration, Mechanism of Filtration, Filter media, Filter Aids, Pretreatment of materials, small scale filtration methods, filtration equipment, filter presses, Leaf filters, stacked disc filters, meta filters, Rotary continuous filters, other methods, ceramic filters, seitz filters, sintered (fritted) Glass filters, Membrane filters, factors affecting the rate of filtration, filter operation, theory of filtration, Limitations of filter theory.
Centrifugation: General principles, theoretical aspects, classification, Laboratory equipment, Large scale equipment, Semi continuous centrifuge, equipment with non-perforated basket, de laval clarifier, vertical solid bowl centrifuges, continuous centrifuges.
Theory of filtration, filter aids, filter media, industrial filters including filter press, rotary filter, edge filter, etc. Factors affecting filtration, mathematical problems on filtration, optimum cleaning cycle in batch filters. Principles of centrifugation, industrial centrifugal filters, centrifugal filters, and centrifugal sedimeters.

UNIT - II
Crystallization: Introduction, Crystal forms and crystal Habit, classification of crystallizers, tank crystallizers, agitated batch crystallizers, Swenson Walker Crystallizer, others, Krystal Crystallizer, Vacuum Crystallizer without External Classifying seed Bed, theoretical aspects of Crystallization, Calculation of yields, theory of Crystallization. The miers super saturation theory, limitations of themiers theory, rate of crystal growth, Caking of crystals.
Characteristics of crystals like; purity, size, shape, geometry, habit, forms, size and factors affecting it. Solubility curves and calculation of yields, Material and heat balances around Swenson Walker Crystallizer. Super saturation theory and its limitations, Nucleation mechanisms, crystal growth. Study of various types of crystallizers, tanks, agitated batch, single vacuum, circulating magma and crystal crystallizers. Caking of crystals and its prevention. Numerical problems on yields.

UNIT - III
Humidity control and Refrigeration: Basic concepts and definition, wet bulb temperature, adiabatic cooling lines, use of Humidity chart, determination of humidity, air conditioning, humidification and

humidifying equipment, dehumidifiers. Introduction, refrigeration equipment, coefficient of performance and refrigerants, Brine systems, refrigeration load, absorption systems.

Evaporation and Distillation Heat Processes: Factors affecting evaporation, study of evaporating stills and evaporating pans, heat transferring evaporators, vapor compression evaporators and evaporation under reduced pressure. Distillation: Importance of distillation in Pharmacy, methods of distillation. Brief introduction to freeze drying, sublimation, desiccation and exsiccation, efflorescence and its importance.

UNIT - IV
Size Reduction and Separation: Introduction, mechanism and principles of size reduction, classification of size reduction equipment, law of size reduction, large equipment, mills using impact force for size reduction, cage mills, pin mills, fluid energy or jet mills, attrition and grinding mills tumbling mills. Ball mills and tube mills, practical size classifiers used with grinding mills, wet classifiers, nonrotary ball and bead mills, dry vs wet grinding, end runner mill, edge runner mills, disc attrition mills, dispersion and colloid mills, roller mills, size reduction combined with other operations, factors influencing choice of size reduction machinery, changes resulting in the material due to size reduction.

size separation sieving, Screening equipment, sedimentation, screen analysis Definition, objectives of size reduction, factors affecting size reduction, laws governing energy and power requirements of a mill, types of mills including ball mill, hammer mill, fluid energy mill etc. Various methods and equipments employed for size separation, centrifugal elutriation, microscopic methods.

UNIT - V
Mixing and Homogenization: Introduction, equipment for4 mixing of miscible liquids, mixing of a soluble solid with a low viscon liquid etc., mixing solids with solids, equipment, consideration while choosing solids mixing equipment, theory of mixing, mixing solids with liquids, mixing miscible liquids, mixing viscous masses, mixing of immiscible liquids, equipment for emulsification.

Theory of mixing, solid solid, solid liquid and liquid liquid mixing equipment, double cone, twin-shell, silverson mixer, colloid mill, sigma blade mixer, planetary mixer, propeller mixer and turbine mixer.Semi solid mixing, Triple roller mill.

TEXT BOOKS:
1. K. Samba Murthy, Pharmaceutical Engineering.
2. CVS Subhramanyam, Pharmaceutical Engineering

REFERENCE BOOKS:
1. Tutorial Pharmacy, S.J. Carter, Cooper and Gunn's, 6th ed., CBS publisher, Delhi. Perry's Handbook of Chemical Engineering.
2. Unit Operations by Mc Cabe & Smith.

EI732PE: DIGITAL CONTROL SYSTEMS (PE-III)

B.Tech. IV Year I Semester

	L	T	P	C
	3	0	0	3

Prerequisite: Control Systems

Course Objectives:
1. To understand the fundamentals of digital control systems representations, z-transforms
2. To understand analysis of discrete complex domain: Z-Transforms
3. To understand the concepts of state variables analysis for discrete LTI systems.
4. To understand the concepts of controllability and observability of discrete time systems
5. To get exposed the design aspects of controllers and for discrete time systems
6. To understand the concepts of the stability for discrete LTI systems
7. To understand the design aspects of observers for discrete time systems.

Course Outcomes: At the end of this course, students will demonstrate the ability to
1. Obtain discrete representation of LTI systems.
2. Find the state space analysis of discrete time systems.
3. Test and analyze the controllability and observability for discrete time systems.
4. Analyze stability of discrete time systems using various methods
5. Design and analyze digital controllers and Design state feedback controllers and observers.

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	-	-	-	-	1	-	-	2
CO2	3	3	3	3	-	-	-	-	1	-	-	2
CO3	3	3	2	3	-	-	-	-	1	-	-	2
CO4	3	3	3	3	-	-	-	-	1	-	-	2
CO5	3	3	3	3	-	-	-	-	1	-	-	2

UNIT - I:
Representation of Discrete Time Systems
Basics of Digital Control Systems. Discrete representation of continuous systems. Sample and hold circuit. Mathematical Modeling of sample and hold circuit. Effects of Sampling and Quantization. Choice of sampling frequency. ZOH equivalent.
Z-Transforms, Mapping from s-plane to z plane, Properties of Z-Transforms and Inverse Z Transforms. Pulse Transfer function: Pulse transfer function of closed loop systems. Solution of Discrete time systems. Time response of discrete time system, Steady State errors.

UNIT - II:
Discrete Time State Space Analysis
State space representation of discrete time systems, Conversion of pulse transfer function to state space models and vice-versa, Solving discrete time state space equations, State Transition Matrix, Pulse Transfer Function Matrix. Discretization of continuous time state space equations. Concept of Controllability, stabilizability, observability, reachability – Controllability and observability tests. Effect of pole zero cancellation on the controllability & observability.

UNIT - III:
Stability Analysis of Discrete Time System
Concept of stability in z-domain, Stability analysis of discrete time system: by Jury test, using bilinear transformation. Stability Analysis of discrete time systems using Lyapunov methods.

UNIT - IV:
Design of Digital Control System by Conventional Methods
Design and realization of digital PID Controller, Design of discrete time controllers with bilinear transformation, Design of digital control system with dead beat response, Practical issues with dead beat response design.

UNIT - V:
Design State Feedback Controllers and Observers
Design of discrete state feedback controllers through pole placement, Design of Discrete Observer for LTI System: Design of full order and reduced observers, Design of observer-based controllers.

TEXT BOOKS:
1. K. Ogata, "Digital Control Engineering", Prentice Hall, Englewood Cliffs, 1995.
2. M. Gopal, "Digital Control Engineering", Wiley Eastern, 1988.
3. V.I, George and C.P. Kurian, Digital Control Systems, CENGAGE Learning, 2012

REFERENCE BOOKS:
1. G. F. Franklin, J.D. Powell and M. L. Workman, "Digital Control of Dynamic Systems", Addison-Wesley, 1998.
2. B.C. Kuo, "Digital Control System", Holt, Rinehart and Winston, 1980.

EI733PE: MEMS AND ITS APPLICATIONS (PE – III)

B.Tech. IV Year I Semester

L	**T**	**P**	**C**
3	**0**	**0**	**3**

Course Objectives: The course is intended for students to:
1. **Acquire** knowledge about MEMS devices and their applications in various domains.
2. **Understand** the techniques to fabricate MEMS devices.
3. **Learn** the design considerations for MEMS devices and Microsystems.
4. **Learning** to characterize Microsystems using optical and electron microscopy and other techniques.

Course Outcomes: After completion of the course the student is able to:
1. **Apply** fundamental knowledge of physics and chemistry to design Microsystems for various applications.
2. **Select** appropriate tools and techniques considering particular practical need for a micro system application.
3. **Realize** the need for advancement of technology towards Microsystems for better living in the society.
4. **Understand** the need to keep one updated constantly to understand the ease of use of emerging technologies.

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	-	-	1	-	-	-	1	-	-	1
CO2	3	2	1	1	1	-	-	-	1	-	-	1
CO3	3	1	2	1	1	-	-	-	1	-	-	1
CO4	3	1	1	1	1	-	-	-	1	-	-	1

UNIT - I
Fundamentals of MEMS: Overview of MEMS and Microsystems; Evolution of microfabrication; Applications of MEMS in optical devices (Micro-Opto-Electro-Mechanical Systems or MOEMS), healthcare and biomedicine (including Bio-MEMS and Bio-MOEMS), aerospace, telecommunications, consumer products, automotive, and industrial products; Working principles of microsystems: Microsensors – acoustic wave, bio-, chemical, optical, pressure, thermal; Microactuation – thermal, shape-memory alloys, piezoelectric, electrostatic; MEMS devices – Microgrippers; Micromotors; Microfluidics – Micropumps, Microvalves; Micro accelerometers

UNIT - II
Materials for MEMS and Microsystems: Substrates and Wafers; Silicon as a Substrate, Silicon Compounds, Silicon piezo resistors, Non-silicon-based materials: Gallium Arsenide, Gallium Nitride, Quartz, Piezoelectric Crystals, Polymers.

UNIT - III
Basics of Micromanufacturing: Photolithography; Cleanroom Environment; Deposition techniques: Ion implantation, Diffusion, Vapour Deposition (PVD, CVD, PECVD), Oxidation, Epitaxial growth; Etching techniques: Chemical (Wet) Etching, Plasma (Dry) Etching
Design considerations; Process Design; Photomask layout using CAD; Mechanical design overview

UNIT - IV
Fabrication of MEMS: Bulk micromachining, Surface micromachining, LIGA Process, Deep X-Ray Lithography (DXRL)

UNIT - V

Characterization of MEMS: Characterization techniques: Principle of working and operation of: Scanning Electron Microscope (SEM), Transmission Electron Microscope (TEM), Atomic Force Microscope (AFM), X-Ray Diffraction (XRD), Optical microscope

TEXT BOOKS:
1. Tai-Ran Hsu, ―MEMS and Microsystems Design and Manufacture‖, Tata McGraw Hill, 2002 (ISBN: 978-0070487093)
2. N. Mahalik, ―MEMS‖, McGraw-Hill Education (India) Pvt. Ltd., 2007 (ISBN: 9780070634459)

REFERENCE BOOKS
1. Marc J. Madou, ―Fundamentals of Microfabrication: The Science of Miniaturization‖, CRC Press, 2002 (ISBN: 978-0849308260)
2. Stephen D. Senturia, ―Microsystem Design‖, Springer, 2004 (ISBN: 9788181285461) Ville Kaajakari, ―Practical MEMS‖, Small Gear Publishing, 2009 (ISBN: 9780982299104)

EI741PE: IMAGE AND VIDEO PROCESSING (PE - IV)

B.Tech. IV Year I Semester
                                                                      L   T   P   C
                                                                      3   0   0   3

Prerequisite: Digital Signal Processing

Course Objectives:
1. The student will be able to understand the quality improvement methods of Image.
2. To study the basic digital image and video filter operations.
3. Understand the fundamentals of Image Compression.
4. Understand the Representation of video, principles and methods of motion estimation.

Course Outcomes: On completion of this course student will be able to
1. Learn the image representation, and fundamental processing steps of an image.
2. Know the different enhancement techniques in both spatial and frequency domains.
3. Understand the importance of compression and different compression techniques.
4. Learn the representation, modelling and motion estimation of Video.

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	1	1	-	-	-	1	-	-	2
CO2	3	3	2	1	1	-	-	-	1	-	-	2
CO3	3	3	2	1	1	-	-	-	1	-	-	2
CO4	3	3	2	1	1	-	-	-	1	-	-	2

UNIT – I
Fundamentals of Image Processing and Image Transforms: Basic steps of Image Processing System Sampling and Quantization of an image, Basic relationship between pixels.
Image Segmentation: Segmentation concepts, Point, Line and Edge Detection, Thresholding, Region based segmentation.

UNIT – II
Image Enhancement: Spatial domain methods: Histogram processing, Fundamentals of Spatial filtering, smoothing spatial filters, Sharpening spatial filters.
Frequency domain methods: Basics of filtering in frequency domain, image smoothing, image sharpening, Selective filtering.

UNIT – III
Image Compression: Image compression fundamentals - Coding Redundancy, Spatial and Temporal redundancy, Compression models: Lossy & Lossless, Huffman coding, Bit plane coding, Transform coding, Predictive coding, Wavelet coding, Lossy Predictive coding, JPEG Standards.

UNIT - IV
Basic Steps of Video Processing: Analog Video, Digital Video. Time-Varying Image Formation models: Three-Dimensional Motion Models, Geometric Image Formation, Photometric Image Formation, Sampling of Video signals, Filtering operations

UNIT – V
2-D Motion Estimation: Optical flow, General Methodologies, Pixel Based Motion Estimation, Block-Matching Algorithm, Mesh based Motion Estimation, Global Motion Estimation, Region based Motion Estimation, Multi resolution motion estimation, Waveform based coding, Block based transform coding, Predictive coding, Application of motion estimation in Video coding.

TEXT BOOKS:
1. Gonzalez and Woods, Digital Image Processing –4th Ed., Pearson, 2018.
2. M. Tekalp, Digital Video Processing –Prentice Hall International

REFERENCE BOOKS:
1. Yao Wang, Joem Ostermann and Ya–quin Zhang, Video Processing and Communication – 1st Ed., PH Int.
2. S. Jayaraman, S. Esakkirajan, T. Veera Kumar, Digital Image Processing —TMH, 2009

EI742PE: COMPUTER NETWORKS (PE – IV)

B.Tech. IV Year I Semester

	L	T	P	C
	3	0	0	3

Prerequisites:
1. A course on "Programming for problem solving".
2. A course on "Data Structures".

Course Objectives:
1. The objective of the course is to equip the students with a general overview of the concepts and fundamentals of computer networks.
2. Familiarize the students with the standard models for the layered approach to communication between machines in a network and the protocols of the various layers.

Course Outcomes:
1. Gain the knowledge of the basic computer network technology.
2. Gain the knowledge of the functions of each layer in the OSI and TCP/IP reference model.
3. Obtain the skills of subnetting and routing mechanisms.
4. Familiarity with the essential protocols of computer networks, and how they can be applied in network design and implementation.

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	1	-	-	-	-	1	-	-	3
CO2	3	3	2	1	-	-	-	-	1	-	-	3
CO3	3	3	2	1	-	-	-	-	1	-	-	3
CO4	3	3	2	1	-	-	-	-	1	-	-	3

UNIT - I
Network hardware, Network software, OSI, TCP/IP Reference models, Example Networks: ARPANET, Internet.
Physical Layer: Guided Transmission media: twisted pairs, coaxial cable, fiber optics, Wireless transmission.

UNIT - II
Data link layer: Design issues, framing, Error detection and correction.
Elementary data link protocols: simplex protocol, A simplex stop and wait protocol for an error-free channel, A simplex stop and wait protocol for noisy channel.
Sliding Window protocols: A one-bit sliding window protocol, A protocol using Go-Back-N, A protocol using Selective Repeat, Example data link protocols.
Medium Access sub layer: The channel allocation problem, Multiple access protocols: ALOHA, Carrier sense multiple access protocols, collision free protocols. Wireless LANs, Data link layer switching.

UNIT - III
Network Layer: Design issues, Routing algorithms: shortest path routing, Flooding, Hierarchical routing, Broadcast, Multicast, distance vector routing, Congestion Control Algorithms, Quality of Service, Internetworking, The Network layer in the internet.

UNIT - IV
Transport Layer: Transport Services, Elements of Transport protocols, Connection management, TCP and UDP protocols.

UNIT - V
Application Layer –Domain name system, SNMP, Electronic Mail; the World WEB, HTTP, Streaming audio and video.

TEXT BOOK:
1. Andrew S Tanenbaum, David. j. Wetherall, Computer Networks -- 5th Edition. Pearson Education/PHI.

REFERENCE BOOKS:
1. S. Keshav, An Engineering Approach to Computer Networks- 2nd Edition, Pearson Education
2. Behrouz A. Forouzan, Data Communications and Networking –Third Edition TMH.

EI743PE: ARTIFICIAL NEURAL NETWORKS (PE – IV)

B.Tech. IV Year I Semester

	L	T	P	C
	3	0	0	3

Course Objectives:
1. To understand the biological neural network and to model equivalent neuron models.
2. To understand the architecture, learning algorithms
3. To know the issues of various feed forward and feedback neural networks.
4. To explore the Neuro dynamic models for various problems.

Course Outcomes: Upon completing this course, the student will be able to
1. Explore the similarity of Biological networks and Neural networks
2. Perform the training of neural networks using various learning rules.
3. Demonstrate the concepts of forward and backward propagations.
4. Construct the Hopfield models.

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	1	1	1	-	-	-	-	1
CO2	3	3	2	2	1	1	1	-	-	-	-	1
CO3	3	3	2	2	3	1	1	-	-	-	-	1
CO4	3	3	3	2	3	1	1	-	-	-	-	1

UNIT - I:
Introduction: A Neural Network, Human Brain, Models of a Neuron, Neural Networks viewed as Directed Graphs, Network Architectures, Knowledge Representation, Artificial Intelligence and Neural Networks
Learning Process: Error Correction Learning, Memory Based Learning, Hebbian Learning, Competitive, Boltzmann Learning, Credit Assignment Problem, Memory, Adaption, Statistical Nature of the Learning Process

UNIT - II:
Single Layer Perceptrons: Adaptive Filtering Problem, Unconstrained Organization Techniques, Linear Least Square Filters, Least Mean Square Algorithm, Learning Curves, Learning Rate Annealing Techniques, Perceptron –Convergence Theorem, Relation Between Perceptron and Bayes Classifier for a Gaussian Environment
Multilayer Perceptron: Back Propagation Algorithm XOR Problem, Heuristics, Output Representation and Decision Rule, Computer Experiment, Feature Detection

UNIT - III:
Back Propagation: Back Propagation and Differentiation, Hessian Matrix, Generalization, Cross Validation, Network Pruning Techniques, Virtues and Limitations of Back Propagation Learning, Accelerated Convergence, Supervised Learning

UNIT - IV:
Self-Organization Maps (SOM): Two Basic Feature Mapping Models, Self-Organization Map, SOM Algorithm, Properties of Feature Map, Computer Simulations, Learning Vector Quantization, Adaptive Patter Classification

UNIT - V:
Neuro Dynamics: Dynamical Systems, Stability of Equilibrium States, Attractors, Neuro Dynamical Models, Manipulation of Attractors as a Recurrent Network Paradigm
Hopfield Models – Hopfield Models, restricted boltzmen machine.

TEXT BOOKS:
1. Simon S Haykin, Neural Networks a Comprehensive Foundations, PHI Ed.
2. Jacek M. Zurada, Introduction to Artificial Neural Systems JAICO Publishing House Ed. 2006.

REFERENCE BOOKS:
1. Li Min Fu, Neural Networks in Computer Intelligence, TMH 2003
2. James A Freeman David M S Kapura, Neural Networks - Pearson Ed., 2004.
3. B. Vegnanarayana, Artificial Neural Networks - Prentice Hall of India P Ltd 2005

EI721OE: FUNDAMENTALS OF BIOMEDICAL INSTRUMENTATION (OE – II)

B.Tech. IV Year I Semester   **L   T   P   C**
                                                                        3   0   0   3

Course Objectives:
1. To provide basic knowledge on bio medical instrumentation system and its characteristics.
2. To explain waveforms of ECG, EEG, EMG and biochemical electrode.
3. To provide knowledge on blood pressure measurement and use of pacemaker and defibrillator and ventilator.

Course Outcomes: At the end of the course, the student should be able to
1. Understand the significance of instrumentation in human physiology.
2. Acquire confidence in delivering effective therapeutic and diagnostic tools for doctors.
3. Develop concepts in cardiac and neuromuscular instrumentation.

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	1	1	-	-	-	-	1	-	-	1
CO2	1	1	2	2	-	-	-	-	1	-	-	1
CO3	1	2	3	1	-	-	-	-	1	-	-	1

UNIT – I
Basic of Biomedical Instrumentation: Components of Medical Instrumentation System, Static and dynamic characteristics of medical instruments, Problems encountered with measurements from human beings. Organization of Cell: Derivation of Nernst equation for membrane Resting potential, Generation of action potential and refractory periods, propagation methods of action potentials.

UNIT – II
ECG Measurements and Interpretation: Medical Recorders: Classification of recorders, general features of ink-jet, and PMMC writing systems. Basics of Bio chemical electrodes. Electrocardiography: Electrical conduction system of the heart, electrodes and their placement, Standard 12 – lead configurations, Interpretation of ECG waveform with respect of electro mechanical activity of the heart.

UNIT –III
Blood Pressure Measurements: Blood pressure measurement: Introduction to blood pressure, and measurements methods, Blood flow measurement methods, Phonocardiography.

UNIT – IV
Therapeutic Equipment: Basics of Pacemakers, Defibrillator, electrotherapy and its applications, Dialysis and its significance-.

UNIT – V
EEG, EMG and Respiratory Measurements: EEG block diagram, electrodes and their placement, EMG block diagram, electrode and their placement, study of neuromuscular junction, nerve conduction velocity using EMG. Respiratory Instrumentation: Mechanism of respiration, Spirometrey, Pnemuotachograph and its types, ventilators and its mode of operation.

TEXT BOOKS:
1. John G. Webster, John Wiley and sons, Medical Instrumentation – Application and Design, Inc., 3rd Ed., 2003
2. Khandpur R. S, Hand Book of Biomedical Instrumentation, Tata McGraw Hill, 1994

REFERENCE BOOKS:
1. Joseph J. Carr ad John M. Brown, Introduction to Biomedical Equipment Technology, Pearson Education, 2001.
2. Bronzino Joseph D, Hand Book of Biomedical Engineering, CRC Press, 1995.

EI722OE: MEASURING INSTRUMENTS (OE - II)

B.Tech. IV Year I Semester

	L	T	P	C
	3	0	0	3

Course Objectives:
1. To provide basic knowledge in transduction principles, sensors and transducer technology and measurement systems.
2. To provide better familiarity with the concepts of Sensors and Measurements.
3. To provide the knowledge of various measurement methods of physical parameters like velocity, acceleration, force, pressure and viscosity.

Course Outcomes: After Completion of the course the student is able to
1. Able to identify suitable sensors and transducers for real time applications.
2. Able to translate theoretical concepts into working models.
3. Able to understand the basic of measuring device and use them in relevant situation.

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	1	1	-	-	-	-	1	-	-	1
CO2	2	2	2	1	-	-	-	-	1	-	-	1
CO3	1	1	1	1	-	-	-	-	1	-	-	1

UNIT - I
Introduction to measurements: Physical measurement, Forms and methods of measurements, Measurement errors, Statistical analysis of measurement data, Probability of errors, Limiting errors, Standards, Definition of standard units, International standards, Primary standards, Secondary standards, Working standards, Voltage standard, Resistance standard, Current standard, Capacitance standard, Time and frequency standards.

UNIT – II
Passive Sensors Resistive Sensors: Potentiometers, Strain Gages, Resistive Temperature Detectors (RTDs), Thermistors, Light-dependent Resistors (LDRs), Resistive Hygrometers, Capacitive Sensors: Variable capacitor, Differential capacitor, Inductive Sensors: Reluctance variation sensors, Eddy current sensors.

UNIT - III
Metrology: Measurement of length – Plainness – Area – Diameter – Roughness – Angle – Comparators – Gauge Blocks, Optical Methods for length and distance measurements. Velocity and Acceleration Measurement: Relative velocity – Translational and Rotational velocity measurements – Revolution counters and Timers - Magnetic and Photoelectric pulse counting stroboscopic methods, Accelerometers- different types, Gyroscopes-applications.

UNIT - IV
Force and Pressure Measurement: Gyroscopic Force Measurement – Vibrating wire Force transducer. Basics of Pressure measurement –Manometer types – Force-Balance and Vibrating Cylinder Transducers – High- and Low-Pressure measurement

UNIT - V
Flow: Density and Viscosity Measurements: Flow Meters- Head type, Area type (Rota meter), electromagnetic type, Positive displacement type, Density measurements – Strain Gauge load cell method – Buoyancy method. Units of Viscosity, Two float viscorator –Industrial consistency meter

TEXT BOOKS:
1. Doeblin E.O., Measurement Systems – Applications and Design – by 4/e, McGraw Hill International, 1990.
2. Patranabis D, Principles of Industrial Instrumentation –TMH. End edition 1997.

REFERENCE BOOKS:
1. Jon Wilson, Sensor Technology Hand Book –Newne 2004.
2. Herman K.P. Neubrat, Instrument Transducers – An Introduction to their Performance and design – Oxford University Press.
3. E.O. Doeblin, Measurement system: Applications and Design – McGraw Hill Publications.
4. H.S. Kalsi, Electronic Instrumentation.

EI702PC: PROFESSIONAL PRACTICE, LAW AND ETHICS

B.Tech. IV Year I Semester

L	T	P	C
2	0	0	2

Course Objectives:
1. To make the students understand the types of roles they are expected to play in the society as practitioners of the civil engineering profession
2. To develop some ideas of the legal and practical aspects of their profession.

Course Outcome: The students will
1. understand the importance of professional practice, Law and Ethics in their personal lives and professional careers.
2. learn the rights and responsibilities as an employee, team member and a global citizen.

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	1	1	2	1	3	3	1
CO2	-	-	-	-	-	1	1	2	1	3	3	1

UNIT - I

Professional Practice and Ethics: Definition of Ethics, Professional Ethics - Engineering Ethics, Personal Ethics; Code of Ethics - Profession, Professionalism, Professional Responsibility, Conflict of Interest, Gift Vs Bribery, Environmental breaches, Negligence, Deficiencies in state-of-the-art; Vigil Mechanism, Whistle blowing, protected disclosures. Introduction to GST- Various Roles of Various Stake holders

UNIT - II

Law of Contract: Nature of Contract and Essential elements of valid contract, Offer and Acceptance, Consideration, Capacity to contract and Free Consent, Legality of Object. Unlawful and illegal agreements, Contingent Contracts, Performance and discharge of Contracts, Remedies for breach of contract. Contracts-II: Indemnity and guarantee, Contract of Agency, Sale of goods Act -1930: General Principles, Conditions & Warranties, Performance of Contract of Sale.

UNIT - III

Arbitration, Conciliation and ADR (Alternative Dispute Resolution) system: Arbitration – meaning, scope and types – distinction between laws of 1940 and 1996; UNCITRAL model law – Arbitration and expert determination; Extent of judicial intervention; International commercial arbitration; Arbitration agreements – essential and kinds, validity, reference and interim measures by court; Arbitration tribunal – appointment, challenge, jurisdiction of arbitral tribunal, powers, grounds of challenge, procedure and court assistance; Distinction between conciliation, negotiation, mediation and arbitration, confidentiality, resort to judicial proceedings, costs; Dispute Resolution Boards; Lok Adalats.

UNIT - IV

Engagement of Labour and Labour & other construction-related Laws: Role of Labour in Civil Engineering; Methods of engaging labour- on rolls, labour sub-contract, piece rate work; Industrial Disputes Act, 1947; Collective bargaining; Industrial Employment (Standing Orders) Act, 1946; Workmen's Compensation Act, 1923; Building & Other - Construction Workers (regulation of employment and conditions of service) Act (1996) and Rules (1998); RERA Act 2017, NBC 2017.

UNIT - V

Law relating to Intellectual property: Introduction – meaning of intellectual property, main forms of IP, Copyright, Trademarks, Patents and Designs, Secrets; Law relating to Copyright in India including Historical evolution of Copy Rights Act, 1957, Meaning of copyright – computer programs, Ownership

of copyrights and assignment, Criteria of infringement, Piracy in Internet – Remedies and procedures in India; Law relating to Patents under Patents Act, 1970.

TEXT BOOKS:
1. R. Subramanian, Professional Ethics: Oxford University Press, 2015.
2. Ravinder Kaur, Legal Aspects of Business, 4e, Cengage Learning, 2016.

REFERENCE BOOKS:
1. Wadhera (2004), Intellectual Property Rights, Universal Law Publishing Co.
2. T. Ramappa (2010), Intellectual Property Rights Law in India, Asia Law House.
3. O.P. Malhotra, Law of Industrial Disputes, N.M. Tripathi Publishers.

EI703PC: ANALYTICAL INSTRUMENTATION LAB

B.Tech. IV Year I Semester	L	T	P	C
	0	0	4	2

Course Objectives:
1. To introduce the student to principles and theory of instrument analysis.
2. To introduce the student to a whole array of modern analytical instruments.
3. To emphasize a hands-on approach with sample preparation, application, method development, data analysis and interpretation being key elements.
4. They can understand the applications and usage of Water quality, Air Quality, Spectrometry, chromatography in real time industrial environments.

Course Outcomes: After completion of the course the student is able to:
1. Develop an understanding of the range and theories of instrumental methods available in analytical instrumentation
2. Apply knowledge pertaining to the appropriate selection of instruments for the successful analysis of complex mixtures
3. develop an understanding of the role of the Instrumentation Engineer in measurement and problem solving in chemical analysis
4. Expand skills in the scientific method of planning, developing, conducting, reviewing and reporting experiments

List of Experiments:
1. Ambient and emission air monitoring using gas analyzer.
2. Separation of different constituents in a mixture of chemical using chromatography
3. Identification of atoms and its concentration through absorption spectra with UV-VIS spectrophotometer.
4. Identification of chemical compound and its concentration using FTIR spectrometer.
5. Identification of atoms and its concentration through emission spectra using flame photometer.
6. Measurement of calorific value using digital bomb calorimeter
7. Determination of acid/alkaline nature of water using pH meter.
8. Food product quality determination using protein analyzers.
9. Qualitative analysis of milk –Milk Analyzer.
10. Determination of concentration of an unknown solution using colorimeter.
11. Radiation intensity measurement with varying distance and measurement of absorber thickness using nuclear radiation detector-G.M. counter.
12. Analysis of water quality using water purity meter
13. Measurement of TDS and conductivity of water using digital conductivity meter
14. Measurement of turbidity of water using digital turbidity meter.

EI851PE: MACHINE LEARNING (PE – V)

B.Tech. IV Year II Semester

	L	T	P	C
	3	0	0	3

Course Objectives:
1. To introduce the foundations of Artificial Neural Networks
2. To acquire the knowledge on Deep Learning Concepts
3. To learn various types of Artificial Neural Networks
4. To gain knowledge to apply optimization strategies

Course Outcomes:
1. Ability to understand the concepts of Neural Networks
2. Ability to select the Learning Networks in modeling real world systems
3. Ability to use an efficient algorithm for Deep Models
4. Ability to apply optimization strategies for large scale applications

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	1	1	1	-	-	-	-	1
CO2	3	3	2	2	1	1	1	-	-	-	-	1
CO3	3	3	2	2	3	1	1	-	-	-	-	1
CO4	3	3	2	2	3	1	1	-	-	-	-	1

UNIT - I
Artificial Neural Networks Introduction, Basic models of ANN, important terminologies, Supervised Learning Networks, Perceptron Networks, Adaptive Linear Neuron, Back-propagation Network. Associative Memory Networks. Training Algorithms for pattern association, BAM and Hopfield Networks.

UNIT - II
Unsupervised Learning Network- Introduction, Fixed Weight Competitive Nets, Maxnet, Hamming Network, Kohonen Self-Organizing Feature Maps, Learning Vector Quantization, Counter Propagation Networks, Adaptive Resonance Theory Networks. Special Networks-Introduction to various networks.

UNIT - III
Introduction to Deep Learning, Historical Trends in Deep learning, Deep Feed - forward networks, Gradient-Based learning, Hidden Units, Architecture Design, Back-Propagation and Other Differentiation Algorithms

UNIT - IV
Regularization for Deep Learning
Parameter norm Penalties, Norm Penalties as Constrained Optimization, Regularization and Under-Constrained Problems, Dataset Augmentation, Noise Robustness, Semi-Supervised learning, Multi-task learning, Early Stopping, Parameter Typing and Parameter Sharing, Sparse Representations, Bagging and other Ensemble Methods, Dropout, Adversarial Training, Tangent Distance, tangent Prop and Manifold, Tangent Classifier

UNIT - V
Optimization for Train Deep Models
Challenges in Neural Network Optimization, Basic Algorithms, Parameter Initialization Strategies, Algorithms with Adaptive Learning Rates, Approximate Second-Order Methods, Optimization Strategies and Meta-Algorithms
Applications: Large-Scale Deep Learning, Computer Vision, Speech Recognition, Natural Language Processing

TEXT BOOKS:
1. Goodfellow and Yoshua Bengio and Aaron Courville, Deep Learning:An MIT Press Book by Ian
2. Simon Haykin, Neural Networks and Learning Machines, 3rd Edition, Pearson Prentice Hall.

EI852PE: DIGITAL IMAGE PROCESSING WITH JAVA

B.Tech. IV Year II Semester   **L   T   P   C**
                                                                   3   0   0   3

Course Objectives:
1. To provide knowledge on software for digital image processing.
2. To give overview of Java and ImageJ.
3. To provide information of various transforms and operations on images and their implementation using Java.
4. To provide different algorithms for processing of image.

COURSE OUTCOMES: After completion of this course the student will be able to
1. Acquire knowledge on ImageJ (Image Processing with Java).
2. Perform various operations in ImageJ like Filter, Edge, Point operations.
3. Implement different algorithms for image matching with Java.
4. Know different types of filters for coloring images and their implementation using Java.

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	-	-	-	1	-	-	1
CO2	3	3	3	3	3	-	-	-	1	-	-	1
CO3	3	3	3	3	3	-	-	-	1	-	-	1
CO4	3	3	3	3	3	-	-	-	1	-	-	1

UNIT - I
ImageJ:
Software for Digital Imaging, ImajeJ Overview, Additional information on ImajeJ and Java, point operations in ImajeJ, Filter Operations in ImajeJ, Edge Operations in ImageJ.

UNIT - II
Transforms:
Discrete Cosine Transform- 1D DCT, 2D DCT, Java Implementation, Scale-invariant Feature Transform (SIFT) – Interest Points at Multiple Scales, Key Point Selection and Refinement, creating Local Descriptors, SIFT Algorithm Summary, Matching SIFT Features, Efficient Feature Matching, Java Implementation.

UNIT - III
Geometric Operations:
2D Coordinate Transformations, Resampling the Image, Java Implementation. Pixel Interpolation - Simple Interpolation Methods, Interpolation by Convolution, Cubic Interpolation, Spline Interpolation, Interpolation in 2D.

UNIT - IV
Image Matching:
The Lucas-Kanade Technique, The Lucas-Kanade Algorithm, Inverse Compositional algorithm, Parameter setups for Various Linear Transformations, Java Implementation.
Fourier shape Descriptors:
Closed Curves in the Complex Plane, Discrete Fourier Transform (DFT), Geometric Interpretation of Fourier Coefficients, Effects of Geometric Transformations, Transformation-Invariant Fourier Descriptors, Shape Matching with Fourier Descriptors, Java Implementation.

UNIT - V
Color Images:

Linear Filters, Nonlinear Color Filters, Java Implementation, Edge Detection in color Images - Edges in Vector-Valued Images, Canny Edge Detector for Color Images, Other Color Edge Operators, Edge-Preserving Smoothing Filters - Kuwahara-Type Filters, Bilateral Filter, Anisotropic Diffusion Filters, Java Implementation.

TEXT BOOK:
1. Wilhelm Burger, Mark J. Burge "Digital Image Processing: An Algorithmic Introduction Using Java" second edition, Springer.

REFERENCE BOOKS:
1. Dr Nick Efford, "Digital Image Processing: A Practical Introduction Using Java", Pearson Publications.
2. Kenny A. Hunt, "The Art of Image Processing with Java", Routledge publications.
3. Jujen Broeke, Jose Maria Mateos Perez, Javier Pascau, "Image Processing with ImageJ", Packt Publications.

EI853PE: VLSI DESIGN (PE – V)

B.Tech. IV Year II Semester

	L	T	P	C
	3	0	0	3

Prerequisite: Electronic Circuit Analysis; Switching Theory and Logic Design

Course Objectives: The objectives of the course are to:
1. Give exposure to different steps involved in the fabrication of ICs.
2. Explain electrical properties of MOS and BiCMOS devices to analyze the behavior of inverters designed with various loads.
3. Give exposure to the design rules to be followed to draw the layout of any logic circuit.
4. Provide design concepts to design building blocks of data path of any system using gates.
5. Understand basic programmable logic devices and testing of CMOS circuits.

Course Outcomes: Upon completing this course, the student will be able to
1. Acquire qualitative knowledge about the fabrication process of integrated circuits using MOS transistors.
2. Draw the layout of any logic circuit which helps to understand and estimate parasitic effect of any logic circuit
3. Design building blocks of data path systems, memories and simple logic circuits using PLA, PAL, FPGA and CPLD.
4. Explore different types of faults that can occur in a system and learn the concept of testing and adding extra hardware to improve testability of system.

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	1	1	1	-	-	-	1	1
CO2	3	3	2	2	1	1	1	-	-	-	1	1
CO3	3	3	2	2	3	1	1	-	-	-	1	1
CO4	3	3	2	2	3	1	1	-	-	-	1	1

UNIT - I:
Introduction: Introduction to IC Technology – MOS, PMOS, NMOS, CMOS & BiCMOS
Basic Electrical Properties: Basic Electrical Properties of MOS and BiCMOS Circuits: I_{ds}-V_{ds} relationships, MOS transistor threshold Voltage, g_m, g_{ds}, Figure of merit; Pass transistor, NMOS Inverter, Various pull ups, CMOS Inverter analysis and design, Bi-CMOS Inverters.

UNIT - II:
VLSI Circuit Design Processes: VLSI Design Flow, MOS Layers, Stick Diagrams, Design Rules and Layout, Transistors Layout Diagrams for NMOS and CMOS Inverters and Gates, Scaling of MOS circuits.

UNIT - III:
Gate Level Design: Logic Gates and Other complex gates, Switch logic, Alternate gate circuits, Time delays, Driving large capacitive loads, Wiring capacitance, Fan – in, Fan – out.

UNIT - IV:
Data Path Subsystems: Subsystem Design, Shifters, Adders, ALUs, Multipliers, Parity generators, Comparators, Zero/One Detectors, Counters.
Array Subsystems: SRAM, DRAM, ROM, Serial Access Memories.

UNIT - V:
Programmable Logic Devices: Design Approach – PLA, PAL, Standard Cells FPGAs, CPLDs.

CMOS Testing: CMOS Testing, Test Principles, Design Strategies for test, Chip level Test Techniques.

TEXT BOOKS:
1. Kamran Eshraghian, Eshraghian Dougles and A. Pucknell, Essentials of VLSI circuits and systems –PHI, 2005 Edition
2. Neil H. E Weste, David Harris, Ayan Banerjee, CMOS VLSI Design – A Circuits and Systems Perspective, 3rd Ed, Pearson, 2009.

REFERENCE BOOKS:
1. Ming-BO Lin, Introduction to VLSI Systems: A Logic, Circuit and System Perspective –CRC Press, 2011
2. John. P. Uyemura, CMOS logic circuit Design - Springer, 2007.
3. Wayne Wolf, Modern VLSI Design - Pearson Education, 3rd Edition, 1997.
4. K. Lal Kishore, V. S. V. Prabhakar, VLSI Design- I.K International, 2009.

EI861PE: POWER PLANT INSTRUMENTATION (PE – VI)

B.Tech. IV Year II Semester   **L   T   P   C**
                                                            3   0   0   3

Course Objective: Student will be able to
1. **Understand** the working model of power plant
2. **Understand** the necessity of a instrumentation engineer in a power plant
3. **Understand** different components and their control in power plants.
4. **Understand** various analyzers used in power plant

Course Outcome: After completion of the course the student is able to:
1. **Appreciate** the power generation technique used in different types of power plants
2. **Appreciate** different parameters and their control in the power plant
3. **Understand** and standby the saying —one watt saved = two watts generated‖.
4. **Understand** the concepts of Nuclear power plants.

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	1	1	-	-	-	1	-	-	1
CO2	3	3	2	1	1	-	-	-	1	-	-	1
CO3	3	3	2	1	1	-	-	-	1	-	-	1
CO4	3	3	2	1	1	-	-	-	1	-	-	1

UNIT - I
An Overview of Power Generation
Introduction-various sources of Electrical Energy - **Non-conventional Energy sources**-
Wind power, solar power, tidal power, geothermal power, magnetohydrodynamic (MHD) Power, Fuel Cells, Biomass Power, **Conventional energy sources-** hydropower, nuclear power, gas power, steam power (Thermal Power), comparison of various conventional power plants, Importance of instrumentation and control in power Generation **–** Classification of Instruments in a power plant, objectives of Instrumentation and control.
Piping and Instrumentation diagram (P and I Diagram) – Examples of ISA Instrumentation diagram symbols, examples of SAMA instrumentation diagram symbols, examples of ISA and SAMA diagram, piping and instrumentation diagramming, Cogeneration of Power-back pressure turbine, pass-out turbine process heat unit, control rooms, thermal or boiler control room, electrical control room, plan of control rooms.

UNIT - II
Instrumentation and Control in Water Circuit
Water circuit, boiler feed water circulation- natural circulation, forced circulation, combined circulation, **Measurements in Water Circuit-** Water Flow Measurement, Differential Pressure transmitter (DPT), steam flow measurement, water and steam pressure measurements, water and steam temperature measurements, drum water level measurement.
Controls in water circuit-boiler drum level control, superheated steam temperature control, steam pressure control, **impurities in water and steam-** impurities in Raw Water, Effects of Impurities, Measurement of Impurities, feed water treatment.

UNIT - III
Instrumentation and Control in Air-Fuel Circuit
Air-Fuel Circuit – Fuels, combustion air, flue gases, waste gases, **Measurements in Air Fuel Circuit –** Measurement of flow/quantity, Measurement of Pressures, Measurement of Temperatures, Measurement of level.

Controls in Air-Fuel Circuit – Combustion control, furnace Draft Control, **Analytical Measurement –** Oxygen Measurement in Flue Gas, Measurement of carbon dioxide in flue gas, combustibles analyser $(CO+H_2)$, Infrared flue gas analyser, smoke detector, dust monitor, closed circuit television, fuel analysers, chromatography, pollution monitoring instruments.

UNIT - IV
Turbine Monitoring and Control
Introduction – Classification, instrumentation control points of View, Principal parts of steam turbines, **Turbine Steam Inlet System** – Inlet valve arrangements, inlet measurements, Governors, Turbine Measurements – Process Parameters, mechanical parameters, electrical parameters, Turbine control system **–** safety control systems, process control systems, **Lubrication for turbo-alternator –** Lubrication system, Controls in Lubrication system, **Turbo-Alternator Cooling System –** Lube Oil cooling system, Alternator/Generator cooling system.

UNIT - V
Nuclear Power Plant Instrumentation
Introduction – Instrumentation and Control for Nuclear Power Plant - Important Components of I&C System - Evolution of I&C in NPP **–** Reactor Control **–** Methods of Control, Control loops, Functions of control system, Pressurized water reactor (PWR) controls, boiler water reactor (BWR) controls, Liquid metal cooled reactor (LMCR) Control, role of reactor controls during start-up, normal operation and shut down.
Digital Architectures in Nuclear Power Plants- System-level Instrumentation and control architecture, safety related systems, non-safety-related systems, man machine interface system (MMIS), Instrumentation and controls architecture platform.
Radiation protection and monitoring – accident at three-mile Island, USA, disaster at
Chernobyl nuclear power plant, Ukraine, calamity at Fukushima, Daiichi nuclear power plant,
Japan, Radiation Units, Biological Effects of Radiation, Radiation Monitoring, **Nuclear Reactor Safety** - Reactor protection system, Reactor Tripping, Engineered Safety Features, **Surveillance, Diagnostics and Prognostics** – Surveillance, Diagnosis, Prognosis.

TEXT BOOKS:
1. Modern Power Station Practice, Volume. 6, Instrumentation, Controls and Testing, Pergamon Press, Oxford, 1971.
2. Wakil M.M., Power Plant Technology, McGraw Hill.

REFERENCE BOOKS:
1. Elonka S. M and Kohal A.L., Standard Boiler Operations-Questions and Answers., Tata McGraw Hill, New Delhi, 1994.
2. Prof. K. Krishna Swamy, Power Plant Instrumentation, New Age International Publisher.
3. Elonka S. M., and Kohal A.L., Standard Boiler Operations - Questions and Answers – TMH, New Delhi, 1994.

EI862PE: BIOMEDICAL INSTRUMENTATION (PE – VI)

B.Tech. IV Year II Semester

	L	T	P	C
	3	0	0	3

Course Objectives
1. **Identify** significant biological variables at cellular level and ways to acquire different bio-signals.
2. **Elucidate** the methods to monitor the activity of the heart, brain, eyes and muscles.
3. **Introduce** therapeutic equipment for intensive and critical care.
4. **Outline** medical imaging techniques and equipment for certain diagnosis and therapies.

Course Outcomes: After completion of the course the student is able to:
1. Explore bio systems and medical systems from an engineering perspective.
2. Identify the techniques to acquire record and primarily understand physiological activity of the human body through cell potential, ECG, EEG, BP and blood flow measurement and EMG.
3. Articulate the working of various medical instruments and critical care equipment.
4. Know the imaging techniques including CT, PET, SPECT and MRI used in diagnosis of various medical conditions.

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	2	2	1	1	1	-	-	1	1	1
CO2	3	1	2	2	1	1	1	-	-	1	1	1
CO3	3	1	2	2	1	1	1	-	-	1	1	1
CO4	3	1	2	2	1	1	1	-	-	1	1	1

UNIT - I:
Bio-Potential Signals and Electrodes
Bio-signals and their characteristics, Organization of cell, Nernst equation of membrane, Resting and Action potentials.
Bio-amplifiers, characteristics of medical instruments, problems encountered with measurements from living systems.
Bio-potential electrodes – Body surface recording electrodes, Internal electrodes, micro electrodes.
Bio-chemical transducers – reference electrode, the pH electrodes, Blood gas electrodes.

UNIT - II:
Cardiovascular Instrumentation: Heart and cardiovascular system Heart electrical activity, blood pressure and heart sounds. Cardiovascular measurements electro cardiography – electrocardiogram, ECG Amplifier, Electrodes and leads, ECG recorder principles. Types of ECG recorders. Principles of blood pressure and blood flow measurement.

UNIT - III:
Neurological Instrumentation: Neuronal communication, electro encephalogram (EEG), EEG Measurements EEG electrode-placement system, interpretation of EEG, EEG system Block diagram, preamplifiers and amplifiers. EMG block diagram and Stimulators

UNIT - IV:
Equipment for Critical Care: Therapeutic equipment - Pacemaker, Defibrillator, Shortwave diathermy, Hemodialysis machine. Respiratory Instrumentation - Mechanism of respiration, Spirometry, Pneumotachograph, Ventilators.

UNIT - V:
Principles of Medical Imaging: Radiography, computed Radiography, Computed Tomography (CT), Magnetic Resonance Imaging (MRI), Nuclear Medicine, Single Photon Emission Computed

Tomography (SPECT), Positron Emission Tomography (PET), Ultrasonography, Introduction to Telemedicine.

TEXT BOOKS:
1. R.S. Khandpur, Hand-book of Biomedical Instrumentation – McGraw-Hill, 2003.
2. John G. Webster, John Wiley, Medical Instrumentation, Application and Design.

REFERENCE BOOKS:
1. Leslie Cromwell, F.J. Weibell, E.A. Pfeiffer, Biomedical Instrumentation and Measurements – PHI.
2. L.A. Geoddes and L.E. Baker, Principles of Applied Biomedical Instrumentation –John Wiley and Sons.
3. Joseph Carr and Brown, Introduction to Biomedical equipment technology.

EI863PE: ROBOTICS AND AUTOMATION (PE - VI)

B.Tech. IV Year II Semester

L	T	P	C
3	0	0	3

Course Objectives: Student will be able to
1. **Classification** by coordinate system and control system.
2. **Acquire Knowledge** on Different types Power Sources and Sensors.
3. **Classification** of Manipulators, Actuators and Grippers.
4. **Acquire Knowledge** on kinematics and Applications of different Robots.

Course Outcomes: After completion of the course the student is able to:
1. **Acquire knowledge** on different types of Power Sources (actuators) and Sensors, Classification of Manipulators, Actuators and Grippers.
2. **Acquire knowledge** on different applications of various types of robots.
3. **Analyze** the direct and the inverse kinematic problems and calculate the manipulator dynamics.
4. Able to **identify** the applications of robots in different process operations.

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Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	1	-	-	-	1	-	-	1
CO2	3	3	2	2	1	-	-	-	1	-	-	1
CO3	3	3	2	2	1	-	-	-	1	-	-	1
CO4	3	3	2	2	1	-	-	-	1	-	-	1

UNIT - I:
Basic Concepts & Power Sources Fundamentals:
An over view of Robotics, classification of Robots, Robot Components, Robot degrees of freedom, Robot Joints, Robot Coordinates, Robot reference frames, Programming modes, Robot Characteristics.
Actuators:
Characteristics of activating system, comparison of activating system Hydraulic devices, Pneumatic devices, electric motors, magnetostrictive actuators.

UNIT - II:
Sensors, Manipulators and Grippers
Sensors: Sensors characteristics, Position sensors, velocity sensors, acceleration sensors, torque sensors, micro switches, lighten infrared sensors, touch and tactile sensors, proximity sensors, range finders.
Grippers: Robot end effectors, Classification, drive system for Gripper, Mechanical Grippers, Magnetic Grippers, Vacuum Grippers, Adhesive Grippers, Hooks, Scoops and other Miscellaneous Devices, Gripper force Analysis and Gripper Design, Active and passive Grippers.

UNIT - III:
Kinematics
Matrix representation of translational and Rotational motion – Homogeneous Transformation- DH representation of standard configuration Robots- Inverse Kinematics. Joint space vs. Cartesian space- Basics of Trajectory planning in joint and Cartesian space.

UNIT - IV:
Low level and high-level vision
Image acquisition, Illumination Techniques, Imaging Geometry, Some Basic Relationships between Pixels, Segmentation, Description, Segmentation and Description of 3-D Structures, Recognition, Interpretation.

UNIT V:
Robot Applications
Material Transfer and Machine loading/unloading: General Considerations in Robot Material Handling, Material Transfer application, Machine loading and unloading. Liquid handling and pumping.
Processing operations: Spot welding, Continuous Arc Welding, Spray Coating, other processing operations using Robots.
Assembly and Inspection: Assembly and Robot Assembly automation, Parts Presentation methods, Assembly operations, compliance and the Remote Center Compliance (RCC) Device, Assembly system configuration, Adaptable-Programmable assembly system, Designing for Robotic Assembly, Inspection Automation.

TEXT BOOKS:
1. Mikell. P, Weiss.G. M, Nage. I R. N and Odraj. N.G, ‖*Industrial Robotics"*, McGraw Hill Singapore, 1996.
2. Ghosh, ‖*Control in Robotics and Automation: Sensor Based Integration"*, Allied Publishers, Chennai, 1998.

REFERENCE BOOKS:
1. Deb. S. R, *Robotics technology and flexible Automation"*, John Wiley, USA 1992.
2. Asfahl. C.R, —*Robots and manufacturing Automation"*, John Wiley, USA 1992.
3. Klafter. R. D, Chimielewski. T. A, Negin. M, —*Robotic Engineering – An integrated approach"*, Prentice Hall of India, New Delhi, 1994.

EI831OE: BASICS OF VIRTUAL INSTRUMENTATION (OE – III)

B.Tech. IV Year II Semester

	L	T	P	C
	3	0	0	3

Course Objectives:
1. To develop virtual instruments for specific applications using LabVIEW software.
2. To ease the programming required to make computer interact with real world.
3. To analyze and display the throughput of any compactible system.
4. To provide knowledge on connections with third party software and hardware.

Course Outcomes: After completion of the course the student is able to:
1. Create Virtual Instrument using LabVIEW software for Control system, Signal Processing and Image processing applications.
2. Create effective Virtual Instrument that shall use minimum memory space and work effectively with any processor.
3. Interface the computer with DAQ to monitor, process and control real world applications
4. Analyze the throughput using the tools in LabVIEW software.

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	1	1	-	-	-	-	1	-	-	1
CO2	2	2	2	1	-	-	-	-	1	-	-	1
CO3	1	1	-	1	-	-	-	-	1	-	-	1
CO4	1	1	-	1	-	-	-	-	1	-	-	1

UNIT - I

An introduction Historical perspective, advantages, blocks diagram and architecture of a virtual instrument, data-flow techniques, graphical programming in data flow, comparison with conventional programming.

UNIT - II

VI programming techniques VIs and sub-VIs, loops and charts, arrays, clusters and graphs, case and sequence structures, formula nodes, local and global variables, string and file I/O, Instrument Drivers, mathscript.

UNIT - III

VI Interface requirements Common Instrument Interfaces: Current loop, RS 232C/ RS485, GPIB. Bus Interfaces: USB, PCMCIA, VXI, SCSI, PCI, PXI, Firewire. PXI system controllers, Ethernet control of PXI, VISA and IVI, Data Acquisition Hardware

UNIT - IV

Application of Virtual Instrumentation Application of Virtual Instrumentation: Instrument Control using RS-232C and IEEE488, Development of Virtual Instrument using GUI, Real-time systems, Embedded Controller, OPC, Active X programming, Publishing measurement data in the web.

UNIT - V

VI toolsets Distributed I/O modules, Control Design and Simulation, Digital Signal processing tool kit, Image acquisition and processing, Motion control

TEXT BOOKS:
1. Gary Johnson, LabVIEW Graphical Programming, Second edition, McGraw Hill, New York, 1997.
2. Lisa K. wells & Jeffrey Travis Prentice Hall, LabVIEW for everyone, New Jersey, 1997.

REFERENCE BOOKS:
1. Kevin James, PC Interfacing and Data Acquisition: Techniques for Measurement, Instrumentation and Control, Newnes, 2000.
2. Rick Bitter, LabVIEW advanced programming technique, 2nd Edition, CRC Press, 2005 3. Jovitha Jerome, Virtual Instrumentation using LabVIEW, 1st Edition, PHI, 2001.

EI832OE: ELECTRONICS FOR HEALTH CARE (OE - III)

B.Tech. IV Year II Semester   **L   T   P   C**
                                                                 3   0   0   3

Course Objective:
1. To provide knowledge on Health care data.
2. To demonstrate need of Electronics in Health Care.
3. To give basic knowledge on electronic equipments used in medical field.

Course Outcomes: Upon completion of this course, the students will be able to
1. Know about health care data and its conversion to information and to knowledge.
2. Acquire knowledge on (Electronic Health Records) EHRs and their Implementation.
3. Understand the working of electronic devices used for the patient monitoring.
4. Know the concepts of Telemedicine and therapeutic devices used inside the human body.

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	-	1	-	-	-	-	1	-	-	1
CO2	1	1	-	1	-	-	-	-	1	-	-	1
CO3	1	1	-	1	-	-	-	-	1	-	-	1
CO4	1	1	-	1	-	-	-	-	1	-	-	1

UNIT - I:
Health care data, Information and Knowledge: Definitions and Concepts, Converting Data to Information to Knowledge, Clinical Data Warehouses, What makes Health Informatics Difficult, Why Health IT fails Sometimes, Terminology of Analytics, Challenges to Data Analytics, Research and application of analytics, Role of Informatics in analytics.

UNIT - II:
Electronic Health Records: Introduction, Need for Electronic Health Records, Institute of Medicine's Vision for EHRs, Electronic Health Record Key Component, Electronic Prescribing, Electronic Health Record Adoption, Electronic Health Record Adoption and Meaningful use Challenges, Electronic Health Record Examples, Logical Steps to Selecting and Implementing an EHR

UNIT - III:
Patient Monitoring Systems: System Concepts, Cardiac Monitor, Bedside Patient Monitoring Systems, Central Monitors, Measurement of Heart Rate, Measurement of Pulse Rate, Blood Pressure Measurement, Measurement of Temperature, Measurement of Respiration Rate, Catheterization Laboratory Instrumentation.

UNIT - IV:
Biomedical Telemetry and Telemedicine: Wireless Telemetry, Single Channel Telemetry Systems, Multi-channel Wireless Telemetry Systems, Multi-patient Telemetry, Implantable Telemetry Systems, Transmission of Analog Physiological Signals, Over Telephone, Telemedicine.

UNIT - V:
Therapeutic devices: Need for Cardiac Pacemaker, Implantable Pacemakers, DC Defibrillator, Electronics in the Anaesthetic Machine.

TEXT BOOKS:
1. Robret E. Hoyt MD FACP "Health Informatics" sixth edition 2007.
2. R. S. Kandpur "Biomedical Instrumentation Technology and Applications" second edition Tata McGraw-Hill.

REFERENCE BOOKS:
1. Edward H. Shortlliffe, James J. Cimino "Biomedical Informatics, Computer applications in Health care and Biomedicine" third edition Springer.
2. G. V. R. K. Acharyulu, Bhimaraya Metri, L. Kalyan Viswanath REDDY "Health care and Hospital Management Contemporary Issues and Strategies".