Department of Instrument Technology

SCHEME OF INSTRUCTION & SYLLABUS

FOR

B.Tech Instrumentation Engineering

(With effect from 2021-22 Admitted Batch)

Department of Instrument Technology

AU College of Engineering

Andhra University

Visakhapatnam

ANDHRA UNIVERSITY

DEPARTMENT OF INSTRUMENT TECHNOLOGY, AUCE(A)

Scheme and syllabi (With effect from 2021-22 admitted batch)

PEOs, POs and PSOs of B.Tech. Programme in "Instrumentation Engineering"

Programme Educational Objectives (PEOs) UG ProgramB.Tech Instrumentation Engineering.

PEO.1.To provide students with a solid foundation in Mathematics, Engineering Sciences, Electronics andInstrumentation Engineering which prepares students for wide range of careeropportunities in Industries, Research field and in academics.

PEO.2.To train the students with good engineering breadth to comprehend, analyze, innovateand design new products in core and multidisciplinary domain, to provide technicalsolutions to real life problems and to render technical services to the needs of thesociety.

PEO.3. To provide students with an academic environment of excellence, proactiveness,leadership positions in multidisciplinary teams and lifelong learning for successfulprofessional career.

PEO.4. To inculcate professional and ethical attitude, creative, effective communication andpresentation skills and enhanced ability to work in teams to pursue complex, openended investigations and research.

PEO.5. To motivate students towards becoming entrepreneurs, collaborators and innovators,leading or participating in efforts to address social, technical and business challenges.

Programme Educational Objectives (PEOs) For Post Graduate (PG) ProgramM.Tech Instrumentation Engineering

The following Programme Educational Objectives are designed based on the department mission. The post-graduates of Instrumentation and Control Engineering should be able to:

1. Extract knowledge through literature survey, experimentation, expertise in research methodology, technique and tools.
2. Utilize, expertise in designing and analysing complex and real life problems that are techno-economically and socially sustainable.
3. Demonstrate professional ethics and commitment to organizational goals.
4. Demonstrate Leadership and team work while working with diverse multi-disciplinary/interdisciplinarygroups.

5. Exhibit sustained learning and adaptation to modern engineering tools, techniques and practices through instruction, group activity and self-study.

Programme Outcomes (POs) Of UG Program.

PO1. Knowledge of Basic Sciences:

The students shall be able to apply the principles of Basic Sciences and Mathematical skills inlearning in Basic Engineering subjects. The knowledge gained thus enables the students toapply them in learning the core branch i.e. Instrumentation Engineering.

PO2. Computational Skills:

The students shall acquire Analytical Thinking; Problem solving abilities, get exposure to themodern computational procedures and apply them in the core Instrumentation Engineering.

PO3. Design and Development of Solutions:

The background knowledge gained, the Analytical and computational skills acquired by thestudents shall enable the students to apply them in the core Instrumentation Engineering todesign Electronic circuits, highly sensitive sensor networks for monitoring and control ofvarious physical, chemical, and Industrial parameters and processes.

PO4. Conduct of Investigations into Complex Problems:

The students shall be able to apply the knowledge and adopt research methodologies for themodernization of existing designs of Instruments, design sophisticated instrumentation systemsinterfaced to dedicated embedded controllers or High-end computers. They shall be able toAcquire, Analyze, Interpret and Control any complex processes or problems in Industry andR&D.

PO5. Usage of Modern Tools:

The students gain expertise in the utilization of modern software tools like C, JAVA, Multisim,Signal and Image processing tools for applications in communications, Biomedical (ECG, EEG,MRI) etc. Hardware gadgets like the Digital Storage Oscilloscopes, Function Generators,Spectrum Analyzers; and ultra-sensitive instruments like the UV-VIS and Infra-Red Spectrophotometers, Chromatographs, Process control stations etc. for applications in Industry andR&D.

PO6. Engineers and Society:

The students of Instrumentation engineering should be motivated to utilize their Scientific, Technological, Computational and Instrumentation skills for the better addressing the societal needs. Designnewsophisticated instruments for the high-end Research and Process Industries,Pharmaceutical and Bio-medical fields. They should also utilize their expertise to develop indigenoustechnologies, instruments, gadgets, affordable by common people. Design inexpensivehealthcare systems and extend the same to the remote areas through telemedical network systemmaking use of Satellite facility.

PO7. Environment and Sustainability:

Instrumentation Engineering is a multi-disciplinary branch. The students shall be motivated toutilize their knowledge for design of highly sensitive and low energy consumption, lowradiation emitting, lowerenvironment polluting instruments, operating on renewable energysources and implement all such measures to sustain the quality of the environment.

PO8.Ethics:

The students are motivated to follow a code of ethics and moral perspectives at the individuallevel as well as professional level to protect the interests of all the stakeholders, with aconcern for societalresponsibilities.

PO9. Individual and Team work:

Communication skills, Aptitude development programs, Team activities like SPIKES National level workshops/ SeminarPresentations etc. contribute greatly for the development of individual talents/skills.Involvement in Professional, Cultural, Sports activities provided in the institute shall alsodevelop capabilities of a student to mould oneself as an Individual member, Team leader or anOrganizer.

PO10. Communication Skills:

The intensity of inputs (Listening, Speaking, Reading and Writing Skills) inputs and trainingsimparted through all these activities, the students shall acquire excellent communication skillsboth oralas well as writing skills. They shall be able to transform their innovative ideas intoexcellent technical reports forpresentation or publication in seminars and journals.

PO11. Project Management and Finance:

The students shall be able to conceptualize ideas, formulate projects, visualize their executionand realize final product. The students shall demonstrate the skills required for drafting ofproposals for projects with thorough understanding of the procurement plans (materials,software, hardware), project management and financial allocations and management during theexecution of the project.

PO12. Life-Long learning:

The students shall be motivated to keep themselves in-tune with the contemporary changes intechnological processes through life-long learning and contribute their expertise for the benefitof the current stake holders and the society.

Program Specific Outcomes (PSOs) of UG Program

PSO.1. Specify, design, prototype and test Instrumentation systems that perform processing as peruser requirements using contemporary devices and technology.

PSO.2. Develop hardware and software tools/ programs used in industrial and otherautomation systems.

PSO.3. Inculcate comprehensive education in Instrumentation engineering to ensure core competency in Instrumentation, Control and Automation.

PSO.4. Conduct themselves in a responsible, professional and ethical manner supporting sustainable economic development which enhances the quality of life.

Program Specific Outcomes (PSOs) For PGProgram In Instrumentation and Control Engineering

1.Apply knowledge to design, analyze and synthesize problems related to Instrumentation and Control Engineering.

2. To evolve innovative solutions for real-time and industrial problems using skills, modern tools and recent technologies.

B.Tech & B.Tech+M.Tech
I Year - I Semester

Course code	Category	Course Title	Hours per week		Internal Marks	External Marks	Total Marks	Credits
			L	P				
IN 1101	BS	Maths – I	4	0	30	70	100	3
IN 1102	BS	Physics	4	0	30	70	100	3
IN 1103	ES	Engg .Graphics	2	3	30	70	100	3
IN 1104	ES	Electronic Devices & Circuits	4	0	30	70	100	3
IN 1105	ES	Material Science	4	0	30	70	100	3
IN 1106	ES	Workshop	0	3	50	50	100	1.5
IN 1107	BS	Physics Lab	0	3	50	50	100	1.5
IN 1108	ES	Electronic Devices & Circuits Lab	0	3	50	50	100	1.5
Total Credits								**19.5**

B.Tech & B.Tech+M.Tech
I Year - II Semester

Course code	Category	Course Title	Hours per week		Internal Marks	External Marks	Total Marks	Credits
			L	P				
IN 1201	BS	Maths – II	4	0	30	70	100	3
IN 1202	BS	Chemistry	4	0	30	70	100	3
IN 1203	HSS	English	4	0	30	70	100	3
IN 1204	ES	CPNM	4	0	30	70	100	3
IN 1205	ES	Analog Electronic Circuits	4	0	30	70	100	3
IN 1206	HSS	English Language Lab	0	3	50	50	100	1.5
IN 1207	BS	Chemistry Lab	0	3	50	50	100	1.5
IN 1208	ES	CPNM Lab	0	3	50	50	100	1.5
Total Credits								**19.5**

B.Tech & B.Tech+M.Tech
II Year - I Semester

Course code	Category	Course Title	Hours per week		Internal Marks	External Marks	Total Marks	Credits
			L	P				
IN 2101	BS	Maths III	4	0	30	70	100	3
IN 2102	PC	Strength of Materials &Theory of Machines	4	0	30	70	100	3
IN 2103	PC	Electrical Machines	4	0	30	70	100	3
IN 2104	PC	Sensors & Transducers	4	0	30	70	100	3
IN 2105	HSS	Managerial Economics	4	0	30	70	100	3
IN 2106	PC	Analog electronic circuits LAB	0	3	50	50	100	1.5
IN 2107	PC	Transducers LAB	0	3	50	50	100	1.5
IN 2108	PC	Electrical machines LAB	0	3	50	50	100	1.5
IN 2109	SC	Object Oriented Programming through C++	1	2	50	50	100	2
IN 2110	MC	Professional Ethics& Universal Human values	0	0	-	100	100	0
IN 2111	MC	NCC/NSS	0	2	-	-	-	0
Total credits								**21.5**

B.Tech & B.Tech+M.Tech
II Year - II Semester

Course code	Category	Course Title	Hours per week		Internal Marks	External Marks	Total Marks	Credits
			L	P				
IN 2201	BS	Maths IV	4	0	30	70	100	3
IN 2202	PC	Electrical Measurements and Measuring Instruments	4	0	30	70	100	3
IN 2203	PC	Signals and Systems	4	0	30	70	100	3
IN 2204	PC	Op amps and linear IC's	4	0	30	70	100	3
IN 2205	PC	Digital logic design	4	0	30	70	100	3
IN 2206	PC	DLD lab	0	3	50	50	100	1.5
IN 2207	PC	Electrical measurements lab	0	3	50	50	100	1.5
IN 2208	SC	MATLAB Skills	1	2	50	50	100	2
IN 2209	MC	Environmental Sciences	0	0	-	100	100	0
Total credits								**20**
Summer Internship(Community Service)								

B.Tech & B.Tech+M.Tech
III Year - I Semester

Course code	Category	Course Title	Hours per week		Internal Marks	External Marks	Total Marks	Credits
			L	P				
IN 3101	PC	Control Systems	4	0	30	70	100	3
IN 3102	PC	Microprocessors and Microcontrollers	4	0	30	70	100	3
IN 3103	PC	Industrial Instruments	4	0	30	70	100	3
IN 3104	PE	PE-I	4	0	30	70	100	3
IN 3105	OE	OE-I	4	0	30	70	100	3
IN 3106	PC	Industrial Instruments Lab	0	3	50	50	100	1.5
IN 3107	PC	Control Systems Lab	0	3	50	50	100	1.5
IN 3108	SC	LABVIEW	1	2	50	50	100	2
Summer Internship 2 Months (Mandatory) after 2nd year (to be evaluated during III Year I Semester)			0	0	50	50	100	2
							Total Credits	22

B.Tech & B.Tech+M.Tech
III Year - II Semester

Course code	Category	Course Title	Hours per week		Internal Marks	External Marks	Total Marks	Credits
			L	**P**				
IN 3201	PC	Digital Signal Processing	4	0	30	70	100	3
IN 3202	PC	Process Control and Control components	4	0	30	70	100	3
IN 3203	PC	Biomedical Instrumentation	4	0	30	70	100	3
IN 3204	PE	PE-II	4	0	30	70	100	3
IN 3205	OE	OE-II	4	0	30	70	100	3
IN 3206	PC	Microprocessors Lab	0	3	50	50	100	1.5
IN 3207	PC	Process control Lab	0	3	50	50	100	1.5
IN 3208	PC	Bio-medical Instrumentation Lab	0	3	50	50	100	1.5
IN 3209	SC	Python Programming	1	2	50	50	100	2
	Industrial / Research Internship 2 months							
							Total Credits	**21.5**

B.Tech & B.Tech+M.Tech
IV Year - I Semester

Course code	Category	Course Title	Hours per week		Internal Marks	External Marks	Total Marks	Credits
			L	P				
IN 4101	PE	PE-III	4	0	30	70	100	3
IN 4102	PE	PE-IV	4	0	30	70	100	3
IN 4103	PE	PE-V	4	0	30	70	100	3
IN 4104	OE	OE-III	4	0	30	70	100	3
IN 4105	OE	OE-IV	4	0	30	70	100	3
IN 4106	HSS	Industrial Management and entrepreneurship	4	0	30	70	100	3
IN 4107	SC	VHDL Programming	1	2	50	50	100	2
Industrial / Research Internship 2 months (Mandatory) after 3rd year (to be evaluated during IV Year I Semester)			0	0	50	50	100	2
							Total Credits	**22**

B.Tech & B.Tech+M.Tech
IV Year - II Semester

Course code	Category	Course Title	Hours per week		Internal Marks	External Marks	Total Marks	Credits
			L	P				
IN 4201	PROJ	Project work, Seminar and Internship in Industry	0	0	100	100	200	14
Internship (6 Months)								
							Total Credits	**14**

SA **:** Skill Advanced
SI **:** Skill Interdisciplinary
OE/JOE **:** Open Elective / Job Oriented Elective

PROFESSIONAL ELECTIVES

1. Electronics instrumentation
2. Advanced sensors
3. Analog signal processing
4. Power plant Instrumentation
5. Steel Plant Instrumentation
6. Industrial safety Instruments
7. Instrumental communication & Networks
8. VLSI
9. Fundamentals of Nano sensors
10. Computer Control processes
11. Advanced control theory
12. Robotics and computer control components
13. Design of Instrument Systems
14. IOT sensors and Devices
15. Micro and Nano Sensors

OPEN ELECTIVES

1. Industrial electronics
2. Artificial Intelligence
3. Digital Image processing
4. Computer Organization and Architecture
5. Virtual Instrumentation
6. Programmable control systems
7. Telemetry
8. Fibre optics & Laser Instrumentation
9. Communication systems
10. Analytical Instruments
11. Advanced sensing techniques
12. Non-destructive testing

IN 1101
MATHEMATICS-I

Course Objectives:

- To transmit the knowledge of Partial differentiation.
- To know of getting maxima and minima of function of two variables and finding errors and approximations.
- To evaluate double and triple integrals, volumes of solids and area of curved surfaces.
- To expand a periodical function as Fourier series and half-range Fourier series.

Course Outcomes:

- Find the partial derivatives of functions of two or more variables.
- Evaluate maxima and minima, errors and approximations.
- Evaluate double and triple integrals, volumes of solids and area of curved surfaces.
- To expand a periodical function as Fourier series and half-range Fourier series.
- Have a fundamental understanding of Fourier series and be able to give Fourier expansions of a given function.

SYLLABUS

(Partial Differentiation)

Introduction - Functions of two or more variables - Partial derivatives - Homogeneous functions – Euler's theorem - Total derivative - Change of variables – Jacobins. Mean value Theorems (without proofs)

(Applications of Partial Differentiation)

Geometrical interpretation -Tangent plane and Normal to a surface -Taylor's theorem for functions of two variables - Errors and approximations -Total differential. Maxima and Minima of functions of two variables - Lagrange's method of undetermined multipliers - Differentiation under the integral Sign - Leibnitz's rule.

(Multiple Integrals)

Introduction - Double Integrals - Change of Order of Integration - Double Integrals in Polar Coordinates - Triple Integrals - Change of Variables.

(Multiple Integrals-Applications)

Area enclosed by plane curves - Volumes of solids - Area of a curved surface - Calculation of Mass - Center of gravity - Moment of inertia - product of inertia – principal axes- Beta Function - Gamma Function - Relation between Beta and Gamma Functions. Error Function or Probability Integral.

(Fourier Series)

Introduction - Euler's Formulae - Conditions for a Fourier Expansion - Functions having points of discontinuity - Change of Interval - Odd and Even Functions - Expansions of Odd or Even Periodic Functions, Half-Range Series - Parseval's Formula. Practical Harmonic analysis.

TEXT BOOK:

Scope and Treatment as in "Higher Engineering Mathematics", by Dr. B.S. Grewal, 43rd Edition, Khanna publishers.

REFERENCE BOOKS:

1. Graduate Engineering Mathematics by V B Kumar Vatti., I.K.International publishing house Pvt. Ltd.
2. Advanced Engineering Mathematics by Erwin Kreyszig.
3. A text book of Engineering Mathematics, by N.P. Bali and Dr. Manish Goyal, Lakshmi Publications.
4. Advanced Engineering Mathematics by H.K. Dass. S. Chand Company.
5. Higher Engineering Mathematics by B.V. Ramana, Tata Mc Graw Hill Company.
6. Higher Engineering Mathematics by Dr. M.K.Venkataraman.

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IN 1102
PHYSICS

Course Objectives:

- To impart knowledge in basic concept of physics of Thermodynamics relevant to engineering applications.
- To grasp the concepts of physics for electromagnetism and its application to engineering. Learn production of Ultrasonics and their applications in engineering.
- To Develop understanding of interference, diffraction and polarization: connect it to a few engineering applications.
- To Learn basics of lasers and optical fibers and their use in some applications.
- To Understand concepts and principles in quantum mechanics and Nanopahse Materials. Relate them to some applications.
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Course Outcomes:

- Understand the fundamentals of Thermodynamics and Laws of thermodynamics. Understand the working of Carnot cycle and concept of entropy.
- Gain Knowledge on the basic concepts of electric and magnetic fields. Understand the concept of the nature of magnetic materials. Gain knowledge on electromagnetic induction and its applications .
- Understand the Theory of Superposition of waves. Understand the formation of Newton's rings and the working of Michelson's interferometer. Remember the basics of diffraction, Evaluate the path difference. Analysis of Fraunhofer Diffraction due to a single slit
- Understand the interaction of matter with radiation, Characteristics of Lasers, Principle, working schemes of Laser and Principle of Optical Fiber. Realize their role in optical fiber communication.
- Understand the intuitive ideas of the Quantum physics and understand dual nature of matter. Compute Eigen values, Eigen functions, momentum of Atomic and subatomic particles using Time independent one Dimensional Schrodinger's wave equation. Understand the fundamentals and synthesis processes of Nanophase materials.

SYLLABUS

THERMODYNAMICS

Introduction, Heat and Work, First law of thermodynamics and applications, Reversible and Irreversible process, Carnot cycle and Efficiency, Second law of thermodynamics, Carnot's Theorem, Entropy, Second law in terms of entropy, Entropy and disorder, Third law of thermodynamics (statement only).

ELECTROMAGNETISM

Concept of electric flux, Gauss's law - some applications, Magnetic field - Magnetic force on current, torque on current loop, The Biot-Savart's Law, B near a long wire, B for a circular Current loop, Ampere's law, B for a solenoid, Hall effect, Faraday's law of induction, Lenz's law, Induced magnetic fields, Displacement current, Maxwell's equations (no derivation), Magnetic materials: Classification of magnetic materials and properties.

Ultrasonics : Introduction, Production of Ultrasonics – Piezoelectric and Magnetostriction methods, acoustic grating, applications of ultrasonics.

OPTICS

Interference: Principles of superposition – Young's Experiment – Coherence - Interference in thin films (reflected light), Newton's Rings, Michelson Interferometer and its applications.

Diffraction: Introduction, Differences between interference and diffraction, Fresnel and Fraunhofer diffraction, Fraunhofer diffraction at a single slit **(**Qualitative and quantitative treatment**)**.

Polarisation: Polarisation by reflection, refraction and double refraction in uniaxial crystals, Nicol prism, Quarter and Half wave plate, circular and elliptical polarization.

LASERS and FIBRE OPTICS

Introduction, characteristics of a laser beam, spontaneous and stimulated emission of radiation, population inversion, Ruby laser, He-Ne laser, Semiconductor laser, applications of lasers

Introduction to optical fibers, principle of propagation of light in optical fibers, Acceptance Angle and cone of a fibre, Numerical aperture, Modes of propagations, classification of fibers, Fibre optics in communications, Application of optical fibers.

MODERN PHYSICS

Introduction, De Broglie concept of matter waves, Heisenberg uncertainty principle, Schrodinger time independent wave equation, application to a particle in a box. Free electron theory of metals, Kronig - Penney model (qualitative treatment), Origin of energy band formation in solids, Classification of materials into conductors, semi conductors and insulators.

Nanophase Materials

Introduction, properties, Top-down and bottom up approaches, Synthesis - Ball milling, Chemical vapour deposition method , sol-gel methods, Applications of nano materials.

TEXT BOOKS :

1. Physics by David Halliday and Robert Resnick – Part I and Part II **-** Wiley.
2. A textbook of Engineering Physics, Dr. M. N. Avadhanulu, Dr. P.G. Kshirsagar - S. Chand
3. Engineering Physics by R.K. Gaur and S.L. Gupta –Dhanpat Rai

Reference Books:

1. Modern Engineering Physics by A.S. Vadudeva
2. University Physics by Young and Freedman

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IN 1103
ENGINEERING GRAPHICS

Course Objectives:

- Understand the basics of Engineering Graphics and BIS conventions.
- Develop the graphical skills for communication of concepts, ideas and design of engineering products through technical drawings
- Demonstrate and practice the various profiles/curves used in engineering practice through standard procedures.
- Demonstrate and practice the orthographic projections of points, lines, planes, solids and section of solids
- Demonstrate and practice the development of surfaces of simple solids
- Familiarize the basic concept of isometric views clearly.

Course Outcomes:

- Develop simple engineering drawings by considering BIS standards.
- Able to draw different engineering curves with standard Procedures
- Comprehend the basics of orthographic projections and deduce orthographic projections of points, lines, planes and solids at different orientations in real life environment.
- Visualize clearly the sections of solids.
- Apply the concepts of development of surfaces while designing/analyzing any product.
- Recognize the significance of isometric drawing to relate 2D environment with 3D environment.

SYLLABUS

Introduction: Lines, Lettering and Dimensioning, Geometrical Constructions, and Scales.
Curves: Conic sections: General construction of ellipse, parabola and hyperbola. Construction of involutes of circle and polygons only. Normal and tangent to curves.

Projections of Points: Principal or Reference Planes, Projections of a point situated in any one of the four quadrants.

Projections of Straight Lines: Projections of straight lines parallel to both reference planes, perpendicular to one reference plane and parallel to other reference plane, inclined to one reference plane and parallel to the other reference plane.

Projections of Straight Line Inclined to Both the Reference Planes: Projections of Planes: Projection of Perpendicular planes: Perpendicular to both reference planes, perpendicular to one reference plane and parallel to other reference plane and perpendicular to one reference plane and inclined to other reference plane. Projection of Oblique planes. Introduction to Auxiliary Planes.

Projections of Solids: Types of solids: Polyhedra and Solids of revolution. Projections of solids in simple positions: Axis perpendicular to horizontal plane, Axis perpendicular to vertical plane and Axis parallel to both

the reference planes, Projection of Solids with axis inclined to one reference plane and parallel to other and axes inclined to both the reference planes.

Sections of Solids: Perpendicular and inclined section planes, Sectional views and True shape of section, Sections of solids (Prism, Pyramid, Cylinder and Cone) in simple position only.

Development of Surfaces: Methods of Development: Parallel line development and radial line development. Development of a cube, prism, cylinder, pyramid and cone.

Isometric Views: Isometric projection, Isometric scale and Isometric view. Isometric view of Prisms, Pyramids, cylinder, cone, and their combinations.

Text Book:
Elementary Engineering Drawing by N.D.Bhatt, Charotar Publishing House.

Reference:
Engineering Graphics by K.L. Narayana and P. Kannaiah, Tata Mc-Graw Hill

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IN 1104
ELECTRONIC DEVICES AND CIRCUITS

Course Objectives:

- This course gives an overview of carrier transport phenomena in semiconductors, characteristics and applications of semiconductor devices like P-N junction diode,
- Bipolar Junction transistor (BJT), Field Effect Transistors (FET), Metal oxide Semiconductor Field Effect Transistor (MOSFET) and various special devices.
- Emphasis is placed on analysis, selection and proper biasing of transistors like BJT and FET.

Course Outcomes:

- At the end of the course, the student will be able to Remember the transport phenomena of charge carriers in semiconductors.
- Understand the operation of Diode, BJT and FET.
- Apply different types of filters in AC and DC conversion.
- Analyze the different types of diodes, operation and its characteristics.
- Evaluate the different biasing techniques used in BJT and FET.

SYLLABUS

Semiconductor Physics: Energy band theory of crystals, conductors, insulators, semiconductors, mobility and conductivity, energy distribution of electrons, electrons and holes in a Intrinsic semiconductors, conductivity of semiconductor, carrier concentration in Intrinsic semiconductors, donor and acceptor impurities, mass action law, charge densities in a semiconductor with impurities, Fermi level in semiconductor with impurities, diffusion, carrier life time, continuity equation, hall effect.

Semiconductor Diode Characteristics: Qualitative theory of p-n junction, p-n junction as a diode, band structure of an open circuited p-n junction, current components in a diode, qualitative theory of diode currents, Volt-Ampere characteristics , temperature dependence of a diode characteristics, diode resistance, diode capacitance, transition and diffusion capacitances.

Rectifiers: Half wave rectifier, Full wave rectifier with center tap transformer and Bridge circuit –Derivation of DC, RMS currents and voltages, Ripple factor, Efficiency, Peak inverse voltage , Transformer utilization factor and percentage regulation. Rectifiers using filters: Inductive filter, capacitive filter, L-section filter, Pi filter.

Bipolar Junction Transistor (BJT) : Introduction to three terminal devices, BJT construction, types and different regions of operations, Transistor as an amplifier. Transistor current components-Emitter efficiency, Transport factor, Large Signal current gain, input and output characteristics of transistor in common base, common emitter and common collector configurations, relation between alpha, beta and gamma, base width modulation, Ebers-Moll Model.

Field Effect Transistors (FET): Comparison between FET and BJT, Classification of FET, Construction, operation, Drain and Transfer characterstics of JFET and MOSFET.

TEXT BOOKS

1. Jacob Milliman Christos C Halkias, “Electriionic Devices and Circuits,” Tata Mcgraw Hill Publishers, New Delhi.
2. Bes Streetman and Sanjay Banerjee,” Solid State Electronic Devices,” Prentice Hall

IN 1105
MATERIAL SCIENCE

Course Objectives:

- An introduction to the mechanical properties of metals and physical properties is explained.
- Gives the beginning student an appreciation of recent developments in materials science & engineering within the framework of this class. To review physics and chemistry in the context of materials science & engineering. To describe the different types of bonding in solids.
- The meaning of phases, and the different types of phase transformations. How to interpret a binary phase diagram, especially the compositions and fractions of equilibrium phases according to the lever rule.
- The meaning and use of time-temperature-transformation diagrams. The crystal structures for common metals and semiconductors. To give knowledge about semiconductor physics, charge carriers and energy band diagrams. It discusses working and applications of basic devices, including p-n junctions.
- Magnetic Materials and Dielectric materials, their applications which discusses the principles and concepts behind magnetic materials and dielectric materials. It explains their applications in the fields of physics and engineering.
- The powder metallurgy process provides a host of advantages over competing metalworking technologies.

Course Outcomes:

- An ability to apply knowledge of mathematics, science and engineering, to understand different materials and their properties.
- Given a type of material, be able to qualitatively describe the bonding scheme and its general physical properties, strength as well as possible applications.
- Given a binary phase diagram microstructures obtained by suitable thermal treatments. An ability to identify the phases and their interrelationship in different alloy systems.
- An ability to design a system, component or process to meet desired needs within, realistic constraints such as economic, safety, manufacturability and sustainability etc.., while selecting a material to manufacture the designed components.
- Powder metallurgy processes add up to part-to-part uniformity for improved product quality, shape and material flexibility, application versatility, and cost effectiveness, types and manufacturing of composite materials. An ability to use modern techniques, skills, and engineering tools appropriate to materials research and engineering.

SYLLABUS

MECHANICAL PROPERTIES: Definitions of mechanical properties, Tensile Testing, Impact Testing, Hardness Tests- Brinell, Vickers and Rockwell tests, Plastic deformation.

EQUILIBRIUM DIAGRAMS: Phase rule-binary Alloy systems-Solid Solutions-Eutectic-Peritectic-Meritect-Entectoid systems-The Lever Rule, IRON-CARBON Diagram.

MAGNETIC MATERIALS : Types of magnetic materials, Ferromagnetism and related Phenomena- Domain structure-Hysteresis Loop- Soft and Hard magnetic materials.

DIELECTRIC MATERIALS : Dielectric materials, Polarization, Types of Polarization, Temperature and Frequency effects on polarization, Dielectric loss, Dielectric Breakdown- Ferro Electric materials.

SEMICONDUCTORS: Intrinsic and Extrinsic semiconductors-different types of extrinsic semi conducting ma-Energy band diagrams- Fermi energy level and P-N junction diode, Homojunction and Heterojunction

POWDER METALLURGY: Steps in Powder Metallurgy Processes- Powder production, Compaction, Sintering, & Secondary operations

TEXTBOOKS:

1. Material Science and Engineering by V.Raghavan-prentice Hall of India, New Delhi.
2. Testing of Metallic Materials by A.V.K.SuryaNarayana, Prentice Hall of India.

REFERENCE BOOKS:

1. Introduction to Material science for Engineers by J.F.Shackelford, Macmillan publishing Co., New York
2. Semiconductor and Electronic devices, Adir Bar-Lev, Prentice Hall of India, New Delhi.
3. Practical Experimental Metallurgy by D.Eurof Davies, Elsevier Publishing Co. Ltd. London

IN 1106
WORKSHOP LAB

Course Objectives:

- Get hands on experience with the working skills in Carpentry trade.
- Know how to work with Sheet Metal tools.
- Get familiar with the working skills of Metal Fitting operations.
- Get hands on experience with house hold electrical wiring.

Course Outcomes:

- Can be able to work with Wood Materials in real time applications.
- Can be able to build various parts with Sheet Metal in day-to-day life.
- Can be able to apply Metal Fitting skills in various applications.
- Can be able to apply this knowledge to basic house electrical wiring and repairs.

SYLLABUS

Carpentry: Any three jobs from – Half lap joint, Mortise and Tenon joint, Half – lap Dovetail joint, Corner Dovetail joint, Central Bridle joint.
Sheet Metal: Any three jobs from – Square tray, Taper tray(sides), Funnel, Elbow pipe joint.
Fitting: Any three jobs from – Square, Hexagon, Rectangular fit, Circular fit and Triangular fit.
House wiring: Any three jobs from – Tube light wiring, Ceiling fan wiring, Stair-case wiring, Corridor wiring.

References:

1. Elements of workshop technology, Vol.1 by S. K. and H. K. Choudary.
2. Work shop Manual / P.Kannaiah/ K.L.Narayana/ SciTech Publishers.
3. Engineering Practices Lab Manual, Jeyapoovan, Saravana Pandian, 4/e Vikas.

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IN 1107
PHYSICS LAB

Course Objectives:

- To enable the students to acquire skill, technique and utilization of the Instruments
- Draw the relevance between the theoretical knowledge and to imply it in a practical manner with respect to analyze various electronic circuits and its components.
- To impart the practical knowledge in basic concepts of Wave optics, Lasers and Fiber optics.
- To familiarize the handling of basic physical apparatus like Vernier callipers, screw gauge, spectrometers, travelling microscope, laser device, optical fibre, etc.

Course Outcomes:

- Ability to design and conduct experiments as well as to analyze and interpret
- Ability to apply experimental skills to determine the physical quantities related to Heat, Electromagnetism and Optics
- The student will learn to draw the relevance between theoretical knowledge and the means to imply it in a practical manner by performing various relative experiments.

SYLLABUS

1. Determination of Radius of Curvature of a given Convex Lens By forming Newton's Rings.
2. Determination of Wavelength of Spectral Lines in the Mercury Spectrum by Normal Incidence method.
3. Study the Intensity Variation of the Magnetic Field along axis of Current Carrying Circular Coil.
4. Determination of Cauchy's Constants of a Given Material of the Prism using Spectrometer.
5. Determination of Refractive Index of Ordinary ray μ_o and Extraordinary μ_e ray.
6. Determination of Thickness Given Paper Strip by Wedge Method.
7. Calibration of Low Range Voltmeter.
8. Calibration of Low Range Ammeter.
9. Determination of Magnetic Moment and Horizontal Component of Earth's Magnetic Field.
10. Lees Method - Coefficient of thermal Conductivity of a Bad Conductor.
11. Carey Foster's Bridge – Verification of laws of Resistance and Determination Of Specific Resistance.
12. Melde's Apparatus – Frequency of electrically maintained Tuning Fork.
13. Photoelectric cell-Characteristics.
14. Planks Constants.
15. Laser- Diffraction.

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IN 1108

Electronic Devices and Circuits Laboratory

Course Objective:

- The course gives an overview of basic lab equipments like CRO, Function generators, calculation of basic semiconductor device parameters from their VI characteristics and application of P-N junction diodes in rectifier circuits.

Course Outcomes:

- At the end of the curse, the student will be able to
- Understand the operation of regulated power supplies, Function generators and CRO.
- Analyze the characteristics of different electronic devices such as diodes and transistors.
- Design the rectifier circuits.

Lab Experiments

1. Study of functionality of basic devices and lab equipment.
2. Measurement of signal characteristics using CRO
3. P-N Junction diode Volt- Ampere characteristics
4. Zener diode Volt – Ampere characteristics
5. Half wave rectifier with out filters
6. Half wave rectifier with capacitor and inductor filters
7. Full wave rectifier with out filters
8. Full wave rectifier with capacitor and inductor filters
9. Bridge rectifier with out and with filters.
10. Transistor characteristics under CB configuration
11. Transistor characteristics under CE configuration
12. Transistor characteristics under CC configuration
13. Drain and Transfer characteristics of Field effect Transistor
14. Study of Low pass filter
15. Study of high pass filter

IN 1201
MATHEMATICS – II

Course Objectives:

- The way of obtaining rank, eigen values and eigen vectors of a matrix.
- To know the importance of Cayley-Hamilton theorem and getting canonical form from a given quadratic form.
- To solve the system of equations by using direct and indirect methods.
- To solve first order and higher order differential equations by various methods.
- To obtain the Laplace transforms and inverse Laplace transforms for a given functions and their applications.

Course Outcomes:

- Find rank, eigen values and eigen vectors of a matrix and understand the importance of Cayley-Hamilton theorem.
- Reduce quadratic form to canonical forms and solving linear systems by direct and indirect methods.
- Demonstrate solutions to first order differential equations by various methods and solve basic applications problems related to electrical circuits, orthogonal trajectories and Newton's law of cooling
- Discriminate among the structure and procedure of solving higher order differential equations with constant and variable coefficients.
- Understand Laplace transforms and its properties and finding the solution of ordinary differential equations.

SYLLABUS

(Linear Algebra)

Rank of a matrix- Echelon form, Normal Form - Solution of Linear System of Equations - Consistency of Linear System of Equations - Direct & Indirect Methods: Gauss elimination method, LU Factorization method, Gauss Seidal Method. Complex Matrices: Hermitian, Skew-Hermitian and Unitary Matrices and their Properties.

(Eigen Values and Eigen Vectors)

Eigen Values and Eigen Vectors of a Matrix - Cayley-Hamilton theorem - Inverse and Powers of a Matrix using Cayley-Hamilton's theorem and its applications. Diagonalization of a Matrix - Quadratic Forms - Reduction of Quadratic Form to Canonical Form - Nature of a Quadratic Form.

(Ordinary Differential Equations of First Order and its Applications)

Formation of ordinary differential equations (ODEs) - Solution of an ordinary differential equation - Equations of the first order and first degree - Linear differential equation - Bernoulli's equation - Exact differential equations - Equations reducible to exact equations - Orthogonal Trajectories - Simple Electric (LR & CR) Circuits - Newton's Law of Cooling - Law of Natural growth and decay.

(Differential Equations of Higher Order)

Solutions of Linear Ordinary Differential Equations with Constant Coefficients - Rules for finding the complimentary function - Rules for finding the particular integral - Method of variation of parameters - Cauchy's linear equation - Legendre's linear equation - Simultaneous linear differential equations.

(Laplace Transforms)

Introduction - Existence Conditions - Transforms of Elementary Functions - Properties of Laplace Transforms - Transforms of Derivatives - Transforms of Integrals - Multiplication by t^n - Division by t – Evaluation of integrals by Laplace Transforms - Inverse Laplace Transform - Applications of Laplace Transforms to Ordinary Differential Equations - Simultaneous Linear Differential Equations with Constant Coefficients - Second Shifting Theorem - Laplace Transforms of Unit Step Function, Unit Impulse Function and Laplace Transforms of Periodic Functions.

TEXT BOOK:

Scope and Treatment as in "Higher Engineering Mathematics", by Dr. B.S. Grewal, 43r^d edition, Khanna publishers.

REFERENCE BOOKS:

7. Graduate Engineering Mathematics by V B Kumar Vatti., I.K. International publishing house Pvt. Ltd.
1. Advanced Engineering Mathematics by Erwin Kreyszig.
2. A text book of Engineering Mathematics, by N.P. Bali and Dr. Manish Goyal. Lakshmi Publications.
3. Advanced Engineering Mathematics by H.K. Dass. S. Chand Company.
4. Higher Engineering Mathematics by B.V. Ramana, Tata Mc Graw Hill Company.

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IN 1202
CHEMISTRY

Course Objectives:

- To apply the basic knowledge of Chemistry to the Engineering Discipline.
- To develop knowledge about water and its treatment for industrial and potable purposes.
- To develop understanding in the areas of Polymers, Mechanism of Corrosion of Metals and Corrosion Control Methods, Fuels, Lubricants and Nanomaterials for of conducting polymers, bio-degradable polymers and fiber reinforced plastics and apply the knowledge for solving existing challenges faced in various engineering and societal areas.

Course outcome:

- This course applies the basic concepts and principles studied in Chemistry to Engineering.
- It provides an application of chemistry to different branches of engineering
- The students will be able acquire knowledge in the areas of Water Chemistry,Polymers, Corrosion, Fuels and Lubricants and nanomaterials and suggest innovative solutions for existing challenges in these areas.

SYLLABUS

Water Chemistry

Sources of Water – Impurities and their influence of living systems – WHO Limits – Hardness and its Determination – Boiler Troubles and their removal – Water Softening Methods – Lime-Soda, Zeolite and Ion Exchange - Municipal Water Treatment-Break Point Chlorination – Desalination of Sea Water – Reverse Osmosis Method, Electro-dialysis.

Polymers and Plastics

Polymers: Definition – Types of Polymerization (Addition & Condensation) – Mechanisms of Addition Polymerization – Radical and Ionic – Thermodynamics of Polymerization Process. **Plastics:** Thermosetting and Thermoplastics – Effect of Polymer Structure on Properties of Cellulose Derivatives – Vinyl Resins – Nylon (6,6), Reinforced Plastics – Conducting Polymers.

Corrosion

Corrosion: Origin and Theory – Types of Corrosion: Chemical and Electrochemical; Pitting, Inter granular, Waterline, Stress – Galvanic Series – Factors Effecting Corrosion.

Corrosion Controlling Methods: Protective Coatings: Metallic Coatings, Electroplating and Electroless Plating – Chemical conversion Coatings – Phosphate, Chromate, Anodized, Organic Coatings – Paints and Special Paints.

Fuels and Lubricants

Solid Fuels: Wood and Coal, Ranking of Coal – Analysis (Proximate and Ultimate) Coke Manufacture – Otto Hoffmann's Process – Applications; **Liquid Fuels:** Petroleum Refining – Motor Fuels – Petrol and Diesel Oil – Knocking – Octane number – Cetane Number; **Gaseous Fuels:** Biogas, LPG and CNG – Characteristics – Applications; **Rocket Fuels:** Propellants – Classification – Characteristics

Lubricants: Classification – Mechanism – Properties of Lubricating Oils – Selection of Lubricants for Engineering Applications.

Nanomaterials

Nanomaterials, Properties and application of fullerenes, fullerols, Carbon nanotubes and nanowires. Synthesis - Top-down and Bottom-up approaches - Nanocomposites - Nanoelectronics- Applications of nanomaterials in catalysis, telecommunication and medicine.

Text Books:

1. Engineering Chemistry – PC Jain and M. Jain – Dhanpath Rai and Sons, New Delhi.
2. A Text book of Engineering Chemistry – S. S. Dara – S. Chand & Co. New Delhi.

Reference Books:

1. Engineering Chemistry – B. K. Sharma – Krishna Prakashan – Meerut.
2. Introduction to Nanoscience - S. M. Lindsay - Oxford University Press
3. Engineering Chemistry - B. L. Tembe, Kamaluddin and M. S. Krishnan, (NPTEL).

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IN 1203
ENGLISH

Course Objectives:

- To make students understand the explicit and implicit meanings of a text/topic;
- To give exposure to new words and phrases, and aid to use them in different contexts;
- To apply relevant writing formats to draft essays, letters, emails and presentations; and
- To adapt oneself to a given situation and develop a functional approach to finding solutions: adaptability and problem solving.

Course Outcomes:

- Students will be able to analyse a given text and discover the various aspects related to language and literature;
- Learn the various language structures, parts of speech and figures of speech;
- Develop one's reading and writing abilities for enhanced communication; and
- Learn to apply the topics in real-life situations for creative and critical use.

SYLLABUS

On the conduct of life: William Hazlitt
Life skills: Values and Ethics
If: Rudyard Kipling

The Brook: Alfred Tennyson
Life skills: Self-Improvement
How I Became a Public Speaker: George Bernard Shaw

The Death Trap: Saki
Life skills: Time Management
On saving Time: Seneca

Chindu Yellama
Life skills: Innovation
Muhammad Yunus

Politics and the English Language: George Orwell
Life skills: Motivation
Dancer with a White Parasol: Ranjana Dave

Grammar:

Prepositions – Articles – Noun-Pronoun Agreement, Subject-Verb Agreement – Misplaced Modifiers – Clichés, Redundancies.

Vocabulary:

Introduction to Word Formation – Root Words from other Languages – Prefixes and Suffixes – Synonyms, Antonyms – Common Abbreviations

Writing:

Clauses and Sentences – Punctuation – Principals of Good Writing – Essay Writing – Writing a Summary
Writing: Essay Writing
Life skills: Innovation
Muhammad Yunus

Textbook: *Language and Life: A Skills Approach* Board of Editors, Orient Blackswan Publishers, India. 2018.

References :

1. *Practical English Usage*, Michael Swan. OUP. 1995.
2. *Remedial English Grammar*, F.T. Wood. Macmillan.2007
3. *On Writing Well*, William Zinsser. Harper Resource Book. 2001
4. *Study Writing*, Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.
5. *Communication Skills*, Sanjay Kumar and PushpLata. Oxford University Press. 2011.
6. *Exercises in Spoken English*, Parts. I-III. CIEFL, Hyderabad. Oxford University Press.

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IN 1204
CPNM

Course Objectives:

- The course is designed to provide complete knowledge of C language.
- To provide students with understanding of code organization and functional hierarchical decomposition with using complex data types.
- To provide knowledge to the Students to develop logics which will help them to create programs, applications in C.
- This course aims to identify tasks in which the numerical techniques learned are applicable and apply them to write programs, and hence use computers effectively to solve the task.
- This course provides the fundamental knowledge which is useful in understanding the other programming languages.

Course Outcomes:

- **Identify** basic elements of C programming structures like data types, expressions, control statements, various simple functions and **Apply** them in problem solving.
- **Apply** various operations on derived data types like arrays and strings in problem **solving**.
- **Design** and Implement of modular Programming and memory management using Functions, pointers.
- **Apply** Structure, Unions and File handling techniques to **Design** and **Solve** different engineering programs with minimal complexity.
- **Apply** Numerical methods to **Solve** the complex Engineering problems.

SYLLABUS

1. Introduction to C: Basic structure of C program, Constants, Variables and data types, Operators and Expressions, Arithmetic Precedence and associativity, Type Conversions. Managing Input and Output Operations Formatted Input, Formatted Output.

2. Decision Making, Branching, Looping, Arrays & Strings: Decision making with if statement, Simple if statement, The if…else statement, Nesting of if…else statement, the else..if ladder, switch statement, the (?:) operator, the GOTO statement., The while statement, the do statement, The for statement, Jumps in Loops ,One, Two-dimensional Arrays, Character Arrays. Declaration and initialization of Strings, reading and writing of strings, String handling functions, Table of strings.

3. Functions: Definition of Functions, Return Values and their Types, Function Calls, Function Declaration, Category of Functions: No Arguments and no Return Values, Arguments but no Return Values, Arguments with Return Values, No Argument but Returns a Value, Functions that Return Multiple Values. Nesting of functions, recursion, passing arrays to functions, passing strings to functions, the scope, visibility and lifetime of variables.

4. Pointers: Accessing the address of a variable, declaring pointer variables, initializing of pointer variables, accessing variables using pointers, chain of pointers, pointer expressions, pointers and arrays, pointers and

character strings, array of pointes, pointers as function arguments, functions returning pointers, pointers to functions, pointers to structures-Program Applications

5. Structure and Unions: Defining a structure, declaring structure variables, accessing structure members, structure initialization, copying and comparing structure variables, arrays of structures, arrays within structures, structures within structures, structures and functions and unions, size of structures and bit-fields-Program applications.

6. File handling: Defining and opening a file, closing a file, Input/ Output operations on files, Error handling during I/O operations, random access to files and Command Line Arguments- Program Applications

7. Numerical Methods: Solutions of Algebraic and Transcendental Equations, Bisection Method, Newton Raphson Method. Newton's forward and backward Interpolation, Lagrange's Interpolation in unequal intervals. Numerical Integration: Trapezoidal rule, Simpson's 1/3 rules. Solutions of Ordinary First Order Differential Equations: Euler's Method, Modified Euler's Method and Runge-Kutta Method.

Text Book:

1. Programming in ANSI C, E Balagurusamy, 6th Edition. McGraw Hill Education (India) Private Limited.
2. Introduction to Numerical Methods, SS Sastry, Prentice Hall

Reference Books:

1. Let Us C ,YashwantKanetkar, BPB Publications, 5th Edition.
2. Computer Science, A structured programming approach using C", B.A.Forouzan and R.F.Gilberg, " 3rd Edition, Thomson, 2007.
3. The C –Programming Language' B.W. Kernighan, Dennis M. Ritchie, PHI.
4. Scientific Programming: C-Language, Algorithms and Models in Science, Luciano M. Barone (Author), Enzo Marinari (Author), Giovanni Organtini, World Scientific.

IN 1205
ANALOG ELECTRONIC CIRCUITS

Course Objectives: In this course student will learn about

- Analysis of single and multi stage amplifiers.
- Frequency response of single and multi stage amplifiers.
- Different power amplifiers.
- Concept of negative feedback in amplifiers.
- Operation, types and stability of oscillators.

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

- Design different single and multi stage amplifiers.
- Understand the effect of capacitance on frequency response.
- Understand the application of power amplifiers.
- Know the importance of negative feedback in amplifiers.
- Design sinusoidal oscillators for different frequencies.

Small Signal Frequency Transistor Amplifiers: Hybrid parameter model of a Two Port network, h parameter model for transistor in CE, CB and CC configurations. Typical h-parameter values, h parameter conversion from one configuration to another configuration. Analysis of CE, CB and CC Amplifiers using h parameter model. CE Amplifier with emitter resistance.

Multistage Amplifiers: Cascade Amplifier (RC Coupled Amplifier), Cascade Amplifier, Darlington Pair and Analysis.

Transistor at High Frequencies: The hybrid common Emitter Transistor model, Hybrid π conductance in terms of low frequency h parameters- Transconductance, input impedance, Feedback conductance. Base spreading resistance, output conductance and hybrid capacitance. The CE short circuit current gain obtained with the hybrid π model- Bandwidth f_p and parameter f_T, current gain with resistive load, Transistor amplifier response with source resistance-Gain Bandwidth product.

Power Amplifiers: Classification of large signal amplifiers, Distortion in Amplifiers- Second harmonic Distortion and higher order harmonic distortion, Class A power amplifiers, Direct coupled and Transformer coupled Class B power amplifiers- push pull and complementary symmetry class AB power amplifiers, Class C power amplifiers, Class D and S power amplifiers.

Feedback Amplifiers: Open loop amplifiers, voltage amplifiers, current amplifier, Transresistance Amplifier and Transconductance Amplifiers, Closed loop amplifiers- Block diagram, concept of negative feedback, concept of positive feedback, characteristics of negative feedback amplifiers, classification of negative feedback amplifiers-Voltage series negative feedback amplifiers, voltage shun feedback amplifiers, current series feedback amplifiers, current shunt feedback amplifiers and their analysis.

Sinusoidal Oscillators: Barkhausen Criterion, classification of oscillators, Hartly oscillators, Colpitts oscillators, RC phase shift oscillators using BJT and JFET, Wein Bridge oscillators, crystal oscillators, Frequency and amplitude stability of Oscillators.

TEXT BOOKS

Jacob Milliman and Christos C Halkias, " Electronic Devices and Circuits," Tata Mcgra Hill Publishers, New Delhi, Fourth REprint, 2011.

IN 1206
ENGLISH LANGUAGE LAB

Course Objectives:

- To make students recognize the sounds of English through Audio-Visual aids;
- To help students build their confidence and help them to overcome their inhibitions and self-consciousness while speaking in English;
- To familiarize the students with stress and intonation and enable them to speak English effectively; and
- To give learners exposure to and practice in speaking in both formal and informal contexts.

Course Outcomes:

- Students will be sensitized towards recognition of English sound patterns and the fluency in their speech will be enhanced;
- A study of the communicative items in the laboratory will help students become successful in the competitive world;
- Students will be able to participate in group activities like roleplays, group discussions and debates; and
- Students will be able to express themselves fluently and accurately in social as well professional context.

SYLLABUS

Introduction to Phonetics: The Sounds of English (Speech sound – vowels and consonants) - Stress and Intonation - Accent and Rhythm.

Listening Skills: Listening for gist and specific information - listening for Note taking, summarizing and for opinions - Listening to the speeches of eminent personalities.

Speaking Skills: Self-introduction - Conversation Skills (Introducing and taking leave) - Giving and asking for information - Role Play - Just A Minute (JAM) session - Telephone etiquette.

Reading and Writing skills: Reading Comprehension – Précis Writing - E-Mail writing - Punctuation.

Presentation skills: Verbal and non-verbal communication - Body Language - Making a Presentation.

Reference Books:

1. Ashraf Rizvi. *Effective Technical Communication*. Tata McGraw Hill Education Private Limited, New Delhi.
2. *Speak Well*. Orient Blackswan Publishers, Hyderabad.
3. Allan Pease. *Body Language*. Manjul Publishing House, New Delhi.

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IN 1207
CHEMISTRY LAB

Course Objectives:

- To develop the fine skills of quantitative determination of various chemical components through titrimetric analysis
- To prepare and use ionexchange/ zeolite columns for the removal of hardness of water
- To develop the skill of organic synthesis through the preparation of a polymer/ drug

Course Outcomes:

- The course provides quantitative determine the amount of various chemical species in solutions by titrations and conduct the quantitative determinations with accuracy
- The course provides to develop novel materials to be used as zeolite and prepare columns for removal of hardness of water
- The course provides to synthesise a polymer or a drug

SYLLABUS

1. Determination of Sodium Hydroxide with HCl (Na_2CO_3 Primary Standard)
2. Determination of Alkalinity (Carbonate and Hydroxide) of water sample
3. Determination of Fe(II)/Mohr's Salt by Permanganometry
4. Determination of Oxalic Acid by Permanganometry
5. Determination of Chromium (VI) by Mohr's Salt Solution
6. Determination of Zinc by EDTA method
7. Determination of Hardness of Water sample by EDTA method
8. Determination of Chlorine in water by Iodometric Titration
9. Ionexchange/ Zeolite column for removal of hardness of water
10. Synthesis of Polymer/ drug

Reference Books:

1. Vogel's Quantitative Chemical Analysis – V – Edition – Longman.
2. Experiments in Applied Chemistry (For Engineering Students) – Sinita Rattan – S. K. Kataria & Sons, New Delhi

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IN 1208
CPNM LAB

Course Objectives:

- To impart writing skill of C programming to the students and solving problems.
- To write and execute programs in C to solve problems such as Modularize the problems into small modules and then convert them into programs.,
- To write and execute programs in C to solve problems such as arrays, files, strings, structures and different numerical methods.
- This reference has been prepared for the beginners to help them understand the basic to advanced concepts related to Objective-C Programming languages.

Course Outcomes:

- Understand various computer components, Installation of software. C programming development environment, compiling, debugging, and linking and executing a program using the development environment.
- Analyzing the complexity of problems, Modularize the problems into small modules and then convert them into programs.
- Construct programs that demonstrate effective use of C features including arrays, strings, structures, pointers and files.
- Apply and practice logical ability to solve the real world problems.
- Apply Numerical methods to Solve the complex Engineering problems.

SYLLABUS

1. Write a program to read x, y coordinates of 3 points and then calculate the area of a triangle formed by them and print the coordinates of the three points and the area of the triangle. What will be the output from your program if the three given points are in a straight line?
2. Write a program, which generates 100 random integers in the range of 1 to 100. Store them in an array and then print the arrays. Write 3 versions of the program using different loop constructs. (e.g. for, while, and do while).
3. Write a set of string manipulation functions e.g. for getting a sub-string from a given position, Copying one string to another, Reversing a string, adding one string to another.
4. Write a program which determines the largest and the smallest number that can be stored in different data types like short, int, long, float, and double. What happens when you add 1 to the largest possible integer number that can be stored?
5. Write a program, which generates 100 random real numbers in the range of 10.0 to 20.0, and sort them in descending order.
6. Write a function for transposing a square matrix in place (in place means that you are not allowed to have full temporary matrix).
7. First use an editor to create a file with some integer numbers. Now write a program, which reads these numbers and determines their mean and standard deviation.

8. Given two points on the surface of the sphere, write a program to determine the smallest arc length between them.
9. Implement bisection method to find the square root of a given number to a given accuracy.
10. Implement Newton Raphson method to det. a root of polynomial equation.
11. Given table of x and corresponding f(x) values, Write a program which will determine f(x) value at an intermediate x value by using Lagrange's interpolation/
12. Write a function which will invert a matrix.
13. Implement Simpson's rule for numerical integration.
14. Write a program to solve a set of linear algebraic equations.

B.Tech II year - I Semester

IN 2101 MATHS III

OBJECTIVES:

In general, the students are introduced with a knowledge on the topics: Vector Calculus, Partial differential equations, theirapplications and Integral Transforms (Fourier transforms, FST, FCT) so as to facilitate them to use these concepts in core subjects.

The objectives, in particular are to learn:

- the basic knowledge and applications of Vector Calculus used in Engineering problems.
- About the gradient, divergence and curl under the differentiation of scalar and vector point functions, also on Line-, Surface- and Volume integrals under the integration of point functions along with their applications in Engineering issues.
- Transformation theorems such as **Green's** theorem in the plane, **Stoke's** theorem, **Gauss Divergence** theorem and their applications.
- How to formulate the Partial Differential Equations from the relation between the dependent and independent variables, the methods of solving first order first degree linear, non-linear P**artial Differential Equations**, Homogeneous and Non homogeneous linear partial differential equations with constant coefficients .
- The procedure to find out the solutions of Partial Differential Equations by using the method of separation of variables (product method) about the formulation of one dimensional wave (string equation), one-and two-dimensional **Heat flow equations**, **Laplace's equation** in Cartesian and polar coordinates, and how to solve these equations using the method of separation of variables.
- The concept of integral transforms, namely, **Fourier transforms**, **Fourier Sine, Cosine and related inverse transforms, and** their applications in solving several Physical and Engineering problems.

OUTCOMES:

After going through this course , the students would be able to:

- operate the differential operator 'del' to the scalar and vector point functions, Calculate the Gradient, Divergence and Curl, Vector normal to a surface, maximum rate of change of a scalar field, test whether two surfaces are to cut orthogonally or not .
- find the rate per unit volume at which the physical quantity is issuing from a point, the rate of inflow minus out flow using the Divergence and the angular velocity of rotation at any point of the vector field using the Curl.

- **test** whether the given motion is irrotational or rotational, whether a vector force acting on a particle is conservative or not
- find out the potential function from a given vector field.
- obtain the well known Laplace and poisson equations from an irrotational field
- understand to determine the work done by a force field and circulation using a Line integral
- find out the Line, Surface and Volume integrals, find flux using surface integral and volumes using the volume integral.
- apply the vector integral theorems (Green's theorem in the plane, Stoke's and Divergence theorems) for evaluating thedouble and triple integrals as these are used to find areas and volumes.
- know the methods of solving Linear and Non linear first order and first degree partial differential equations.
- solve the Linear Partial Differential Equations with constant coefficients (homogeneous and non homogeneous) and know the procedure for finding the complementary function and particular integrals
- apply the method of separation of variables to obtain solutions to the boundary value problems involving Linear partial differential equations occurred in engineering studies
- solve wave equation, heat flow equation and the Laplace's equations in Cartesian and polar coordinates using the method of separation of variables.
- apply and extend the knowledge of Fourier transform techniques in solving several Initial and Boundary value problems of Engineering, such as in Conduction of heat **/** Thermodynamics, Hydraulics transverse vibrations of a string, oscillations of an elastic beam, bending of beams, electrical circuits, free and forced vibrations of a membrane and transmission lines , etc.

(VECTOR CALCULUS-DIFFERENTIATION)

Differentiation of vectors, curves in space, velocity and acceleration, relative velocity and relative acceleration, scalar andvector point functions, vector operator □ applied to scalar point functions- gradient, □ applied to vector point functions-

divergence and curl. Physical interpretation of gradient, divergence and culrl (i.e., $\square f$, $\square . \underline{F}$, $\square \square \underline{F}$), Irrotational and

Solenoidal fields, the relations obtained after □ applied twice to point functions, □ applied to products of two functions.

(VECTOR INTEGRATION)

Integration of vectors, line integral, circulation, work done, surface integral-flux, Green's theorem in the plane, Stoke's theorem, volume integral, Gauss Divergence theorem. (All theorems without proofs)

Introduction of orthogonal curvilinear coordinates, cylindrical and spherical polar coordinates

(PARTIAL DIFFERENTIAL EQUATIONS)

Formation of partial differential equations, solutions of partial differential equations- equations solvable by direct integration, linear equations of first order: Lagrange's Linear equation, non-linear equations of first order, Charpit's method. Homogeneous linear equations with constant coefficients- rules for finding the complementary function, rules for finding the particular integral (working procedure), non- homogeneous linear equations.

(APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS)

Method of separation of variables, One dimensional wave equation-vibrations of a stretched string, one dimensional Heat flow equation, Two dimensional heat flow in steady state - solution of Laplace's equation in Cartesian and polar coordinates (two dimensional).

(INTEGRAL TRANSFORMS (Fourier Transform)

Introduction, definition, Fourier integral, Sine and Cosine integrals, Complex form of Fourier integral, Fourier transform,Fourier Sine and Cosine transforms, Finite Fourier Sine and Cosine transforms, properties of Fourier transforms.

Convolution theorem for Fourier transforms, Parseval's identity for Fourier transforms, Fourier transforms of thederivatives of a function, simple applications to Boundary value problems.

TEXT BOOKS:

Scope and treatment as in "Higher Engineering Mathematics", by Dr. B.S.Grewal, **43rd Edition**, Khanna Publishers.

REFERENCE BOOKS:

1. Graduate Engineering Mathematics by V B Kumar Vatti, I.K.International publications
2. Advanced Engineering Mathematics by Erwin Kreyszig.
3. A text book of Engineering Mathematics by N.P. Bali and Dr. Manish Goyal, Lakshmi Publications.
4. Mathematical Methods of Science & Engineering aided with MATLAB by Kanti B.Dutta, Cengage Learning India Pvt. Ltd.
5. Higher Engineering Mathematics by B. V. Ramana, Tata McGraw Hill Company.
6. Advanced Engineering Mathematics by H.K.Dass. S.Chand Company.

IN 2102 - STRENGTH OF MATERIALS AND THEORY OF MACHINES

Course Objective: The basic objective of including this course is to bring awareness in the students about the subject Theory of machines, is that branch of Engineering science which deals with the study of relative motion between the various parts of a machine and forces which act on them. The strength of materials is a subject from which the stress, strain and several other load factors that apply for a cantilever & beam can be inferred. It brings an insight into various topics of friction,link & element mechanisms.

Course Outcomes: Theory of machines gives an idea about several mechanisms which welcome across in several Industries & in our day to day life. The students could properly identify the mechanisms that run typical machines. This is important because every process industry a student joins needs thebasic knowledge about the mechanisms & mechanical science.

Simple stresses and strains – Tensile, compressive and shear stresses. Elastic limit, Hook's law, stress-strain relation, poission's ratio, Relationship between Modulus of Elasticity and Modulus of Rigidity. Stresses in bars of varying section, Stresses in bars of composite sections, temperature stresses.

Shear Force Bending Moments– Definitions, Cantilever with concentrated load, uniformly distributed loads, load whose intensity varies uniformly, S.F and B.M diagrams, Simply supported beams with pointed loads, uniformly distributed loads, load whose intensity varies uniformly, S.F and B.M diagrams.

Simple Mechanisms: Link and element, lower and higher pairs, kinematic pairs, types of kinematic pairs, kinematic chain, Mechanism, Inversion, degrees of freedom, joint, Grubler's criteria, Mechanisms with turning and sliding pairs : Four bar mechanism and Inversions of Four bar mechanism, Single slider crank chain and Inversions of Single slider crank chain, Double slider crank chain and Inversions of Double slider crank chain.

Mechanisms with lower pairs- pantograph, Exact straight line mechanisms: Scott-Russel mechanism, Peaucellier mechanism, Harts mechanism, Approximate straight line mechanisms-Modified Scott Russel mechanism, Watt's mechanism , Tchebicheff's mechanism, Roberts mechanism, Grasshopper mechanism.

Friction and bearings- Friction definition, types of friction, laws of Friction, limiting friction, limiting angle of Friction, angle of repose, Effort required to move a body on a rough horizontal plane, Effort required to move a body on an inclined plane: up the inclined plane and down the inclined plane, Efficiency of Inclined plane, friction between screw and nut, friction in journal bearings, friction circle.

Text books:

1. Strength of Materials- S.Ramamrutham
2. Strength of materials- J.A.Taraporebala

3. Machines of structures- S.B.Junnarkar-
4. Theory of machines- Toft.L. and Kersy A.T.J
5. Theory of machines - R.S.Kurmi and J.K.Gupta

IN 2103 - ELECTRICAL MACHINES

Course Objectives:

The subject aims to provide the student with:

- Understanding of the basics of electrical machines and their construction
- Knowledge of testing and performance of electrical machines.
- Knowledge for learning advanced machines and their control.
- In-depth understanding of application based knowledge in the field of electrical drives

Course Outcome:

At the end of this course, students will demonstrate the ability to

- Analyse and apply the energy conversion principles to rotating machines.
- Evaluate the steady state parameters, basic operating characteristics and performance of DC Machine and its application.
- Evaluate the steady state parameters, basic operating characteristics and performance of transformers

POLYPHASE CIRCUITS
Star and why connections, vector diagrams, phase sequence, voltage, current relations in two phase and three phase circuits. Analysis of balanced three phase circuits. Measurements of power in three phase circuits.

TRANSFORMERS
Single phase transformer-construction-voltage equation, transformer on no-load and full-load. Equivalent circuit – losses- efficiency-auto transformer, use of transformers with instruments-testing of transformer – Short circuit test and open circuit test.

D.C.Machines
DC Generator – construction - armature windings – principle - e.m.f equation-armature reaction (in brief) and commutation- losses - efficiency - Generator characteristics
D.C.motor – construction- back e.m.f- - losses – efficiency- speed torque characteristics-starters-speed control testing.

Synchronous machines-
Alternators- principle and working - synchronous impedance-armature reaction (in brief) - e.m.f.equation-synchronous motor, nature of torque, vector diagram-characteristics of a synchronous motors-starting methods.

Induction motor-construction-theory of induction motor –efficiency-equivalent circuit and speed control.

TEXT BOOKS:

1. Electrical technology by B.L.Theraja.
2. Electrical technology by H.Cotton.
3. Electrical machinery by Fitzgerald/kingsley/umans.
4. Electrical machinery by Irving L.Kosow.

IN 2104 - SENSORS AND TRANSDUCERS

Course Objectives:

- To understand about measurement systems and their classification
- To understand about errors in measurement systems and calibration of measurement systems
- To enable the students to select and design suitable instruments to meet the requirements of industrial applications and various transducers used for the measurement of various physical quantities
- To understand about Various types of Sensors & Transducers and their working principle Resistive, Capacitive and Inductive, Piezo electric and Some of the miscellaneous transducers Characteristics of transducers

Course Outcomes:

- Upon completion of this course the student shall be able to understand the working of basic sensors and transducers used in process and manufacturing industries.
- The student will be able to select particular type of sensor/transducer in a typical application in a process Industry.

Measurements and Measurement systems- functional elements of measurement system- classification of measuring instruments- specifications of measuring instruments-
Standards of measurement-calibrations of measuring instruments- static and dynamic characteristics of measurement systems-errors in measurement systems.

Mathematical modeling of measurement systems- Modeling of mechanical systems-electrical system-thermal systems and fluidic systems- order of measurement systems –zero order,1st order, 2nd order and higher order systems – transfer function of measurement systems – system response to standard test signals – response of 1st order and second order systems for standard test signals.

Primary sensing elements-mechanical sensors springs-cantilever- torsion bars, load cells elastic sensors- diaphragms, capsules-Bellous and bourden tube gauges- flapper-nozzle sensors – Thermal sensors - filled in systems- Bimetal sensors – Level sensors- floats and displacers – flow sensors- Head flow sensors (Orifice, venture and pitot tubes) Area flow sensors (Rota meter and piston meters)

Transducers-Active and passive transducers – Transducers- characteristics- basic requirements hesistive transducers- strain gaues- potentiometers RTD's and thermistors – Inductive transducers- self inductance and variable inductance transducers _LVDT and its applications – capacitive transducers- variable distance and variable area and dielective type

Piezo electric transducers and their applications- magnetic strictive- thermo electric and hall effect transducers- photo electric transducers- photo emissive and photo voltaic types and their applications- advanced sensors smart transducers- intelligent transducers and MEMS sensors.

IN 2105 MANAGERIAL ECONOMICS

Course Objectives:

- To bring about an awareness about the nature of Managerial Economics and its linkages with other disciplines.
- To understand the Micro and Macro Environment of Business.
- To familiarize the prospective engineers with the concepts and tools of Managerial Economics with an objective to understand the real world of business.

Course Outcomes:

After completion of the course, student will be able to:

- Understand the various economic activities in business and industry.
- Analyse the real world business problems.
- Make optimal business decisions for the effective and efficient management of Organisations.

Significance of Economics and Managerial Economics:

Economics: Definitions of Economics- Wealth, Welfare and Scarcity definitions Classification of Economics- Micro and Micro Economics.

Managerial Economics: Definition, Nature and Scope of Managerial Economics, Differences between Economics and Managerial Economics, Main areas of Managerial Economics, Managerial Economics with other disciplines.

Demand and Utility Analysis:

Demand - Definition, Meaning, Nature and types of demand, Demand function, Law of demand - Assumptions and limitations. Exceptional demand curve.

Elasticity of demand - Definition, Measurement of elasticity, Types of Elasticity (Price, Income, Cross and Advertisement), Practical importance of Price elasticity of demand, Role of income elasticity in business decisions, Factors governing Price Elasticity of demand.

Utility Analysis: Utility- Meaning, Types of Economic Utilities, Cardinal and Ordinal Utility, Total Utility, Marginal Utility, The law of Diminishing Marginal Utility and its Limitations**.**

Theory of Production and Cost analysis:

Production - Meaning, Production function and its assumptions, use of production function in decision making;

Cost analysis - Nature of cost, Classification of costs - Fixed vs. Variable costs, Marginal cost, Controllable vs. Non - Controllable costs, Opportunity cost, Incremental vs. Sunk costs, Explicit vs. Implicit costs, Replacement costs, Historical costs, Urgent vs. Postponable costs, Escapable vs. Unavoidable costs, Economies and Diseconomies of scale.

Market Structures : Definition of Market, Classification of markets; Salient features or conditions of different markets - Perfect Competition, Monopoly, Duopoly , Oligopoly, Importance of kinked demand curve ;Monopolistic Competition.

Pricing and Business Cycles:

Pricing Analysis : Pricing – Significance; Different Pricing methods- Cost plus pricing, Target pricing, Marginal cost pricing, Going -rate pricing, Average cost pricing, Peak load pricing , Pricing of joint Products, Pricing over the life cycle of a Product, Skimming pricing Penetration pricing, Mark- up and Mark- down pricing of retailers.

Business cycles - Definition, Characteristics, Phases, Causes and Consequences; Measures to solve problems arising from Business cycles.

Text Books:

1. Sankaran,S., **Managerial Economics,** Marghan Publications, 2015, Chennai.
2. Aryasri, A.R., **Managerial Economics and Financial Analysis,** MC Graw Hill Education, New Delhi,2015.

Reference Books:

1. Dwivedi, D.N., **Managerial Economics,** Vikhas Publishing House Pvt. Ltd. 6th Edition, New Delhi,2004.
2. Dewett, K.K., **Modern Economic Theory**, S.Chand & Company Ltd., New Delhi, 2005.

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IN 2106 Analog Electronics Circuits Lab

Course Educational Objective: This course gives an overview of amplifiers, power amplifiers, Feedback Amplifiers and Oscillators.

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

CO1 : Understand the operation of different types of amplifiers and oscillators.

CO2: Analyze the characteristics of different types of amplifiers.

CO3: Design an amplifier.

List of Experiments

1. **Common Emitter Amplifier**
2. **Common Source Amplifier**
3. **Two Stage RC coupled CE amplifier**
4. **Two Stage RC coupled CS FET amplifier**
5. **Class A power amplifiers**
6. **Class B power amplifiers**
7. **Class C power amplifiers**
8. **Voltage –current series feedback amplifier**
9. **RC phase shift Oscillator using Transistor**
10. **Wein Bridge oscilator**

IN 2107 Transducers Lab

Course Objective:

1. This Lab explores the Calibration of Various kinds of Transducers & Industrial Instruments
2. To make the students familiarize with several Industrial parameters.

To obtain the practical knowledge on working principle of several transducers & Sensors what they have studied intheory.

Course Outcomes:

The purpose of inclusion of this lab into the curriculum is to illustrate the Working principle, Calibration and characteristics of various types of transducers

At the completion of this lab, the student will be able to:

1. Calibrate & plot Characteristics of different kinds of transducers such as Strain Gauge, LVDT, Dead weight tester etc….
2. Visualize the working principle of various types of sensors Like RTD, Thermo couple, Orifice meter etc… which they have studied in theory.
3. Control the Industrial parameters like Pressure, Level, Flow, Temperature etc….
4. Obtain the knowledge about practical applications of several transducers, Sensors & Industrial Instruments.

IN 2108: ELECTRICAL MACHINES LAB

Course Objective:

1. This Lab explores all the possible design connections of a DC machine and it also experimentallyobtains the characteristics and thus observes the performance of different DC motors andgenerators and performs tests on DC machines to derive their efficiency.

2. To make the students familiarize the students with all necessary AC electrical machines likeSingle phase and three phase induction motors all of which help to enhance the technical skills ofstudents.

3. The working of a transformer, wattmeter and dc, ac motors are apparent to the students. Theycould practically visualize & can correlate with what they have studied in theory and grasp theconcepts well.

Course Outcomes:

The purpose of inclusion of this lab into the curriculum is to illustrate the working andcharacteristics of transformers & various types of dc & ac motors and generators under no-load,loaded conditions.

At the completion of this lab, the student will be able to:

1. Obtain the operating characteristics of dc machines, transformers and Induction motors.

2. Examine the relationship between torque, speed, voltage and Current for various types ofmotor & generator connections in no-load and loaded configurations.

3. Predict, by calculation, the performance of dc machines Motor & Generator.

4. Analyze and select appropriate dc machines & ac machines for given applications.

5. The working of a transformer, wattmeter and DC Motors, ACMotors are apparent to the students. Theycould practically visualize & can correlate with what they have studied in theory and grasp theconcepts well.

List of Experiments:

IN 2109: Object Oriented Programming through C++

Course Objectives:

- Exposure to basics of object oriented mode, C++ programming and I/O in C++
- Acquaintance with classes, objects and member functions.
- Concentration on inheritance, types of inheritance, polymorphism, virtual functions
- Focus on constructors , destructors, variants in them

Course Outcome:

- Expertise in object oriented principles and their implementation in C++

INTRODUCTION: Differences Between C And C++, Disadvantage of Conventional Programming, Concepts of Object Oriented Programming, Advantages of OOP. Structure of a C++ Program, Header Files And Libraries.
INPUT AND OUTPUT IN C++: Introduction ,Formatted And Unformatted I/O Operations, Bit Fields, Manipulators.
FUNCTIONS IN C++: Introduction ,Inline Functions, Function Overloading, Recursion.
CLASSES AND OBJECTS: Introduction, Access Specifiers And Their Scope, , Data Hiding or Encapsulation, Classes, Objects and Memory, Array Of Objects, Friend Functions, Recursive Member Function.

CONSTRUCTORS AND DESTRUCTORS :Introduction, Characteristic Of Constructors & Destructors, Applications With Constructors, Parameterized Constructor, Overloading Constructors (Multiple Constructors), Destructors, Private Constructors And Destructors ,Local Vs. Global Object.
INHERITANCE: Introduction, Access Specifiers And Simple Inheritance, Protected Data With Private Inheritance, Types Of Inheritances(Single Inheritance, Multilevel Inheritance, Multiple Inheritance, Hierarchical Inheritance, Hybrid Inheritance, Multipath Inheritance), ,Advantages Of Inheritance, Disadvantages Of Inheritance.POLYMORPHISM: Virtual Functions, Pure Virtual Functions.

TEXT BOOKS

- Object Oriented Programming with C++, E. Balaguruswamy, TMH
- Programming In C++ , Ashok N Kamthane. Pearson 2nd Edition.
- Object Oriented Programming C++ , Joyce Farrell, Cengage
- Mastering C ++, Venugopal, Rajkumar, Ravi kumar TMH

REFERENCE BOOKS

- The Complete Reference, C++, 4ed, Herbert Schildt, TMH

LIST OF PROGRAMS:

PROGRAM NO	TOPIC	PROGRAM TITLE
1	INPUT &OUTPUT IN C++	Program to print a string
2		Program to accept a string and display using cin & cout statements.
3		Simple c++ program for Addition of two numbers
4		Simple c++ program for Division of two numbers
5		Simple c++ program for Multiplication of two numbers
6		Simple c++ program for Subtraction of two numbers
7		Simple c++ program for Average of two numbers
8		Program to display data using typecasting
9	UNFORMATTED I/O FUNCTIONS	Program to read and display string using get() & put()functions
10		Program to demonstrate the use of gcount()function
11	FORMATTED I/O FUNCTIONS	Program to set number of precision points. Display the result of 22/7 in different precision settings
12	BITFIELDS	Program to convert decimal number to hexa decimal and octal format
13	MANIPULATORS	Program to display message using Manipulators.
14	FUNCTIONS IN C++ : INLINE FUNCTIONS	Write a program to find the cube of a number using inline function

15	RECURSION	Write a program to calculate Factorial of a Number Program
16	FUNCTION OVERLOADING	Write a program to compute the area of a square , rectangle and circle
17	CLASSES & OBJECTS: ACCESS SPECIFIERS: PUBLIC,PRIVATE,PROTECTED	Write a program using class to declare member variable and functions Private ,Public ,and Protected section and make an attempt to access them using object
18	DATA HIDING OR ENCAPSULATION	Write a program to calculate simple interest. Hide the data elements of the class using Private Keyword
19	ARRAY OF OBJECTS	Write a program to declare the array of objects. Initialize and display the contents of array. Eg: Read and display the information of the players on the screen.
20	FRIEND FUNCTIONS	Write a program to access private data using non-member function .Use friend function
21	RECURSIVE MEMBER FUNCTION	Write a program to find the sum of n Fibonacci number by using recursion.
22	CONSTRUCTORS AND DESTRUCTORS:CONSTRUCTORS	Write a Program to define a constructor and initialize the class data member variables with constant
23	OVERLOADING CONSTRUCTORS (MULTIPLE CONSTRUCTORS)	Write a program to overload constructor and display date and time
	DESTRUCTORS	Write a program to demonstrate execution of constructor and destructor
25	PRIVATE CONSTRUCTOR AND DESTRUCTOR	Write a program to declare constructor and destructor as private and call them explicitly
26	LOCAL VS GLOBAL OBJECT	Write a program to show the difference between local and global object
27	INHERITANCE :PROTECTED DATA WITH PRIVATE INHERITANCE:	Write a program to declare protected data in base class .Access data of base class declared under protected section using member function of derived class
28	SINGLE INHERITANCE	Write a program to demonstrate single inheritance.
29	MULTILEVEL INHERITANCE	Write a program to explain multilevel inheritance with member functions
30	POLYMORPHISM : PURE VIRTUAL FUNCTIONS	Write a program to declare pure Virtual Functions

IN 2110 Professional Ethics and Universal Human Values
(Common for all Branches)

Course Objectives:

The objective of the course is Six fold:

- Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.
- This course will illuminate the students in the concepts of laws and its applicability to engineers
- Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence
- Strengthening of self-reflection, Development of commitment and courage to act and also enable the students to imbibe and internalize the Values and Ethical Behaviour in the personal and professional lives
- To enable the students to imbibe the Values and Ethical Behavior in the personal and Professional lives
- The students will learn the rights and responsibilities Individual, employee, team member and a global citizen

Course Outcomes:

By the end of the course Student will be able to:

- Grasp the meaning of the concept – Law and also Get an overview of the laws relating to Engineers and also Apprehend the importance of being a law abiding person and They would have better critical ability
- Self-explore by using different techniques to live in harmony at various levels
- Analyze themselves and understand their position with respect to the moral and ethical character needed for a successful and satisfactory work life
- Students are expected to become more aware of themselves and their surroundings (family, society, nature)
- They would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.
- They would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society

SYLLABUS

Need, Basic Guidelines, Content and Process for Value Education

•,Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation - as the process for self-exploration, Continuous Happiness and Prosperity - A look at basic Human Aspirations, Right understanding, Relationship and Physical Facility - the basic requirements for fulfillment of aspirations of every human being with their correct priority, Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario, Method to fulfill the above human aspirations: understanding and living in harmony at various levels. Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking, Include practice sessions and case studies.

Understanding Harmony in the Human Being - Harmony in Myself!

• Understanding human being as: a co-existence of the sentient 'I' and the material 'Body', the needs of Self ('I') and 'Body' - happiness and physical facility, the Body as an instrument of 'I' (I being the doer, seer and enjoyer), the characteristics and activities of 'I' and harmony in 'I', the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail, P to ensure Sanyam and Health, Include practice sessions and case studies.

Understanding Harmony in the Family and Society - Harmony in Human – Human Relationship

• Understanding values in human-human relationship: meaning of Justice (nine universal values in relationships) and program for its fulfillment to ensure mutual happiness; Trust and Respect as the foundational values of relationship, the meaning of Trust; Difference between intention and competence, the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship, the harmony in the society (society being an extension of family), Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals, Visualizing a universal harmonious order in society- Undivided Society, Universal Order from family to world family, Include practice sessions and case studies.

Understanding Harmony in the Nature and Existence - Whole existence as Coexistence

• Understanding the harmony in the Nature, Interconnectedness and mutual fulfillment among the four orders of nature recyclability and self-regulation in nature, Understanding Existence as Co-existence of mutually interacting units in all – pervasive space, Holistic perception of harmony at all levels of existence, Include practice sessions and case studies.

Concept of Law and Law of Torts

• Understanding Essentials of a Valid Contract and the basics of contract law protecting rights and obligations, Introduction to the Law of Torts and the basics to protect oneself and the company Law affecting the Workplace Employers Responsibilities/Duties Hiring Practices, Introduction to Intellectual Property Law, Professional Code of Conduct for Engineers, Relationship between Law and Ethics, Include practice sessions and case studies.

Implications of the above Holistic Understanding of Harmony on Professional Ethics

• Natural acceptance of human values, Definitiveness of Ethical Human Conduct, Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order, Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems, Case studies of typical holistic technologies, management models and production systems, Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations, Include practice sessions and case studies.

Text Books

1. R R Gaur, R Asthana, G P Bagaria, "A Foundation Course in Human Values and Professional Ethics", 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1
2. R R Gaur, R Asthana, G P Bagaria, "Teachers' Manual for A Foundation Course in Human Values and Professional Ethics", 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2

3. R. Subramanian, “Professional Ethics”, Oxford University Press.
4. S.B. Srivasthva, “Professional Ethics & Human Values”, SciTech Publications (India) Pvt. Ltd. New Delhi.
5. D.R. Kiran, “Professional Ethics & Human Values”, TATA Mc Graw Hill Education.
6. Saroj Kumar, “Business Law” and Avtar Singh, “Law of Contract”

Reference Books

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amar kantak, 1999.
2. A. N. Tripathi, “Human Values”, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book), Mohandas Karamchand Gandhi “The Story of My Experiments with Truth”, E. FSchumacher. “Small is Beautiful”, Slow is Beautiful –Cecile Andrews, J C Kumarappa “Economy of Permanence”, Pandit Sunderlal “Bharat Mein Angreji Raj” and Dharampal, “Rediscovering India
4. G K Kapoor, “Business Law” and Sen & Mitra, “Business & Commercial Laws” and Calvin Frank Allen, “Business law for Engineers”
5. Hilgard, E. R.; Atkinson, R. C. & Atkinson, R.L. (1975). *Introduction to Psychology*. 6th Edition. New Delhi: Oxford and IBH Publishing Co. Pvt. Ltd.
6. Govindarajan, M; Natarajan, G. M. & Senthilkumar, V.S. (2013). *Professional Ethics & Human Values*. Prentice Hall: New Delhi
7. Gogate, S. B. (2011). Human Values & Professional Ethics. Vikas Publishing: New Delhi.
8. Charles E Harris Jr., Michael S Pritchard, Michael J Rabins, “Engineering Ethics, Concepts Cases: 4e, Cengage learning, 2015.
9. Caroline Whitbec, “ Ethics in Engineering Practice & Research: 2e, Cambridge University Press 2015.

IN 2111 NCC/NSS

IN 2201 MATHS IV

Objectives: The student should be able to use the concepts of difference equations, Z - transforms, Numerical differentiation and Sampling theory. The student should know the applications of the difference equations in the deflection of a loaded string. The student should be able to estimate unknown parameters of population and apply the tests of hypothesis. They should be able to evaluate Z-transform, inverse Z-transforms and apply these transforms to solve difference equations. The student should be able to know the techniques in the evaluation of numerical solution of ordinary differential equations.

(Functions of Complex Variables)

Introduction-Limit and continuity of f(z)- Derivative of f(z), Cauchy-Reimann Equations, Analytic Functions, Harmonic functions, Orthogonal systems, Applications to flow problems, Geometrical representation of f(z). Integration of complex functions, Cauchy's theorem, Cauchy's integral formula and their applications.

(Conformal Mappings and Contour Integration)

Introduction to Conformal transformation, Bilinear transformation $w = \frac{az + b}{cz + d}$, Series of complex terms -Taylor's and Laurent's series (without proofs), Zero's and Singularities of analytic functions.
Residues and Calculations of residues, Cauchy's Residue Theorem (without proofs), Evaluation of real definite integrals: Integration around unit circle, semi circle.

(Difference Equations & Z-transforms)

Introduction - Formation of difference equations - Linear difference equations - Rules for finding complementary function - Rules for finding particular integral - simultaneous difference equations with constant coefficients - Applications to deflection of a loaded string.

Introduction to Z-Transforms - Some standard Z-transforms - Linear Property - Damping Rule - Shifting U_n to the right and to the left-multiplication by n-Two basic theorems - Some useful Z-transforms - Inverse Z-transformation - Convolution theorem - Convergence of Z-transform - Two sided Z-transform - Evaluation of inverse Z-transform - Application to Difference equations.

(Correlation, Regression and Distributions)

Introduction - correlation - coefficient of correlation -Lines of regression. Introduction to Discrete and Continuous Random Variables - Distributions: binomial distribution, Poisson distribution, exponential distribution, normal distribution.

(Sampling Theory)

Introduction - Testing of hypothesis - Level of significance - Confidence limits - Test of significance of large samples - comparison of large samples- Test of significance for means of two large samples. Student t-distribution - Significance test of sample mean - Significance test of difference between sample means - Chi-square test - Goodness of fit - F-distribution.

TEXT BOOK:

Scope and treatment as in "Higher Engineering Mathematics", by Dr.B.S.Grewal,43rd Edition, Khanna Publications.

REFERENCE BOOKS:

1. Graduate Engineering Mathematics by V B Kumar Vatti, I.K.International publications
2. Advanced Engineering Mathematics by Erwin Kreyszig.
3. A text book of Engineering Mathematics by N.P. Bali and Dr.Manish Goyal; Lakshmi publications.
4. Advanced Engineering Mathematics by H.K. Dass. S. Chand Company.
5. Higher Engineering Mathematics by B.V. Ramana, Tata Mc Graw Hill Company.
6. Engineering Mathematics series by Chandrica Prasad.

IN 2202 - ELECTRICAL MEASUREMENTS AND MEASURING INSTRUMENTS

Course Objectives:

- This course provides adequate knowledge of various instruments for measuring electrical quantities.
- understand basic laws governing the operation and working of instruments and their equivalent circuits used for the measurement of voltage, current, power, energy.

Course Outcomes:

The student will be able to:

- differentiate PMMC and MI instruments.
- determine R, L and C of the given impedances using different bridges.
- understand the functioning and errors present different type of instruments

MEASUREMENT OF RESITANCE, CAPACITANCE AND INDUCTANCE: D.C bridges, potentiometers, A.C bridges, measurement of inductance and capacitance, errors in bridge measurements, Wagner's earthing device.

CLASSIFICATION OF INSTRUMENTS: Electrical analog instruments, classification and constructional details, galvanometers, operating principle dynamic response, measurement of galvanometer constants

MEASUREMENT OF VOLTAGE AND CURRENT: moving-iron, PMMC, Electro dynamic, electro static and inductive type instruments, range extension

MEASUREMENT OF POWER: Watt meters, dynamometer induction electrostatic watt meters, poly phase watt meters.

MEASUREMNT OF ENERGY: induction watt-hour meter-errors and compensation, polyphase induction watt-hour meter, measurement of frequency, phase angle, power factor, special purpose instruments.

TEXT BOOKS:

1.Electrical measurement and measuring Instruments by Golding and Widdis.
2. Electrical and Electronic measurements and Instruments By A.K.Sawhney.
3.Electrical measurements and Measuring instruments By Rajendra Prasad.

IN 2203 - SIGNALS AND SYSTEMS

Course Educational Objectives: This course describe signals mathematically and how to perform mathematical operations on signals, represents the signals in both time and frequency domains, provides the concepts of signal approximation using orthogonal functions and Fourier Series, the Fourier Transform and its properties, Laplace Transform and their properties, analysis of systems using Laplace Transforms.

Course Outcomes (COs): At the end of this course, student will be able to

CO1 Remember the classification and properties of the signals & systems, properties of Fourier and Laplace Transforms.

CO2 Understand the fundamental characteristics of the signals , systems and their classifications

CO3 Apply mathematical tools to model and examine signals and systems in both time and frequency domains.

CO4 Analyze the concept of Fourier Series, Region of convergence and convolution in time and frequency domains

CO5 Evaluate system for linearity, causality, time variance, stability, memorability and reliability.

SIGNAL ANALYSIS: Approximation of a function by a set of mutually orthogonal functions, evaluation of mean square error. Orthogonality in complex functions. Trigonometric and exponential Fourier series. Representation of a periodic function by Fourier series. Fourier transform, properties of Fourier transform. Fourier transform of simple functions.

Convolution integral. Convolution in time domain and frequency domain. Graphical representation. Sampling theorem – statement and proof, aliasing.

CORRELATION: Cross correlation and auto correlation functions, properties of correlation function, correlation and convolution, energy and power spectral density functions. Parseval's theorem.

SIGNAL TRANSMISSION THROUGH LINEAR NETWORKS: Linear time invariant system. Transfer function. Filter characteristics of linear systems. Conditions for distortionless transmission. Causality and physical realizability. Bandwidth and rise time.

LAPLACE TRANSFORMS: Review of Laplace transforms, partial fraction expansion, inverse Laplace transforms, concept of region of convergence (ROC) for Laplace transforms. Constraints on ROC for various classes of signals, properties of Laplace transforms, relation between Lapalce transform and Fourier transform of a signal. Laplace transform of a certain signals using wave form synthesis.

Z-TRANSFORMS : Fundamental difference between continuous and discrete time signals, discrete time complex exponential and sinusoidal signals, periodicity of discrete time complex exponential signals. Concept of Z – transform of a discrete sequence. Distinction between Laplace, Fourier & Z –transforms. Region of convergence in Z-transforms, constraints on ROC for various classes of signals, inverse Z – transforms, properties of Z-transforms.

TEXT BOOKS:

1. Signals, systems and communications – by B.P Lathi, BS publications.
2. Signals and systems – by A.V Oppenheim , AS Willesky & SH Nawab, PHI

REFERENCE:

1. Signals and systems – by Simon Haykins, Wiley Student Ed.

IN 2204- OPAMPS AND LINEAR IC'S

TotalCourse Objective: The operational amplifier is responsible for a dramatic and continuingrevolution in our approach to analog system design. The availability of high performance,inexpensive devices influences the entire spectrum of circuits and systems, ranging from simple,mass-produced circuits to highly sophisticated equipment designed for complex data collectionor processing operations. At one end of this spectrum, modern operational amplifiers havelowered cost and improved performance; at the other end, they allow us to design and implementsystems for various purposes.

Course Outcomes:

The final outcome of this subject is that they areused in designing many circuits like filters, multivibrators and differentamplifier circuits.

INTRODUCTION TO OPERATIONAL AMPLIFIER: IC definition, advantages, Classification of ICs, Block diagram of typical op-amp, Electrical characteristics of an op-amp, Ideal op-amp characteristics, Equivalent circuit of an op-amp, Ideal voltage transfer curve, open loop operational amplifier configuration: Differential amplifier configuration, Inverting amplifier configuration and non-inverting amplifier configuration.

AN OPERATIONAL AMPLIFIER WITH NEGATIVE FEEDBACK: Block diagram representation of feedback configurations: voltage-series feedback, voltage shunt feedback, Current-series feedback, Current-shunt feedback, **Voltage-series feedback amplifier analysis:** closed loop voltage gain, difference input

voltage ideally zero, input resistance with feedback, output resistance with feedback, Bandwidth with feedback, total output offset voltage with feeedback, Voltage follower, **Voltage shunt**

feedback amplifier analysis: closed loop voltage gain, Inverting input terminal at virtual ground, input resistance with feedback, output resistance with feedback, Bandwidth with feedback, total output offset voltage with feeedback, Current-to-voltage converter, Inverter, **Differential Amplifiers:** Differential Amplifier with one Op-Amp Differential Amplifier with two Op-Amps.

THE PRACTICAL OPERATIONAL AMPLIFIER: Introduction, Input offset voltage, Offset voltages, offset voltage null circuit, offset voltage compensating network, configurations of inverting and non-inverting amplifiers with feedback and offset- voltage compensation, thermal drift, noise.

GENERAL LINEAR APPLICATIONS OF OPERATIONAL AMPLIFIER: DC and AC amplifiers, the Peaking Amplifier, Summing, Scaling and Averaging Amplifiers: Inverting configuration, Non Inverting configuration, Differential configuration, A Subtractor, Instrumentation amplifier, Instrumentation amplifier using Transducer bridge, V/I converter with floating load, low-voltage DC voltmeter, low-voltage AC voltmeter, V/I converter with grounded load, I/V converter, The Integrator, The Differentiator.

ACTIVE FILTERS: Filter definition, Classification of Filters, First order low pass filter butter worth filter, Filter design, Frequency scaling, Second order low pass filter butter worth filter, Filter design, First order high pass butter worth filter, Filter design, Second order high pass butter worth filter, High order filters, Band pass filters: wide band-pass filter, narrow band-pass filter, Band Reject Filters: wide band-reject filter, narrow band reject filter, All Pass Filter.

SPECIALIZED IC APPLICATIONS: Logarithmic amplifier, antilog amplifier, Basic Comparator, Zero crossing detector, Schmitt Trigger, 555 Timer, 555 Timer as Monostable Multivibrator, Frequency divider, 555 Timer as Astable Multivibrator, free running ramp generator, block diagram of a Phase locked loop and its operating principle.

TEXT BOOKS:

1.Op-amps and linear integrated circuits by RamaKant A.Gayakwad, P.H.I.
2. Op-amps and linear integrated circuits by Robert Coughlin.
3. Applications of analog integrated circuits by Sidneysoclof PHI.

IN 2205 - DIGITAL ELECTRONICS AND LOGIC DESIGN

Course Objectives:

The objectives of this course are to:

- Introduce the concept of digital and binary systems
- Be able to design and analyze combinational logic circuits.
- Be able to design and analyze sequential logic circuits.
- Understand the basic software tools for the design and implementation of digital circuits and systems.
- Reinforce theory and techniques taught in the classroom through experiments and projects in the laboratory.

Course Outcomes:

On completion of the course, student will be able to:

- Use the basic logic gates and various reduction techniques of digital logic circuit in detail.
- Design combinational and sequential circuits.
- Design and implement hardware circuit to test performance and application.

Number systems & codes : Review of number systems, weighted codes, conversion from one to another, non weighted codes, error detecting codes, error correcting codes , binary arithmetic.

Digital logic & Boolean algebra : Basic gates OR, AND, NOT, universal gates NAND ,NOR, introduction to HDL. Boolean law & theorems, representation of switching functions, Karnaugh map representation, minimization using Karnaugh map, SOP and POS methods. Design of single out put and multi out put functions using conventional gates

Combinational circuits:
Arithmetic circuits : Half & full adders and subtractors , 4 bit binary adder, fast adder.
Data processing circuits : Multiplexers, demultiplexers, 1 of 16 decoder, seven segment decoders, encoders.

Synchronous circuits : RS flip - flops, gated flip - flops, edge triggered RS,D,JK flip - flops, master slave flip - flop, T flip- flop switch contact bounce circuits, analysis of sequential circuits.

Registers and Counters : Types of registers, serial in – Serial out, Serial in – parallel out, parallel in – Serial out , Parallel in - Parallel out registers, design of Asynchronous & Synchronous counters, mod counter , Decade counters, Presettable counters, Digital clock.
design of programmable logic array (PLA) and programmable array logic (PLD)

Text Books:

1. Digital Principles and Applications. Albert paul Malvino and Donaldp. Leach, T.M.H.
2. Digital Integrated Electronics. Herbert Taub and Donald Schilling, Mcgraw Hill Co.
3. Digital Logic and Computer Design by M. Morris Mano, P.H.I.

IN 2206 DIGITAL LOGIC DESIGN Lab

Course Educational Objective: This course gives an overview of logic gates, Adders and Subtractors, Code converters, Decoders and multiplexers.

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

CO1 : Understand the operation of different types of Flip Flops and logic circuits

CO2: Analyze the characteristics of logic circuits

CO3: Design an logic circuit

List of Experiments

1. Verification of Logic gates
2. Construction of adders and subtrators
3. Code converters
4. Four bit Adder
5. BCD to 7 Segment display
6. Decoders
7. Multiplexers
8. Verification of Flip Flops using SSI gates.
9. Ripple counters
10. MOD 11 Ripple counters.

IN 2207 Electrical measurements lab

Course Objectives:

This course provides

- Adequate knowledge of constructing DC and AC bridge circuits and implementing bridge balancing conditions for measurement of resistance, inductance and capacitance.
- Immense knowledge on calibration of ammeters and voltmeters and their range extensions
- Practical capability for handling CRO for measurement of various parameters
- Exposure to measure power in single phase and three phase circuits

Course Outcomes:

The student will be able to

- Design and construction of bridge circuits for measuring various parameters
- Handle CRO
- Calibrate devices like ammeters, voltmeters, watt meters and energy meters

List of Experiments:

1. Measurement of Low Resistance by Kelvin's Double Bridge Method.
2. Measurement of Inductance of low Q coils (1<Q<10) by maxwells bridge
3. Measurement of Inductance of high Q coils (Q>10) by hay bridge
4. Measurement of capacitance by Schering bridge
5. Study of Galvanometer and Determination of Sensitivity and Galvanometer Constants.
6. Calibration of Voltmeters
7. Calibration of Ammeters
8. Extension of ranges of ammeters and voltmeters
9. Testing of Energy meters (Single phase type).
10. Measurement of voltage, current using CRO.
11. Measurement of Phase in CRO using Lissajous figures
12. Measurement of Power in a single phase circuit
13. Measurement of Power and Power Factor in a three phase AC circuit by two-wattmeter method.
14. Measurement of R, L and C using Q meter

IN 2208 MATLAB Skills

CEOs (Course Educational Objectives)

1. To study basics of Matlab, functions and Data types.
2. To learn and application of processing of Data techniques from different sources.
3. To learn and create customized algorithms.
4. To study about linear algebra Fourier transforms and Math functions for analyse data.
5. To learn and create Two- and three-dimensional plots, images and graphs.
6. To study about functions and file handling.

Course syllabus

Matlab Basics, Matrices and Arrays, Array Indexing, Variables, Text and Characters, Calling Functions, Data Types, Operators and Elementary Operations, Statements. Import and export data, including large files, pre-processing data, visualize and explore Access data from text files, spreadsheets, hardware, other software, or the web. Explore the data to identify trends, test hypotheses, and estimate uncertainty. Create customized algorithms, visualizations, and models. Linear algebra, differentiation and integrals, Fourier transforms, and other mathematics, Math

functions for analyzing data, developing algorithms, and creating models. Core functions. Two- and three-dimensional plots, images, animation, Graphics functions. Scripts, functions, live scripts and classes. Files and folders programming utilities. Develop apps interactively using App Designer, or programmatically using MATLAB® functions

Text Books:

- A Hand book on Numerical technique lab : MATLAB based experiments, K.K.Sharma, Wiley publisher.
- Modeling and simulation using MATLAB- Simulink, 2nd Edition, Sailendra Jain, Wiley publisher
- Basics of MATLAB Programming, R. Balaji

Reference Book:

- MATLAB Help file documentation available in MATLAB Version 10.1

COs (Course outcomes)

After completion of the course the students will be able to

1. Describe the basic concepts functions and variables.
2. Use Calling Functions, Data Types, Operators and Elementary Operations.
3. Classify data from text files, spreadsheets, hardware, other software, or the web.
4. Solve differentiation and integrals and Math functions for analyzing data.
5. Develop Two- and three-dimensional plots, images
6. Design algorithms and create models

List of Laboratory Programs:

1. Write a Matlab program to perform some basic operations on matrices such as addition, subtraction, multiplication.
2. Write a Matlab Program to generate various signals and sequences, such as unit impulse, unit step, unit ramp, sinusoidal, square, saw tooth, triangular.
3. Write a Matlab program to plot for two given functions
   y1 = cos(x)
   y2 = 2cos(x) in the interval $0 \leq x \leq 2\pi$.
4. Write a Matlab program for calculating c = a + b ,d = a – b, for the given matrices
   a = [1 2 3 ; 4 5 6; 7 8 9];
   b = [7 5 6 ; 2 0 8; 5 7 1].
5. Write a Matlab program to find inverse of A and determinant of matrix A.
   A = [1 2 3; 4 5 6 ;7 8 0]

6. Write a Matlab program to solve the following system of linear equations
   x + 2y + 3z = 1
   4x + 5y + 6z = 1
   7x + 8y = 1
7. Write a Matlab program to compare two given number A & B.
8. Write a Matlab program to determine the frequency response of First order system y(n)=x(n)+8y(n-1).
9. Write a Matlab program to generate sum of two given sine waves x1=sin (0.1*pi*n)
   x2=sin (0.2*pi*n)
10. Write a Matlab program to determine solution of difference equation dy/dx = (xy - y 2)/ x 2

IN 2209 ENVIRONMENTAL SCIENCE

(Common for all Branches)

Course Objectives

The objectives of the Environmental Science course are to

- Familiarize the fundamental aspects of environment and the environmental management'
- Provide information of some of the important international conventions which will be useful during the future endeavors after graduation.
- Make realize the importance of natural resources management for the sustenance of the life and the society.
- Apprise the impact of pollution getting generated through the anthropogenic activities on the environment
- Provide the concept of Sustainable Development, energy and environmental management
- Impart knowledge on the new generation waste like e-waste and plastic waste.

Course Outcomes

After completion of the course the students will have

- Knowledge on the fundamental aspects of environment and the environmental management
- The knowledge on the salient features of the important international conventions
- Understanding of the importance of natural resources management for the sustenance of the life and the society.
- Familiarity on various forms of pollution and its impact on the environment.
- Understand the elements of Sustainable Development, energy and environmental management
- Knowledge on the new generation waste like e-waste and plastic waste.

SYLLABUS

Introduction: Structure and functions of Ecosystems-Ecosystems and its Dynamics-Value of Biodiversity-impact of loss of biodiversity, Conservation of bio-diversity. Environmental indicators - Global environmental issues and their impact on the ecosystems.
Salient features of International conventions on Environment: Montreal Protocol, Kyoto protocol, Ramsar Convention on Wetlands, Stockholm Convention on Persistent Organic Pollutants, United Nations Framework Convention on Climate Change (UNFCCC),

Natural Resources Management: Importance of natural resources management-Land as resource, Land degradation, Soil erosion and desertification, Effects of usage of fertilizer, herbicides and pesticide- watershed management.

Forest resources: Use and over-exploitation, Mining and dams – their effects on forest ecosystems and the living beings.

Water resources: Exploitation of surface and groundwater, Floods, droughts, Dams:benefits and costs.

Mineral Resources: Impact of mining on the environment and possible environmental management options in mining and processing of the minerals.
Sustainable resource management (land, water, and energy), and resilient design under the changing environment.
Environmental Pollution: Local and Global Issues. Causes, effects and control measures. Engineering aspects of environmental pollution control systems.

Air pollution: impacts of ambient and indoor air pollution on human health. Water pollution: impacts water pollution on human health and loss of fresh water resources. Soil pollution and its impact on environment. Marine pollution and its impact on blue economy. Noise pollution.

Solid waste management: Important elements in solid waste management- Waste to energy concepts. Air (prevention and control of pollution) Act, Water (prevention and control of pollution) Act and their amendments. Salient features of Environmental protection Act, 1986.

Sustainable Development: Fundamentals of Sustainable Development– Sustainability Strategies and Barriers – Industrialization and sustainable development. Circular economy concepts in waste (solid and fluid) management.

Energy and Environment: Environmental Benefits and challenges, Availability and need of conventional energy resources, major environmental problems related to the conventional energy resources, future possibilities of energy need and availability. Solar Energy: process of photovoltaic energy conversion, solar energy conversion technologies and devices, their principles, working and applications, disposal of solar panel after their usage. Biomass energy: Concept of biomass energy utilization, types of biomass energy, conversion processes, Wind Energy, energy conversion technologies, their principles, equipment and suitability in context of India.

Management of plastic waste and E-waste: Sources, generation and characteristics of various e- and plastic wastes generated from various industrial and commercial activities; Waste management practices including onsite handling, storage, collection and transfer. E-waste and plastic waste processing alternatives. E-Waste management rules and Plastic waste management rules, 2016 and their subsequent amendments.

Text Books:

1. Bharucha,Erach (2004). Textbook for Environmental Studies for Undergraduate Courses of all Branches of Higher Education, University Grants Commission, New Delhi.
2. Basu, M., Xavier, S. (2016). Fundamentals of Environmental Studies, Cambridge University Press, India
3. Masters, G. M., &Ela, W. P. (1991). Introduction to environmental engineering and science. Englewood Cliffs, NJ: Prentice Hall.
4. Enger, E. and Smith, B., Environmental Science: A Study of Interrelationships, Publisher: McGraw-Hill Higher Education; 12th edition, 2010.

Reference Books:

1. Sharma, P. D., & Sharma, P. D. (2005). Ecology and environment. Rastogi Publications
2. Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
3. Clark R.S. (2001). Marine Pollution, Clanderson Press Oxford (TB)
4. Jadhav, H & Bhosale, V.M. (1995). Environmental Protection and Laws. Himalaya Pub. House, Delhi 284 p.
5. MoEF&CC, Govt. of India, CPCB: E-waste management rules, 2016 and its amendments 2018.
6. MoEF&CC, Govt. of India, CPCB: Plastic waste management rules, 2016.

IN 3101:CONTROL SYSTEMS

L	T	PD	TOTAL Pds	Univ Exam Hrs	Univ Exam Marks	Sessnl Marks	Total Marks
4	0	--	4	3	70	30	100

Course Educational Objectives:

CEO_1: Understand the basics of control systems and mathematical modelling of different types of physical systems and converting into signal flow graph.

CEO_2: Elucidate procedure for deriving transfer function in different ways

CEO_3: Study the time domain response of first order and second order systems and design of linear compensation.

CEO_4: Construct root locus, polar plots and discussing stability of system

CEO_5: Investigate Routh Hurwitz stability criterion of closed loop systems.

CEO_6: Enhance the knowledge on frequency response

Unit 1: Categorizing control systems, difference of open and closed loop control systems, Feed-Back Characteristics, servo mechanisms, Differential equations of physical systems.

Learning Outcomes: students are able to

LO_1: Explain and construct open and closed loop systems including feedback concept and their applications

LO_2: Functionalize governing equations for the given physical systems

Unit 2: Transfer functions, procedure for deriving transfer functions, Block diagram, algebra, signal flow graphs, Mason's gain formula, and application of signal flow graph to control systems.

Learning Outcomes: students are able to

LO_1: Derive transfer function using various techniques

LO_2: Differentiate graphical and block diagram approaches and capable to select suitable method with less complexity

Unit 3:Time Response: Time domain specifications, types of test inputs, I and II order system response, error coefficients, steady state error and error constants. Effects of proportional derivative, proportional integral systems. The Root locus concept, construction of root loci, construction rules, determination of roots from root locus.

Learning Outcomes: Students are capable

LO_1: Derive the time response of first and second order system for standarized inputs
LO_2: Construct and analyze roots of closed loop system using root locus

Unit 4:The concept of stability, necessary conditions for stability, Hurwitz stability criterion, Routh stability criterion and limitations, application of a Routh stability criterion to Linear feedback systems, Relation between time and frequency response, polar plots.

Learning Outcomes: Students are able to
LO_1: Expose the need of routh stability criterion and applications based on it
LO_2: Analyze the relationship between time domain and frequency domain analysis
LO_3: Analyze the frequency response using polar plots

Unit 5: Using Bode plots design of Lag, Lead, Lag-Lead compensators, Nyquist stability criterion, gain margin and phase margin Analysis, closed loop frequency response, State Space Analysis of LTI Systems.

Learning outcomes: students are able to
LO_1: Expose concepts of enclosed and encirclement in a plane, State Space Analysis of LTI Systems and capble to design compensators.
LO_2: Construct Nyquist plot and discuss about closed loop system stability

TEXT BOOKS:

1. Control Systems principles and design, M. Gopal, Tata McGraw Hill education Pvt Ltd., 4th Edition.
2. Automatic control systems, Benjamin C. Kuo, Prentice Hall of India, 2nd Edition.

NPTEL Links:

1. https://nptel.ac.in/courses/107/106/107106081/
2. https://nptel.ac.in/courses/108/106/108106098/
3. https://onlinecourses.nptel.ac.in/noc20_ee90/preview

Course Outcomes: On completion of the course, student will be able to:
CO_1: Identify the type of physical systems and capable to handle mathematical modeling of it
CO_2: Select suitable method for deriving transfer function for a required system

CO_3: Derive time domain frequency specifications and error coefficients for standard signals
CO_4: Acquires the stability analysis of open and closed loop LTI system using time domain as well as frequency domain analysis
CO_5: Construct root locus, bode plot, polar plots and Nyquist plot for a given transfer function
CO_6: Enhance the knowledge on higher order systems and able to design Lag, Lead, Lag-Lead compensators.

IN 3102: MICROPROCESSORS AND MICRO CONTROLLERS

Pre requisites: Digital Electronics and logic Design

Course Educational Objectives: The course is designed

Ceo1: To introduce students with the architecture and operation of typical 8 bit,16 bit and 32 bit Microprocessors and micro controllers.

Ceo2: To familiarize the students with the programming and interfacing of microprocessors and Micro controllers.

Ceo3: To introduce various peripheral interfacing devices and their interfacing with various microprocessors.

Ceo4: To provide strong foundation for designing real world applications using microprocessors and micro controllers.

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

Co1: Understand about microprocessors and its architecture, instruction sets and demonstrate programming proficiency using various addressing modes and data transfer instructions of the target microprocessor and microcontroller.

Co2: Design logic circuits for I/O ports in order to interface the microprocessor to various types of external devices.

Co3: Make use of various peripheral interface devices for performing parallel and serial I/O and timers/ counters.

Co4: Understand about advanced microprocessors and micro controllers and their performance for programming and applications in real time systems.

Co5: To understand about real time embedded system using advanced microcontroller for measurement and control applications.

SYLLABUS

Module I: Introduction to microprocessors- microprocessor architecture-address, data and control buses-8bit microprocessors -8085- architecture- addressing modes- instruction set – programming –stacks and subroutines-interrupts of8085.

(Lo1: The student will be able to understand about microprocessors and their architecture, addressing modes, instruction set and programming)

Module II: Interfacing concepts-memory interfacing-I/O interfacing methods-memory mapped I/O and direct I/O. Types of I/O-simple, polled and interrupt I/O-DMA. Interfacing keyboard and led interfacing data converters interfacing.

(Lo2: able to understand about various types of I/O techniques and interfacing different peripheral to microprocessors for data communication.)

Module III: Data communication with parallel and serial devices-8255A PPI, 8253-programmable interval timer, 8257 programmable DMA controller interface-8259 programmable interrupt controller- Serial data communication techniques.8251 USART serial interfacing device.

(Lo3: To learn various peripheral interfacing devices and their programming for data communication techniques in microprocessor based systems.)

Module IV:16-bit microprocessors-8086 architecture-Addressing modes-instruction set-Programming 8086. 80286 microprocessor-Real address and PVAM mode of operation -32 Bit microprocessors-80386 microprocessor and its features- Memory management -paged addressing mode- 80486 microprocessor-features- Pipelining-NDP processor -Cache Memory organization.

(Lo4: The student will be able to get the knowledge of advanced microprocessors and their features for efficient programming skills and advancements in microprocessor technology.)

Module V: Microcontrollers- 8bit microcontrollers-8051 architecture-program memory-data memory organization-addressing modes- Timers/Counters organization, serial I/O organization-Interrupt handling- Advanced microcontrollers-8096-PIC microcontrollers-AT mega controllers and their features.

(Lo5: the student will be able to understand about microcontrollers and their programming and applications in real time and embedded systems.)

TEXT BOOKS:

1. R. S. Goankar, Microprocessors architecture, programming and applications – Wiley Eastern IndiaPublications.
2. Kenneth J Ayala, The 8051 Microcontroller Architecture Programming and Application, third Edition, Penram International Publishers
3. D.V. Hall Microprocessors and interfacing – 2nd edition –, McGraw HillPublications.
4. Badri Ram Fundamentals of microprocessors and microcomputers –Dhanpat Rai & sons publications.

REFERENCE BOOKS:

1. Mohamed Rafiquzzaman, Microprocessor and Microcomputer based system design, second edition, CRC press.
2. A.K Ray & K.M. Burchandani, Advanced Microprocessor and peripherals Architectures,

Programming and interfacing “, second edition, Tata McGraw Hill Publications
3. Ajit Pal, Microcontrollers: Principles and applications-PHI Publications

IN 3103:INDUSTRIAL INSTRUMENTS

Course Educational Objectives:

1. To Introduce Calibration & measuring techniques of transducers and sensors.
2. Acceleration & Vibration measurement using different types of transducers.
3. To provide sound knowledge about measurement of several Industrial parameters such as Humidity, Viscosity and Moisture.
4. To make students familiar with measurement, control & Calibration of multiple parameters like Level, Temperature, Flow and Pressure etc**….**

Course Syllabus:

Selection of Measuring and Test Equipment & Calibration procedures: Identification of Measurement needs, Formulating Specifications, Evaluation of M & TE and Calibration procedure formats.

Vibration and Acceleration measurement: Standards, working principle, types, materials, design criterion: Eddy current type, piezoelectric type, Seismic Transducer, Accelerometer: Potentiometric type, LVDT type, Piezo-electric type.

Learning Outcomes:

1. Calibration & measurement of multiple types of transducers
2. Study of Various techniques to measure Acceleration & Vibration using LVDT, Piezo electric transducers etc….

Pressure measurement: Elastic types-Resistive- Capacitive and Inductive pressure pickups. Piezoelectric- Piezoresistive types. Vacuum measurement: McLeod gauges-Ionization gauges- Alphatron gauge. High Pressure measurement. Force balance and Motion balance type transmitters – P/I and I/P converters. IC pressure sensors and calibration of pressure measuring devices.

Temperature measurement: Filled-in thermal systems- Bimetallic thermometers - RTD, Thermistor, Thermocouple - Radiation and Optical pyrometers - Digital IC thermometers - Accuracy, errors and compensation.

Flow measurement: Head flow meters- types, Area flow meters– Rotameter bypass rotameter- Turbine meter. Electromagnetic flow meter – Principle – DC AC and pulsed type. Ultrasonic flow meters – Principles – transit time – Doppler shift – beam deflection– Cross correlation flowmeters. Vortex flowmeters -Coriolis flowmeters- Solid flow measurement- conveyor belt type. Installation and Calibration procedures of various flowmeters
Level Measurement: Conductive and Capacitive methods –Ultrasonic, Microwave and RADAR level sensors - Solid level measurement by Paddlers method. Capacitance method for powder level measurement. Density, Viscosity and PH measurement.

1. To know about various Pressure and Flow measurement techniques also Calibration of Pressure measuring devices.
2. To study Standard techniques for Temperature & Level measurement.

Allied Sensors: leak detector, flame detector, smoke detector, density, Sound sensors, and Proximity sensors, Gas Sensors and digital transducers.

Learning Outcomes:

1. Study of different kinds of Sensors.
2. Detection of various objectives with the help of several sensors.

Course outcome:

At the end of the course students will be able

1. To measure and control various kinds of Industrial parameters like Level, Humidity, and Flow etc…
2. To acquire knowledge on the working principle, measuring Units and Characteristics of those Industrial parameters.
3. To perform Calibration of those parameters using several kinds of Transducers & sensors.
4. To gain Vast Knowledge about Selection of suitable sensors & transducers for sensing, detecting different objectives in Industrial applications.

TEXT BOOKS:

1. Industrial Instrumentation – D.Patranabis.
2. A Course on Electrical and Electronic Measurements and Instrumentation -A.K.Sawhney.
3. Instrumentation Devices and Systems – C.S.Rangan. , Mani, Sharma

REFERENCE BOOKS

1. Mechanical and Industrial Instruments – R.K Jain.
2. Process Instrumentation and Analysis – G.B.Liptak.
3. Sensors and Transducer – D.Patranabis.
4. Transducers and Instrumentation – D.V.S. Murthy.

IN 3106 INDUSTRIAL INSTRUMENTS LAB

Course Objective:

1. This Lab explores the Calibration of Various kinds of Transducers & Industrial Instruments
2. To make the students familiarize with several Industrial parameters.
3. To obtain the practical knowledge on working principle of several transducers & Sensors what they have studied in theory

List of Experiments:

1. To Calibrate Strain gauge or Load Cell.
2. To study the Characteristics of Linear Variable Differential Transformer (LVDT).
3. Calibration of Pressure gauge using Dead weight tester.
4. Synchro Transmitter and Receiver.
5. To study the measurement of flow using Orifice meter.
6. To study the measurement of speed using Magnetic pick up.
7. To study the measurement of speed using Inductive pick up
8. Calibration of Level measurement.

Course Outcomes:

The purpose of inclusion of this lab into the curriculum is to illustrate the Working principle, Calibration and characteristics of various types of transducers.

At the completion of this lab, the student will be able to:

1. Calibrate & plot Characteristics of different kinds of transducers such as Strain Gauge, LVDT, Dead weight tester etc….
2. Control the Industrial parameters like Pressure, Level, Flow, Temperature etc….
3. Obtain the knowledge about practical applications of several transducers, Sensors & Industrial Instruments.
4. Select appropriate transducer for the measurement of specified parameter

IN 3107 CONTROL SYSTEMS LAB

Course Objectives:

Students undergoing this course are expected to:

CEO-1 Understand the design and implementation of Lead and Lead-Lag networks

CEO-2 Able to analyze speed torque characteristics for different Motors

CEO-3 Be able to report the results of their work in the laboratory accurately, in appropriate detail, and concisely.

Course Outcomes:

At the end of the course, students will be able to

CO-1	Design Compensating networks for control systems
CO-2	Analyze speed torque characteristics for armature and field control of Dc servo motors
CO-3	Design speed control of DC and AC servo motors

1. STUDY OF COMPENSATING NETWORK-(LEAD NETWORK)
2. SPEED CONTROL OF DC MOTOR(OPENLOOP)
3. SYNCHRO TRANSMITTER - RECEIVER PAIR
4. AC SERVO MOTOR SPEED TORQUE CHARACTERISTICS
5. DC SERVO MOTOR SPEED TORQUE CHARACTERISTICS(ARMATURE CONTROL)
6. STUDY OF COMPENSATING NETWORK(LEAD-LAG NETWORK)
7. SPEED CONTROL OF DC MOTOR(OPENLOOP)

8. MAGNETIC AMPLIFIER

9..DC SERVO MOTOR SPEED TORQUE CHARACTERISTICS(FIELD CONTROL)

10. POTENTIOMETER AS ERROR DETECTOR

3208 LABVIEW

Course Educational Objectives:

CEO_1:To design addition and subtraction of two numbers with and without case structure.
CEO_2:To find sum of 'n' natural numbers, factorial of a number.
CEO_3:To find roots of quadratic equation, average of two numbers.
CEO_4:Generating & analyzing of signals, merging, addition and subtraction of two signals.
CEO_5:To understand filtering of signals, simulation of function generator, Plot circle.
CEO_6:To implement Addition of 2-D number array, determinant of 2x2 matrix.

Learning outcomes: Students are able to learn

LO_1: Express knowledge of If, while loop, Case structure conditions on Addition & subtraction, Average of two numbers, Sum of 'n' natural numbers, Factorial of a number, and determining of roots of quadratic equation.
LO_2: Gain knowledge on Merging, Addition & subtraction, Filtering of signals using Lab view.
LO_3: Express knowledge on 2-D array systems or numbers and mathematical calculation process.

List of experiments

1. Addition and subtraction of two numbers using Lab view.
2. Addition and subtraction of two numbers with case structure using Lab view.
3. Average of two numbers using Lab view.
4. Sum of 'n' natural numbers using Lab view.
5. Factorial of a number using Lab view.
6. Roots of quadratic equation using Lab view.
7. Generating & analyzing of signals using Lab view.
8. Merging of two signals using Lab view.
9. Addition and subtraction of two signals using lab view.
10. Filtering of signals using Lab view.
11. Simulation of function generator using Lab view.
12. Plot circle using Lab view.
13. Addition of 2-D number array using Lab view.
14. Determinant of 2x2 matrix using Lab view.

Course Outcomes: On completion of the course, student will be able to

CO_1: Design addition & subtraction of two numbers with and without case structure.
CO_2: Find sum of 'n' natural numbers, factorial of a number for different 'n' values.
CO_3: Find roots of quadratic equation, average of two numbers.
CO_4: Analyze merging, addition and subtraction of two signals for different wave forms.
CO_5: Design LPF, HPF, Butterworth of signals, simulation of function generator and plot circle.
CO_6: Implement Addition of 2-D number array, determinant of 2x2 matrixes.

IN 3201 DIGITAL SIGNAL PROCESSING

Course educational objectives:

CEO_1 :To understand the basic Discrete time signals and system types,convolution sum,impule and frequency response concepts
CEO_2:To understand the realization of LTI systems and basic properties of these
CEO_3: To understand the DFT and relation between DFT and other transforms.To understand convolution and its types
CEO_4: To understand the FFT . Differences between DIT and DIF algorithms
CEO_5: To understand the concept of Frequency selective filters
CEO_6: To understand the concept of architecture of DSP processor

UNIT-I: Discrete – Time Signals and Linear Systems: Signals, systems, signal processing, advantages and applications of digital signal processing, Analog to digital conversion, reconstruction of analog signal, types of A/D converters, digital- to- analog converters.

Learning Outcomes: Students can able to
LO_1:Define signal and how to process a signal ,advantages and applications of signal processing
LO_2: Reconstruct a analog signal and digital to analog converters
UNIT-II: The Discrete Fourier Transform: Discrete Fourier series, properties of Discrete Fourier series, The discrete Fourier Transform, relationship of the DFT to other transforms, properties of Discrete Fourier Transform, comparison between circular convolution and linear convolution, methods to evaluate circular convolution of two sequences, linear convolution from circular convolution.
Learning Outcomes: Students can able to
LO_1:Define Discrete fourier series. Relationship of the DFT to other transforms
LO_2: Comparision between circular convolution and linear convolution
UNIT-III: The Fats Fourier Transforms: Introduction, direct evolution of the DFT, the fast Fourier transforms, Decimation-in-time algorithm, Decimation-in-frequency algorithms, differences and similarities between DIT and DIF algorithms, IDFT using FFT algorithms.
Learning Outcomes: Students can able to
LO_1: Define and do the Decimation-in-time algorithm, Decimation-in-frequency algorithms
LO_2: Differences and similarities between DIT and DIF algorithms
UNIT-IV: Infinite Impulse Response Filters: Introduction, Frequency selective filters, design of digital filters from analog filters, analog low pass filter design, analog low pass Butterworth filters, analog low pass Chebyshev filters, frequency transformation in analog domain, realization of digital filters.
Learning Outcomes: Students can able to
LO_1: design of digital filters from analog filters
LO_2: realization of digital filters
UNIT-V:
INTRODUCTION TO DSP PROCESSORS: Introduction to programmable DSPs: Multiplier and Multiplier Accumulator (MAC), Modified Bus Structures and Memory Access schemes in DSPs Multiple access memory ,multiport memory, VLSI architecture, Pipelining, Special addressing modes, On-Chip Peripherals. Architecture of TMS 320C5X Introduction, Bus Structure, Central Arithmetic Logic Unit, Auxiliary Register, Index Register, Block Move Address Register, Parallel Logic Unit, Memory mapped registers, program controller, Some flags in the status registers, On- chip registers, On-chip peripherals
Learning Outcomes: Students can able to
LO_1: Modified bus structure and memory access schemes

LO_2: give the architecture of TMS320C5XXX

TEXT BOOKS

1. Digital Signal Processing : Principals, Algorithms and Applications- John G. Proakis, and Dimitris G.Manolakis, Pearson Edn.,,PHI, 2007.
2. Digital Signal Processing –Alan V. Oppenheim, Ronald W. Schaffer PHI Ed 2006

REFERENCES

1. Manson H Hayes," Digital Signal Processing," TMH Publications, 2004.
2. P.RameshBabu," Digial Signal Processing ," Scitech Publications Pvt. Ltd, Chennai

COs (Course outcomes):

After completion of the course the students will be able to
CO-1:Explain digital signal,sampling, convolution
CO_2: Explain Discrete fourier transform in DIT and DIF
CO_3: Explain programmable DSPs

IN 3202 PROCESS CONTROL & CONTROL COMPONENTS

CEOs (Course Educational Objectives)

1. To study and review of Process Control Principles.
2. To study basic Servo mechanisms and discrete state control systems.
3. To learn Process control block diagram and identification of elements.
4. To study about various evaluation-stability.
5. To learn about steady state regulation, transient regulation, evaluation criteria.
6. To study about Process control (P&I) drawings.

Course syllabus

Unit-1: Introduction: control systems- process control principles, servo mechanisms, discrete state control systems; Process control block diagram- identification of elements; Control system evaluation-stability, steady state regulation, transient regulation, evaluation criteria; Process control (P&I) drawings.

Learning outcomes:

Students can

1. Outline the basic principals of control systems- process control principles.
2. Describe various Components of Process control block diagram and concepts.
3. Identify of steady state regulation, transient regulation, evaluation criteria and (P&I) drawings.

Unit-2: Controller Principles: Process characteristics: process equation, process load, process lag,selfregulation; control system parameters; Controller Modes: Discontinuous control modes- two position mode, multi-position mode; Continuous controller modes: Proportional control modes, Integral control mode, Derivative control mode, Composite control modes: PI, PD, PID; Special terminology

Learning outcomes:

Students can

1. Explain basic Process characteristics.

2. Describe process equation, process load, process lag, self regulation; control system parameters.
3. Explain Discontinuous and continuous control modes.
4. Define PI, PD, PID control modes.

Unit -3: Optimum controller settings: Evaluation criteria-1/4 decay ratio, I.A.E., ISE, ITAE; Tuning of controllers: Continuous oscillation and damped oscillation methods- process reaction curve method.

Learning outcomes:

Students can

1. Classify I.A.E., ISE, ITAE.
2. Describe Tuning of controllers such as continuous and damped Oscillation
3. Describe process reaction curve method.

Unit -4: Multi loop control systems: Feed forward, ratio, cascade and split range controls. Multi variable control –examples from distillation column and boiler systems.

Learning outcomes:

Students can

1. Explain Feed forward, ratio, cascade and split range controls
2. Describe Multi variable control.
3. Explain boiler systems.

Unit -5: Final control elements: Flapper-Nozzle system, I/P, P/I converters, pneumatic, electric and hydraulic actuators. Globe and Butterfly valves, volume booster relays.

Learning outcomes:

Students can

1. Explain Flapper-Nozzle system.
2. Differentiate between pneumatic, electric and hydraulic actuators
3. Outline Globe and Butterfly valves, volume booster relays.

Unit -6: Control valve characteristics and sizing: Valve characteristics-quick opening, linear and equal percentage characteristics; Sizing: Flow formulae through control valves. Specific gravity and Viscosity correction, range ability, turn down ; cavitation and flashing in control valves.

Learning outcomes:

Students can

1. Define characteristics of quick opening, linear and equal percentage.
2. Define Sizing and mention about Flow formulae .
3. Explain Specific gravity and Viscosity correction, range ability, turn down.

Unit -7: Expert Controllers and Applications: Expert controller- Fuzzy logic systems-fuzzy controller-Fuzzy logic tools -Artificial neural networks - perceptron -neural controllers.

Learning outcomes:

Students can

1. Explain Expert Controller.
2. Differentiate between Fuzzy logic systems-fuzzy controller
3. Outline Artificial neural networks and neural controllers.

Text books

1. Curtis.D.Jhonson: Process control instrument Technology, Pearson education.
2. Pollard A, Process control.
3. Eckman, D.P., Automatic Process and Control.
4. Harriot,P., Process control.
5. Patrinabis,D, Principles of process control.
6. Krishna Kant, 'Computer based Industrial Control", Prentice Hall of India Pvt., Ltd.2002

COs (Course outcomes)

After completion of the course the students will be able to

1. Describe control systems- process control principles.
2. Can use various Controller Principles.
3. Classify Evaluation criteria-1/4 decay ratio.
4. Able to Explain various Multi loop control systems.
5. Categories various control elements.
6. Can explain Control valve characteristics and sizing.
7. Able to know the Implementation of Fuzzy and Neural networks.

IN 3203 BIOMEDICAL INSTRUMENTATION

Course Educational Objectives:

1. To introduce the fundamentals of bio electric potentials, resting and action potentials
2. To understand the anatomy of heart and physiological measurements of cardio vascular system
3. To understand anatomy of respiratory system and its diagnostic and therapeutic equipment
4. To provide the insight into the of nervous system and its physiological measurements
5. To understand the working of X Ray, CT scan and MRI Scanning equipment
6. To know the shock hazards and electrical safety in hospitals
7. To train the students to measure temperature and Oxygen saturation in blood

Introduction to the Man-Instrument system – components of the system – Problems encountered in measuring a living system —– sources of bioelectric potentials – Structure of a cell- resting and action potentials.

Learning Outcomes:

LO-1: Learn the components of Man-Instrument system

LO-2: Understand the sources of bioelectric potentials

LO-3: Knowledge about cell resting potential and action potential

The cardiovascular system – The heart anatomy – Generation of Electrocardiogram – Recording ECG - Blood pressure measurement- Direct and Indirect methods - Sphygmomanometer – Blood flow measurement – heart sounds – Phono Cardiograph – measurement of blood flow and cardiac output - plethysmography– pacemakers – defibrillators.

Learning Outcomes:

LO-1: Understand the anatomy of heart

LO-2: Learn to measure different physiological parameters related to heart

LO-3: Knowledge about pacemakers and defibrillators

Physiology of the respiratory system – tests and instrumentation for the mechanics of the breathing – Spirometers- respiratory therapy inhalators – ventilators-humidifiers nebulizers and aspirators.

Learning Outcomes:

LO-1: Understand the physiology of respiratory system

LO-2: Learn the respiratory therapy equipment

The nervous system and its anatomy – neuronal communication – the organization of brain – neuronal receptors – the somatic nervous system – the autonomic nervous system – measurements from the nervous system – electrode placement-neuronal firing measurements EEG and EMG.

Learning Outcomes:

LO-1: Learn the anatomy of nervous system

LO-2: Understand the electrode placement in EEG

LO-3: Knowledge about EMG measurement

Noninvasive diagnostic instrumentation - temperature measurement – principles of ultra sound measurement and diagnosis – echo cardiogram – echo encephalogram – ultra sonogram. X-ray machine- CT Scan- MRI Scan- Computer in biomedical instrumentation. Physiological effects of electric current – shock hazards from electric equipment – methods of accident prevention.

Learning Outcomes:

LO-1: Learn the working of non invasive diagnostic equipment

LO-2: Know the methods of accident prevention

Basal skin resistance measurement, Temperature measurement, Thermogram, Oximeters.

LO-1: Learn the different methos od body temperature measurement

LO-2: Understand the principles of oximeters.

TEXT BOOKS:

1. Biomedical Instrumentation and Measurements – C. Cromwell, F.J. Weibell, E.A. Pfeiffer – Pearsoneducation.
2. Handbook of biomedical instrumentation R. S. Khandpur, Tata McGraw hill company Ltd, NewDelhi.

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

1. Understand the physiology of Cardiovascular system, Respiratory system and Nervous system
2. Measure, detect and analyze the bio-electric potentials
3. Select and apply the appropriate medical instruments for measurement
4. Design medical devices for diagnosis and therapeutic applications
5. Analyze simple bio-sensing and transduction problems.
6. Apply safety standards and select disposal method and procedures for electrical diagnostic equipment
7. Learn to measure the Oxygen Saturation in blood

IN 3206 MICROPROCESSORS LAB

Course Educational Objectives:

CEO_1:To write and execute addition & subtraction of two 8 &16 bit numbers.
CEO_2:To implement Multiplication and Division of two 8 bit numbers.
CEO_3:To find smallest & largest from the given array in stored in address fields.
CEO_4:To understand Sum of n numbers.
CEO_5:To understand Arrange ascending and descending order of a given string.
CEO_6:To Display “Fire” & “Help Us”, “SUPERB” in seven segment of trainer kits.

Learning outcomes: Students are able to learn

LO_1: Assembly language program on MPS-85, ESA-85E trainer kits for two 8 bit & 16 bit numbers and their mathematical calculations verification in Hex or Decimal format
LO_2: Gain knowledge on arranging order from the given string and finding smallest & largest numbers.
LO_3: Express knowledge on calling functions, delay time programs, subroutine programms.

List of experiments

1. Addition of two 8 bit numbers .
2. Subtraction of two 8 numbers by 2’s complement method.
3. Addition of two 16 bit numbers.
4. 2’s complement of a 16 bit number.
5. Multiplication of two 8 bit numbers.
6. Division of two 8 bit numbers.
7. Smallest from data array.
8. Largest from data array.
9. Sum of n numbers
10. Arranging data in ascending order.
11. Arranging data in descending order.

12. Generating and displaying decimal count.
13. Generating and displaying Hex decimal count.
14. Display “Fire” & “Help Us” in address and data fields.
15. Display “SUPERB” in address and data fields.

Course Outcomes: On completion of the course, student will be able to

CO_1: Execution ADD& SUB of two 8&16 bit numbers on MPS-85, ESA-85E trainer kits.
CO_2: Find Multiplication and Division of two 8 bit numbers.
CO_3: Find smallest & largest from the given array and Sum of n numbers.
CO_4: Displaying decimal and Hex decimal count.
CO_5: Arrange ascending and descending order of a given string.
CO_6: Display “Fire” & “Help Us”, “SUPERB” in seven segment display.

IN 3207: PROCESS CONTROL LAB

CEOs (Course Educational Objectives)

1. To control process parameters with the help of different control modes.
2. To verify the operation of different controllers.
3. To verify the operation of I/P & P/I converters.
4. To study about data acquisition systems.
5. To verify the operations of PLC.

COs (Course outcomes)

After completion of the course the students will be able to

1. Explain I/P Converter characteristics.
2. Use the various P, PD and PID Control actions.
3. Design data acquisition systems for various applications.
4. Describe temperature measurement using RTD.
5. Design and ladder logic programming of programmable logic controller (PLC).

List of experiments:

1. I/P Converter characteristics.
2. Pressure process control loop.
    - P, PD and PID Control actions.
    - Tuning of PID controller for optimum control settings
3. Study of SCADA systems
4. ON-OFF Control of temperature with RTD as a measuring element and LED as an indicator.
5. Programmable logic controller ladder diagram programming.

- Door bell and switching of light simulation
- Logic gates simulation.
- Stepper motor control simulation
- DC Servo motor control simulation
- Simulation of tank level control
- Simulation of elevator
- Simulation of bottle filling
- Simulation of washing machine
- A.C .servo motor control simulation
- Simulation of automatic coffee vending machine.

Learning Outcomes:

1. Able to verify operation of temperature, level, flow, pressure transmitter.
2. Able to verify the operation of I/P & P/I converters.
3. Able to verify the operation of SCADA System.
4. Able to tune the different controllers.
5. Able to simulate a programmable logic controller ladder diagram programming.

IN 3208: Bio-Medical Instrumentation Lab

Course objectives:

The course has the following objectives:

- To introduce fundamentals of transducers as applicable to physiology.
- To explore the human body parameter measurements setups.
- To introduce students with timer circuits & heart-rate meter.
- To emphasis on the study of EMG, ECG, EEG waveform & analysis.
- To familiarize students with the design of biopotential amplifiers.
- To introduce students with basic operation of X-ray system.
- To introduce students on the study of isolation of biosignals.

Course Outcome:

After completion of this course the students will be able to

1. Understand and implement isolation techniques in designing biomedical instruments.
2. Measure and Analyze EMG, ECG, EEG and PCG waveforms in diagnostic point of views
3. Measure and Analyze QRS components from diagnostic point of view.
4. Design and analyze the characteristics of Biopotential amplifiers.
5. Understand & describe the basic operation of an X-ray system.
6. Measure heart rate meter using F-V Converter.
7. Measure ON-Time & OFF-Time delay of a waveform using Timer circuit.

List of Experiments:

1. Monitoring of Pulse Rate using Pulse Rate Monitor.
2. Monitoring of Heart Sounds using Phono Cardiogram.
3. Measuring the blood flow rate using Blood Flow Meter,
4. Recording ECG using Electrocardiography.
5. Recording the electrical activity of the brain using EEG.
6. Recording the muscle electrical activities using EMG.
7. Measurement of lung parameters using Spirometer.
8. Measuring the respiration rate using Respiration Rate Monitor.
9. Studying the working of AED using Mannequin.
10. Studying the working of Pacemaker using Mannequin.

IN 3209: PYTHON PROGRAMMING LAB

Course Objectives:

- To be able to introduce core programming basics and program design with functions using Python programming language.
- To understand a range of Object-Oriented Programming, as well as in-depth data and information processing techniques.
- To understand the high-performance programs designed to strengthen the practical expertise.

Syllabus:

- Introduction to Python
- Plotting
- Saving Scripts
- Numpy Arrays
- IPython Notebooks
- Basic Data Types
- Control Flow
- Core Data Structures
- Functions
- Files
- Modules

- Exceptions

Text Books:

1. Core Python Programming, Wesley J. Chun, Second Edition, Pearson.
2. Paul Barry, "Head First Python a Brain Friendly Guide" 2nd Edition, O'Reilly, 2016
3. Dainel Y.Chen "Pandas for Everyone Python Data Analysis" Pearson Education, 2019

Reference Books:

1. Think Python, Allen Downey, Green Tea Press
2. Introduction to Python, Kenneth A. Lambert, Cengage
3. Python Programming: A Modern Approach, Vamsi Kurama, Pearson
4. Learning Python, Mark Lutz, O'Really.

E-Resources:

1. Peter Wentworth, Jeffrey Elkner, Allen B. Downey and Chris Meyers, "How to Think Like a Computer Scientist: Learning with Python 3", 3rd edition, Available at http://www.ict.ru.ac.za/Resources/cspw/thinkcspy3/thinkcspy3.pdf
2. The Python Tutorial : https://docs.python.org/3/tutorial
3. Code Academy Python Track: http://www.codecademy.com/tracks/python
4. Learn Python the Hard Way: http://learnpythonthehardway.org/book
5. Core Python Programming: http://corepython.com
6. Dive Into Python 3: http://www.diveinto.org/python3
7. Python for You and Me: http://pymbook.readthedocs.org/en/latest
8. Think Python: http://greenteapress.com/thinkpython
9. Python 101: http://www.blog.pythonlibrary.org/2014/06/03/python-101-book-published-today
10. Problem Solving with Algorithms and Data Structures: http://interactivepython.org/runestone/static/pythonds/index.html
11. Python Course: http://www.python-course.eu/python3_course.php
12. Python Essential Reference: http://www.dabeaz.com/per.html
13. Hitchhikers Guide to Python: http://docs.python-guide.org/en/latest
14. Writing Idiomatic Python: https://www.jeffknupp.com/writing-idiomatic-python-ebook
15. Fluent Python: http://shop.oreilly.com/product/0636920032519.do
16. Python 3 Object Oriented Programming : https://www.packtpub.com/application-development/python-3-object-oriented-programming

List of Experiments:

1. Write a program to demonstrate different number data types in Python.
2. Write a program to perform different Arithmetic Operations on numbers in Python.
3. Write a program to create, concatenate and print a string and accessing sub-string from a given string.

4. Write a python script to print the current date in the following format “Sun May 29 02:26:23 IST 2017”.
5. Write a program to create, append, and remove lists in python.
6. Write a program to demonstrate working with tuples in python.
7. Write a program to demonstrate working with dictionaries in python.
8. Write a python program to find largest of three numbers.
9. Write a Python program to convert temperatures to and from Celsius, Fahrenheit.
   [Formula :c/5 = f-32/9]
10. Write a Python program to construct the following pattern, using a nested for loop

    *

    * *

    * * *

    * * * *

    * * *

    * *

    *

    *
11. Write a Python script that prints prime numbers less than 20.
12. Write a python program to find factorial of a number using Recursion.
13. Write a program that accepts the lengths of three sides of a triangle as inputs. The program output should indicate whether or not the triangle is a right triangle (Recall from the Pythagorean Theorem that in a right triangle, the square of one side equals the sum of the squares of the other two sides).
14. Write a python program to define a module to find Fibonacci Numbers and import the module to another program.
15. Write a program to compute summary statistics such as mean, median, mode, standard deviation and variance of the given different types of data.
16. Write a python program to define a module and import a specific function in that module to another program.
17. Write a script named copyfile.py**.** This script should prompt the user for the names of two text files. The contents of the first file should be input and written to the second file.
18. Write a program to demonstrate Regression analysis with residual plots on a given data set.
19. Write a program that inputs a text file. The program should print all of the unique words in the file in alphabetical order.
20. Write a Python class to convert an integer to a roman numeral.
21. Write a Python class to implement pow(x, n)
22. Write a Python class to reverse a string word by word.

Course Outcome:

- Student should be able to understand the basic concepts scripting and the contributions of scripting language.
- Ability to explore python especially the object-oriented concepts, and the built in objects of Python.
- Ability to create practical and contemporary applications such as TCP/IP network programming, Web applications, discrete event simulations.

Modeling and functional simulation of the following digital circuits (withXilinx/ ModelSim tools) using VHDL

Syllabus:

Part I: Combinational Logic: Basic gates, multiplexer, comparator, adder/substractor, multipliers, decoders, address decoders, parity generator, ALU.

Part II: Sequential Logic: D-Latch, D-Flip flop, JK-Flip flop, registers,ripple counters, synchronous counters, shift registers (serial-to-parallel,parallel-to-serial), cyclic encoder/ decoder.

Part III: Memories and State Machines: Read only memory (ROM), randomaccess memory (RAM), mealy state machine, Moore state machine,arithmetic multipliers using FSMs.

Pre-requisite: The fundamentals of digital logic design

List of Experiments:

1. Modelling of Full adder, Full Subtractor using VHDL
2. Modelling of 2-4 decoder, 4-2 encoder and 2-1 Multiplexer using all three modelling style
3. Modelling of BCD – to – 7 Segment Display Code Converterusing VHDL
4. Modelling of 8-Bit Parity Generatorusing VHDL
5. Modelling od D-latch and D-FF with synchronous and asynchronous clock signal

6. Modelling of Registers (PIPO, PISO,SIPO,SISO, Bidirectional and Universal shift register)
7. Modelling of Counters(up-counter, down-counter and up-down counter and BCD counter)
8. Modelling of RAM and ROM
9. Modelling of Mealy and Moore FSM's
10. Mini Project

ELECTRONIC INSTRUMENTATION

L	T	PD	TOTAL Pds	Univ Exam Hrs	Univ Exam Marks	Sessnl Marks	Total Marks
3	**-**	**--**	**3**	**3**	**70**	**30**	**100**

Course Educational Objectives:

1. To introduce the fundamentals about the basic Instrumentation system and the units of measurement.
2. To equip the students with the design details of Conventional CRO and Special purpose CRO's.
3. To explore the various signal generators, Wave analyzers, Spectrum analyzers and Q Meters.
4. To provide the insight into the design of AC and DC Electronic Volt Meters.
5. To understand the design aspects of various types of Digital Instruments
6. To familiarize the students about the overall design of Electronic Instruments

Generalized Instrumentation system – Units and standards- Calibration methods- Standards of measurement- Classification, Introduction to mechanical, electrical and electronic instruments.

Learning Outcomes:

LO-1: Ability to describe the basic building blocks of Instrument System
LO-2: Compare the performances of mechanical, electrical and electronic Instruments
LO-3: Knowledge about the standards of measurement

Cathode ray oscilloscope: Block diagram vertical and horizontal amplifiers, sweep circuits, delay line, electrostatic focusing and electrostatic deflection. Special purpose oscilloscopes- sampling oscilloscopes, analog storage and digital storage oscilloscopes, dual beam and dual trace oscilloscopes.

Learning Outcomes:

LO-1: Ability to describe the operations involved in a CRO
LO-2: Learn thedetails of different special purpose oscilloscopes

Instruments for generating and analyzing wave forms, square wave, pulse, standard-signal, random noise and function generators, wave analysers, spectrum analysers, Q-meters, vector – voltmeters, vector impedance meters.

Learning Outcomes:

LO-1: Knowledge about the Instruments that generate different signals
LO-2: To design and develop the wave analyzers, spectrum analyzers and Q Meters.

Electronic analog meters: Electronic voltmeters VTVM, TVM, FETVM Voltmeters, electronic – multimeters differential voltmeters. DC voltmeters- Loading- Transfer volt meter- Chopper type– Differential voltmeter – Peak responding voltmeter – True RMS voltmeter – Calibration of DC instruments.

Learning Outcomes:

LO-1: Familiar with the design aspects of AC and DC Voltmeters
LO-2: Learn to calibrate the instruments

Digital Instruments: – Digital multimeters – Digital frequency meter – Digital Measurement of time – Universal counter – Electronic counter – Digital Tachometer- Digital voltmeter– Ramp Type DVM – Dual slope Ramp DVM- Integrating type DVM – Successive approximations type DVM – Resolution and sensitivity of digital meters – General specifications of a DVM, Data acquisition system.

Learning Outcomes:

LO-1: Ability to describe the working of digital frequency meter, counters and tacho meters.
LO-2: Compare the performances of different types of DVM's
LO-3: Knowledge about the Data Acquisition System

TEXT BOOKS:

1. Modern electronic instrumentation measurements techniques by Helfrick andcooper.
2. A course in electrical and electronic measurement and instrumentation by A.K.Shawney.

3. Electronic Instrumentation by H.S.Kalsi.

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

1. Compare and analyze the performance of Mechanical, Electrical and Electronic Instruments.
2. Apply the theoretical design aspects to develop Cathode Ray Oscilloscope
3. Obtain the knowledge on the different signal generators.
4. Analyze and compare the working of AC and DC voltmeters
5. Evaluate the performances of Digital Instruments.
6. Develop the Electronic Instruments by applying the theoretical concepts

ADVANCED SENSORS

L	T	PD	TOTAL Pds	Univ Exam Hrs	Univ Exam Marks	Sessnl Marks	Total Marks
3	-	--	3	3	70	30	100

Course Educational Objectives:

1. To provide in depth knowledge in physical principles applied in sensing, measurement and a comprehensive understanding on how measurement systems are designed, calibrated, characterised, and analysed.
2. To introduce the students to sources and detectors of various semiconductor sensors and provide in-depth understanding of the principle of measurement, and theory of instruments and sensors.
3. An understanding of the principles of silicon sensors.
4. To give a fundamental knowledge on the basic laws and phenomena on which operation of Chemical and biomedical sensors.
5. To impart a reasonable level of competence in the design, construction, and execution of micro sensors.

Chemical Sensors: Amperometry-Potentiometry-Conductivity sensors- Semi conductive sesors-MEMS sensors. Materials for sensors-Electrical conducting materials- Ionic conductors-zirconia-alumina-NASICON. Semiconductor materials-Titania-tinoxide-zinc oxide. Insulating materials-Ferroelectric Materials-Negative temperature ceramic thermistors.

Thin and Thick film sensors: Thick film processes-Thin film processes- Thin film deposition methods- thin film characterization methods-thin film delineation techniques-compatibility issues- Longmuir-Blodgett films for sensor materials-film forming apparatus-dipping-ion sensors-gas sensors. Applications of thin and thick film sensors.

Biosensors: Colorimetric- Optical- Potentiometric- Amperometic- Conductometric-

Semiconductor- Mechanical and Molecular electronic based sensors. Chemiluminescence based biosensors. Applications of biosensors in medical and health care- food and agricultural- Industrial process and environmental monitoring.

Integrated Magnetic Sensors: Overview of magnetic field sensor Technology-AMR-GMR-SQUIDS-Optoelectronic MFS- Semiconductor magnetic effects-materials and figure of merit-Standard MFS technologies-limitations and applications.

Sensor Applications: Automotive Sensors- Environmental Sensors- Sensors for Medical Diagnosis and patient monitoring- Aerospace sensors.

Course Outcomes:

1. Explain the various principles employed in transducers.
2. Examine the methods of fabricating a sensor.
3. Apply knowledge in designing smart sensors.
4. Discuss the techniques of fabrication and application of MEMS.
5. Describe the various applications of smart sensors.
6. Discuss advanced sensing technology.

REFERENCE BOOKS

1. Sensors- A Comprehensive study-W.Gopal, J Hesse, J N Zemel –VHC Press, 1989.
2. Sensors Handbook-SabreeSoloman—McGraw Hill Publishers-1998
3. Electro Optical Instrumentation- SilvanoDonati, Pearson Education 2005.
4. Introduction to Medical Equipment Technology: Carr and Brown- Addison Weseley-2001.

ANALOG SIGNAL PROCESSING

L	T	PD	Total periods	Univ exam		Sessnl Marks	Total Marks
				Hrs	Marks		
3	1	--	4	3	70	30	100

CEOs (Course Educational Objectives)

7. To study basic introduction of different amplifiercomponentsandoperations.
8. To study and review analog signal filter functions and realizations.
9. To understand the pole locations and low pass filter specifications.
10. To study Delay equalization procedures modules and strategies.
11. To Define Bode sensitivity.
12. List out the different types of Techniquescomponents and properties of Lossless ladders.

Course syllabus

Unit1: Introduction to domains and the analogue/digital trade off, Introduction to basic building blocks: null or, voltage feedback amplifier, operation transconductance amplifier, current conveyor, current feedback amplifier. Analog signal filtering: introduction to bilinear transfer

functions and active realizations. First-order and second-order filter realization, filter design parameters (Q and ω0), frequency response, effect of finite gain of op-amp, realization of Single-Amplifier Biquad and General Impedance Convertor circuit.

Learning outcomes:

Students can

1. Outline the basic principles of analog circuits.
2. Describe various building blocks of amplifiers, filters and concepts.
3. Explain filter realization, designparameters, frequency response, gain and impedance.

Unit2: Ideal low-pass filter, Butterworth and Chebyshev magnitude response, pole locations, low-pass filter specifications.

Learning outcomes:

Students can

1.Explain basic Ideal low-pass filter.

2.DescribeChebyshey magnitude response, pole locations of Butterworth and Ideal low-pass filter

3.Explain low-pass filter specifications.

Unit3: Delay equalization: equalization procedures, equalization with first-order and second- order modules, strategies for equalization design. Definition of Bode sensitivity.

Learning outcomes:

Students can

1. Explain Delay equalization and equalization procedures.
2. Design equalization with strategies and with first-order and second-order modules.
3. Define Bode sensitivity.

Unit4: Properties of Lossless ladders, the general impedance convertor (GIC), optimal design of the GIC, realization of simple ladders, Gorski-Popiel's Embedding Technique, Bruton's FDNR technique, creating negative components.

Learning outcomes:

Students can

1. Explain the properties of Lossless ladders and general impedance Gorski-Popiel's Embedding Technique, Bruton's FDNR technique converter (GEC).
2. Describe optimal design of the GIC and realization of simple ladders.
3. Use Gorski-Popiel's Embedding Technique and Bruton's FDNR technique.

Text books

1. R. Schaumann and M.E. Valkenberg," Design of Analog Circuits", Oxford University

e-Resourses

1. http://wp.kntu.ac.ir/dfard/ebook/filter/[Rolf_Schaumann,_the_late_Mac_E._Van_Valkenburg]_D(b-ok.org).pdf
2. https://aktu.ac.in/pdf/syllabus/syllabus2021/24th%20August%20Revised%20Final%20B.Tech.%203rd%20Year%20ECE%20AICTE%20Model%20Curriculum%202020-21.pdf
3. https://bbdu.ac.in/wp-content/uploads/2018/03/btech-ec-old.pdf
4. https://www.youtube.com/watch?v=P3CTCmDLPss

5. https://www.digimat.in/nptel/courses/video/117106088/L01.html
6. https://youtu.be/8ybxGhhkr20

COs (Course outcomes)

After completion of the course the students will be able to

7. Describe the analog signal processing concepts and components.
8. Design amplifiers and filters.
9. Develop magnitude response, pole locations and specifications of low-pass filters.
10. Design delay equalization and Define Bode sensitivity.
11. Analyse properties of Lossless ladders and develop negative components.
12. Develop new techniques for realization of simple ladders.

POWER PLANT INSTRUMENTATION

L	T	PD	TOTAL Pds	Univ Exam Hrs	Univ Exam Marks	Sessnl Marks	Total Marks
3	**1**	**--**	**4**	**3**	**70**	**30**	**100**

Course Educational Objectives:

1. To introduce the fundamentals about different types of energy sources
2. To understand the different methods of power generation and performance parameters of power plants
3. To explore the various controls in a thermal power plant
4. To know the details of operations of thermal power plant
5. To understand the basic operations of turbines and governers
6. To train the students to work in Industries

Energy sources, their availability. Introduction to Power generation- Classification: Renewable and nonrenewable energy generation resources. Renewable-wind power, solar, geothermal and bio-fuels, Nonrenewable-fossil fuels (coal, oil and natural gas) and nuclear power.

Learning Outcomes:

LO-1: Ability to classify renewable and non renewable sources of energy

LO-2: Compare the different energy sources and their availability

Comparison of thermal power plant, hydroelectric power plant, wind, solar, nuclear power plant on the basis of Performance, efficiency, site selection, Economics-capital and running, safety standards, pollution, effluent management and handling.

Learning Outcomes:

LO-1: Compare the performance of various power plants

LO-2: Learn the considerations of site selection for a specific power plant

LO-3: Knowledge about safety standards and pollution handling

Basic boiler operations, boiler safety standards, Combustion controls; series-parallel operation, optimizing control for air-flow- oxygen trimming control, Drum level control: feed water control, drum level control, steam flow control, two-element control, and three-element control, Furnace pressure control, steam temperature control, super heatercontrol.

Learning Outcomes:

LO-1: Understand the basic boiler operations
LO-2: Learn to design the control loops for various control actions in a power plant

Thermal Power Plant- Method of power generation, layout and energy conversion process, major input variables, major control variables.

Learning Outcomes:

LO-1: Understand the layout and energy conversion in a thermal power plant
LO-2: Learn the major input variables and control variables

Turbines and governers: basic operations, turbine speed control methods. Automatic startup systems- safety systems.

Learning Outcomes:

LO-1: Understand the basic operations of a turbines and governers
LO-2: Design the control loops for turbine speed control
LO-3: Knowledge about safety systems and automatic startup systems

TEXT BOOKS:

1. D. Patranabis: Principles of process control., TMH, New Delhi, secondedition.
2. Bela.G.Liptak: Instrumentation Engineers Handbook
3. George Stephanopoulos: Chemical process control; Prentice Hall India PvtLtd.

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

1. Compare and analyze the performance of various power plants
2. Develop the control loops for any control actions in power plant
3. Obtain the detailed knowledge on the operations of thermal power plant
4. Design the control loops for turbine speed control
5. Apply the theoretical aspects of power plants to design the entire control system.
6. Install and commission the power plant

STEEL PLANT INSTRUMENTATION

Course educational objectives:

CEO_1: To learn about the process of making steel from the raw materials.
CEO_2: To know the role of instrumentation in a steel industry

CEO_3: To deal with the control operations carries out at various stages
CEO_4: To know the role of various utilities

UNIT-1

Basics of steel production; mill zones: iron zone, steel zone, mill zone, utility zone Automation strategy: different levels, input, and output data. Iron zone: supervisory control, direct digital control; instrumentation for-raw material handling, coke oven, sinter plant, Blast furnace; input/output data, control architecture. Steel zone: Automation for- LD converters, continuous casting, soaking pit control, blooming mill controls.

Learning Outcomes: Students can able to
LO_1: Understand the different zones of steel plant automation
LO_2: Understand the blooming mill controls for rolling facilities

UNIT-2

Utility zone: instrumentation for-Gas distribution, liquid fuel distribution, power generation, steam generation, compressed air generation.

Learning Outcomes: Students can able
LO_1: Understand the different utilities for steel plant
LO_2: Understand the concept of power, steam and compressed air generation.

UNIT-3

Instrumentation for water management system.

Learning Outcomes: Students can able
LO_1: Understand the water management system in steel plant.

UNIT-4

Pollution control and monitoring for steel plant environment.

Learning Outcomes: Students can able
LO_1: Understand the concept of pollution control and monitoring for plant environment

TEXT BOOKS:

1. D. Patranabis: Principles of process control, TMH, New Delhi, second edition.
2. Krishna Kant: Computer based industrial control, Prentice Hall India Pvt Ltd.
3. George Stephanopoulos: Chemical process control; Prentice Hall India Pvt Ltd.

REFERENCE BOOKS:

Bela.G.Liptak: Instrumentation Engineers Hand book

COs (Course outcomes):

After completion of the course the students will be able to
CO_1: Describe various process in Iron and Steel industry

CO_2: Indicate the use of instruments in steel making and Suggest suitable sensor for a typical measurement
CO_3: Develop control systems for the various operations in Steel Industries
CO_4: Evaluate the usefulness of Instrumentation in monitoring and control in the Steel industry

Industrial Safety Instruments

L	T	PD	TOTAL Pds	Univ Exam Hrs	Univ Exam Marks	Sessnl Marks	Total Marks
3	1	--	4	3	70	30	100

COURSE EDUCATIONAL OBJECTIVES :

1)To impart adequate knowledge in safety rules, standards and different codes in Engineering Industry.
2)To understand the safety importance and study various machines .
3)To impart basic knowledge of different welfare and safety measures in industry .
4)To study the operation of protective devices and their importance of safety.
5)To familiarize the saftety risks and the working principle of different processes in the Industry .
6) To learn the working principle of machine guarding .

COURSE SYLLABUS :

Unit -I Safety In Metal Working Machinery And Wood Working Machines General safety rules, principles, maintenance, Inspections of turning machines, boring machines, milling machine, planning machine and grinding machines, CNC machines, Wood working machinery, types, safety principles, electrical guards, work area, material handling, inspection, standards and codes- saws, types, hazards.

LEARNING OUTCOMES:
1)Explain the general safety rules in metal working machinery
2)Describe the inspections of different machines
3)Discuss the safety rules and principles in wood working machinery

Unit -II Principles of Machine Guarding. Guarding during maintenance, Zero Mechanical State (ZMS), Definition, Policy for ZMS – guarding of hazards - point of operation protective devices, machine guarding, types, fixed guard, interlock guard, automatic guard, trip guard, electron eye, positional control guard, fixed guard fencing- guard construction- guard opening. Selection and suitability: lathe-drilling-boring-milling-grinding-shaping-sawingshearingpresses- forge hammer-flywheels-shafts-couplings-gears-sprockets wheels and chains-pulleys and belts- authorized entry to hazardous installations-benefits of good guarding systems.

LEARNING OUTCOMES:
1)Explain the principles of machine guarding
2)Define Zero mechanical state (ZMS)
3)Discuss the concept of guard construction and guard opening

Unit -III Safety In Welding And Gas Cutting Gas welding and oxygen cutting, resistances welding, arc welding and cutting, common hazards, personal protective equipment, training, safety precautions in brazing, soldering and metalizing – explosive welding, selection, care and maintenance of the associated equipment and instruments – safety in generation, distribution and handling of industrial gases-colour coding – flashback arrestor – leak detection-pipe line safety- storage and handling of gas cylinders.

LEARNING OUTCOMES:
1)Explain the safety in gas welding and oxygen cutting
2)Describe the concept of the care and maintenance of equipment's and instrument's in industry.
3)Explain leak detection and pipeline safety .

Unit -IV Safety In Cold Forming And Hot Working Of Metals Cold working, power presses, point of operation safe guarding, auxiliary mechanisms, feeding and cutting mechanism, hand or foot-operated presses, power press electric controls, power press set up and die removal, inspection and maintenance-metal sheers-press brakes. Hot working safety in forging, hot rolling mill operation, safe guards in hot rolling mills – hot bending of pipes, hazards and control measures. Safety in gas furnace operation, cupola, crucibles, ovens, foundry health hazards, work environment, material handling in foundries, foundry production cleaning and finishing foundry processes.

LEARNING OUTCOMES:
1)Explain the way of inspection and maintenance of metal sheers-press brakes
2)Explain the safety measures in gas furnace operation.
3)Describe the foundry production cleaning and finishing foundry processes.

Unit -V Safety In Finishing, Inspection And Testing Heat treatment operations, electro plating, paint shops, sand and shot blasting, safety in inspection and testing, dynamic balancing, hydro testing, valves, boiler drums and headers, pressure vessels, air leak test, steam testing, safety in radiography, personal monitoring devices, radiation hazards, engineering and administrative controls, Indian Boilers Regulation.

LEARNING OUTCOMES:
1)Explain the safety in heat treatment operations .
2)Describe the way of inspection and testing in boiler drums and headers.
3)Explain safety in radiation hazards radiography and personal monitoring devices.

REFERENCE BOOKS:

1. "Accident Prevention Manual" – NSC, Chicago, 1982.
2. "Occupational safety Manual" BHEL, Trichy, 1988.

3. “Safety Management by John V. Grimaldi and Rollin H. Simonds, All India Travelers Book seller, New Delhi, 1989.
4. “Safety in Industry” N.V. Krishnan Jaico Publishery House, 1996.
5. Indian Boiler acts and Regulations, Government of India.
6. Safety in the use of wood working machines, HMSO, UK 1992.
7. Health and Safety in welding and Allied processes, welding Institute, UK, High Tech. Publishing Ltd., London, 1989.

COURSE OUTCOMES:

1)Understand and memorize the safety rules, standards and codes.
2)Design machine guarding systems for different machines.
3)Implement safety concepts in different processes.
4)Have knowledge in testing and inspection in the heat treatment operations and boilers as per rules .
5) Explain the working principle of processes such as metal forming and joining process and their safety risks.
6) Understand how to take accident preventive measures in health and the welfare of workers in Engineering Industry.

INDUSTRIAL COMMUNICATION & NETWORKS

Category	Hours per week			Internal Marks	External Marks	Total Marks	Credits c
	L	T	P				
PE	3	0	0	30	70	100	3

CEOs (Course Educational Objectives)

1. To study and review Industrial communication & networks.
2. To build an understanding among students about the fundamental concepts of computer networking, protocols, architectures, and applications.
3. To study Data Communications and Networking, Evolution of network, Requirements , Applications, Network Topology.
4. To help students to acquire knowledge in design, implement and analyze performance of OSI and TCP-IP based Architectures.
5. To study Switched Communications Networks – Circuit Switching – Packet Switching.
6. To implement new ideas in Networkingthrough assignments.

Course syllabus

Unit-1: Networking Principles and layered architecture: Data Communications and Networking: A Communications Model – Data Communications - Evolution of network, Requirements , Applications, Network Topology (Line configuration, Data Flow), Protocols and Standards, Network,Models (OSI, TCP/IP).

Learning outcomes:

Students can

1. Outline the basics of Networking principles and layered architecture.
2. Describe various Communication networks and concepts.
3. Explain Network Topology .& network models.

Unit-2: Circuit and Packet switching : Switched Communications Networks – Circuit Switching –

Packet Switching – Comparison of Circuit Switching and Packet Switching – Implementing Network Software, Networking.Parameters(Transmission Impairment, Data Rate and Performance).

Learning outcomes:

Students can

1. xplain basic circuit and packet switching.
2. Implement Network Software .
3. Explain Networking parameters.

Unit -3: Data Link Layer: Error Detection and Correction – Hamming Code , CRC, Checksum-Flow control mechanism – Sliding Window Protocol - GoBack - N - Selective Repeat - Multiple access Aloha - Slotted Aloha -CSMA, CSMA/CD – Multiple Access Networks (IEEE 802.3), Token Ring(IEEE 802.5) and Wireless Networks (IEEE 802.11, 802.15.

Learning outcomes:

Students can

1. Explain Data Link Layer.
2. Describe Checksum- Flow control mechanism – Sliding Window Protocol.
3. Describe Multiple Access Networks .

Unit -4: Network Layer: IPV4 Address Space – Notations – Classful Addressing – Classless Addressing – Network Address Translation – IPv6 Address Structure – IPv4 and IPv6 header format.

Learning outcomes:

Students can

1. Explain Network Layer.
2. Describe classless addressing and address space-Notations.
3. Explain IP address structures.

Unit -5: Routing Protocols: Routing-Link State and Distance Vector Routing Protocols-Implementation-Performance Analysis- Packet Tracer.

Learning outcomes:

Students can

1. Explain Routing protocols.
2. Implement the different routing protocols.
3. Outline the performance Analysis-packet Tracker

Text books

1. Computer Networks: A Systems Approach, Larry Peterson and Bruce Davie, 5th Ed, The Morgan Kaufmann Series, Elsevier, 2011.
2. Computer Networking: A Top-Down Approach Featuring the Internet, J.F. Kurose and K.W.Ross, 6th Ed., Pearson Education, 2012.

Reference books

1.Data Communications and Networking, Behrouz A. Forouzan, McGraw Hill Education, 5th Ed., 2012.

2.TCP/IP Protocol Suite, Behrouz A. Forouzan, McGraw-Hill Education, 4 Ed., 2009.

3.Data and Computer Communications, William Stallings, Pearson Education, 10th Ed, 2013.

e-resourses

1. https://instrumentationtools.com/basics-of-industrial-communication-networks/.
2. https://link.springer.com/chapter/10.1007/978-3-319-09411-3_97.
3. https://automationforum.co/overview-industrial-communication-network/.
4. https://new.siemens.com/global/en/products/automation/industrial-communication.html.
5. https://ebhorsman.com/blog/industrial-communication-network.
6. https://pdhonline.com/courses/e497/e497content.pdf.

COs (Course outcomes)

After completion of the course the students will be able to

1.Interpret the different building blocks of Communication network and its architecture.
2.Contrast different types of switching networks and analyze the performance of network
3. Identify and analyze error and flow control mechanisms in data link layer
4. Design subnetting and analyze the performance of network layer
5. Construct and examine various routing protocols.
6. Able to know the Implementation of Industrial communication & Networks.

VLSI

L	T	PD	Total periods	Univ exam		Sessnl Marks	Total Marks
				Hrs	Marks		
3	-	--	3	3	70	30	100

CEO's (Course Educational Objectives)

1.To understand the concept of different IC technologies and analyse basic electrical properties of Bi-polar, MOS, CMOS, NMOS, PMOS, Bi-CMOS devices.
2. Analyse the concepts of alternate gate circuits, interconnect delays, fan-in and fan-out relationship.
3. Acquire knowledge of Semi-custom and full custom ASICS, standard cell design, PLA, PAL, Programmable gate Arrays-CPLD, FPGAs.
4. Outline the concepts and Methodologies for chip design using circuit design flow in VHDL synthesis, design verification tools, validation & testing techniques.
5. To understand the different types of VLSI packages and VLSI design rules.
6. To analyze the Electrical, Mechanical, Thermal design considerations of IC packages.

Course Syllabus

Unit -1 : INTRODUCTION TO MOS TECHNOLOGY:

Various types of technologies – Bi-polar, MOS, CMOS, NMOS, PMOS. Comparison, fabrication of NMOS, PMOS, CMOS, Bi-CMOS devices. Basic Electrical Properties: Drain-to- source current versus Voltage relationship, Threshold voltage, MOS transistor trans conductance and output conductance, figure of merit, Pass transistor, determination of Pull-up to Pull-down ratio of NMOS Inverter driven by another Inverter, determination of Pull-up to Pull-down ratio of NMOS Inverter driven through one or more Pass transistors.

Learning outcomes:

Students can

1.Be able to apply MOS technology rules in the placement and routing of transistors and interconnect, and to verify the functionality, timing, power, and parasitic effects.

2. Be able to create models of moderately sized PMOS,NMOS circuits that realize specified digital functions.

Unit-2: CIRCUIT DESIGN PROCESSES:

NMOS circuits: Inverter, NAND and NOR gates, CMOS circuits: Inverter, NAND and NOR gates. Stick Diagrams: NMOS Design style and CMOS Design Style. Design rules: Lambda based design rules, contact cuts, CMOS Lambda based design rules, Layout diagrams: NMOS Inverter, NAND and NOR gates, CMOS Inverter, NAND and NOR gates. Inverter delays, propagation delays.

Learning outcomes:

Students can

1.Be able to use mathematical methods and circuit analysis models in analysis of CMOS digital electronics circuits.

2.. Be able to create models of moderately sized CMOS circuits that realize specified digital functions.

Unit -3: INTEGRATED CIRCUIT DESIGN:

Types of ASICs: full custom and semi-custom devices, Major activities in ASIC Design, ASIC Design and Development flow, Standard Cell based ASICs, Gate arrays based ASICs including channeled, sea-of gates, structured gate arrays. PLDs: Block diagram of PLA, PLA design, Bipolar PLA, NMOS PLA, PLA organization, folded PLA, CPLD, PAL design,

FPGA block diagram, CLB, interconnect, I/O blocks

Learning outcomes:

Students can

1.Design of different integrated circuits.

2.Designing of memory elements using PAL,PLA,CPLD and FPGA's.

Unit-4: VLSI DESIGN TOOLS:

VHDL synthesis, VHDL synthesizer, Circuit design flow, Circuit Synthesis, Simulation, types of Simulations, Simulation versus Synthesis, Design verification tools, Test vector generation, Scan based techniques, Boundary scan test, BIST.

Learning outcomes:

1.Be able to apply VHDL verification tools, validation & testing.

2.By using VHDL design tools, we designing a circuit , Synthesizing a Circuit and Simulating a Circuit.

Unit -5: PACKAGING:

Types of packages, VLSI design rules, Constraints: Electrical, Mechanical, Thermal design considerations of IC packages.

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Learning outcomes:

Students can

1. To verify the Electrical, Mechanical considerations of VLSI packages.
2.Apply the VLSI design rules to complete a significant various VLSI design project having a set of objective criteria and design constraints.

Textbooks:

1) Basic VLSI Design by Douglass 3rd Edition, A Pucknell and Kamran Eshraghian, PHI,1994.
2) Applications specific integrated Circuits by Michel John Sebastian Smith, Addison Wesley, 1997.
3) Introduction of VLSI by Mead and Convay.

e-Resourses

1. https://nptel.ac.in/courses/117/101/117101058/
2. https://nptel.ac.in/courses/108/107/108107129/
3. https://nptel.ac.in/courses/117/106/117106093/
4. https://www.youtube.com/watch?v=o9vEnzLL-lY
5. https://www.youtube.com/watch?v=ZwD1kNvzO_g

CO's (Course Outcomes):

After completion of the course the students will be able to

1.Understanding the characteristics of MOS, CMOS, NMOS, PMOS, Bi-CMOS devices and the comparison between different MOS technologies and processes.
2. Able to design CMOS combinational and sequential logic at the transistor level.
3. Design of different functional units using Programmable gate Arrays.
4. Getting the idea of VHDL synthesis, verification tools, validation & testing.
5. Identify the various VLSI packages and design rules.
6. Be able to complete a significant VLSI design project having a set of objective criteria and design constraints.

FUNDAMENTALS OF NANO SENSORS

L	T	PD	Total periods	Univ exam		Sessnl Marks	Total Marks
				Hrs	Marks		
3	-	--	3	3	70	30	100

CEOs (Course Educational Objectives)

1. To study and review of Micro and nano-sensors.
2. To study basic Accelerometer, Pressure Sensor, Night Vision System.
3. To learn Sensor for bio-medical applications.
4. To study about RF MEMS – MEMS variable capacitors.

5. To learn and application of various color image processing techniques.
6. To study Nanolithography Basics of lithography.

Course syllabus

Unit -1: NANOSENSORS I Micro and nano-sensors, Fundamentals of sensors, biosensor, micro fluids, Packaging and characterization of sensors, Method of packaging at zero level, dye level and first level. Sensors for aerospace and defense: Accelerometer, Pressure Sensor, Night Vision System, Nano tweezers, nano-cutting tools, Integration of sensor with actuators and electronic circuitry.

Learning outcomes:

Students can

1. Outline the basic fundamentals of sensors, biosensor, micro fluids.
2. Describe various Components of Sensors for aerospace and defense.
3. Identify Accelerometer, Pressure Sensor, Night Vision System, Nano tweezers, nano-cutting tools.

Unit-2: NANOSENSORS II Sensor for bio-medical applications: Cardiology, Neurology and as diagnostic tool, For other civil applications: metrology, bridges etc. Biosensors. Clinical Diagnostics, generation of biosensors, immobilization, characteristics, applications, conducting Polymer based sensor, DNA Biosensors, optical sensors. Biochips. Metal Insulator Semiconductor devices, molecular electronics, information storage, molecular switching, Schottky devices.

Learning outcomes:

Students can

1. Explain basic Cardiology, Neurology and as diagnostic tool, For other civil applications
2. Describe immobilization, characteristics, applications, conducting Polymer based sensor, DNA Biosensors, optical sensors. Biochips.
3. Explain Metal Insulator Semiconductor devices, molecular electronics.

Unit -3: NEMS Inertial sensors – accelerometer – gyroscope - micromechanical pressure sensors – piezoresistive –capacitive - micro robotics – micro channel heat sinks – optical MEMS – visual display – precision optical platform – optical data switching – RF MEMS – MEMS variable capacitors – MEMS switches – Resonators.

Learning outcomes:

Students can

1. Explain various NEMS Inertial sensors, Accelerometer, Gyroscope, Micromechanical pressure sensors, Piezoresistive, Capacitive

2. Describe optical MEMS, Visual display, Precision optical platform, Optical data switching.
3. Describe RF MEMS – MEMS variable capacitors

Unit-4: NANOLITHOGRAPHY Basics of lithography, optical, micro, ion beam lithography, lithographic tools, nanoimprint lithography – polymeric nanofiber templates – focused ion beam doping wet chemical etching – stencil lithography and sacrificial etching – large scale integration – future challenges – applications.

Learning outcomes:

Students can

1. Classify optical, micro, ion beam lithography, lithographic tools, nanoimprint lithography.
2. Describe focused ion beam doping wet chemical etching, Stencil lithography and Sacrificial etching.
3. Explain large scale integration, future challenges and its applications.

Text books

1. K. Goser, P. Glosekotter and J. Dienstuhl, "Nanoelectronics and Nanosystems-From Transistors to Molecular Quantum Devices", Springer, 2004.

2. W.R.Fahrner, "Nanotechnology and Nanoelectronics – Materials, Devices and Measurement Techniques" Springer, 2006.

3. Sensors: Micro &Nanosensors, Sensor Market trends (Part 1&2) by H. Meixner.

4. Nanoscience & Technology: Novel structure and phenomea by Ping Sheng (Editor).

5. Nano Engineering in Science &Technology: An introduction to the world of nano design by Michael Rieth.

6. Tai –Ran Hsu, "MEMS & Microsystems Design and Manufacture", Tata McGraw-Hill publication, 2001.

7. P. Rai-Choudhury, "MEMS and MOEMS technology and applications", PHIlearning private Ltd, 2009.

8. Mohamed Gad-el-Hak, "The MEMS Handbook", CRC Press, 2002.

COs (Course outcomes)

After completion of the course the students will be able to

1. Describe Integration of sensor with actuators and electronic circuitry.

2. Use the various Sensors for bio-medical applications.
3. Classify DNA Biosensors, Optical sensors. Biochips.
4. Explain RF MEMS – MEMS variable capacitors.
5. Categories various doping wet chemical etching – stencil lithography and sacrificial etching.
6. Able to explain Nanolithography and Basics of lithography

Computer control of process

Hours per week			Internal Marks	External Marks	Total Marks	Credits C
L	T	P				
3	0	0	30	70	100	3

CEOs (Course Educational Objectives)

CEO_1:To study and review of current trends in computer control of process plants.
CEO_2:To study basics of automatic process control and basic building blocks.
CEO_3:To learn DDC Structure and algorithms.
CEO_4:To study about Distributed Digital Control systems and its architectures.
CEO_5:To study Personal Computers in real time environment.
CEO_6:To study Industrial control applications.

Course syllabus

Unit - 1: Introduction: Historical developments of control systems-current trends in computer control of process plants.

Fundamentals of automatic process control: Introduction - Process definition feedback control - Single controller loop - Two Position control - multi-position control - PID control – Multivariable control - Feed forward control.

Learning outcomes:

Students can
LO_1:Outline the Historical developments of control systems.
LO_2:Describe various current trends in computer control of process plants.
LO_3:Identify of different types of controllers.

Unit-2: Building blocks of Automation system: Introduction - Processing system – Multi-microprocessor systems - local area networks- Analog and digital I/O modules - supervisory and data acquisition systems - Remote terminal unit.

Learning outcomes:

Students can
LO_1:Explain processing system.
LO_2:Describe Analog and digital I/O modules.
LO_3:Explain supervisory and data acquisition systems.

Unit -3: Direct Digital Control (DDC): Introduction - DDC Structure - DDC software position algorithm and velocity algorithm, Microcomputer based DDC structure. Programmable logic controllers (PLC's)-Principles of operation, Architecture of programmable controller- Programming the programmable controllers-Ladder diagram instructions-Software-configuration-applications.

Learning outcomes:

Students can
LO_1:Explain DDC Structure.
LO_2:Describe DDC software position algorithm and velocity algorithm.
LO_3:Describe Programmable logic controllers.

Unit-4: Distributed Digital Control: Introduction - Distributed vs Centralized control - Advantages-Functional requirements of distributed process control system - System Architecture-Distributed Control System (DCS)-Sub-systems-Local field station-Presentation and monitoring device-Communication options in DCS - configuration. Some popular distributed control systems. Display systems-Display parameters-Display in process control environment-Computer graphics.

Learning outcomes:

Students can
LO_1:Classify Functional requirements of distributed process control system.
LO_2:Describe System Architecture of Distributed Control System (DCS).
LO_3:Explain various Display systems & Display parameters.

Unit -5: Personal Computers in real time environment - PC system and facilities-PC bus and signals - interrupts-interfacing PC to outside world - PC in real time environment - Application of IBM PC in real time - PC based distributed control systems.

Modeling and simulation - Mathematical model of a plant-model evaluation and improvement-modern tools for modeling and simulation of systems, application examples.

Learning outcomes:

Students can
LO_1:Identify PC system and facilities , PC bus and signals.
LO_2:Outline various modern tools for modeling and simulation of systems.

Unit -6: Industrial control applications - cement plant - thermal power plant- water treatment plant irrigation canal management steel plant.

Learning outcomes:

Students can
LO_1:Identify different Industrial control applications.
LO_2:Describe water treatment plant irrigation and canal management of steel plant.

Text books

1. Computer - Based Industrial Control, by Krishna Kanth , Second edition , PHI.
2. Process control , by S.K.Singh ,PHI

e-Resourses

1. https://electrical-engineering-portal.com/9-reasons-for-automation-of-manufacturing-processes
2. https://modelingandcontrol.com/2011/02/valve_position_control_1/
3. https://www.youtube.com/watch?v=sFqFrmMJ-sg
4. https://www.youtube.com/watch?v=nlFM1q9QPJw
5. https://sa-nitk.vlabs.ac.in/DCS/index.html
6. https://blog.advids.co/20-brilliant-distributed-control-systems-video-examples/
7. https://realpars.com/dcs/

COs (Course outcomes)

After completion of the course the students will be able to

CO_1:Describe historical developments and current trends in computer control of process.
CO_2:Explain about various controllers.
CO_3:Describe various DDC algorithms.
CO_4:Explain distributed process control systems.
CO_5:Describe Personal Computers applications in real time environment.
CO_6:Design Industrial control applications.

ADVANCED CONTROL THEORY

L	T	PD	Total periods	Univ exam		Sessnl Marks	Total Marks
				Hrs	Marks		
3	0	0	3	3	70	30	100

CEOs (Course Educational Objectives)

1. To study basic compensators in time domain and frequency domain
2. Derive the Cascade, Feedback compensations
3. To study state variables and state space analysis of controllability and observability
4. To study and learn the linearization methods of linear systems
5. Demonstrate the non-linear system behavior by phase plane analysis
6. Describe the function analysis of non-linear systems

Course syllabus

Unit 1: INTRODUCTION TO DESIGN

The deign problem, preliminary considerations of classical design, realization of basic compensators like phase lead compensation, phase lag compensation in time domain using root locus method

Learning outcomes:

Students can

1. Design basic compensators phase-lead, phase-lag and lead-lag compensators
2. Implement root locus method on various compensators in time domain

Unit 2: DESIGN OF COMPENSATORS

Cascade compensation in time domain and frequency domain, feedback compensation using both root locus and bode plot and Lead-Lag compensation using bode plot.

Learning outcomes:

Students can

1. Identify Cascade, feedback compensations
2. Implement both root locus and bode plot on various compensations

Unit 3: STATE VARIABLE ANALYSIS

Concept of state variables – State models for linear and time invariant Systems –Solution of state and output equation in controllable canonical form –Concepts of controllability and

observability –Effect of state feedback.

Learning outcomes:

Students can

1. Explain state variables and state models for linear and time invariant systems
2. Functionalize linear time invariant systems using state space concept

Unit 4: PHASE PLANE ANALYSIS

Features of linear and non-linear systems -Common physical non-linearity's–Methods of linearization Concept of phase portraits –Singular points –Limit cycles –Construction of phase portraits –Phase plane analysis of linear and non-linear systems –Isocline method.

Learning outcomes:

Students can

1. Identify the methods of various linearity and non -linearity concepts
2. Implement Phase plane analysis of line linear and non-linear systems

UNIT 5: DESCRIBING FUNCTION ANALYSIS

Basic concepts, derivation of describing functions for common non-linearities –Describing function analysis of non-linear systems –limit cycles –Stability of oscillations.

Learning outcomes:

Students can

1. Analyze the stability of the discrete system
2. Analyze the stability of the non-linear system

TEXT BOOKS:

1. K. P. Mohandas, "Modern Control Engineering", Sanguine Technical Publishers, 2006.
2. Gopal, M. – "Modern control theory", New Age International publishers, 2002

e- Resources

1. https://nptel.ac.in/courses/108/103/108103007/
2. http://www.nptelvideos.in/2012/11/advanced-control-system-design_27.html
3. https://www.digimat.in/nptel/courses/video/108103007/L01.html
4. https://drive.google.com/drive/folders/1Az5-b4-VA33opS0s02rSgr5M-btbXRqj

COs (Course outcomes)

After completion of the course the students will be able to

1. The design of phase-lead, phase-lag compensators in time domain
2. The design of lead-lag compensators in time domain and frequency domain
3. Concept of state space analysis for linear time invariant systems
4. Concept of phase plane analysis for linear systems
5. Concept of phase plane analysis for non-linear systems
6. The stability behavior of non-linear systems

ROBOTS & COMPUTER CONTROL OF MACHINE PARTS

L	T	PD	TOTAL Pds	Univ Exam Hrs	Univ Exam Marks	Sessnl Marks	Total Marks
3	1	--	4	3	70	30	100

COURSE EDUCATIONAL OBJECTIVES :

1)To introduce the basics of Robotics their principles and their classification.
2)To understand the concept of Robot kinematics, dynamics, and their control.
3)To provide adequate knowledge in Robot programming languages and computers that control manufacturing automation.
4)To describe various automation techniques and methods in the design and selection of a Robot.
5)To familiarize the basics of machine vision and its applications in the field of Robotics.
6) To impart fundamental knowledge of the latest technologies in the area of Robotics and Automation.

COURSE OUTCOMES:

1)Understand the Laws of Robotics and classify robot's joint and arm configurations.
2)Program a robot to perform a specific task.
3)Analyse the design and selection of robots for manufacturing and Non-manufacturing applications.
4)Determine forward and inverse kinematics of different robots.
5) Selection of suitable sensors for robotic application.
6)Identify major components of the vision system.

COURSE SYLLABUS :

Unit-I Robot anatomy: Definition, law of robotics, History and Terminology of Robotics-Accuracy and repeatability of Robotics-Simple problems Specifications of Robot-Speed of Robot-Robot joints and links-Robot Classifications-Architecture of robotic systems.

LEARNING OUTCOMES:

1.Explain the Laws and history of robots.
2.Classify robot joint and link configurations
3.Determine the degrees of freedom for a Robot

Unit- II Introduction to automation: Components and subsystems, basic building block of automation, manipulator arms, wrists and end-effectors. Transmission elements: Hydraulic, pneumatic and electric drives. Gears, sensors, materials, user interface, implications for robot design, controllers.

LEARNING OUTCOMES:

1.Understand the concept of automation
2.Explain different types of an end effector
3.Identify different sensors and transmission elements in robotic applications.

Unit- III Machine Vision: Introduction, Low level &High-level vision, Sensing &Digitizing, Image processing & analysis, Segmentation, Edge detection, Object description & recognition, Interpretation, Applications

LEARNING OUTCOMES:

1. Describe the basic components of machine vision.
2. Discuss the effect of low-level & high-level vision algorithms.
3. Simulate real-time application using image processing techniques.

Unit- IV Kinematics, dynamics and control: Object location, three-dimensional transformation matrices, inverse transformation, kinematics and path planning, Jacobian work envelope, manipulator dynamics, dynamic stabilization, position control and force control, present industrial robot control schemes.

LEARNING OUTCOMES:

1.Differentiate forward and inverse Kinematics

2. Comprehend the concept of three-dimensional transformation of matrices and manipulator dynamics 3.Identify the industrial robot control schemes

Unit-V Robot programming: Robot programming languages and systems, levels of programming robots, problems peculiar to robot programming, control of industrial robots using PLCs.

LEARNING OUTCOMES:

1.Discuss different methods and levels of robot programming.

2.Learn PLC programming using ladder logic for simple applications like pick and place.3.Design real-time applications using programming languages

Unit- VI Automation and robots: Case studies, multiple robots, machine interface, robots in manufacturing and non-manufacturing applications, robot cell design, selection of a robot.

LEARNING OUTCOMES:

1.Identify and analyse different case studies of robots in manufacturing and non-manufacturing applications.

2.Discuss the challenges in robot cell design

3.Describe several considerations in selecting a Robot

REFERENCE BOOKS:

1. S.R.Deb,Robotics technology and flexibl automation, Tata McGraw-Hill Education company 2009.
2. Mikell P Groover & Nicholas G Odrey, Mitchel Weiss, Roger N Nagel, Ashish Dutta, Industrial Robotics, Technology programming and Applications, McGraw Hill, 2012.
3. Richard D.Klafter,Thomas.AChriElewski,Michael Negin, Robotics Engineering, and Integrated Approach, Phi Learning, 2009.
4. Francis N. Nagy, Andras Siegler, Engineering Foundation of Robotics, Prentice Hall Inc, 1987.
5. P.A.Janaki Raman, Robotics and Image Processing an Introduction, Tata McGraw Hill Publishing company Ltd, 1995.

DESIGN OF INSTRUMENT SYSTEMS

L	T	PD	Total periods	Univ exam		Sessnl Marks	Total Marks
				Hrs	Marks		
3	1	--	4	3	70	30	100

CEOs (Course Educational Objectives)

1. To deal with various types of pressure and vacuum gauges
2. To discuss manometers and flow meters of various types.
3. To gain knowledge on the design aspects of temperature measuring systems like RTD, Thermistors.
4. To explain the design procedures of Displacement measuring systems
5. To understand the Design of strain gauges , LVDT measuring circuits.
6. To utilize concepts of control system components and valves

Course Syllabus:

Unit -1 Design of Pressure and vacuum gauges with bourdon tubes, bellows and diaphragms. Design of manometers-single, two liquid U-Tube manometers, inclined tube, well and ring types.

Learning outcomes:

Students can

1. Classify different pressure transducers.
2. Explain different types of vacuum gauges
3. Describe different types of manometers

Unit- 2 Design of flow meters- orifice, venturi and Rota meters. Design of liquid level measuring instruments displacer and bubble types.

Learning outcomes:

Students can

1. Classify different flow meters.
2. Explain liquid level measuring instruments and design methodologies
3. Describe working of flow meters and liquid level measuring instruments.

Unit- 3 Design of control system components-flapper nozzle with ball valve, pneumatic globule valve, butterfly valve and Saunders patent valve.

Learning outcomes:

Students can

1. Classify different control system components
2. Explain about valves and their mechanism
3. Describe working of different types of Valves.

Unit- 4 Design of temperature measuring systems with RTD, thermocouples and Thermistors.

Learning outcomes:

Students can

1. Explain the design methods of RTD.
2. Classify different temperature measuring systems.
3. Explain about thermocouples and Thermistors.

Unit- 5 Design of displacement measuring circuits with LVDT, and differential capacitors.

Learning outcomes:

Students can

1. Classify different displacement measuring circuits.
2. Explain about Differential capacitors
3. Explain the design methods of LVDT

Unit-6 Design of strain gauges and measuring circuits. Design of piezoelectric transducers and measuring circuits.

Learning outcomes:

Students can

1. Learn about Design of strain gauges
2. Describe stress versus strain measurement systems.
3. Describe about Design of piezoelectric transducers

e-**Resources**

1. https://nptel.ac.in/courses/108/105/108105064/
2. https://nptel.ac.in/courses/103/103/103103037/ (series 1-7)
3. https://nptel.ac.in/noc/courses/noc17/SEM2/noc17-ec09

Reference Books:

1. DP Eckman-Industrial Instrumentation.

Cos (Course outcomes)

After completion of the course the students will be able to

CO1: Analyze the various instruments and the design of measurement meters

CO2: Identify the additional attributes in various types of flow meters, liquid level measuring instruments.

CO3: Select the relevant transducer for measurement of physical quantities, different valves to meet the requirements of industrial applications.

CO4: Identify the type of transducer based on the transduction principles (Temperature, pressure, flow, displacement)

CO5: Identify the type of transducer based on the transduction principles and design of differential capacitors, LVDTs.

CO6: Identify the type of transducer based on the transduction principles and design of strain gauges, piezoelectric transducers.

IOT SENSORS and Devices

L	T	PD	TOTAL Pds	Univ Exam Hrs	Univ Exam Marks	Sessnl Marks	Total Marks
3	**1**	**--**	**4**	**3**	**70**	**30**	**100**

Course Objectives:

1. To introduce the concepts of IOT with hardware platforms.
2. To make Familiar with History of IOT Architecture
3. Applications of IOT.
4. To share knowledge about security aspects in IOT
5. Explain the concept of applications of IOT

Unit 1: IoT Platform overview

Overview of IoT supported Hardware platforms such as: Raspberry pi, ARM Cortex

Processors, Arduino and Intel Galileo boards.

Learning outcome:

1. Overview of IOT supported Hardware platforms.

Unit 2: IoT Architecture:

History of IoT, M2M – Machine to Machine, Web of Things, IoT protocols

Applications: Remote Monitoring & Sensing, Remote Controlling, Performance Analysis

Unit 3: The Architecture

The Layering concepts, IoT Communication Pattern, IoT protocol Architecture, The 6LoWPAN

Learning outcome:

1. Study the History of IOT.
2. Applications of IOT for Remote control, monitoring & Sensing.
3. To acquire knowledge about IOT communication process.

Unit 4: Security aspects in IoT

Case Study & advanced IoT Applications:

IoT applications in home, infrastructures, buildings, security, Industries, Home Appliances, other IoT electronic equipment. Use of Big Data and Visualization in IoT, Industry 4.0 concepts. Sensors and sensor Node and interfacing using any Embedded target boards (Raspberry Pi / Intel Galileo/ARM Cortex/ Arduino)

Learning outcome:

1. Gain knowledge on Security aspects of IOT
2. Grasp information on advanced IOT applications.
3. Learn the fundamentals of interfacing with embedded boards.
4. Use of Big Data & Visualization in IoT.

Course Outcome:

1. Student can understand the History & overview of IOT.
2. Gain knowledge about IOT supported hardware
3. Learn security concepts of IOT.
4. Vast knowledge on applications of IOT.
5. Visualize the interfacing with Embeddedboards.
6. Familiarize with Industry 4.0 concepts.

3	**-**	**--**	**3**	**3**	**70**	**30**	**100**

CEOs (Course Educational Objectives)

1. To make them understand various advanced concepts in Nano Technology.
2. Explore the fundamentals of different kinds of Sensors and it's applications.
3. Understand various methods used for production of carbon nanotubes.
4. Gain the concepts of Micro and nanoelectronics .

5. Understand various nanostructures and its applications towards Micro/Nano cantilever sensors
6. Acquire the fundamentals of DNA structures
7. Obtain the knowledge on optical Bio sensors

Course syllabus

Unit 1: Introduction sensors, Micro technology, Nano technology, Micro and nanobiosensors: Introduction to Micro/Nano biosensor, Biosensor history and current status, Classical Sensors. Applications of micro electrons and nano electrons.

Learning outcomes:

2. To have a vast knowledge on Micro and Nano sensor technology.
3. Advanced Development on micro/nano sensors for bio medical applications
4. Vast knowledge on applications of Micro and nano electronics.

Unit 2: Carbon-Nanotube-Based Sensors: Introduction , Synthesis of Carbon Nanotubes, Relevant Physical Characteristics of Carbon Nanotubes, Chemical Sensors and MEMS-Based Nanotube Sensors. Carbon-Nanotube-Based Fluidic Shear-Stress Sensors: Overview of Carbon Nanotube Sensors , Types of Shear-Stress Sensors.

Learning outcomes:

5. Make familiar with Synthesis of Carbon Nano tubes and characteristics.
6. Design & fabrication of Chemical sensors, shear –stresss sensors.
7. Have a great knowledge of Carbon nano tube sensors.

Unit 3: Nanomechanical Cantilever Sensors: Theory and Applications: Introduction, Operation Principles, Preparation of Microcantilever Sensors. Protein in Films: Sensing Elements for Sensors: Protein-Containing LB Films for Biosensor Applications, Antibody-Containing LB Films, Enzyme-Containing LB Films.DNA Sensors: DNA Hybridizations, DNA sequencing, DNA-Containing Monolayers and LB Films

Learning outcomes:

8. Design, Fabrication, working condition & applications of Micro cantilever Sensors
9. Can explain DNA Hybridization & sequencing.

Unit 4: Biomolecules, Protein, DNA structures and their immobilizations on sensor surface, Thermodynamic and Kinetics at biosensor surface.Microfluidics: Advances in micro fluidics, Sensor integrations. Immunosensors: antibody- antigen, Single molecule detections.

Learning outcomes:

10. To have a deep knowledge on DNA structures and Bio-sensor micro fluidics.
11. Make familiar with immune sensors
12. Detection of single molecule, study of Immunosensors.

Unit 5: Optical Capillary Sensors for Intelligent Classification of Micro fluidic Samples: Introduction, Operating Principles and Construction Aspects of the Optical Capillary Head, General Description of the Sensor System, e Measurement Cycle of the Capillary Sensor. Optical biosensors: Optical Imaging, Optical Sensing, Opto-genetics.

Learning outcomes:

13. Understanding Construction & operating principles of optical capillary sensors.
14. Study of different types of Optical sensors & it's applications.

Reference Books:

1. Nanosensors: Theory and Applications in Industry, Healthcare and Defense Edited ByTeik-Cheng Lim (https://www.taylorfrancis.com/books/e/9780429130793).
2. Introduction to Biosensors, Jeong-Yeol Yoon et al. Springer.
3. Handbook of Biosensors and Biosensor Kinetics, AjitSadana, Elsevier.
4. Nanofabrication Towards Biomedical Applications, Challa Kumar, Wiley-VCH.
5. Optical Biosensors: Present & Future, Frances Ligler, Elsevier

Course outcome:

1. Have a good vision to the future of micro/nano technology.
2. Vast knowledge on synthesis, Characteristics & applications of Carbon Nano tubes.
3. Obtain an idea about preparation of cantilevers along with it's applications.
4. Sound knowledge on Optical sensors.
5. Gain experience on Bio molecule, Protein, DNA structures etc..
6. Familiarize with Classic sensors for Micro/Nano electronic applications.

OPEN ELECTIVES:

INDUSTRIAL ELECTRONICS

Course Objectives:

Students undergoing this course are expected to:

CEO-1.Familiarize industrial and power electronic devices

CEO-2.chose different polyphase rectifiers for different applications

CEO-3.Able to know electric welding and high frequency heating

CEO-4.analyze voltage controlled rectifiers

CEO-5.Explain electronic speed control of motors

Course Outcomes:

At the end of the course, students will be able to

CO-1	Summarize the operation of various industrial and power semiconductor devices.
CO-2	Outline various polyphase rectifiers against various performance parameters
CO-3	Explain different methods of Electric welding
CO-4	Analyze the performance of phase controlled rectifiers for various loads.
CO5	Demonstrate the Electronic speed control of motors

INTRODUCTION TO INDUSTRIAL ELECTRONICS: Scope of Industrial Electronics, Main task of Power Electronics, Applications, Advantages, Disadvantages, Applications, Block diagram of Power Electronic System, PNPN device- Basic structure, two transistor version, Volt Ampere Characteristics, Holding current. Latching current, Gate circuit of Thyristor, Thyristor gate characteristics, Design of firing circuit, Triggering methods of thyristor, thyristor connected in series and parallel, Thyristor ratings, Silicon Controlled Switch(SCS): Basic structure, Two transistor equivalent, characteristics, Uni-junction transistor- Basic structure, Potential divider equivalent, Static emitter characteristics, delay firing of SCR by UJT. Bilateral PNPN diode switch(DIAC): Basic structure, Volt-Ampere characteristics, Traic- Basic structure, Volt-Amperecharacteristics.

POLYPHASE RECTIFIERS: Introduction, uses of Polyphase Rectifiers, Three phase half wave delta-wye rectifier with resistive load, Six -phase star Half wave rectifier with resistive load, Delta line to line double wye half wave rectifier with inter phase transformer and with resistive load, Three phase delta wye bridge rectifier with resistive load, General m-phase rectifier DC power outputs, efficiencies and ripple factors, Transformer utility factor, Rectifier performance, Commutation in Polyphase rectifiers.

ELECTRIC WELDING AND HIGH FREQUENCY HEATING: Methods of high frequency heating,Welding: Plastic Welding, Fusion Welding, Basic block diagram for a.c.

resistance welding, types: Spot welding. Projection welding. Butt welding, Seam welding and Pulsating welding arrangements. InductionHeating: Principle of induction heating. Applications. Dielectric Heating: Principle of dielectric heating. Electrodes used in dielectric heating. Methods of coupling of Electrodes to R.F. Generator. Applications.

VOLTAGE CONTROLLED RECTIFIERS: (outlines of topics only): Single-Phase Half- wave controlled rectifier with resistance load. Single-Phase Full-wave controlled rectifier with resistance load. Three-Phase Half wave controlled rectifier with resistance load. Six-phase half-wave Controlled rectifier with resistance load.

ELECTRONIC SPEED CONTROL OF MOTORS: (outlines of topics only): DC Motor speed Control: single phase dc drives, single phase half wave converter drives, phase control, SCR feedback circuit for series motor drive. Half wave controlled SCR bridge for series motor drive.Choppercontrolleddcdrives.ACmotorspeedcontrol-Speedcontrolbyvariationofstator voltage using SCRs, Variable-frequency A.C motor drive, Voltage-fed inverter control. P.W.M. control scheme, Current-fed inverter control, chopper controlled wound rotor Induction motor, rotor resistance control.

TEXT BOOKS:

1. 1.Industrial Electronics and by Power Electronics G.K.mithal, Khannapublishers.
2. Power Electronics by P.C.Sen,T.M.H.
3. Power Electronics by Dr.P.S.Bimbra, Khanna publishers

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ARTIFICIAL INTELLIGENCE

L	T	PD	Total periods	Univ exam		Sessnl Marks	Total Marks
				Hrs	Marks		
3	-	--	3	3	70	30	100

CEO's (Course Educational Objectives):

1. To introduce to the basic concepts of Artificial Intelligence with illustrations of current state of the art research and applications.
2. To identify the type of an AI problem in search inference, decision making under uncertainty, game theory etc.
3. To recognize the characteristics of AI languages that make it useful to real-world problems.
4. To describe the strengths and limitations of various search algorithms and choose the appropriate algorithm.
5.To understand the basic concept of fuzzy sets, fuzzy logic and defuzzification.
6.Identify and describe Neural network and Fuzzy logic techniques in building intelligent system.

Course Syllabus

Unit -1 : Basic Problem-Solving Methods: Production systems – state space search –control strategies – heuristic search – forward and backward reasoning – hill climbing techniques – breadth first search – depth first search – best search – staged search.

Learning outcomes:

Students can

1.Explain what constitutes Artificial Intelligence and how to identify systems with Artificial Intelligence.

2.Use classical Artificial Intelligence techniques, such as search algorithms, hill climbing techniques.

Unit-2: Knowledge Representation: Predicate logic – resolution question answering – non monotic reasoning – statistical and probabilistic reasoning semantic nets – conceptual dependency – frames-scripts.

Learning outcomes:

Students can

1.Explain the knowledge representation in question answering and reasoning.

2. Select appropriately Artificial Intelligence techniques when implementing intelligent systems.

Unit -3: Image Restoration: AI Languages: important characteristics of AI languages- PROLOG, introduction to expert systems, structure of an expert system-interaction with an expert design of an expert system.

Learning outcomes:

Students can

1. Explain the characteristics of Artificial Intelligence language PROLOG .

2.Use expert systems with an expert design of an expert system.

Unit-4: Neural Networks: basic structure of a neuron, perception feed forward, back propagation, Hopfield network.

Learning outcomes:

Students can

1.Identify different neural network architectures, their limitations and appropriate learning rules for each of the architectures.

2. To analyze various techniques in feedback , feed forward and Hopfield Neural networks.

Unit -5: Fuzzy Logic: fuzzy sets, member ship function, rules and algorithms, de-fuzzication and implementation.

Learning outcomes:

Students can

1.Implementation of new Fuzzy logic system using fuzzification ,fuzzy interference and de-fuzzification.

2. Apply the knowledge and understanding of fuzzy system in engineering and science.

Textbooks:

1. Rich E and knight K- Artificial intelligence. Tata McGraw Hill, New Delhi 1991.
2. Nillson NJ – Principals of artificial intelligence, Springer Veriag Berlin 1980.
3. Barr A.Fergenbaum E A & Cohen P R- Artificial intelligence, edition- Wesley reading (mass 0,1989).
4. Water man D A- A guide to expert systems, edition- Wesley reading (mass),1986.
5. Artificial intelligence Hand book VOL 1-2,ISA,Reasearch triangle park,1989.
6. Kos Ko B-neural networks and fuzzy systems, PHI.

e-Resourses

1. https://nptel.ac.in/courses/106/105/106105077/
2. https://nptel.ac.in/courses/106/102/106102220/
3. https://www.youtube.com/watch?v=2ePf9rue1Ao
4. https://www.youtube.com/watch?v=X_Qt0U66aH0&t=2s
5. https://www.youtube.com/watch?v=sZXsMo7iDbM

COs (Course Outcomes):

After completion of the course the students will be able to

1. Exhibit strong familiarity with a AI techniques including in particular search, knowledge representation, planning and constraint management.
2. Interpret the modern view of AI as the study of agents that receive percepts from the environment and perform actions.
3. Ability to apply AI techniques to real-world problems to develop intelligent systems.
4. Build awareness of AI facing major challenges and the complexity of typical problems within the field.
5. To analyze various techniques in feedback and feed forward Neural networks.
6. Apply the basic knowledge of fuzzy sets and fuzzy logics to implement a new algorithms.

DIGITAL IMAGE PROCESSING

L	T	PD	Total periods	Univ exam		Sessnl Marks	Total Marks
				Hrs	Marks		
3	1	--	4	3	70	30	100

CEOs (Course Educational Objectives)

13. To study and review of Light and Electromagnetic spectrum.
14. To study basic image processing concepts and components.
15. To learn and application of various image enhancement techniques.
16. To study about various image restoring techniques in various domains.
17. To learn and application of various color image processing techniques.
18. To study algorithms for image compression and image segmentation.

Course syllabus

Unit -1 : Digital image fundamentals: Light and Electromagnetic spectrum, Components of Image processing system, Image formation and digitization concepts, Neighbors of pixel adjacency connectivity, regions and boundaries, Distance measures, Applications.

Learning outcomes:

Students can

4. Outline the basic principals the Digital Image Processing system.
5. Describe various Components of Image processing system and concepts.
6. Identify of pixel adjacency connectivity, regions and boundaries, Distance measures.

Unit-2: Image Enhancements: Image Enhancements: In spatial domain: Basic gray level transformations, Histogram processing, Using arithmetic/Logic operations, smoothing spatial

filters, Sharpening spatial filters. In Frequency domain: Introduction to the Fourier transform and frequency domain concepts, smoothing frequency-domain filters, Sharpening frequency domain filters.

Learning outcomes:

Students can

1. Explain basic gray level transformation
2. Describe Histogram processing, Using arithmetic/Logic operations, smoothing spatial filters, Sharpening spatial filters.
3. Explain Fourier transform and frequency domain concepts, smoothing frequency-domain filters, Sharpening frequency domain filters.

Unit -3: Image Restoration: Various noise models, image restoration using spatial domain filtering, image restoration using frequency domain filtering, Estimating the degradation function, Inverse filtering.

Learning outcomes:

Students can

4. Explain various noise models.
5. Describe image restoration using spatial domain filtering.
6. Describe Estimating the degradation function, Inverse filtering.

Unit-4: Color Image processing: Color fundamentals, Color models, Color transformation, Smoothing and Sharpening, Color segmentation

Learning outcomes:

Students can

4. Classify Color fundamentals, Color models.
5. Describe color Smoothing and Sharpening.
6. Explain Color segmentation.

Unit -5: Image compression: Introduction, Image compression model, Error-free compression, Lossy compression.

Learning outcomes:

Students can

1. Identify image compression models
2. Outline various error free and loss-less image compression models.

Unit -6: Image segmentation: Detection of discontinuities, Edge linking and boundary detection, thresholding

Learning outcomes:

Students can

1. Identify discontinuous, edges in images.
2. Use thresholding technique.

Text books

1. R. C. Gonzalez and R. E. Woods, Digital Image Processing, 3rd edition, Prentice Hall, 2008.
2. R. C. Gonzalez, R. E. Woods and Steven L. Eddins , Digital Image Processing Using MATLAB , 2rd edition, Prentice Hall, 2009.
3. Anil K.Jain, “Fundamentals of Digital Image Processing”, Prentice Hall of India, 9th Edition.
4. Jayaraman, S. Esakkirajan, and T. Veerakumar, Digital Image Processing, Tata McGrawHill Education, 2011.

e-Resourses

8. https://nptel.ac.in/courses/117/105/117105135/
9. https://nptel.ac.in/courses/117/105/117105079/
10. https://www.youtube.com/watch?v=994ZNi7rSXo
11. https://www.youtube.com/watch?v=F1Fi6FdLn1s
12. https://www.youtube.com/watch?v=svgZodJgKaU
13. https://www.youtube.com/watch?v=j3_Ck5oP5oI

COs (Course outcomes)

After completion of the course the students will be able to

13. Describe the image processing concepts and components.
14. Use the various image enhancement techniques.
15. Classify the various noise models.
16. Explain various color image processing techniques.
17. Categories various error free and loss-less image compression models.
18. Design algorithms for image segmentation

COMPUTER ORGANIZATION AND OPERATING SYSTEMS

L	T	PD	Total periods	Univ exam		Sessnl Marks	Total Marks
				Hrs	Marks		
3	-	--	3	3	70	30	100

CEOs (Course Educational Objectives)

1. Discuss the Basic Operational Concepts.
2. Assess the performance of Multiprocessors and Multi Computers.
3. Learn the Basic Concepts of Semiconductor RAM Memories
4. Assess the performance of Input-Output Processor.
5. Assess the performance of various multiplication algorithms.
6. List out the different types of Micro-Operations.

Course syllabus

Unit-I:Basic Structure of Computers: Computer Types, Functional UNIT, Basic Operational Concepts, Bus, Structures, Software, Performance, Multiprocessors and Multi Computers, Data Representation, Fixed Point Representation, Floating - Point Representation.Register Transfer Language and Micro Operations: Register Transfer Language, Register Transfer Bus and Memory Transfers, Arithmetic Micro Operations, Logic Micro Operations, Shift Micro Operations, Arithmetic Logic Shift Unit, Instruction Codes, Computer Registers Computer Instructions - Instruction Cycle. Memory - Reference Instructions, Input - Output and Interrupt, STACK Organization, Instruction Formats, Addressing Modes, DATA Transfer and Manipulation, Program Control, Reduced Instruction Set Computer.

Learning outcomes:

Students can

1. List out the different components of computer organization.
2. Explain the different types of Micro-Operations.
3. Define Register transfer language.

Unit-2:Micro Programmed Control: Control Memory, Address Sequencing, Microprogram Examples, Design of Control Unit, Hard Wired Control, Microprogrammed Control. The Memory System: Basic Concepts of Semiconductor RAM Memories, Read-Only Memories, Cache Memories Performance Considerations, Virtual Memories secondary Storage, Introduction to RAID.

Learning outcomes:

Students can

4. Design Address Sequencing.
5. Design the hardwired control unit.

Unit-3:Input-Output Organization: Peripheral Devices, Input-Output Interface, Asynchronous Data Transfer Modes, Priority Interrupt, Direct Memory Access, Input-Output Processor (IOP), Serial Communication; Introduction to Peripheral Components, Interconnect (PCI) Bus, Introduction to Standard Serial Communication Protocols like RS232, USB, IEEE1394.

Learning outcomes:

Students can

7. Explain various noise models.
8. Describe the Direct Memory Access.

Unit-4: Operating Systems Overview: Overview of Computer Operating Systems Functions, Protection and Security, Distributed Systems, Special Purpose Systems, Operating Systems Structures-Operating System Services and Systems Calls, System Programs, Operating System Generation. Memory Management: Swapping, Contiguous Memory Allocation, Paging, Structure of the Page Table, Segmentation, Virtual Memory, Demand Paging, Page-Replacement Algorithms, Allocation of Frames, Thrashing Case Studies - UNIX, Linux, Windows Principles of Deadlock: System Model, Deadlock Characterization, Deadlock Prevention, Detection and Avoidance, Recovery from Deadlock.

Learning outcomes:

Students can

7. Describe Protection and Security.
8. Explain Operating System Generation.
9. Explain Deadlock Characterization.

Unit -5: File System Interface: The Concept of a File, Access Methods, Directory Structure, File System Mounting, File Sharing, Protection. File System Implementation: File System Structure, File system Implementation, Directory Implementation, Allocation Methods, Free-Space Management.

Learning outcomes:

Students can

3. Explain File System Mounting.
4. Describe Directory Implementation.

Text books

1. Computer Organization - Carl Hamacher, ZvonksVranesic, SafeaZaky, 5th Edition, McGraw Hill.
2. Computer System Architecture - M. morismano, 3rd edition, Pearson
3. Operating System Concepts – AbrehamSilberchatz, Peter B. Galvin, Greg Gagne, 8th Edition, John Wiley.

E-Resources

1. https://www.youtube.com/watch?v=leWKvuZVUE8&list=PL1A5A6AE8AFC187B7
2. https://www.youtube.com/watch?v=z3Nw5o9dS7Q&list=PLsylUObW5M3CAGT6OdubyH6FztKfJCcFB
3. https://www.youtube.com/watch?v=oAneKttKjt
4. https://www.youtube.com/watch?v=kTdvOlA2ko0
5. https://www.youtube.com/channel/UCJihyK0A38SZ6SdJirEdIOw
6. https://www.youtube.com/watch?v=RozoeWzT7IM&list=PLdo5W4Nhv31a5ucW_S1K3-x6ztBRD-PNa

COs (Course outcomes)

After completion of the course the students will be able to

1. Apply the fundamental issues related to computer arithmetic operation and circuits to support the system computation.
2. Understand the various components of memory system to organize the operational units of CPU.
3. Analyze the data processing operations of central processing and control unit to design the CPU specification.
4. Understand the concepts of pipeline design techniques to increase the execution rate of a processor.
5. Analyze File System Implementation and File System Structure.
6. Analyze various mechanisms used in virtual memory management.

VIRTUAL INSTRUMENTATION

L	T	P	Total periods	Univ exam		Sessnl Marks	Total Marks
				Hrs	Marks		
3	-	0	3	3	70	30	100

CEOs (Course Educational Objectives)

1. To know the History of Instrumentation systems.
2. To understand software Environment.
3. To describe Virtual Instrumentation & sub Virtual Instrumentation.
4. To know the Analog inputs, Analog outputs.
5. Describe input and output files.

Course syllabus

Unit-I: Introduction to Virtual Instrumentation: History of Instrumentation systems, Evolution of Virtual Instrumentation, premature challenges, programming requirements, Drawbacks of recent approaches, conventional Virtual Instrumentation, Distributed Virtual Instrumentation, Virtual Instrumentation versus Traditional Instruments, Advantages.

Learning outcomes:

Students will be able to

1. Describe Evolution of Virtual Instrumentation.
2. Understand the Distributed Virtual Instrumentation.

Unit-2: Introduction to LabVIEW: Introduction, Advantages of LabVIEW, software Environment, Front panel, Block diagram, Data flow programming, G programming.

Learning outcomes:

Students will be able to

1. Understand Advantages of LabVIEW.
2. Understand Data flow programming.

Unit-3: Programming Concepts of Virtual Instrumentation: VI & sub VI, loops, shift registers, feedback node, formula node, case and sequence structures, arrays, clusters.

Learning outcomes:

Students will be able to

1. Understand case and sequence structures
2. Describe local and global variables

Unit-4: Output Verification: Tools Waveform Graphs, Waveform charts, files I/O, local and global variables.

Learning outcomes:

Students will be able to

1. Describe output waveform graphs.
2. Understand global variables.

Unit-5: Data Acquisition system: Introduction, transducers, Signals, Signal conditioning, DAQ Hardware configuration, DAQ Hardware, Analog inputs, Analog outputs, counters, Digital I/O, DAQ software architecture, DAQ assistant.

Learning outcomes:

Students will be able to

1. Describe transducers.
2. Understand the DAQ software architecture.

Text books

2. S. Sumathi, P. Surekha, "Virtual Instrumentation with LabVIEW," ACME Learning Pvt. Ltd 2007.

References

2. Jovitha Jerome, "Virtual Instrumentation Using LabVIEW," PHI learning Pvt. Ltd 2006.
3. Jeffrey Travis," LabVIEW for everyone," Pearson Education 2009.

E-Resources:

1. https://www.youtube.com/watch?v=9EhTc-kLRyM
2. https://www.youtube.com/watch?v=Cpb3fQtOFJ4
3. https://www.youtube.com/watch?v=cSbTp-XjzeY
4. https://www.youtube.com/watch?v=VwxO1oYowC0
5. https://www.youtube.com/watch?v=VwxO1oYowC0

COs (Course outcomes)

After completion of the course the students will be able to

1. Describe Virtual Instrumentation versus Traditional Instruments
2. Explain concept of LabVIEW.
3. Classify output verification Tools Waveform Graphs.
4. Appraise the DAQ Hardware configuration.

5. Explore output verification waveform charts..

PROGRAMMABLE CONTROL SYSTEMS

COURSE EDUCATIONAL OBJECTIVES:

1. At the end of chapter one will able of understand the knowledge of Industrial automation and control tools such as DCS, SCADA, PLC etc.,
2. Making aware of standard communication protocols implementation of RS 232, RS 485 and comparison with MODBUS process and its advantages.
3. Comparision of HART used to communicate with devices for device configuration- reconfiguration, Diagnosis, Trouble shooting, device health and status. Devicenet, Industrial ethernet applications
4. PLC programming methods and Analog controlling using PLC and its its interfacing with SCADA /DCS using communication links.
5. PLC its architecture and comparision of PLC with DCS and concepts on ladder diagrams and relay diagrams and study of industrial PLC.
6. Distributed Control Systems introduction, functions , advantages and its limitations, database management system.

Unit- I Control Systems and Automation Strategy

Evolution of instrumentation and control, Role of automation in industries, Benefits of automation, Introduction to Descriptive automation tools PLC, DCS, SCADA, Hybrid DCS/PLC, Automation strategy evolution, Control system audit, and performance criteria.

LEARNING OUT COMES:

1. Application oriented knowledge on basic Control systems.
2. Automation tools like SCADA, PLC and DCS and its Hybrid could be developed as a skill set for industries.

Unit- II Instrumentation Standard Protocols

Definition of protocol, Introduction to Open System Interconnection (OSI) model, Communication standard (RS232, RS485), Modbus (ASCII/RTU), Introduction to third party interface, concept of OPC (Object linking and embedding for Process Control), HART Protocol: Introduction, frame structure, programming, implementation examples, benefits, advantages and limitation.

Foundation Fieldbus H1: Introduction, frame structure, programming, implementation examples, benefits, advantages and limitation. Comparison of HART, Foundation Fieldbus, Devicenet, Profibus, Controlnet, Industrial Ethernet.

LEARNING OUT COMES:

1. Implementation of logical programming in HART protocol can be achieved.
2. Application oriented PLC Controllers can be evaluated Graphically and logically with at least one industrial PLC.

Unit- III Programmable logic controllers (PLC)

Introduction, architecture, definition of discrete state process control, PLC Vs PC, PLC Vs DCS, relay diagram, ladder diagram, ladder diagram examples, relay sequencers, timers/counters, high speed counter, PTO, PWM and PID blocks in PLC, PLC design, study of at least one industrial PLC.

LEARNING OUT COMES:

1. In depth knowledge upon various communication links.
2. Protocols like RS 232, RS 485, MODBUS(ASCII/RTU) which are widely used in Programmable Control systems can be gained.

Unit- IV Advance Applications of PLC and SCADA

PLC programming methods as per IEC 61131, PLC applications for batch process using SFC, Analog Control using PLC, PLC interface to SCADA/DCS using communication links (RS232, RS485) and protocols (Modbus ASCII/RTU)

LEARNING OUT COMES:

1. Knowledge gained on Industrial process for DCS as an automationtool.
2. different areas to implement andto support third party interface.

Unit- V Distributed Control Systems

DCS introduction, functions, advantages and limitations, DCS as an automation tool to support Enterprise Resources Planning, DCS Architecture of different makes, specifications, configuration and programming, functions including database management, reporting, alarm management, communication, third party interface, control, display etc. Enhanced functions viz. Advance Process Control, Batch application, Historical Data Management, OPC supports, Security and Access Control etc.

1. Batch application, Security and Access Control etc., can be observed for valuation. Phase Diagrams, Programmable and logic control system implementation.
2. Graphical representation can be successfully analyse.
3. Applications of Distributed control systems in various areas can be observed.

REFERENCE BOOKS:

1. Distributed Computer Control for Industrial Automation, PoppovikBhatkar, Dekkar Publications.
2. Programmable Logic Controllers: Principles and Applications, Webb and Reis, PHI.
3. Computer Aided Process Control, S. K. Singh, PHI.
4. Introduction to Programmable Logic Controllers, Garry Dunning, Thomson Learning.
5. Computer Based Process Control, Krishna Kant, PHI. 6. The Management of Control System: Justification and Technical Auditing, N. E. Battikha, ISA.

COURSE OUTCOMES:

1. After conclusion of control and automation topic we can understand the calibration process for PLC and DCS systems.
2. A brief knowledge on OSI (open System Inter connection) model and OPC (Object Linking and embedding for Process Control) is achieved.
3. Graphical representation and mathematical analysis can be implemented for different timers and counters and for High speed counter can be achieved.

4. In depth knowledge on different PTO, PWM and PID blocks in PID design and study can be fulfilled.
5. Programming methods as per IEC 61131 for PLC can be implemented and executed.
6. In depth knowledge can be achieved in various functions of Distributed Control Systems like interfacing, Display, Historical data Management etc., can be studied.

TELEMETRY

L	T	PD	Total periods	Univ exam		Sessnl Marks	Total Marks
				Hrs	Marks		
3	-	--	3	3	70	30	100

Course Educational Objectives:

1. Comprehend frontier areas of knowledge in modulation techniques and telemetry systems.
2. To describe the Knowledge on functions of telemetry system
3. To classify various methods in land telemetry
4. To construct about the radio telemetry and positioning telemetry systems
5. To Understand analog communication and modulation methods
6. To Learn frequency modulation methods and pulse code communication techniques.

Course Syllabus:

Unit -1 Classification of Telemetry Systems: voltage, current position, frequency, pulse, land-line and radio telemetry. Land-Line Telemetry: voltage telemetering system, current telemetering system, motion balance current telemetering system, position telemetering system using bridge configuration, position telemetering system using synchro's .

Learning outcomes:

Students can

1. Classify different telemetry systems
2. Understand the importance of radio, land, position telemetering systems
3. Able to analyze various telemetering systems.

Unit -2 Amplitude Modulation and Demodulation of a Carrier Wave: Expression for an AM- wave, frequency spectrum of an AM-wave, bandwidth, AM-detector, illustration of AM for measuring system, full-wave phase sensitive demodulator, block diagram of carrier amplifier system.

Learning outcomes:

Students can

1. Understand Amplitude modulation and Demodulation techniques.
2. Calculate Modulation index and illustrate the importance of Demodulator circuits.
3. Describe the importance of Frequency Modulation of a carrier wave

Unit -3 Frequency Modulation and Demodulation of A Carrier Wave: Expression for an FM-wave, frequency spectrum of an FM-wave, bandwidth, diode FM modulator, phase shift discriminator, ratio detector.

Learning outcomes:

Students can

1. Explain to design Frequency modulation and Demodulation
2. Gain knowledge on FM modulator Circuits.
3. Describe the bandwidth calculations using FM detectors

Unit -4 Amplitude Modulation and Demodulation Circuits for Measurement Systems: Basic configuration for a modular electromechanical chopper, semiconductor modulator, balanced modulator, basic configuration of a demodulator chopper, demodulator semiconductor, demodulators, balanced demodulator. Block diagrams of DC and AC signal conditioning systems.

Learning outcomes:

Students can

1. Describe the operation of Amplitude modulation and Demodulation circuits.
2. Illustrate the importance of various Demodulator circuits.
3. Explain the operation of DC and AC signal conditioning systems.

Unit -5 Multiplexing in Telemetry Systems: Block diagram of multiplexer and its mechanical switch, equivalent block diagram of a demultiplexer and its mechanical switch, equivalent frequency division multiplexing, time division multiplexing, sample-and –hold circuit, an outline of pulse modulation techniques used in telemetry.

Learning outcomes:

Students can

1. Learn to design multiplexer circuits and switches.
2. Gain knowledge on Multiplexing in Telemetry Systems
3. Explain the importance of sample-and–hold circuits
4. Outline the concepts of pulse modulation techniques used in telemetry.

Unit -6 Radio Telemetry Systems: Analog TDM system, FM-FM telemetry system, standard telemetry channel, frequencies for FDM, block diagrams of PAM, PCM, and FDM telemetry systems.
Transmission Channels: Wire line channels, radio channels, microwave channels, power line carrier channels and fiber optic transmission.

Learning outcomes:

Students can

1. Differentiate radio telemetry Systems and channels.
2. Gain knowledge on Telemetry channels and operation of Pulse code Modulation methods.
3. Explain about various modes of transmission channels

Cos(Course Outcomes)

CO1: List the subsystems used to build a telemetry system and to classify the methods of telemetry
CO2: To know the appropriate use of land line and radio telemetry and to list various transmitting and receiving techniques in radio telemetry.
CO3: Comprehend the performance of Amplitude modulation and demodulation techniques.
CO4: Analyze AM and FM transmitters, receivers and design of AM and FM detectors
CO5: outline of pulse modulation techniques used in telemetry.
CO6: Explain sampling and examine the performance of pulse code modulation and demodulation techniques used in telemetry systems

TEXT BOOKS:

1. Electrical and electronics measurements and instrumentation, by A.K.Sawhney, Dhanpat Rai & Sons .
2. Introduction to Telemetry by Alan Andrews, Foulsham-Sams technical books, published by W-Foulsham&Co Ltd., England.
3. Understanding telemetry circuits, by John D.Lenk, Foulsham – Sams technical books, Published by W.Foulsham& Co., England

e-Resources

1. https://youtu.be/F3slBe2r8vA Principles of Communication Systems -I - Introduction - Prof. Aditya K. Jagannatham, IIT Kanpur.
2. https://youtu.be/lnIvUDsWELc, Transmission of Analog Signal Part I&II, IITKharagpur
3. https://youtu.be/l07FiK7F5FI , Lecture 11a Multiplexing
4. https://youtu.be/aKl17gw_nfU "Pulse Code Modulation in Digital communication by Engineering Funda"

Fiber Optics and Laser Instrumentation

L	T	PD	Total periods	Univ exam		Sessnl Marks	Total Marks
				Hrs	Marks		
3	1	--	4	3	70	30	100

CEOs (Course Educational Objectives)

19. To know the principles of light propagation theory.
20. To learn different types of fibers and their individual properties, characteristics.
21. To study about various fiber optic sensors.
22. To learn about various fiber optic communication systems.
23. To study about fundamentals of lasers and their types.
24. To study about applications of various lasers.

Course Syllabus

Unit-1: Principles of light propagation through fiber- Different types of fibers and their properties– transmission characteristics of optical fibers - absorption losses-scattering losses-dispersion.

Learning outcomes:

Students can

7. Outline the basic principals light propagation theory and different types of fibers.
8. Discuss about total internal reflection.
9. Describe various absorption losses-scattering losses-dispersion.

Unit-2: Fiber optic sensors – Fiber optic communication and instrument system – Advantages of optical communications – Different types of Modulators – Detectors – Fiber optic communication setup – Applications in instrumentation.

Learning outcomes:

Students can

1. Describe various Fiber optic sensors.
2. Compare Different types of Modulators and Detectors.
3. Design Fiber optic communication setup.

Unit-3: Characteristics and fundamentals of lasers – Laser emission and light amplification – Optical Resonators – Modes of resonators – Q-Factors , Q- Switching, Mode locking in lasers – Properties of Laser Beams - Types of lasers – Gas lasers – Solid lasers – liquid lasers – semiconductors lasers.

Learning outcomes:

Students can

1. Describe Characteristics and fundamentals of lasers.
2. Compare Different Modes of resonators.

3. Identify Types of lasers.

Unit-4: Lasers for Analysis – Laser application in holographic microscopy, holographic interferometer and applications -Medical applications of lasers. Laser and tissue interactive – Laser instruments for surgery, removal of tumors of vocal cards, Brain Surgery, Plastic surgery, gynecology & oncology.

Learning outcomes:

Students can

1. Examine Laser application in holographic microscopy.
2. Identify Medical applications of lasers.

Unit:5 Industrial application of Lasers – Measurement of distance and length, velocity, acceleration, atmospheric effects, pollutants, Material processing, laser heating, melting, scribing, splicing, material removal.

Learning outcomes:

Students can

1. Identify Industrial application of Lasers.
2. Uses laser heating, melting, scribing, splicing.

Reference books

1. H.C. Allen, An Introduction to Optical Fibers, McGraw-Hill International Book Co., 1983.
2. John and Harry, Industrial lasers and their applications, McGraw Hill publications,1974
3. Gerd Kaiser, Optical fiber communications, McGraw Hill International Edition,2000
4. D.C. Oshea and W.Russel Callen, Introduction to lasers and their Applications, Addison Wesley, 1978.
5. BS. Wherrelt, Laser Advances and Applications, John Wiley, 1979.
6. W.O.N. Guimarass and A.Mooradian, Lasers and Application Springer Verlag, 1981

e-Resourses

1. https://nptel.ac.in/courses/115/107/115107095/
2. https://www.youtube.com/watch?v=pavBq7HIoIE
3. https://nptel.ac.in/courses/108/106/108106173/
4. https://www.youtube.com/watch?v=YvrwVK9ZqQY
5. http://www.digimat.in/nptel/courses/video/104104085/L38.html

COs (Course outcomes)

After completion of the course the students will be able to

19. Describe the properties and characteristics of optical fibers.
20. Estimate the losses due to attenuation, absorption, scattering.
21. Construct the various fiber optics communication systems.
22. Classify the various types of lasers and its properties.
23. Illustrate various laser applications with laser instruments for medical field.
24. Design systems for Industrial application of Lasers.

ANALYTICAL INSTRUMENTATION

L	T	PD	Total periods	Univ exam		Sessnl Marks	Total Marks
				Hrs	Marks		
3	1	0	4	3	70	30	100

CEOs (Course Educational Objectives)

1. To study the electromagnetic radiation, the Beer Lambert law.
2. To study the concepts related to spectroscopy computerized NMR. Electro spin resonance spectrometer (ESR).
3. To study the X-ray absorption meters X-ray fluorescence spectrometers.
4. To Demonstrate the functions of chromatographic system.
5. To study Measuring circuits. electro-chemical cell.
6. To study Hydrogen gas analyzers-IR gas analyzers.
7. To study the ozone automated wet chemical analyzers water pollution monitoring.

Course syllabus

Unit 1: Introduction, laboratory and industrial analyzers classification of the methods of analysis block diagram of an analyzing system. Colorimeters & Spectrophotometers (visible & ultraviolet) electromagnetic radiation, the Beer Lambert law. Infra - red spectrophotometers types of instruments, principles of operation, basic components of the systems.

Learning outcomes:

Students can

1. *Explain concepts* industrial analyzers classification of the methods of analysis block diagram of an analyzing system.
2. Define properties of Colorimeters & Spectrophotometers (visible & ultraviolet) electromagnetic radiation, the Beer Lambert law.
3. Describe red spectrophotometers types of instruments.

Unit 2: Nuclear magnetic resonance spectrophotometer (NMR) principle, construction, details Fourier transform NMR, spectroscopy computerized NMR. Electro spin resonance spectrometer (ESR), principle of operation construction of the ESR spectrometer.

Learning outcomes:

Students can

1. Implement Nuclear magnetic resonance spectrophotometer (NMR) principle.
2. *Design* Electro spin resonance spectrometer (ESR) its principle of operation construction of the ESR spectrometer.

Unit 3: X-ray spectrometer: X-ray spectrum, instrumentation for X-ray spectrometry X-ray diffractometers X-ray absorption meters X-ray fluorescence spectrometers.

Learning outcomes:

Students can

1. Analyze instrumentation for X-ray spectrometry X-ray.
2. Explain the instrumentation for X-ray spectrometry X-ray diffractometers X-ray absorption meters
3. Describe X-ray fluorescence spectrometers.

Unit 4: Gas & liquid chromatographic systems: Principles of chromatography, Schemes and constructional details and functions of chromatographic system components.

.**Learning outcomes:**

Students can

1. Explain Gas & liquid chromatographic systems.

2. Explain constructional details and functions of chromatographic system components.

Unit 5: Systems working on thermal conductivity. Principle of operation- conductivity cell construction. Measuring circuits. electro-chemical cell, construction. conductivity meters, polarography.

Learning outcomes:

Students can

1. Implement Systems working on thermal conductivity.
2. Explain Principle of operation- conductivity cell construction.
3. Describe electro-chemical cell, construction. conductivity meters, polarography.

Unit 6: **INDUSTRIAL GAS ANALYZERS**: Types of gas analyzers- flue gas analyzers, paramagnetic oxygen analyzers, electrochemical gas analyzers. Hydrogen gas analyzers-IR gas analyzers, analyzers based on gas density systems based on ionization of gases.

Learning outcomes:

Students can

1. Explain flue gas analyzers, paramagnetic oxygen analyzers, electrochemical gas analyzers.
2. Describe Hydrogen gas analyzers-IR gas analyzers.

Unit 7: **ENVIRONMENTAL POLLUTION MONITORING INSTRUMENTS**: Air pollution monitoring, instrument systems for-carbon monoxide-Sulphur dioxide-nitrogen oxides-hydro carbons-ozone automated wet chemical analyzers water pollution monitoring.

Learning outcomes:

Students can

1 Implement instrument systems for-carbon monoxide-Sulphur dioxide-nitrogen oxides.
2 Describe ozone automated wet chemical analyzers water pollution monitoring.

TEXT BOOKS:

1. R.S. Khandpur, Handbook of Analytical Instruments, Tata McGraw Hill publishing Co. Ltd., 2nd edition, 2006.
2. Instrumental methods of analysis - HH Willard,Jr.,JADean,FASettle,JR,CBS Publications.
3. Instrument engineers Handbook. Instrumentation and Analysis-GB Liptak Edition Charge Chilton book Company

COs (Course outcomes)

After completion of the course the students will be able to

1. Able to implement and Colorimeters & Spectrophotometers.
2. Able to describe Nuclear magnetic resonance spectrophotometer (NMR).
3. Able to describe Gas & liquid chromatographic systems.
4. Able to implement X-ray spectrometer: X-ray spectrum.
5. Able to analyze Systems working on thermal conductivity.
6. Able to analyze industrial gas analyzers.
7. Able to describe ozone automated wet chemical analyzers water pollution monitoring.

ADVANCED SENSING TECHNIQUES

L	T	PD	TOTAL Pds	Univ Exam Hrs	Univ Exam Marks	Sessnl Marks	Total Marks
3	-	--	3	3	70	30	100

Course Educational Objectives:

6. To provide in depth knowledge in different phases of automation.
7. To introduce the students to designing and modelling of advanced sensing techniques.
8. An understanding of the principles of physical sensors.
9. To give a fundamental knowledge on the basic laws and phenomena on which operation of Chemical sensors.
10. To impart a reasonable level of competence in the design, construction, and execution of Lab on chip.

Introduction Different Phases of automation. Importance of sensor/smart sensor in automation. Features of Advanced sensing techniques. Sensor classifications according to the energy domains. Introduction of advanced sensing materials. Properties (physical, electrical, chemical, biological) of materials which makes it suitable for sensing in different domain.

Design and modelling, Design and modelling issue in advanced sensing technique, Introduction of different mathematical tools used in sensor design, Study of analytical design from given specification, conformal mapping, Optimization techniques used in sensor design. Numerical design such as FEM, FDM, etc. Study of Tomography and Concept of Feedback in sensing Fabrication and packaging Introduction to MEMS sensor. Comparison between MEMS and Macro sensor. Fabrication and packaging issue in sensor design, Thick film and thin film technique.

Physical sensors, Hall Effect sensors, Eddy current sensors, magneto resistive and magneto strictive detectors, Accelerometers: Capacitive, Piezoelectric, Piezoresistive, Thermal, Humidity and moisture sensor, Proximity detectors using polarized light, Semiconductor gas sensor, Fluidic and Micro-fluidic sensors.

Chemical sensor, Chemical sensor characteristics, specific difficulties related to chemical sensor, Classification of Chemical sensing mechanism, Study of chemical sensor based on the principle of direct sensing techniques such as Metal oxide chemical sensor, electro chemical sensors, potentiometric sensors, conductive sensors, amperometric sensors, enhanced catalytic gas sensors, enzyme sensors, Study of chemical sensors in indirect mode such as thermal sensor, optical chemical sensor, biochemical sensor, enzyme sensor, Sensor array.

Introduction to the concept of Lab on chip/senor platform technology, The role of PCA, LDA, Neural network in designing sensor array, Study of temperature cycle, mode of sensing to obtain virtual sensor array, Case study of a gas sensing platform, liquid sensing.

REFERENCE BOOKS

1. Sensors- A Comprehensive study-W.Gopal, J Hesse, J N Zemel –VHC Press, 1989.
2. Sensors Handbook-SabreeSoloman—McGraw Hill Publishers-1998
3. Electro Optical Instrumentation- SilvanoDonati, Pearson Education 2005.
4. Introduction to Medical Equipment Technology: Carr and Brown- Addison Weseley-2001.

Course Outcomes:

1Explain the various principles employed in Different Phases of automation.
2Examine the designing and modelling of advanced sensing techniques.
3Apply knowledge in designing of physical sensors.
4Discuss the techniques of fabrication and application of chemical sensors.
5Describe the various applications of chemical sensors.
6.Discuss advanced sensing technology.

NON-DESTRUCTIVE TESTING

L	T	PD	TOTAL Pds	Univ Exam Hrs	Univ Exam Marks	Sessnl Marks	Total Marks	Course
3	-	--	3	3	70	30	100	

Educational Objectives:

1. To elucidate in depth information in importance of material inspection.
2. To Comprehend the characteristics of non-destructive testing approaches and estimate the status of necessary properties
3. To summarize the deep knowledge on magnetic methods for non-destructive testing.
4. To acquaint the students with a variety of real-worldscenarios related with ultrasonic testing
5. To discuss the principles of radiographic testing methods.
6. To give the fundamental idea of electrical methods for non-destructive testing.

Course Syllabus:

Unit – I:

Need for inspection- quality of inspection-Benefits of NDT-Liquid penetrant inspection-Principles- Characteristics of a penetrant- Water washable system post emulsifiable system- Solvent removable system- Surface preparation and cleaning- Penetrant application- Sensitivity- Viewing- Recording- Applications.

Learning Outcomes:

Students can

1. Explain the benefits, advantages and uses of non-destructive testing.
2. Describe the process of inspection and quality of inspection.

Unit – II:

Magnetic methods; Basic principles- Magnetising methods- Characteristics of magnetic

particles- Magnetic links- Magnetography- Field sensitive probes- Measurement of metal properties- Ferrography-Applications.

Learning Outcomes:

Students can

1. Identify different magnetic methods for non-destructive testing.
2. Outline the applications of magnetic methods for non-destructive testing.

Unit – III:

Ultrasonic testing: Basic principles- different kinds of ultrasonic waves- Properties propagation- Mode conversion- Construction of normal and angle probes- Piezo electric materials- attenuation. Different methods of flow detection - Transmission, reflection and immersion methods. Pulse- Echo method- Different types of display- A- Scan, B-Scan, C-Scan methods- Identification of detects- Sensitivity- calibration and reference standards- Applications.

Learning Outcomes:

Students can

1. Have anelementaryinformation of ultrasonic testing which allows them to executethe inspectionof samples.
2. Distinguishnumerousfault types and choose the propernon-destructive testing methods.

Unit – IV:

Radiographic methods: general priciples- X-ray and gamma ray sources- Shadow formation- Enlargement and distortion recording of radiation-Radio graphic techinics-Single and double image techniques- Sensitivity- Penetramaters- Fluoroscopic method-Real time radiography- Application.

Learning Outcomes:

Students can

1. Classify a comprehensive theoretical and hands-on understanding of the radiographic testing,interpretation and evaluation.
2. List thesuitable technique and exposure time for animproved imaging.

Unit – V:

Electrical methods: Principle of eddy current testing- Conductivity of material- Magnetic properties- Coil impedance. Lift off factor and edge effect- Skiing effect- Impedance plant diagrams- inspection frequency- Coil arrangements inspection problems- Types of circuit-Reference standards- Phase analysis-Display methods- Typical applications.

Learning Outcomes:

Students can

1. Illustrate different electrical methods for non-destructive testing.
2. Test the reference standards and its applications.

Unit – VI:

Other methods: Optical holographic methods- Electronic / speckle pattern inter-formetry dynamic inspection-Neutron Radiography-Laser induced ultrasonic-Crack depth gauges-

Thermography-Surface texture analysis-Acoustic emissionmethods.

Learning Outcomes:

Students can

1. Revise Optical holographic methods and Neutron radiography.
2. Interpolate Thermography and Surface texture analysis.

TEXT BOOKS:

1. Non-destructive testing by Barry Hull and Vennon johnELBS/Momillon,1988,
2. Non-destructive testing by R.Halmshaw Edward Arnold,London.
3. Non destructive testing by Warren J.McgonnagleMcGraw-hill book Co.,1961.

REFERENCE BOOKS:

1. 1.Ultrasonic testing of material by J.Krantkramer and H.Krantkramer SpringerVerlag, Newyork.
2. Ultrasonic Engineering by Julien r. Frederick, chapters 1,2,4,7, John wiley&son Newyork.

e-RESOURCES:

1. https://inis.iaea.org/collection/NCLCollectionStore/_Public/18/100/18100169.pdf
2. https://nptel.ac.in/courses/113/106/113106070/
3. https://www.edx.org/course/electrical-based-non-destructive-testing-and-sensing
4. https://www.edx.org/course/fundamentals-of-non-destructive-testing
5. https://isnt.in/video-lectures-pct-3-nde2020/
6. https://www.udemy.com/course/non-destructive-testing-methods/

Course Outcomes:

At the end of the course the students will be able to

1. Explain the benefits, advantages and uses of non-destructive testing.
2. Describe the process of inspection and quality of inspection.
3. Identify different magnetic methods Outline the applications of magnetic methods for non-destructive testing.
4. Have an elementary information of ultrasonic testing. Distinguish numerous fault types and choose the proper non-destructive testing methods.
5. Classify a comprehensive theoretical and hands-on understanding of the radiographic testing, interpretation and evaluation.
6. Illustrate different electrical methods for non-destructive testing and its applications.
7. Describe some other types of non-destructive testing methods such as Optical holography and Thermography.

PROGRAMMABLE CONTROL SYSTEMS

COURSE EDUCATIONAL OBJECTIVES:

7. At the end of chapter one will able of understand the knowledge of Industrial automation and control tools such as DCS, SCADA, PLC etc.,
8. Making aware of standard communication protocols implementation of RS 232, RS 485 and comparison with MODBUS process and its advantages.
9. Comparision of HART used to communicate with devices for device configuration- reconfiguration, Diagnosis, Trouble shooting, device health and status. Devicenet, Industrial ethernet applications
10. PLC programming methods and Analog controlling using PLC and its its interfacing with SCADA /DCS using communication links.
11. PLC its architecture and comparision of PLC with DCS and concepts on ladder diagrams and relay diagrams and study of industrial PLC.
12. Distributed Control Systems introduction, functions , advantages and its limitations, database management system.

COURSE OUTCOMES:

7. After conclusion of control and automation topic we can understand the calibration process for PLC and DCS systems.
8. A brief knowledge on OSI (open System Inter connection) model and OPC (Object Linking and embedding for Process Control) is achieved.

9. Graphical representation and mathematical analysis can be implemented for different timers and counters and for High speed counter can be achieved.
10. In depth knowledge on different PTO, PWM and PID blocks in PID design and study can be fulfilled.
11. Programming methods as per IEC 61131 for PLC can be implemented and executed.
12. In depth knowledge can be achieved in various functions of Distributed Control Systems like interfacing, Display, Historical data Management etc., can be studied.

LEARNING OUT COMES:

Unit 1:

3. Application oriented knowledge on basic Control systems.
4. Automation tools like SCADA, PLC and DCS and its Hybrid could be developed as a skill set for industries.

Unit 2:

3. Implementation of logical programming in HART protocol can be achieved.
4. Application oriented PLC Controllers can be evaluated Graphically and logically with at least one industrial PLC.

Unit 3:

3. In depth knowledge upon various communication links.
4. Protocols like RS 232, RS 485, MODBUS(ASCII/RTU) which are widely used in Programmable Control systems can be gained.

Unit 4:

3. Knowledge gained on Industrial process for DCS as an automationtool.
4. different areas to implement andto support third party interface.

Unit 5:

4. Batch application, Security and Access Control etc., can be observed for evaluation.Phase Diagrams, Programmable and logic control system implementation.
5. Graphical representation can be successfully analyse.
6. Applications of Distributed control systems in various areas can be observed.

REFERENCE BOOKS:

6. Distributed Computer Control for Industrial Automation, PoppovikBhatkar, Dekkar Publications.
7. Programmable Logic Controllers: Principles and Applications, Webb and Reis, PHI.
8. Computer Aided Process Control, S. K. Singh, PHI.
9. Introduction to Programmable Logic Controllers, Garry Dunning, Thomson Learning.
10. Computer Based Process Control, Krishna Kant, PHI. 6. The Management of Control System: Justification and Technical Auditing, N. E. Battikha, ISA.

1. Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems, Dr. OvidiuVermesan, Dr. Peter Friess, River Publishers.
2. Interconnecting Smart Objects with IP: The Next Internet, Jean-Philippe Vasseur, Adam Dunkels, MorganKuffmann.
3. 6LoWPAN: The Wireless Embedded Internet, Zach Shelby, Carsten Bormann, Wiley.

MICRO AND NANO SENSORS

L	T	PD	TOTAL Pds	Univ Exam	Sessnl Marks	Total Marks

CEOs (Course Educational Objectives)

8. To make them understand various advanced concepts in Nano Technology.
9. Explore the fundamentals of different kinds of Sensors and it's applications.
10. Understand various methods used for production of carbon nanotubes.
11. Gain the concepts of Micro and nanoelectronics .
12. Understand various nanostructures and its applications towards Micro/Nano cantilever sensors
13. Acquire the fundamentals of DNA structures
14. Obtain the knowledge on optical Bio sensors

Course syllabus

Unit 1: Introduction sensors, Micro technology, Nano technology, Micro and nanobiosensors: Introduction to Micro/Nano biosensor, Biosensor history and current status, Classical Sensors. Applications of micro electrons and nano electrons.

Learning outcomes:

1. To have a vast knowledge on Micro and Nano sensor technology.
2. Advanced Development on micro/nano sensors for bio medical applications
3. Vast knowledge on applications of Micro and nano electronics.

Unit 2: Carbon-Nanotube-Based Sensors: Introduction , Synthesis of Carbon Nanotubes, Relevant Physical Characteristics of Carbon Nanotubes, Chemical Sensors and MEMS-Based Nanotube Sensors. Carbon-Nanotube-Based Fluidic Shear-Stress Sensors: Overview of Carbon Nanotube Sensors , Types of Shear-Stress Sensors.

Learning outcomes:

4. Make familiar with Synthesis of Carbon Nano tubes and characteristics.
5. Design & fabrication of Chemical sensors, shear –stresss sensors.
6. Have a great knowledge of Carbon nano tube sensors.

Unit 3: Nanomechanical Cantilever Sensors: Theory and Applications: Introduction, Operation Principles, Preparation of Microcantilever Sensors. Protein in Films: Sensing Elements for Sensors: Protein-Containing LB Films for Biosensor Applications, Antibody-Containing LB Films, Enzyme-Containing LB Films.DNA Sensors: DNA Hybridizations, DNA sequencing, DNA-Containing Monolayers and LB Films

Learning outcomes:

7. Design, Fabrication, working condition & applications of Micro cantilever Sensors
8. Can explain DNA Hybridization & sequencing.

Unit 4: Biomolecules, Protein, DNA structures and their immobilizations on sensor surface, Thermodynamic and Kinetics at biosensor surface.Microfluidics: Advances in micro fluidics, Sensor integrations. Immunosensors: antibody- antigen, Single molecule detections.

Learning outcomes:

9. To have a deep knowledge on DNA structures and Bio-sensor micro fluidics.
10. Make familiar with immune sensors
11. Detection of single molecule, study of Immunosensors.

Unit 5: Optical Capillary Sensors for Intelligent Classification of Micro fluidic Samples: Introduction, Operating Principles and Construction Aspects of the Optical Capillary Head, General Description of the Sensor System, e Measurement Cycle of the Capillary Sensor. Optical biosensors: Optical Imaging, Optical Sensing, Opto-genetics.

Learning outcomes:

12. Understanding Construction & operating principles of optical capillary sensors.
13. Study of different types of Optical sensors & it's applications.

Reference Books:

6. Nanosensors: Theory and Applications in Industry, Healthcare and Defense Edited ByTeik-Cheng Lim (https://www.taylorfrancis.com/books/e/9780429130793).
7. Introduction to Biosensors, Jeong-Yeol Yoon et al. Springer.
8. Handbook of Biosensors and Biosensor Kinetics, AjitSadana, Elsevier.
9. Nanofabrication Towards Biomedical Applications, Challa Kumar, Wiley-VCH.
10. Optical Biosensors: Present & Future, Frances Ligler, Elsevier

Course outcome:

1. Have a good vision to the future of micro/nano technology.
2. Vast knowledge on synthesis, Characteristics & applications of Carbon Nano tubes.
3. Obtain an idea about preparation of cantilevers along with it's applications.
4. Sound knowledge on Optical sensors.
5. Gain experience on Bio molecule, Protein, DNA structures etc..
6. Familiarize with Classic sensors for Micro/Nano electronic applications.

OPEN ELECTIVES:

INDUSTRIAL ELECTRONICS

Course Objectives:

Students undergoing this course are expected to:

CEO-1**.**Familiarize industrial and power electronic devices

CEO-2.chose different polyphase rectifiers for different applications

CEO-3.Able to know electric welding and high frequency heating

CEO-4.analyze voltage controlled rectifiers

CEO-5.Explain electronic speed control of motors

Course Outcomes:

At the end of the course, students will be able to

CO-1	Summarize the operation of various industrial and power semiconductor devices.
CO-2	Outline various polyphase rectifiers against various performance parameters
CO-3	Explain different methods of Electric welding
CO-4	Analyze the performance of phase controlled rectifiers for various loads.
CO5	Demonstrate the Electronic speed control of motors

INTRODUCTION TO INDUSTRIAL ELECTRONICS: Scope of Industrial Electronics, Main task of Power Electronics, Applications, Advantages, Disadvantages, Applications, Block diagram of Power Electronic System, PNPN device- Basic structure, two transistor version, Volt Ampere Characteristics, Holding current. Latching current, Gate circuit of Thyristor, Thyristor gate characteristics, Design of firing circuit, Triggering methods of thyristor, thyristor connected in series and parallel, Thyristor ratings, Silicon Controlled Switch(SCS): Basic structure, Two transistor equivalent, characteristics, Uni-junction transistor- Basic structure, Potential divider equivalent, Static emitter characteristics, delay firing of SCR by UJT. Bilateral PNPN diode switch(DIAC): Basic structure, Volt-Ampere characteristics, Traic- Basic structure, Volt- Amperecharacteristics.

POLYPHASE RECTIFIERS: Introduction, uses of Polyphase Rectifiers, Three phase half wave delta-wye rectifier with resistive load, Six -phase star Half wave rectifier with resistive load, Delta line to line double wye half wave rectifier with inter phase transformer and with resistive load, Three phase delta wye bridge rectifier with resistive load, General m-phase rectifier DC power outputs, efficiencies and ripple factors, Transformer utility factor, Rectifier performance, Commutation in Polyphase rectifiers.

ELECTRIC WELDING AND HIGH FREQUENCY HEATING: Methods of high frequency heating,Welding: Plastic Welding, Fusion Welding, Basic block diagram for a.c.

resistance welding, types: Spot welding. Projection welding. Butt welding, Seam welding and
Pulsating welding arrangements. InductionHeating: Principle of induction heating. Applications. Dielectric Heating: Principle of dielectric heating. Electrodes used in dielectric heating. Methods of coupling of Electrodes to R.F. Generator. Applications.

VOLTAGE CONTROLLED RECTIFIERS: (outlines of topics only): Single-Phase Half- wave controlled rectifier with resistance load. Single-Phase Full-wave controlled rectifier with resistance load. Three-Phase Half wave controlled rectifier with resistance load. Six-phase half- wave Controlled rectifier with resistance load.

ELECTRONIC SPEED CONTROL OF MOTORS: (outlines of topics only): DC Motor speed Control: single phase dc drives, single phase half wave converter drives, phase control, SCR feedback circuit for series motor drive. Half wave controlled SCR bridge for series motor drive.Choppercontrolleddcdrives.ACmotorspeedcontrol-Speedcontrolbyvariationofstator voltage using SCRs, Variable-frequency A.C motor drive, Voltage-fed inverter control.

P.W.M. control scheme, Current-fed inverter control, chopper controlled wound rotor Induction motor, rotor resistance control.

TEXT BOOKS:

4. 1.Industrial Electronics and by Power Electronics G.K.mithal, Khannapublishers.
5. Power Electronics by P.C.Sen,T.M.H.
6. Power Electronics by Dr.P.S.Bimbra, Khanna publishers

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ARTIFICIAL INTELLIGENCE

L	T	PD	Total periods	Univ exam		Sessnl Marks	Total Marks
				Hrs	Marks		
3	-	--	3	3	70	30	100

CEO's (Course Educational Objectives):

1. To introduce to the basic concepts of Artificial Intelligence with illustrations of current state of the art research and applications.
2. To identify the type of an AI problem in search inference, decision making under uncertainty, game theory etc.
3. To recognize the characteristics of AI languages that make it useful to real-world problems.
4. To describe the strengths and limitations of various search algorithms and choose the appropriate algorithm.
5.To understand the basic concept of fuzzy sets, fuzzy logic and defuzzification.

6.Identify and describe Neural network and Fuzzy logic techniques in building intelligent system.

Course Syllabus

Unit -1 : Basic Problem-Solving Methods: Production systems – state space search –control strategies – heuristic search – forward and backward reasoning – hill climbing techniques – breadth first search – depth first search – best search – staged search.

Learning outcomes:

Students can

1.Explain what constitutes Artificial Intelligence and how to identify systems with Artificial Intelligence.

2.Use classical Artificial Intelligence techniques, such as search algorithms, hill climbing techniques.

Unit-2: Knowledge Representation: Predicate logic – resolution question answering – non monotic reasoning – statistical and probabilistic reasoning semantic nets – conceptual dependency – frames- scripts.

Learning outcomes:

Students can

1.Explain the knowledge representation in question answering and reasoning.

2. Select appropriately Artificial Intelligence techniques when implementing intelligent systems.

Unit -3: Image Restoration: AI Languages: important characteristics of AI languages- PROLOG, introduction to expert systems, structure of an expert system-interaction with an expert design of an expert system.

Learning outcomes:

Students can

1. Explain the characteristics of Artificial Intelligence language PROLOG .

2.Use expert systems with an expert design of an expert system.

Unit-4: Neural Networks: basic structure of a neuron, perception feed forward, back propagation, Hopfield network.

Learning outcomes:

Students can

1.Identify different neural network architectures, their limitations and appropriate learning rules for each of the architectures.

2. To analyze various techniques in feedback , feed forward and Hopfield Neural networks.

Unit -5: Fuzzy Logic: fuzzy sets, member ship function, rules and algorithms, de-fuzzication and implementation.

Learning outcomes:

Students can

1.Implementation of new Fuzzy logic system using fuzzification ,fuzzy interference and de-fuzzification.

2. Apply the knowledge and understanding of fuzzy system in engineering and science.

Textbooks:

1. Rich E and knight K- Artificial intelligence. Tata McGraw Hill, New Delhi 1991.

2. Nillson NJ – Principals of artificial intelligence, Springer Veriag Berlin 1980.
3. Barr A.Fergenbaum E A & Cohen P R- Artificial intelligence, edition- Wesley reading (mass 0,1989).
4. Water man D A- A guide to expert systems, edition- Wesley reading (mass),1986.
5. Artificial intelligence Hand book VOL 1-2,ISA,Reasearch triangle park,1989.
6. Kos Ko B-neural networks and fuzzy systems, PHI.

e-Resourses

6. https://nptel.ac.in/courses/106/105/106105077/
7. https://nptel.ac.in/courses/106/102/106102220/
8. https://www.youtube.com/watch?v=2ePf9rue1Ao
9. https://www.youtube.com/watch?v=X_Qt0U66aH0&t=2s
10. https://www.youtube.com/watch?v=sZXsMo7iDbM

COs (Course Outcomes):

After completion of the course the students will be able to

1. Exhibit strong familiarity with a AI techniques including in particular search, knowledge representation, planning and constraint management.
2. Interpret the modern view of AI as the study of agents that receive percepts from the environment and perform actions.
3. Ability to apply AI techniques to real-world problems to develop intelligent systems.
4. Build awareness of AI facing major challenges and the complexity of typical problems within the field.
5. To analyze various techniques in feedback and feed forward Neural networks.
6. Apply the basic knowledge of fuzzy sets and fuzzy logics to implement a new algorithms.

DIGITAL IMAGE PROCESSING

L	T	PD	Total periods	Univ exam		Sessnl Marks	Total Marks
				Hrs	Marks		
3	1	--	4	3	70	30	100

CEOs (Course Educational Objectives)

25. To study and review of Light and Electromagnetic spectrum.
26. To study basic image processing concepts and components.
27. To learn and application of various image enhancement techniques.
28. To study about various image restoring techniques in various domains.
29. To learn and application of various color image processing techniques.
30. To study algorithms for image compression and image segmentation.

Course syllabus

Unit -1 : Digital image fundamentals: Light and Electromagnetic spectrum, Components of Image processing system, Image formation and digitization concepts, Neighbors of pixel adjacency connectivity, regions and boundaries, Distance measures, Applications.

Learning outcomes:

Students can

10. Outline the basic principals the Digital Image Processing system.
11. Describe various Components of Image processing system and concepts.
12. Identify of pixel adjacency connectivity, regions and boundaries, Distance measures.

Unit-2: Image Enhancements: Image Enhancements: In spatial domain: Basic gray level transformations, Histogram processing, Using arithmetic/Logic operations, smoothing spatial filters, Sharpening spatial filters. In Frequency domain: Introduction to the Fourier transform and frequency domain concepts, smoothing frequency-domain filters, Sharpening frequency domain filters.

Learning outcomes:

Students can

3. Explain basic gray level transformation
4. Describe Histogram processing, Using arithmetic/Logic operations, smoothing spatial filters, Sharpening spatial filters.
5. Explain Fourier transform and frequency domain concepts, smoothing frequency-domain filters, Sharpening frequency domain filters.

Unit -3: Image Restoration: Various noise models, image restoration using spatial domain filtering, image restoration using frequency domain filtering, Estimating the degradation function, Inverse filtering.

Learning outcomes:

Students can

3. Explain various noise models.
4. Describe image restoration using spatial domain filtering.
5. Describe Estimating the degradation function, Inverse filtering.

Unit-4: Color Image processing: Color fundamentals, Color models, Color transformation, Smoothing and Sharpening, Color segmentation

Learning outcomes:

Students can

10. Classify Color fundamentals, Color models.
11. Describe color Smoothing and Sharpening.
12. Explain Color segmentation.

Unit -5: Image compression: Introduction, Image compression model, Error-free compression, Lossy compression.

Learning outcomes:

Students can

5. Identify image compression models
6. Outline various error free and loss-less image compression models.

Unit -6: Image segmentation: Detection of discontinuities, Edge linking and boundary detection, thresholding

Learning outcomes:

Students can

3. Identify discontinuous, edges in images.
4. Use thresholding technique.

Text books

1. R. C. Gonzalez and R. E. Woods, Digital Image Processing, 3rd edition, Prentice Hall, 2008.
2. R. C. Gonzalez, R. E. Woods and Steven L. Eddins , Digital Image Processing Using MATLAB , 2rd edition, Prentice Hall, 2009.
3. Anil K.Jain, "Fundamentals of Digital Image Processing", Prentice Hall of India, 9th Edition.
4. Jayaraman, S. Esakkirajan, and T. Veerakumar, Digital Image Processing, Tata McGrawHill Education, 2011.

e-Resourses

14. https://nptel.ac.in/courses/117/105/117105135/
15. https://nptel.ac.in/courses/117/105/117105079/
16. https://www.youtube.com/watch?v=994ZNi7rSXo
17. https://www.youtube.com/watch?v=F1Fi6FdLn1s
18. https://www.youtube.com/watch?v=svgZodJgKaU
19. https://www.youtube.com/watch?v=j3_Ck5oP5oI

COs (Course outcomes)

After completion of the course the students will be able to

25. Describe the image processing concepts and components.
26. Use the various image enhancement techniques.
27. Classify the various noise models.
28. Explain various color image processing techniques.
29. Categories various error free and loss-less image compression models.
30. Design algorithms for image segmentation

COMPUTER ORGANIZATION AND OPERATING SYSTEMS

L	T	PD	Total periods	Univ exam		Sessnl Marks	Total Marks
				Hrs	Marks		
3	-	--	3	3	70	30	100

CEOs (Course Educational Objectives)

6. Discuss the Basic Operational Concepts.
7. Assess the performance of Multiprocessors and Multi Computers.
8. Learn the Basic Concepts of Semiconductor RAM Memories
9. Assess the performance of Input-Output Processor.
10. Assess the performance of various multiplication algorithms.
11. List out the different types of Micro-Operations.

Course syllabus

Unit-I:Basic Structure of Computers: Computer Types, Functional UNIT, Basic Operational Concepts, Bus, Structures, Software, Performance, Multiprocessors and Multi Computers, Data Representation, Fixed Point Representation, Floating - Point Representation.Register Transfer Language and Micro Operations: Register Transfer Language, Register Transfer Bus and Memory Transfers, Arithmetic Micro Operations, Logic Micro Operations, Shift Micro Operations, Arithmetic Logic Shift Unit, Instruction Codes, Computer Registers Computer Instructions - Instruction Cycle. Memory - Reference Instructions, Input - Output and Interrupt, STACK Organization, Instruction Formats, Addressing Modes, DATA Transfer and Manipulation, Program Control, Reduced Instruction Set Computer.

Learning outcomes:

Students can

3. List out the different components of computer organization.
4. Explain the different types of Micro-Operations.
5. Define Register transfer language.

Unit-2:Micro Programmed Control: Control Memory, Address Sequencing, Microprogram Examples, Design of Control Unit, Hard Wired Control, Microprogrammed Control. The Memory System: Basic Concepts of Semiconductor RAM Memories, Read-Only Memories, Cache Memories Performance Considerations, Virtual Memories secondary Storage, Introduction to RAID.

Learning outcomes:

Students can

6. Design Address Sequencing.
7. Design the hardwired control unit.

Unit-3:Input-Output Organization: Peripheral Devices, Input-Output Interface, Asynchronous Data Transfer Modes, Priority Interrupt, Direct Memory Access, Input-Output Processor (IOP), Serial Communication; Introduction to Peripheral Components, Interconnect (PCI) Bus, Introduction to Standard Serial Communication Protocols like RS232, USB, IEEE1394.

Learning outcomes:

Students can

6. Explain various noise models.
7. Describe the Direct Memory Access.

Unit-4: Operating Systems Overview: Overview of Computer Operating Systems Functions, Protection and Security, Distributed Systems, Special Purpose Systems, Operating Systems Structures-Operating System Services and Systems Calls, System Programs, Operating System Generation. Memory Management: Swapping, Contiguous Memory Allocation, Paging, Structure of the Page Table, Segmentation, Virtual Memory, Demand Paging, Page-Replacement Algorithms, Allocation of Frames, Thrashing Case Studies - UNIX, Linux, Windows Principles of Deadlock: System Model, Deadlock Characterization, Deadlock Prevention, Detection and Avoidance, Recovery from Deadlock.

Learning outcomes:

Students can

13. Describe Protection and Security.
14. Explain Operating System Generation.
15. Explain Deadlock Characterization.

Unit -5: File System Interface: The Concept of a File, Access Methods, Directory Structure, File System Mounting, File Sharing, Protection. File System Implementation: File System Structure, File system Implementation, Directory Implementation, Allocation Methods, Free-Space Management.

Learning outcomes:

Students can

7. Explain File System Mounting.

8. Describe Directory Implementation.

Text books

4. Computer Organization - Carl Hamacher, ZvonksVranesic, SafeaZaky, 5th Edition, McGraw Hill.
5. Computer System Architecture - M. morismano, 3rd edition, Pearson
6. Operating System Concepts – AbrehamSilberchatz, Peter B. Galvin, Greg Gagne, 8th Edition, John Wiley.

E-Resources

7. https://www.youtube.com/watch?v=leWKvuZVUE8&list=PL1A5A6AE8AFC187B7
8. https://www.youtube.com/watch?v=z3Nw5o9dS7Q&list=PLsylUObW5M3CAGT6OdubyH6FztKfJCcFB
9. https://www.youtube.com/watch?v=oAneKttKjt
10. https://www.youtube.com/watch?v=kTdvOlA2ko0
11. https://www.youtube.com/channel/UCJihyK0A38SZ6SdJirEdIOw
12. https://www.youtube.com/watch?v=RozoeWzT7IM&list=PLdo5W4Nhv31a5ucW_S1K3-x6ztBRD-PNa

COs (Course outcomes)

After completion of the course the students will be able to

7. Apply the fundamental issues related to computer arithmetic operation and circuits to support the system computation.
8. Understand the various components of memory system to organize the operational units of CPU.
9. Analyze the data processing operations of central processing and control unit to design the CPU specification.
10. Understand the concepts of pipeline design techniques to increase the execution rate of a processor.
11. Analyze File System Implementation and File System Structure.
12. Analyze various mechanisms used in virtual memory management.

VIRTUAL INSTRUMENTATION

L	T	P	Total periods	Univ exam		Sessnl Marks	Total Marks
				Hrs	Marks		
3	-	0	3	3	70	30	100

CEOs (Course Educational Objectives)

12. To know the History of Instrumentation systems.
13. To understand software Environment.
14. To describe Virtual Instrumentation & sub Virtual Instrumentation.
15. To know the Analog inputs, Analog outputs.
16. Describe input and output files.

Course syllabus

Unit-I: Introduction to Virtual Instrumentation: History of Instrumentation systems, Evolution of Virtual Instrumentation, premature challenges, programming requirements,

Drawbacks of recent approaches, conventional Virtual Instrumentation, Distributed Virtual Instrumentation, Virtual Instrumentation versus Traditional Instruments, Advantages.

Learning outcomes:

Students will be able to

6. Describe Evolution of Virtual Instrumentation.
7. Understand the Distributed Virtual Instrumentation.

Unit-2: Introduction to LabVIEW: Introduction, Advantages of LabVIEW, software Environment, Front panel, Block diagram, Data flow programming, G programming.

Learning outcomes:

Students will be able to

8. Understand Advantages of LabVIEW.
9. Understand Data flow programming.

Unit-3: Programming Concepts of Virtual Instrumentation: VI & sub VI, loops, shift registers, feedback node, formula node, case and sequence structures, arrays, clusters.

Learning outcomes:

Students will be able to

8. Understand case and sequence structures
9. Describe local and global variables

Unit-4: Output Verification: Tools Waveform Graphs, Waveform charts, files I/O, local and global variables.

Learning outcomes:

Students will be able to

1. Describe output waveform graphs.
2. Understand global variables.

Unit-5: Data Acquisition system: Introduction, transducers, Signals, Signal conditioning, DAQ Hardware configuration, DAQ Hardware, Analog inputs, Analog outputs, counters, Digital I/O, DAQ software architecture, DAQ assistant.

Learning outcomes:

Students will be able to

3. Describe transducers.
4. Understand the DAQ software architecture.

Text books

3. S. Sumathi, P. Surekha, “Virtual Instrumentation with LabVIEW,” ACME Learning Pvt. Ltd 2007.

References

4. Jovitha Jerome, “Virtual Instrumentation Using LabVIEW,” PHI learning Pvt. Ltd 2006.
5. Jeffrey Travis,” LabVIEW for everyone,” Pearson Education 2009.

E-Resources:

6. https://www.youtube.com/watch?v=9EhTc-kLRyM

7. https://www.youtube.com/watch?v=Cpb3fQtOFJ4
8. https://www.youtube.com/watch?v=cSbTp-XjzeY
9. https://www.youtube.com/watch?v=VwxO1oYowC0
10. https://www.youtube.com/watch?v=VwxO1oYowC0

COs (Course outcomes)

After completion of the course the students will be able to

6. Describe Virtual Instrumentation versus Traditional Instruments
7. Explain concept of LabVIEW.
8. Classify output verification Tools Waveform Graphs.
9. Appraise the DAQ Hardware configuration.
10. Explore output verification waveform charts..

PROGRAMMABLE CONTROL SYSTEMS

COURSE EDUCATIONAL OBJECTIVES:

13. At the end of chapter one will able of understand the knowledge of Industrial automation and control tools such as DCS, SCADA, PLC etc.,
14. Making aware of standard communication protocols implementation of RS 232, RS 485 and comparison with MODBUS process and its advantages.
15. Comparision of HART used to communicate with devices for device configuration-reconfiguration, Diagnosis, Trouble shooting, device health and status. Devicenet, Industrial ethernet applications
16. PLC programming methods and Analog controlling using PLC and its its interfacing with SCADA /DCS using communication links.
17. PLC its architecture and comparision of PLC with DCS and concepts on ladder diagrams and relay diagrams and study of industrial PLC.
18. Distributed Control Systems introduction, functions , advantages and its limitations, database management system.

Unit- I Control Systems and Automation Strategy

Evolution of instrumentation and control, Role of automation in industries, Benefits of automation, Introduction to Descriptive automation tools PLC, DCS, SCADA, Hybrid DCS/PLC, Automation strategy evolution, Control system audit, and performance criteria.

LEARNING OUT COMES:

5. Application oriented knowledge on basic Control systems.
6. Automation tools like SCADA, PLC and DCS and its Hybrid could be developed as a skill set for industries.

Unit- II Instrumentation Standard Protocols

Definition of protocol, Introduction to Open System Interconnection (OSI) model, Communication standard (RS232, RS485), Modbus (ASCII/RTU), Introduction to third party interface, concept of OPC (Object linking and embedding for Process Control), HART Protocol: Introduction, frame structure, programming, implementation examples,

benefits, advantages and limitation.

Foundation Fieldbus H1: Introduction, frame structure, programming, implementation examples, benefits, advantages and limitation. Comparison of HART, Foundation Fieldbus, Devicenet, Profibus, Controlnet, Industrial Ethernet.

LEARNING OUT COMES:

5. Implementation of logical programming in HART protocol can be achieved.
6. Application oriented PLC Controllers can be evaluated Graphically and logically with at least one industrial PLC.

Unit- III Programmable logic controllers (PLC)

Introduction, architecture, definition of discrete state process control, PLC Vs PC, PLC Vs DCS, relay diagram, ladder diagram, ladder diagram examples, relay sequencers, timers/counters, high speed counter, PTO, PWM and PID blocks in PLC, PLC design, study of at least one industrial PLC.

LEARNING OUT COMES:

5. In depth knowledge upon various communication links.
6. Protocols like RS 232, RS 485, MODBUS(ASCII/RTU) which are widely used in Programmable Control systems can be gained.

Unit- IV Advance Applications of PLC and SCADA

PLC programming methods as per IEC 61131, PLC applications for batch process using SFC, Analog Control using PLC, PLC interface to SCADA/DCS using communication links (RS232, RS485) and protocols (Modbus ASCII/RTU)

LEARNING OUT COMES:

5. Knowledge gained on Industrial process for DCS as an automationtool.
6. different areas to implement andto support third party interface.

Unit- V Distributed Control Systems

DCS introduction, functions, advantages and limitations, DCS as an automation tool to support Enterprise Resources Planning, DCS Architecture of different makes, specifications, configuration and programming, functions including database management, reporting, alarm management, communication, third party interface, control, display etc. Enhanced functions viz. Advance Process Control, Batch application, Historical Data Management, OPC supports, Security and Access Control etc.

7. Batch application, Security and Access Control etc., can be observed for valuation. Phase Diagrams, Programmable and logic control system implementation.
8. Graphical representation can be successfully analyse.
9. Applications of Distributed control systems in various areas can be observed.

REFERENCE BOOKS:

11. Distributed Computer Control for Industrial Automation, PoppovikBhatkar, Dekkar Publications.
12. Programmable Logic Controllers: Principles and Applications, Webb and Reis, PHI.

13. Computer Aided Process Control, S. K. Singh, PHI.
14. Introduction to Programmable Logic Controllers, Garry Dunning, Thomson Learning.
15. Computer Based Process Control, Krishna Kant, PHI. 6. The Management of Control System: Justification and Technical Auditing, N. E. Battikha, ISA.

COURSE OUTCOMES:

13. After conclusion of control and automation topic we can understand the calibration process for PLC and DCS systems.
14. A brief knowledge on OSI (open System Inter connection) model and OPC (Object Linking and embedding for Process Control) is achieved.
15. Graphical representation and mathematical analysis can be implemented for different timers and counters and for High speed counter can be achieved.
16. In depth knowledge on different PTO, PWM and PID blocks in PID design and study can be fulfilled.
17. Programming methods as per IEC 61131 for PLC can be implemented and executed.
18. In depth knowledge can be achieved in various functions of Distributed Control Systems like interfacing, Display, Historical data Management etc., can be studied.

TELEMETRY

L	T	PD	Total periods	Univ exam		Sessnl Marks	Total Marks
				Hrs	Marks		
3	-	--	3	3	70	30	100

Course Educational Objectives:

7. Comprehend frontier areas of knowledge in modulation techniques and telemetry systems.
8. To describe the Knowledge on functions of telemetry system
9. To classify various methods in land telemetry
10. To construct about the radio telemetry and positioning telemetry systems
11. To Understand analog communication and modulation methods
12. To Learn frequency modulation methods and pulse code communication techniques.

Course Syllabus:

Unit -1 Classification of Telemetry Systems: voltage, current position, frequency, pulse, land-line and radio telemetry. Land-Line Telemetry: voltage telemetering system, current telemetering system, motion balance current telemetering system, position telemetering system using bridge configuration, position telemetering system using synchro's .

Learning outcomes:

Students can

4. Classify different telemetry systems
5. Understand the importance of radio, land, position telemetering systems
6. Able to analyze various telemetering systems.

Unit -2 Amplitude Modulation and Demodulation of a Carrier Wave: Expression for an AM-wave, frequency spectrum of an AM-wave, bandwidth, AM-detector, illustration of AM for measuring system, full-wave phase sensitive demodulator, block diagram of carrier amplifier system.

Learning outcomes:

Students can

4. Understand Amplitude modulation and Demodulation techniques.
5. Calculate Modulation index and illustrate the importance of Demodulator circuits.
6. Describe the importance of Frequency Modulation of a carrier wave

Unit -3 Frequency Modulation and Demodulation of A Carrier Wave: Expression for an FM-wave, frequency spectrum of an FM-wave, bandwidth, diode FM modulator, phase shift discriminator, ratio detector.

Learning outcomes:

Students can

4. Explain to design Frequency modulation and Demodulation
5. Gain knowledge on FM modulator Circuits.
6. Describe the bandwidth calculations using FM detectors

Unit -4 Amplitude Modulation and Demodulation Circuits for Measurement Systems: Basic configuration for a modular electromechanical chopper, semiconductor modulator, balanced modulator, basic configuration of a demodulator chopper, demodulator semiconductor, demodulators, balanced demodulator. Block diagrams of DC and AC signal conditioning systems.

Learning outcomes:

Students can

4. Describe the operation of Amplitude modulation and Demodulation circuits.
5. Illustrate the importance of various Demodulator circuits.
6. Explain the operation of DC and AC signal conditioning systems.

Unit -5 Multiplexing in Telemetry Systems: Block diagram of multiplexer and its mechanical switch, equivalent block diagram of a demultiplexer and its mechanical switch, equivalent frequency division multiplexing, time division multiplexing, sample-and –hold circuit, an outline of pulse modulation techniques used in telemetry.

Learning outcomes:

Students can

5. Learn to design multiplexer circuits and switches.
6. Gain knowledge on Multiplexing in Telemetry Systems
7. Explain the importance of sample-and–hold circuits
8. Outline the concepts of pulse modulation techniques used in telemetry.

Unit -6 Radio Telemetry Systems: Analog TDM system, FM-FM telemetry system, standard telemetry channel, frequencies for FDM, block diagrams of PAM, PCM, and FDM telemetry systems.

Transmission Channels: Wire line channels, radio channels, microwave channels, power line carrier channels and fiber optic transmission.

Learning outcomes:

Students can

4. Differentiate radio telemetry Systems and channels.
5. Gain knowledge on Telemetry channels and operation of Pulse code Modulation methods.
6. Explain about various modes of transmission channels

Cos(Course Outcomes)

CO1: List the subsystems used to build a telemetry system and to classify the methods of telemetry
CO2: To know the appropriate use of land line and radio telemetry and to list various transmitting and receiving techniques in radio telemetry.
CO3: Comprehend the performance of Amplitude modulation and demodulation techniques.
CO4: Analyze AM and FM transmitters, receivers and design of AM and FM detectors
CO5: outline of pulse modulation techniques used in telemetry.
CO6: Explain sampling and examine the performance of pulse code modulation and demodulation techniques used in telemetry systems

TEXT BOOKS:

1. Electrical and electronics measurements and instrumentation, by A.K.Sawhney, Dhanpat Rai & Sons .
2. Introduction to Telemetry by Alan Andrews, Foulsham-Sams technical books, published by W-Foulsham&Co Ltd., England.
3. Understanding telemetry circuits, by John D.Lenk, Foulsham – Sams technical books, Published by W.Foulsham& Co., England

e-Resources

5. https://youtu.be/F3slBe2r8vA Principles of Communication Systems -I - Introduction - Prof. Aditya K. Jagannatham, IIT Kanpur.
6. https://youtu.be/lnIvUDsWELc, Transmission of Analog Signal Part I&II, IITKharagpur
7. https://youtu.be/l07FiK7F5FI , Lecture 11a Multiplexing
8. https://youtu.be/aKl17gw_nfU "Pulse Code Modulation in Digital communication by Engineering Funda"

Fiber Optics and Laser Instrumentation

L	T	PD	Total periods	Univ exam		Sessnl Marks	Total Marks
				Hrs	Marks		
3	1	--	4	3	70	30	100

CEOs (Course Educational Objectives)

31. To know the principles of light propagation theory.
32. To learn different types of fibers and their individual properties, characteristics.
33. To study about various fiber optic sensors.
34. To learn about various fiber optic communication systems.
35. To study about fundamentals of lasers and their types.
36. To study about applications of various lasers.

Course Syllabus

Unit-1: Principles of light propagation through fiber- Different types of fibers and their properties– transmission characteristics of optical fibers - absorption losses-scattering losses-dispersion.

Learning outcomes:

Students can

13. Outline the basic principals light propagation theory and different types of fibers.
14. Discuss about total internal reflection.
15. Describe various absorption losses-scattering losses-dispersion.

Unit-2: Fiber optic sensors – Fiber optic communication and instrument system – Advantages of optical communications – Different types of Modulators – Detectors – Fiber optic communication setup – Applications in instrumentation.

Learning outcomes:

Students can

4. Describe various Fiber optic sensors.
5. Compare Different types of Modulators and Detectors.
6. Design Fiber optic communication setup.

Unit-3: Characteristics and fundamentals of lasers – Laser emission and light amplification – Optical Resonators – Modes of resonators – Q-Factors , Q- Switching, Mode locking in lasers – Properties of Laser Beams - Types of lasers – Gas lasers – Solid lasers – liquid lasers – semiconductors lasers.

Learning outcomes:

Students can

4. Describe Characteristics and fundamentals of lasers.
5. Compare Different Modes of resonators.
6. Identify Types of lasers.

Unit-4: Lasers for Analysis – Laser application in holographic microscopy, holographic interferometer and applications -Medical applications of lasers. Laser and tissue interactive – Laser instruments for surgery, removal of tumors of vocal cards, Brain Surgery, Plastic surgery, gynecology & oncology.

Learning outcomes:

Students can

3. Examine Laser application in holographic microscopy.
4. Identify Medical applications of lasers.

Unit:5 Industrial application of Lasers – Measurement of distance and length, velocity, acceleration, atmospheric effects, pollutants, Material processing, laser heating, melting, scribing, splicing, material removal.

Learning outcomes:

Students can

3. Identify Industrial application of Lasers.
4. Uses laser heating, melting, scribing, splicing.

Reference books

1. H.C. Allen, An Introduction to Optical Fibers, McGraw-Hill International Book Co., 1983.
2. John and Harry, Industrial lasers and their applications, McGraw Hill publications,1974
3. Gerd Kaiser, Optical fiber communications, McGraw Hill International Edition,2000
4. D.C. Oshea and W.Russel Callen, Introduction to lasers and their Applications, Addison Wesley, 1978.
5. BS. Wherrelt, Laser Advances and Applications, John Wiley, 1979.
6. W.O.N. Guimarass and A.Mooradian, Lasers and Application Springer Verlag, 1981

e-Resourses

6. https://nptel.ac.in/courses/115/107/115107095/
7. https://www.youtube.com/watch?v=pavBq7HIoIE
8. https://nptel.ac.in/courses/108/106/108106173/
9. https://www.youtube.com/watch?v=YvrwVK9ZqQY
10. http://www.digimat.in/nptel/courses/video/104104085/L38.html

COs (Course outcomes)

After completion of the course the students will be able to

31. Describe the properties and characteristics of optical fibers.
32. Estimate the losses due to attenuation, absorption, scattering.
33. Construct the various fiber optics communication systems.
34. Classify the various types of lasers and its properties.
35. Illustrate various laser applications with laser instruments for medical field.
36. Design systems for Industrial application of Lasers.

DIGITAL COMMUNICATIONS

1. Analog-to-Digital Conversion: Pulse modulation techniques, Sampling, Time Division Multiplexing, Pulse Amplitude Modulation, Pulse Width Modulation, Pulse Position Modulation, Digital Modulation Techniques: Pulse Code Modulation, Differential Pulse Code Modulation, Delta Modulation, Adaptive Delta Modulation, Continuously Variable Slope Delta Modulation, Companding, Noise in Pulse-Code and Delta-Modulation Systems.
2. Binary Phase-Shift Keying, Differential Phase-Shift Keying, Differentially-Encoded PSK (DEPSK), Quadrature Phase-Shift Keying (QPSK), M-ary PSK, Quadrature Amplitude Shift Keying (QASK), Binary Frequency Shift-Keying, Similarity of BFSK and BPSK, M-ary FSK, Minimum Shift Keying (MSK), Duo-binary Encoding.
3. Mathematical Representation of Noise:Some Sources of Noise, Frequency-Domain Representation of Noise, The Effect of Filtering on the Probability Density of Gaussian Noise, Spectral Components of Noise Response of a Narrowband Filter to Noise, Effect of a Filter on the Power Spectral Density of Noise, Superposition of Noises, Mixing Involving Noise, Linear Filtering, Noise Bandwidth, Quadrature Components of Noise, Power Spectral Density of n(t) and n(t), Probability Density of n(t), n(t), and their Time Derivatives, Representation of Noise Using Orthonormal Coordinates, Irrelevant Noise Components
4. Data Transmission: A Base-band Signal Receiver, Probability of Error, The Optimum Filter, White Noise: The Matched Filter, Probability of Error of the Matched Filter, Coherent Reception: Correlation, Phase-Shift Keying, Frequency-Shift Keying, Non-coherent Detection of FSK, Differential PSK, Four Phase PSK (QPSK), Error Probability for QPSK, Probability of Error of Minimum Shift Keying (MSK), Comparison of Modulation Systems.

5. Spread Spectrum Modulation: Direct Sequence (DS) Spread Spectrum, Use of Spread Spectrum with Code Division, Multiple Access (CDMA), Ranging using DS Spread Spectrum, Frequency Hopping (FH) Spread Spectrum, Generation and Characteristics of PN Sequences, Acquisition (Coarse Synchronization) of a FH Signal, Tracking (Fine Synchronization) of a FH Signal, Acquisition (Coarse Synchronization) of a DS Signal, Tracking of a DS Signal.

Text Books:

1. Analog and Digital Communication Systems by Martin S. Roden, 3rd edition, Prentice Hall, 1994;
2. Principles of Communications By Taub and Schilling.

ANALYTICAL INSTRUMENTATION

L	T	PD	Total periods	Univ exam		Sessnl Marks	Total Marks
				Hrs	Marks		
3	1	0	4	3	70	30	100

CEOs (Course Educational Objectives)

5. To study the electromagnetic radiation, the Beer Lambert law.
6. To study the concepts related to spectroscopy computerized NMR. Electro spin resonance spectrometer (ESR).
7. To study the X-ray absorption meters X-ray fluorescence spectrometers.
8. To Demonstrate the functions of chromatographic system.
5. To study Measuring circuits. electro-chemical cell.
6. To study Hydrogen gas analyzers-IR gas analyzers.
7. To study the ozone automated wet chemical analyzers water pollution monitoring.

Course syllabus

Unit 1: Introduction, laboratory and industrial analyzers classification of the methods of analysis block diagram of an analyzing system. Colorimeters & Spectrophotometers (visible & ultraviolet) electromagnetic radiation, the Beer Lambert law. Infra - red spectrophotometers types of instruments, principles of operation, basic components of the systems.

Learning outcomes:

Students can

4. *Explain concepts* industrial analyzers classification of the methods of analysis block diagram of an analyzing system.

5. Define properties of Colorimeters & Spectrophotometers (visible & ultraviolet) electromagnetic radiation, the Beer Lambert law.
6. Describe red spectrophotometers types of instruments.

Unit 2: Nuclear magnetic resonance spectrophotometer (NMR) principle, construction, details Fourier transform NMR, spectroscopy computerized NMR. Electro spin resonance spectrometer (ESR), principle of operation construction of the ESR spectrometer.

Learning outcomes:

Students can

3. Implement Nuclear magnetic resonance spectrophotometer (NMR) principle.
4. *Design* Electro spin resonance spectrometer (ESR) its principle of operation construction of the ESR spectrometer.

Unit 3: X-ray spectrometer: X-ray spectrum, instrumentation for X-ray spectrometry X-ray diffractometers X-ray absorption meters X-ray fluorescence spectrometers.

Learning outcomes:

Students can

4. Analyze instrumentation for X-ray spectrometry X-ray.
5. Explain the instrumentation for X-ray spectrometry X-ray diffractometers X-ray absorption meters
6. Describe X-ray fluorescence spectrometers.

Unit 4: Gas & liquid chromatographic systems: Principles of chromatography, Schemes and constructional details and functions of chromatographic system components.

.**Learning outcomes:**

Students can

3. Explain Gas & liquid chromatographic systems.
4. Explain constructional details and functions of chromatographic system components.

Unit 5: Systems working on thermal conductivity. Principle of operation- conductivity cell construction. Measuring circuits. electro-chemical cell, construction. conductivity meters, polarography.

Learning outcomes:

Students can

4. Implement Systems working on thermal conductivity.
5. Explain Principle of operation- conductivity cell construction.
6. Describe electro-chemical cell, construction. conductivity meters, polarography.

Unit 6: **INDUSTRIAL GAS ANALYZERS**: Types of gas analyzers- flue gas analyzers, paramagnetic oxygen analyzers, electrochemical gas analyzers. Hydrogen gas analyzers-IR gas analyzers, analyzers based on gas density systems based on ionization of gases.

Learning outcomes:

Students can

3. Explain flue gas analyzers, paramagnetic oxygen analyzers, electrochemical gas analyzers.
4. Describe Hydrogen gas analyzers-IR gas analyzers.

Unit 7: **ENVIRONMENTAL POLLUTION MONITORING INSTRUMENTS**: Air pollution monitoring, instrument systems for-carbon monoxide-Sulphur dioxide-nitrogen oxides-hydro carbons-ozone automated wet chemical analyzers water pollution monitoring.

Learning outcomes:

Students can

3 Implement instrument systems for-carbon monoxide-Sulphur dioxide-nitrogen oxides.
4 Describe ozone automated wet chemical analyzers water pollution monitoring.

TEXT BOOKS:

1. R.S. Khandpur, Handbook of Analytical Instruments, Tata McGraw Hill publishing Co. Ltd., 2nd edition, 2006.
2. Instrumental methods of analysis - HH Willard,Jr.,JADean,FASettle,JR,CBS Publications.
3. Instrument engineers Handbook. Instrumentation and Analysis-GB Liptak Edition Charge Chilton book Company

COs (Course outcomes)

After completion of the course the students will be able to

8. Able to implement and Colorimeters & Spectrophotometers.
9. Able to describe Nuclear magnetic resonance spectrophotometer (NMR).
10. Able to describe Gas & liquid chromatographic systems.
11. Able to implement X-ray spectrometer: X-ray spectrum.
12. Able to analyze Systems working on thermal conductivity.
13. Able to analyze industrial gas analyzers.
14. Able to describe ozone automated wet chemical analyzers water pollution monitoring.

ADVANCED SENSING TECHNIQUES

L	T	PD	TOTAL Pds	Univ Exam Hrs	Univ Exam Marks	Sessnl Marks	Total Marks
3	-	--	3	3	70	30	100

Course Educational Objectives:

11. To provide in depth knowledge in different phases of automation.
12. To introduce the students to designing and modelling of advanced sensing techniques.
13. An understanding of the principles of physical sensors.
14. To give a fundamental knowledge on the basic laws and phenomena on which operation of Chemical sensors.
15. To impart a reasonable level of competence in the design, construction, and execution of Lab on chip.

Introduction Different Phases of automation. Importance of sensor/smart sensor in automation. Features of Advanced sensing techniques. Sensor classifications according to the energy domains. Introduction of advanced sensing materials. Properties (physical, electrical, chemical, biological) of materials which makes it suitable for sensing in different domain.

Design and modelling, Design and modelling issue in advanced sensing technique, Introduction of different mathematical tools used in sensor design, Study of analytical design from given specification, conformal mapping, Optimization techniques used in

sensor design. Numerical design such as FEM, FDM, etc. Study of Tomography and Concept of Feedback in sensing Fabrication and packaging Introduction to MEMS sensor. Comparison between MEMS and Macro sensor. Fabrication and packaging issue in sensor design, Thick film and thin film technique.

Physical sensors, Hall Effect sensors, Eddy current sensors, magneto resistive and magneto strictive detectors, Accelerometers: Capacitive, Piezoelectric, Piezoresistive, Thermal, Humidity and moisture sensor, Proximity detectors using polarized light, Semiconductor gas sensor, Fluidic and Micro-fluidic sensors.

Chemical sensor, Chemical sensor characteristics, specific difficulties related to chemical sensor, Classification of Chemical sensing mechanism, Study of chemical sensor based on the principle of direct sensing techniques such as Metal oxide chemical sensor, electro chemical sensors, potentiometric sensors, conductive sensors, amperometric sensors, enhanced catalytic gas sensors, enzyme sensors, Study of chemical sensors in indirect mode such as thermal sensor, optical chemical sensor, biochemical sensor, enzyme sensor, Sensor array.

Introduction to the concept of Lab on chip/senor platform technology, The role of PCA, LDA, Neural network in designing sensor array, Study of temperature cycle, mode of sensing to obtain virtual sensor array, Case study of a gas sensing platform, liquid sensing.

REFERENCE BOOKS

5. Sensors- A Comprehensive study-W.Gopal, J Hesse, J N Zemel –VHC Press, 1989.
6. Sensors Handbook-SabreeSoloman—McGraw Hill Publishers-1998
7. Electro Optical Instrumentation- SilvanoDonati, Pearson Education 2005.
8. Introduction to Medical Equipment Technology: Carr and Brown- Addison Weseley- 2001.

Course Outcomes:

1Explain the various principles employed in Different Phases of automation.
2Examine the designing and modelling of advanced sensing techniques.
3Apply knowledge in designing of physical sensors.
4Discuss the techniques of fabrication and application of chemical sensors.
5Describe the various applications of chemical sensors.
6.Discuss advanced sensing technology.

NON-DESTRUCTIVE TESTING

L	T	PD	TOTAL Pds	Univ Exam Hrs	Univ Exam Marks	Sessnl Marks	Total Marks
3	**-**	**--**	**3**	**3**	**70**	**30**	**100**

Course Educational Objectives:

7. To elucidate in depth information in importance of material inspection.
8. To Comprehend the characteristics of non-destructive testing approaches and estimate the status of necessary properties
9. To summarize the deep knowledge on magnetic methods for non-destructive testing.
10. To acquaint the students with a variety of real-worldscenarios related with ultrasonic testing
11. To discuss the principles of radiographic testing methods.
12. To give the fundamental idea of electrical methods for non-destructive testing.

Course Syllabus:

Unit – I:

Need for inspection- quality of inspection-Benefits of NDT-Liquid penetrant inspection- Principles- Characteristics of a penetrant- Water washable system post emulsifiable system- Solvent removable system- Surface preparation and cleaning- Penetrant application- Sensitivity- Viewing- Recording- Applications.

Learning Outcomes:

Students can

3. Explain the benefits, advantages and uses of non-destructive testing.
4. Describe the process of inspection and quality of inspection.

Unit – II:

Magnetic methods; Basic principles- Magnetising methods- Characteristics of magnetic particles- Magnetic links- Magnetography- Field sensitive probes- Measurement of metal properties- Ferrography-Applications.

Learning Outcomes:

Students can

3. Identify different magnetic methods for non-destructive testing.
4. Outline the applications of magnetic methods for non-destructive testing.

Unit – III:

Ultrasonic testing: Basic principles- different kinds of ultrasonic waves- Properties propagation- Mode conversion- Construction of normal and angle probes- Piezo electric materials- attenuation. Different methods of flow detection - Transmission, reflection and immersion methods. Pulse- Echo method- Different types of display- A- Scan, B-Scan, C-Scan methods- Identification of detects- Sensitivity- calibration and reference standards-Applications.

Learning Outcomes:

Students can

3. Have anelementaryinformation of ultrasonic testing which allows them to executethe inspectionof samples.
4. Distinguishnumerousfault types and choose the propernon-destructive testing methods.

Unit – IV:

Radiographic methods: general priciples- X-ray and gamma ray sources- Shadow formation- Enlargement and distortion recording of radiation-Radio graphic techinics- Single and double image techniques- Sensitivity- Penetramaters- Fluoroscopic method- Real time radiography- Application.

Learning Outcomes:

Students can

3. Classify a comprehensive theoretical and hands-on understanding of the radiographic testing,interpretation and evaluation.
4. List thesuitable technique and exposure time for animproved imaging.

Unit – V:

Electrical methods: Principle of eddy current testing- Conductivity of material- Magnetic properties- Coil impedance. Lift off factor and edge effect- Skiing effect- Impedance plant diagrams- inspection frequency- Coil arrangements inspection problems- Types of circuit- Reference standards- Phase analysis-Display methods- Typical applications.

Learning Outcomes:

Students can

3. Illustrate different electrical methods for non-destructive testing.
4. Test the reference standards and its applications.

Unit – VI:

Other methods: Optical holographic methods- Electronic / speckle pattern inter-formetry dynamic inspection-Neutron Radiography-Laser induced ultrasonic-Crack depth gauges- Thermography-Surface texture analysis-Acoustic emissionmethods.

Learning Outcomes:

Students can

3. Revise Optical holographic methods and Neutron radiography.
4. Interpolate Thermography and Surface texture analysis.

TEXT BOOKS:

4. Non-destructive testing by Barry Hull and Vennon johnELBS/Momillon,1988,
5. Non-destructive testing by R.Halmshaw Edward Arnold,London.
6. Non destructive testing by Warren J.McgonnagleMcGraw-hill book Co.,1961.

REFERENCE BOOKS:

3. 1.Ultrasonic testing of material by J.Krantkramer and H.Krantkramer SpringerVerlag, Newyork.
4. Ultrasonic Engineering by Julien r. Frederick, chapters 1,2,4,7, John wiley&son Newyork.

e-RESOURCES:

7. https://inis.iaea.org/collection/NCLCollectionStore/_Public/18/100/18100169.pdf
8. https://nptel.ac.in/courses/113/106/113106070/
9. https://www.edx.org/course/electrical-based-non-destructive-testing-and-sensing
10. https://www.edx.org/course/fundamentals-of-non-destructive-testing
11. https://isnt.in/video-lectures-pct-3-nde2020/
12. https://www.udemy.com/course/non-destructive-testing-methods/

Course Outcomes:

At the end of the course the students will be able to

8. Explain the benefits, advantages and uses of non-destructive testing.
9. Describe the process of inspection and quality of inspection.
10. Identify different magnetic methods Outline the applications of magnetic methods for non-destructive testing.
11. Have an elementary information of ultrasonic testing. Distinguish numerous fault types and choose the proper non-destructive testing methods.
12. Classify a comprehensive theoretical and hands-on understanding of the radiographic testing, interpretation and evaluation.
13. Illustrate different electrical methods for non-destructive testing and its applications.
14. Describe some other types of non-destructive testing methods such as Optical holography and Thermography.

COURSE EDUCATIONAL OBJECTIVES:

19. At the end of chapter one will able of understand the knowledge of Industrial automation and control tools such as DCS, SCADA, PLC etc.,
20. Making aware of standard communication protocols implementation of RS 232, RS 485 and comparison with MODBUS process and its advantages.
21. Comparision of HART used to communicate with devices for device configuration-reconfiguration, Diagnosis, Trouble shooting, device health and status. Devicenet, Industrial ethernet applications
22. PLC programming methods and Analog controlling using PLC and its its interfacing with SCADA /DCS using communication links.
23. PLC its architecture and comparision of PLC with DCS and concepts on ladder diagrams and relay diagrams and study of industrial PLC.
24. Distributed Control Systems introduction, functions , advantages and its limitations, database management system.

COURSE OUTCOMES:

19. After conclusion of control and automation topic we can understand the calibration process for PLC and DCS systems.
20. A brief knowledge on OSI (open System Inter connection) model and OPC (Object Linking and embedding for Process Control) is achieved.
21. Graphical representation and mathematical analysis can be implemented for different timers and counters and for High speed counter can be achieved.
22. In depth knowledge on different PTO, PWM and PID blocks in PID design and study can be fulfilled.
23. Programming methods as per IEC 61131 for PLC can be implemented and executed.
24. In depth knowledge can be achieved in various functions of Distributed Control Systems like interfacing, Display, Historical data Management etc., can be studied.

LEARNING OUT COMES:

Unit 1:

7. Application oriented knowledge on basic Control systems.
8. Automation tools like SCADA, PLC and DCS and its Hybrid could be developed as a skill set for industries.

Unit 2:

7. Implementation of logical programming in HART protocol can be achieved.
8. Application oriented PLC Controllers can be evaluated Graphically and logically with at least one industrial PLC.

Unit 3:

7. In depth knowledge upon various communication links.
8. Protocols like RS 232, RS 485, MODBUS(ASCII/RTU) which are widely used in Programmable Control systems can be gained.

Unit 4:

7. Knowledge gained on Industrial process for DCS as an automationtool.
8. different areas to implement andto support third party interface.

Unit 5:

10. Batch application, Security and Access Control etc., can be observed for evaluation.Phase Diagrams, Programmable and logic control system implementation.
11. Graphical representation can be successfully analyse.
12. Applications of Distributed control systems in various areas can be observed.

REFERENCE BOOKS:

16. Distributed Computer Control for Industrial Automation, PoppovikBhatkar, Dekkar Publications.
17. Programmable Logic Controllers: Principles and Applications, Webb and Reis, PHI.
18. Computer Aided Process Control, S. K. Singh, PHI.
19. Introduction to Programmable Logic Controllers, Garry Dunning, Thomson Learning.
20. Computer Based Process Control, Krishna Kant, PHI. 6. The Management of Control System: Justification and Technical Auditing, N. E. Battikha, ISA.