VR23

VELAGAPUDI RAMAKRISHNA SIDDHARTHA ENGINEERING COLLEGE

First Year

B.Tech. Syllabus

VR23

SCHEME OF INSTRUCTION

B.Tech. PROGRAMME [VR20]

Applicable for the batch of students admitted from the Academic Year 2023-24

VELAGAPUDI RAMAKRISHNA
SIDDHARTHA ENGINEERING COLLEGE
(An Autonomous, ISO 9001:2015 Certified Institution)
(Approved by AICTE, Accredited by NAAC, Affiliated to JNTUK, Kakinada)
(Sponsored by Siddhartha Academy of General & Technical Education)
Kanuru, Vijayawada
Andhra Pradesh - 520007, INDIA.
www.vrsiddhartha.ac.in

w.e.f. 2023-24

23BS1101

LINEAR ALGEBRA & CALCULUS
(COMMON TO ALL BRANCHES)

Course Category:	Basic Science	**Credits:**	3
Course Type:	Theory	**Lecture -Tutorial-Practice:**	3 - 0- 0
Prerequisites:	10+2 level Mathematics	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:

CO1	Solve the system of homogeneous and non-homogeneous linear equations
CO2	Examine the nature of a quadratic form by transforming into a canonical form
CO3	Determine maxima and minima of multivariable functions
CO4	Evaluate areas and volumes using double, triple integrals

Contribution of Course Outcomes towards achievement of Program Outcomes
(L – Low, M - Medium, H – High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	**H**	**M**			**L**							
CO2	**H**	**M**			**L**							
CO3	**H**	**M**			**L**							
CO4	**H**	**M**			**L**							

COURSE CONTENT

UNIT I Matrices

Rank of a matrix by Echelon form, Normal form, Cauchy–Binet formulae (without proof), Inverse of Non-singular matrices by Gauss-Jordan method, System of linear equations: Solvingsystem of Homogeneous and Non-Homogeneous equations by Gauss elimination method, Jacobi and Gauss-Seidel Iteration Methods.

UNIT II Eigenvalues, Eigenvectors and Orthogonal Transformation

Eigenvalues, Eigenvectors and their properties, Diagonalization of a matrix, Cayley-Hamilton Theorem (without proof), Finding inverse and power of a matrix by Cayley-Hamilton Theorem, Quadratic forms and Nature of the Quadratic forms, Reduction of Quadratic form to Canonical forms by Orthogonal Transformation.

UNIT III Differential Calculus

Mean Value Theorems: Rolle's theorem, Lagrange's mean value theorem with their geometrical

interpretation, Cauchy's mean value theorem, Taylor's and Maclaurin's theorems with remainders (without proof), Problems and applications on the above theorems.

Functions of Several Variables: Continuity and Differentiability, Partial derivatives, Total derivatives, Chain rule, Directional derivative, Taylor's and Maclaurin's series expansion of functions of two variables, Jacobians, Functional dependence, Maxima and Minima of functions of two variables, Method of Lagrange multipliers.

UNIT IV Multiple Integrals (Multivariable Calculus)

Double integrals,Triple integrals, Change of order of integration, Change of variables to polar, cylindrical and spherical coordinates, Finding areas (by double integrals) and volumes (by double integrals and triple integrals).

TEXT BOOKS

[1]. Higher Engineering Mathematics, B. S. Grewal, Khanna Publishers, 2017, 44th Edition

REFERENCE BOOKS

[1]. Advanced Engineering Mathematics, Erwin Kreyszig, John Wiley & Sons, 2018, 10th Edition
[2]. Thomas Calculus, George B. Thomas, Maurice D. Weir and Joel Hass, Pearson Publishers, 2018, 14th Edition
[3]. Advanced Engineering Mathematics, R. K. Jain and S. R. K. Iyengar, Alpha Science International Ltd., 2021 5th Edition(9th reprint)
[4]. Advanced Modern Engineering Mathematics, Glyn James, Pearson publishers, 2018, 5th Edition
[5]. Advanced Engineering Mathematics, Micheael Greenberg, , Pearson publishers, 9th Edition
[6]. Higher Engineering Mathematics, H. K Das, Er. Rajnish Verma, S. Chand Publications,2014, 3rd Edition (Reprint 2021)

E-RESOURCES AND OTHER DIGITAL MATERIAL

[1]. Prof.S. K. Gupta & Prof. Sanjeev Kumar ,IIT Roorkee, Matrix Analysis with Applications[English], Available:https://onlinecourses.nptel.ac.in/noc19_ma28/preview
[2]. Prof. Jitendra Kumar , IIT Kharagpur, Engineering Mathematics – I[English], Available:https://onlinecourses.nptel.ac.in/noc20_ma37/preview
[3]. Prof. Jitendra Kumar & Prof. Somesh Kumar, IIT Kharagpur, Advanced Calculus For Engineers[English], Available:https://onlinecourses.nptel.ac.in/noc22_ma75/preview
[4]. Prof. Denis Auroux, Massachusetts Institute of Technology: MIT Open Courseware,Multivariable Calculus,Available:https://ocw.mit.edu.

23BS1102

ENGINEERING PHYSICS (Common to all Programmes)

Course Category:	Institutional Core	**Credits:**	3
Course Type:	Theory	**Lecture -Tutorial-Practice:**	3 - 0 - 0
Prerequisites:		**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

Course Objectives:

To bridge the gap between the Physics in school at 10+2 level and UG level engineering courses by identifying the importance of the modern optical devices such as Lasers and optical fibers, enlightening the periodic arrangement of atoms in crystalline solids and concepts of quantum mechanics, introduce novel concepts of dielectric and magnetic materials, physics of semiconductors.

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:

CO1	Elaborate different types of lasers, optical fibers and their applications.
CO2	Familiarize with the basics of crystals and their structures.
CO3	Summarize various types of polarization of dielectrics and classify the magnetic materials.
CO4	Explain the basic concepts of Quantum Mechanics and types of semiconductors using Hall Effect.

Contribution of Course Outcomes towards achievement of Program Outcomes
(1 – Low, 2 - Medium, 3 – High)

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
CO1	**H**	**L**										
CO2	**H**	**M**										
CO3	**H**											
CO4	**H**											

COURSE CONTENT

UNIT I Lasers and Fiber Optics (10 periods)

Lasers: Introduction, Characteristics of laser, Basic Principles of lasers (absorption, spontaneous emission and stimulated emission), Requirements of lasers (pumping, population inversion and cavity resonance), Einstein's coefficients, different types of lasers: solid-state lasers (Ruby), gas lasers, (He-Ne), Semiconductor laser, applications of lasers in science, engineering and medicine.

Fibre Optics: Introduction, Fundamentals of optic fibre, Propagation of light through optical fiber, Types of optical fibers, Numerical aperture, Fractional Refractive Index change, Fiber optics in communication and its advantages.

UNIT II Crystallography and X-ray diffraction (10 periods)

Crystallography: Space lattice, Basis, Unit Cell and lattice parameters – Bravais Lattices – crystal systems (3D) – coordination number - packing fraction of SC, BCC & FCC - Miller indices – separation between successive (hkl) planes.

X-ray diffraction: Bragg's law - X-ray Diffractometer – crystal structure determination by Laue's and powder methods.

UNIT III Dielectric and Magnetic Materials (12 periods)

Dielectric Materials: Introduction - Dielectric polarization - Dielectric polarizability, Susceptibility, Dielectric constant and Displacement Vector – Relation between the electric vectors - Types of polarizations- Electronic (Quantitative), Ionic (Quantitative) and Orientation polarizations (Qualitative) - Lorentz internal field - Clausius- Mossotti equation - Frequency dependence of polarization – complex dielectric constant (Qualitative) – dielectric loss (Qualitative).

Magnetic Materials: Introduction - Magnetic dipole moment - Magnetization-Magnetic susceptibility and permeability – Atomic origin of magnetism - Classification of magnetic materials: Dia, Para and Ferro magnetic materials - Domain concept for Ferromagnetism & Domain walls (Qualitative) - Hysteresis - soft and hard magnetic materials.

UNIT IV Quantum Mechanics and Semiconductors (12 periods)

Quantum Mechanics: Dual nature of light, Matter waves,Properties and Debroglie's hypothesis, G.P.Thomson experiment,Heisenberg's Uncertainty Principle and its applications (Non existence of electron in nucleus) and properties of wave function – Schrodinger's time independent and dependent wave equations– Particle in a one-dimensional infinite potential well.

Semiconductors: Formation of energy bands – classification of crystalline solids - Intrinsic semiconductors- Fermi level-Extrinsic semiconductors-Fermi level - Drift and diffusion currents – Einstein's equation – Hall effect and its applications, Photodiode,Light Emitting Diode,Solar cell and its applications.

Textbooks:

1. A Text book of Engineering Physics, M. N. Avadhanulu, P.G.Kshirsagar & TVS Arun Murthy, S. Chand Publications, 11th Edition 2019.
2. Engineering Physics - D.K.Bhattacharya and Poonam Tandon, Oxford press (2015)

Reference Books:

1. Engineering Physics - B.K. Pandey and S. Chaturvedi, Cengage Learning 2021.
2. Engineering Physics - Shatendra Sharma, Jyotsna Sharma, Pearson Education, 2018.
3. Engineering Physics - Sanjay D. Jain, D. Sahasrabudhe and Girish, University Press. 2010
4. Engineering Physics - M.R. Srinivasan, New Age international publishers (2009).

Web Resources: https://www.loc.gov/rr/scitech/selected-internet/physics.html

23BS1102A
ENGINEERING CHEMISTRY (Common to Civil and Mechanical Engineering branches)

Course Category:	Institutional Core	**Credits:**	3
Course Type:	Theory	**Lecture -Tutorial-Practice:**	3 - 0 - 0
Prerequisites:	10 + 2 level Chemistry	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:

CO1	Analyse various water treatment methods and boiler troubles.
CO2	Apply the knowledge of basic electrochemistry principles for electrochemical energy systems and corrosion.
CO3	Compare mechanistic aspects of polymerisation, and different polymers and conventional fuels for their effective utilisation.
CO4	Evaluate various modern engineering materials for their applications in engineering and other fields.

Contribution of Course Outcomes towards achievement of Program Outcomes
(L – Low, M - Medium, H – High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	**H**	**M**					**L**					
CO2	**H**	**M**										
CO3	**H**		**M**				**L**					
CO4	**H**		**M**									

COURSE CONTENT

UNIT – I :

Water Technology-I (Domestic water): Specifications for drinking water - World Health Organization (WHO) standards, domestic water treatment – sedimentation, coagulation, disinfection by chlorination – breakpoint chlorination, desalination of brackish water – electrodialysis and reverse osmosis (RO).

Water Technology-II (Industrial water): Hardness of water, Estimation of hardness of water by EDTA Method, Estimation of dissolved oxygen – Boiler troubles – scales, caustic embrittlement – reasons, disadvantages and control methods – conditioning, Industrial water treatment – Ion-exchange method, concept of adsorption and its applications**.**

UNIT – II :

Electrochemistry: Electrodes, electrochemical cell, Nernst equation, cell potential calculations, Primary cells – zinc-air battery, Secondary cells –lithium ion batteries- working principle of the batteries including cell reactions; Fuel cells – working principle of a fuel cell and working of hydrogen-oxygen fuel cell.

Corrosion: Introduction, electrochemical corrosion – hydrogen evolution and oxygen absorption corrosion, differential aeration corrosion, galvanic corrosion, factors affecting the corrosion, cathodic protection, copper electroplating and copper electroless plating.

UNIT – III :

Polymer Chemistry: Introduction, functionality of monomers, mechanism of chain growth, step growth polymerization, thermoplastics and thermosetting plastics: Preparation, properties and applications of PVC, polystyrene, Nylon 6,6 and Bakelite. Elastomers – Preparation, properties and applications of Buna S and Buna N.

Fuel Chemistry: Fuels- classification, calorific value of fuels, numerical problems based on calorific value;Analysis of coal (proximate and ultimate analysis), Liquid fuels -refining of petroleum, concept of knocking, octane and cetane number, alternative fuels –biomass, biogas, biodiesel.

UNIT – IV :

Modern Engineering Materials-I: *Composites*: classification – particle, fibre and layered reinforced composites, properties and engineering applications.*Lubricants*: classification, mechanisms, properties of lubricating oils-viscosity, viscosity Index, flash point, fire point, and applications.

Modern Engineering Materials-II: *Building materials*: Portland cement, constituents, setting and hardening of cement, refractories – classification and properties –refractoriness, RUL test, porosity, and applications.*Nanomaterials*: classification, properties and applications.

TEXT BOOKS

[1]. Engineering Chemistry, Jain and Jain, 17th Edition, DhanpatRai, 2018.
[2]. Engineering Chemistry, PrasanthaRath& S. ArunaKumari, Cengage Publishers, 2023.

REFERENCE BOOKS

[1]. Peter Atkins, Julio de Paula and James Keeler, Atkins' Physical Chemistry, 10/e, Oxford University Press, 2010.
[2]. H.F.W. Taylor, Cement Chemistry, 2/e, Thomas Telford Publications, 1997.
[3]. Textbook of polymer Science,Fred W.BillmayerJr, 3rd Edition.

E-RESOURCES AND OTHER DIGITAL MATERIAL

1. https://onlinecourses.swayam2.ac.in/cec24_cy02/preview
2. https://www.youtube.com/watch?v=LMSTMBX_2F4
3. https://www.corrosion-doctors.org/
4. https://www.watertechonline.com/videos

23BS1102B / 23BS2102B

CHEMISTRY (Common to ECE, EEE, EIE, CSE, IT, AIDS and AIML)

Course Category:	Institutional Core	**Credits:**	3
Course Type:	Theory	**Lecture -Tutorial-Practice:**	3 - 0 - 0
Prerequisites:	10 + 2 level Chemistry	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:

CO1	Apply the principles of quantum mechanics for determining structure and bonding of molecules.
CO2	Apply the principles electrochemistry for its applications in chemical analysis, electrodes, electrochemical sensors and energy sources.
CO3	Explain the mechanistic aspects of polymerisation and conduction, types, preparation, properties and applications of polymers.
CO4	Compare different spectroscopic and chromatographic techniques for their application in qualitative and quantitative analysis.
CO5	Choose engineering materials including nanomaterials based on their properties for their applications in various industrial fields.

Contribution of Course Outcomes towards achievement of Program Outcomes
(L – Low, M - Medium, H – High)

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
CO1	**H**	**L**										
CO2	**M**		**H**									
CO3	**M**				**H**							
CO4	**M**	**H**										
CO5	**M**				**H**		**L**					

COURSE CONTENT

UNIT – I :

Structure and Bonding Models: Fundamentals of Quantum mechanics, Schrodinger Wave equation, significance of Ψ and Ψ^2, particle in one dimensional box, Molecular orbital theory, bonding in homo and heteronuclear diatomic molecules, energy level diagrams of O_2,N_2, NOand CO,calculation of bond order, π-molecular orbitals of butadiene and benzene.

Engineering Materials: Semiconductors - Introduction, basic concept, applications, Superconductors - Introduction, basic concept, applications, Supercapacitors - Introduction, basic concept, classification, applications.

UNIT – II :

Electrochemistry: Electrochemical cell, Nernst equation, potential and emfcalculations and numerical problems, potentiometry – potentiometric titrations (redox titrations), concept of conductivity, conductivity cell, cell constant and specific conductance, conductometrictitrations (acid-base titrations), Electrochemical sensors – potentiometric sensors andamperometric sensors-principle with examples.

Electrochemical Energy Systems: Types of electrochemical energy systems - Primary cells – Zinc-air battery, Secondary cells – lithium-ion batteries – working of the batteries including cell reactions, Fuel cells – hydrogen–oxygen fuel cell- working of the cells, Polymer Electrolyte Membrane fuel cells(PEMFC).

UNIT – III :

Polymer Chemistry: Introduction to polymers, functionality of monomers, addition and condensation polymerization, mechanism of chain growth and step growth polymerization, coordination polymerization with specific examples.Plastics – Thermo and thermosetting plastics, preparation, properties and applications of PVC, Teflon, Bakelite, Nylon-6,6.Elastomers – Buna-S, Buna-N –Preparation, properties and applications.Conducting Polymers – Principle and examples, mechanism of conduction in undoped, doped polyacetylene and applications, Biodegradable polymers – polyglycolic acid (PGA), Polylacticacid(PLA).

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UNIT – IV :

Instrumental Methods of Analysis: Electromagnetic spectrum, Interaction of radiation with matter, UV-Visible Spectroscopy- principle, electronic transitions, Lambert-Beer's law, Instrumentation, applications,IR spectroscopy-principle, types of vibrations, selection rule, Instrumentation, Chromatography- basic principle andclassification.

Nano materials: Introduction, classification of nanomaterials. Properties and applications of fullerenes, carbon nanotubes, graphene and nanoparticles.

TEXT BOOKS

[1]. Engineering Chemistry, Jain and Jain, 17th Edition, DhanpatRai, 2018.
[2]. Engineering Chemistry, PrasanthaRath& S. ArunaKumari, Cengage Publishers, 2023.

REFERENCE BOOKS

[1]. Peter Atkins, Julio de Paula and James Keeler, Atkins' Physical Chemistry, 10/e, Oxford University Press, 2010.
[2]. Skoog and West, Principles of Instrumental Analysis, 6/e, Thomson, 2007.
[3]. J.D.Lee, Concise Inorganic Chemistry, 5th Edition, Wiley Publications, Feb 2008.
[4]. Textbook of polymer Science,Fred W.BillmayerJr, 3rd Edition.

E-RESOURCES AND OTHER DIGITAL MATERIAL

1. https://onlinecourses.nptel.ac.in/noc24_ph02/preview
2. https://onlinecourses.nptel.ac.in/noc24_cy10/preview
3. https://www.youtube.com/watch?v=LMSTMBX_2F4
4. https://www.youtube.com/watch?v=7jOSbtR8mTs&list=PLzPro5owUhRSV-ezegDDfuNpuJ2uU6jZ0
5. https://onlinecourses.swayam2.ac.in/cec24_cy02/preview

23ES1103A / 23ES2103A
BASICS OF CIVIL & MECHANICAL ENGINEERING
(1103A for CS, IT, AI&DS, AI&ML) (2103A for CE, ME, EEE, EI, EC)

Course Category:	Institutional Core	**Credits:**	3
Course Type:	Theory	**Lecture -Tutorial-Practice:**	4- 0 - 0
Prerequisites:	10 + 2	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:

CO1	Understand various Civil Engineering sub-divisions thereby appreciate their role in ensuring a better society and understand the basic building components along with attaining knowledge of Civil Engineering Materials and prefabricated technology.
CO2	Know the basic concepts, uses and classification of surveying and realize the importance of Transportation in the nation's economy and the engineering measures related to Transportation and understand the importance of Water Storage and Conveyance Structures so that the social responsibilities of water conservation will be appreciated
CO3	Understand the scope of Mechanical Engineering in different sectors and industries and know about different manufacturing processes.
CO4	Explain the basics of thermal engineering, Power plants , power transmission and robotics.

Contribution of Course Outcomes towards achievement of Program Outcomes
(L – Low, M - Medium, H – High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	**M**				**L**	**H**	**M**					
CO2	**L**				**M**	**M**	**H**					
CO3	**M**				**L**	**M**	**H**					
CO4	**M**				**L**	**M**	**H**					

COURSE CONTENT

UNIT I

Basics of Civil Engineering: Role of Civil Engineers in Society- Various Disciplines of Civil Engineering- Structural Engineering- Geo-technical Engineering- Transportation Engineering - Hydraulics and Water Resources Engineering - Environmental Engineering-Scope of each discipline - Building Construction and Planning- Construction Materials-Cement - Aggregate - Bricks- Cement concrete- Steel-Introduction to Prefabricated Construction Techniques

UNIT II

Surveying and Transportation Engineering: Objectives of Surveying- Principles of Surveying- Classification based on function and instruments, Importance of Transportation in Nation's Economic Development- Basics components of Road-Classification of Highways.

Water Resources and Environmental Engineering: Introduction, Sources of water- Quality of water- Specifications- Simple introduction to Dams and Reservoirs.

UNIT III

Introduction to Mechanical Engineering: Role of Mechanical Engineering in Industries and Society- Technologies in different sectors such as Energy, Manufacturing, Automotive, Aerospace, and Marine sectors. Engineering Materials - Metals-Ferrous and Non-ferrous, Ceramics, Composites, Smart materials. Manufacturing Processes: Principles of Casting, joining processes,

Machining, Introduction to CNC machines, 3D printing, and Smart manufacturing.

UNIT IV

Thermal Engineering: –IC engines, 2-Stroke and 4-Stroke engines, SI/CI Engines, Otto cycle,Diesel cycle,Components of Electric and Hybrid Vehicles., Refrigeration and air conditioning Working principle of Boilers: classification of Boilers Power plants – Working principle of Steam, Nuclear power plants. Mechanical Power Transmission - Belt and Gear Drives, Introduction to Robotics

TEXT BOOKS (for UNITS I & II)

[1]. Basic Civil Engineering, M.S.Palanisamy, , Tata Mcgraw Hill publications (India) Pvt. Ltd. Fourth Edition.

[2]. Introduction to Civil Engineering, S.S. Bhavikatti, New Age International Publishers. 2022. First Edition.

[3]. Basic Civil Engineering, Satheesh Gopi, Pearson Publications, 2009, First Edition.

REFERENCE BOOKS (for UNITS I & II)

[1]. Surveying, Vol- I and Vol-II, S.K. Duggal, Tata McGraw Hill Publishers 2019. Fifth Edition.

[2]. Hydrology and Water Resources Engineering, Santosh Kumar Garg, Khanna Publishers, Delhi. 2016

[3]. Irrigation Engineering and Hydraulic Structures - Santosh Kumar Garg, Khanna Publishers, Delhi 2023. 38th Edition.

[4]. Highway Engineering, S.K.Khanna, C.E.G. Justo and Veeraraghavan, Nemchand and Brothers Publications 2019. 10th Edition.

[5]. Indian Standard DRINKING WATER — SPECIFICATION IS 10500-2012

[6]. Advances in Civil Engineering (Volume - 5), S. Sathish, AkiNik Publications,2021

[7]. Advances in Civil Engineering (Volume - 5), S. Sathish, AkiNik Publications,2021.

E-RESOURCES AND OTHER DIGITAL MATERIAL (for UNITS I & II)

1. http://nptel.iitm.ac.in/video.php?subjectId=10810607
2. http://nptel.iitm.ac.in/courses/Webcourse-contents/IIT-%20Guwahati/em/index.htm
3. http://www.mike-willis.com/Tutorial/PF2.htm

TEXT BOOKS (for UNITS III & IV)

[1]. Internal Combustion Engines by V.Ganesan, By Tata McGraw Hill publications (India) Pvt. Ltd.

[2]. A text book of Theory of Machines by S.S. Rattan, Tata McGraw Hill Publications, (India) Pvt. Ltd.

[3]. An introduction to Mechanical Engg by Jonathan Wicker and Kemper Lewis, Cengage learning India Pvt. Ltd.

REFERENCE BOOKS (for UNITS III & IV)

[1]. G. Shanmugam and M.S.Palanisamy, Basic Civil and the Mechanical Engineering, Tata McGraw Hill publications (India) Pvt. Ltd.

[2]. Thermal Engineering by Mahesh M Rathore Tata McGraw Hill publications (India) Pvt. Ltd.

[3]. 3D printing & Additive Manufacturing Technology- L. Jyothish Kumar, Pulak M Pandey, Springer publications

[4]. Appuu Kuttan KK, Robotics, I.K. International Publishing House Pvt. Ltd. Volume-I

E-RESOURCES AND OTHER DIGITAL MATERIAL (for UNITS III & IV)

1. https://www.scribd.com/document/680441639/Basic-Civil-and-Mechanical-Engineering
2. https://www.imeche.org/careers-education/careers-information/what-is-mechanical-engineering/where-do-mechanical-engineers-work

23BS1103B / 23BS2103B
BASIC ELECTRICAL & ELECTRONICS ENGINEERING

Course Category:	Program Core	**Credits:**	3
Course Type:	Theory	**Lecture -Tutorial-Practice:**	3 - 0 - 0
Prerequisites:	Basic Electrical and Electronics Engineering	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:

CO1	**Apply** different techniques to solve DC circuits.
CO2	**Understand** the magnetic circuit concepts.
CO3	A**nalyze the** steady-state response, series, parallel AC circuits, mesh & nodal analysis, and resonance.
CO4	**Apply** network theorems for AC & DC circuits.
CO5	Demonstrate the working principles of basic Electronic devices, circuits and instrumentation System .
CO6	Implementation of simple Combinational and Sequential circuits using Logic gates.

Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	**H**	**H**			**M**							
CO2	**H**	**H**										
CO3	**M**	**H**			**M**							
CO4	**M**	**H**										
CO5	**M**	**L**	**H**	**M**								
CO6	**M**	**L**	**H**	**M**								

COURSE CONTENT

UNIT I DC & AC Circuits

DC Circuits: Electrical circuit elements (R, L and C), Ohm's Law and its limitations, KCL & KVL, series, parallel, series-parallel circuits, Super Position theorem, Simple numerical problems.

AC Circuits: A.C. Fundamentals: Equation of AC Voltage and current, waveform, time period, frequency, amplitude, phase, phase difference, average value, RMS value, form factor, peak factor, Voltage and current relationship with phasor diagrams in R, L, and C circuits, Concept of Impedance, Active power, reactive power and apparent power, Concept of power factor (Simple Numerical problems).

Equipment Safety Measures: Working principle of Fuse and Miniature circuit breaker (MCB), merits and demerits. Personal safety measures: Electric Shock, Earthing phenomenon, Safety Precautions to avoid shock.

UNIT II Machines and Measuring Instruments

Machines: Construction, principle and operation of (i) DC Motor, (ii) DC Generator, (iii) Single Phase Transformer, (iv) Three Phase Induction Motor and (v) Alternator, Applications of electrical machines.

Measuring Instruments: Construction and working principle of Voltage, Current, temperature sensors, basic block diagram of multimeter.

Electricity bill: Power rating of household appliances including air conditioners, PCs, Laptops, Printers, etc. Definition of "unit" used for consumption of electrical energy, calculation of electricity bill for domestic consumers.

UNIT – III : SEMICONDUCTOR DEVICES

Introduction - Evolution of electronics – Vacuum tubes to nano electronics – Characteristics of PN Junction Diode — Zener Effect — Zener Diode and its Characteristics. Bipolar Junction Transistor — CB, CE, CC Configurations and Characteristics — Elementary Treatment of Small Signal CE Amplifier.

Rectifiers and power supplies: Block diagram description of a dc power supply, working of a full wave bridge rectifier, capacitor filter (no analysis), working of simple zener voltage regulator.

Amplifiers: Block diagram of Public Address system, Circuit diagram.

Electronic Instrumentation: Block diagram of an electronic instrumentation system.

UNIT – IV : DIGITAL ELECTRONICS

Overview of Number Systems, Logic gates including Universal Gates, BCD codes, Excess-3 code, Gray code, Hamming code. Boolean Algebra, Basic Theorems and properties of Boolean Algebra, Truth Tables and Functionality of Logic Gates – NOT, OR, AND, NOR,NAND, XOR and XNOR. Simple combinational circuits–Half and Full Adders. Introduction to Flip flops, Registers and counters (Elementary Treatment only)

TEXT BOOKS (for UNITS I & II)

1. Basic Electrical Engineering, D. P. Kothari and I. J. Nagrath, Mc Graw Hill, 2019, Fourth Edition
2. Principles of Power Systems, V.K. Mehtha, S.Chand Technical Publishers, 2020
3. Basic Electrical Engineering, T. K. Nagsarkar and M. S. Sukhija, Oxford University Press, 2017
4. Basic Electrical and Electronics Engineering, S. K. Bhatacharya, Person Publications, 2018, Second Edition.

REFERENCE BOOKS (for UNITS I & II)

1. Basic Electrical Engineering, D. P. Kothari and I. J. Nagrath, Mc Graw Hill, 2019, Fourth Edition
2. Principles of Power Systems, V.K. Mehtha, S.Chand Technical Publishers, 2020
3. Basic Electrical Engineering, T. K. Nagsarkar and M. S. Sukhija, Oxford University Press, 2017
4. Basic Electrical and Electronics Engineering, S. K. Bhatacharya, Person Publications, 2018, Second Edition.

E-RESOURCES AND OTHER DIGITAL MATERIAL (for UNITS I & II)

1. https://nptel.ac.in/courses/108105053
2. https://nptel.ac.in/courses/10810807

TEXT BOOKS (for UNITS III & IV)

[1]. R. L. Boylestad & Louis Nashlesky, Electronic Devices & Circuit Theory, Pearson Education, 2021.

[2]. P. Jain, Modern Digital Electronics, 4th Edition, Tata Mc Graw Hill, 2009. Resnick, Halliday and Krane, “Physics”, 5th edition, Wiley India Pvt. Ltd, New Delhi, 2016.

REFERENCE BOOKS (for UNITS III & IV)

[1]. R. S. Sedha, A Textbook of Electronic Devices and Circuits, S. Chand & Co, 2010.

[2]. Santiram Kal, Basic Electronics- Devices, Circuits and IT Fundamentals, Prentice Hall, India, 2002.

[3]. R. T. Paynter, Introductory Electronic Devices & Circuits – Conventional Flow Version,

[4]. Pearson Education, 2009.

E-RESOURCES AND OTHER DIGITAL MATERIAL (for UNITS III & IV)

[1] https://embeddedengineers.files.wordpress.com/2015/09/electronic-devices-and-circuits-by-salivahanan.pdf

[2]. http://www.nptelvideos.in/2012/12/basic-electronics-drchitralekha-mahanta.html

[3] https://en.wikipedia.org/wiki/Digital_electronics

23ES1104
Introduction To Programming (Common All Brannches)

Course Category:	Engineering Science	**Credits:**	3
Course Type:	Theory	**Lecture -Tutorial-Practice:**	3 - 0 - 0
Prerequisites:	--	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:

CO1	To introduce students to the fundamentals of computer programming.
CO2	To provide hands-on experience with coding and debugging on control structures and arrays.
CO3	To foster logical thinking and problem-solving skills on strings and ponters.
CO4	To familiarize students with programming concepts such as functions, structures and files.

Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	**H**	**L**										
CO2		**M**	**H**									
CO3		**M**	**H**									
CO4		**M**	**H**									

COURSE CONTENT

UNIT – I : Introduction to Programming and Problem Solving

History of Computers, Basic organization of a computer: ALU, input-output units, memory, program counter, Introduction to Programming Languages, Basics of a Computer Program-Algorithms, flowcharts (Using Dia Tool), pseudo code. Introduction to Compilation and Execution, Primitive Data Types, Variables, and Constants, Basic Input and Output, Operations, Type Conversion, and Casting.

Problem solving techniques: Algorithmic approach, characteristics of algorithm, Problem solving strategies: Top-down approach, Bottom-up approach, Time and space complexities of algorithms.

UNIT – II : Control Structures and Arrays

Simple sequential programs Conditional Statements (if, if-else, switch), Loops (for, while, do-while) Break and Continue, Arrays indexing, memory model, programs with array of integers,two

dimensional arrays

UNIT – III : Strings and pointers

Introduction to Strings. Pointers, dereferencing and address operators, pointer and address arithmetic, array manipulation using pointers.

UNIT – IV : Functions, User Defined Data types and File Handling

Introduction to Functions, Function Declaration and Definition, Function call Return Types and Arguments, modifying parameters inside functions using pointers, arrays as parameters. Scope and Lifetime of Variables, User-defined data types-Structures and Unions, Basics of File Handling

TEXT BOOKS

[1]."The C Programming Language", Brian W. Kernighan and Dennis M. Ritchie, Prentice- Hall, 1988.
[2].Schaum's Outline of Programming with C, Byron S Gottfried, McGraw-Hill Education, 1996

REFERENCE BOOKS

[1]. Computing fundamentals and C Programming, Balagurusamy, E., McGraw-Hill Education, 2008.W. H. Hayt and J. A. Buck, "Engineering Electromagnetics", 7th edition, Tata McGraw Hill, New Delhi, 2006
[2]. Programming in C, Rema Theraja, Oxford, 2016, 2nd edition
[3]. C Programming,A Problem Solving Approach,Forouzan,Gilberg,Prasad, CENGAGE, 3rd edition.

E-RESOURCES AND OTHER DIGITAL MATERIAL

1. http://nptel.iitm.ac.in/video.php?subjectId=10810607
2. http://nptel.iitm.ac.in/courses/Webcourse-contents/IIT-%20Guwahati/em/index.htm
3. http://www.mike-willis.com/Tutorial/PF2.htm

23ES1105 / 23ES2105
ENGINEERING GRAPHICS (Common to All branches of Engineering)

Course Category:	Institutional Core	**Credits:**	3
Course Type:	Theory & Practice	**Lecture -Tutorial-Practice:**	1 - 0 - 4
Prerequisites:	NIL	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:

CO1	Understand the principles of engineering drawing, including engineering curves and scales.
CO2	Draw and interpret orthographic projections of points, lines and planes in front,top and side views.
CO3	Understand and draw projection of solids in various positions in first quadrant and Explain principles behind development of surfaces.
CO4	Explain principles behind the Sections of solids, Prepare isometric views and conversion of simple solids.

Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	**H**		**H**				H					
CO2	**H**		**H**				H					
CO3	**M**		**M**				M					
CO4	**L**		**L**				L					

COURSE CONTENT

UNIT I

Introduction: Lines, Lettering and Dimensioning, Geometrical Constructions of regular polygons by general methods.

Curves: Construction of ellipse, parabola and hyperbola by general method and Involutes. Draw normal and tangent to Curves.

Scales: Plain scales and diagonal scales.

UNIT II

Orthographic Projections: Reference plane, importance of reference lines or Plane,

Projections of a point situated in **first quadrant** only.

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: Regular planes Perpendicular to both reference planes, parallel to one reference plane and inclined to the other reference plane; plane inclined to both the reference planes.

UNIT III

Projections of Solids: Projections of solids(Prisms and Pyramids only) in simple positions: Axis perpendicular to horizontal plane, Axis perpendicular to vertical plane and Projection of Solids with axis inclined to one reference plane and parallel to another plane.

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

Computer graphics: Creating 2D & 3D drawings of objects including PCB and Transformations using Auto CAD (*Not for end examination*).

UNIT IV

Sections of Solids: Section planes perpendicular to VP and inclined to HP only, Sectional views (Front View and Top View only) and Sections of solids in simple position only.

Isometric Views: Draw an Isometric views of Simple solids

Conversion of Views: Conversion of isometric views to orthographic views of Simple solids.

TEXT BOOKS

1. N. D. Bhatt, Engineering Drawing, Charotar Publishing House, 2016.

REFERENCE BOOKS

1. Engineering Drawing, Basant Agrawal and C M Agrawal,Tata McGraw Hill, 2009.
2. Engineering Drawing, K.L. Narayana and P. Kannaiah, Tata McGraw Hill, 2013.
3. Engineering Drawing, M.B.Shah and B.C. Rana, Pearson Education Inc,2009.
4. Engineering Drawing with an Introduction to Auto CAD, Dhananjay Jolhe , Tata McGraw Hill, 2017.

23HS1105/ 23HS2105
COMMUNICATIVE ENGLSIH

Course Category:	Institutional Core	**Credits:**	3
Course Type:	Theory	**Lecture -Tutorial-Practice:**	3 - 0- 0
Prerequisites:	Basic understanding of the language skills viz Listening, Speaking, Reading and Writing, including Sentence construction abilities	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:

CO1	Understand the context, topic, and pieces of specific information from social orTransactional dialogues
CO2	Apply grammatical structures to formulate sentences and correct word forms.
CO3	Analyze discourse markers to speak clearly on a specific topic in informal discussions.
CO4	Evaluate reading texts / listening to write summaries based on globalcomprehension and create a coherent paragraph, essay and résumé

Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	M									H		M
CO2	M	M								H		M
CO3	M									H		M
CO4	M	M								H		M

COURSE CONTENT

UNIT I

Lesson: HUMAN VALUES: Gift of Magi **(Short Story)**

Listening: Identifying the topic, the context and specific pieces of information by listeningto short audio texts and answering a series of questions.

Speaking: Asking and answering general questions on familiar topics such as home,family, work, studies and interests; introducing oneself and others.

Reading: Skimming to get the main idea of a text; scanning to look for specific pieces of information.

Writing: Mechanics of Writing-Capitalization, Spellings, Punctuation-Parts of Sentences.

Grammar: Parts of Speech, Basic Sentence Structures-forming questions

Vocabulary: Synonyms, Antonyms, Affixes (Prefixes/Suffixes), Root words.

UNIT II

Lesson: NATURE: The Brook by Alfred Tennyson (Poem)

Listening: Answering a series of questions about main ideas and supporting ideas afterlistening to audio texts.

Speaking: Discussion in pairs/small groups on specific topics followed by short structuretalks.

Reading: Identifying sequence of ideas; recognizing verbal techniques that help to linkthe ideas in a paragraph together.

Writing: Structure of a paragraph - Paragraph writing (specific topics) **Grammar:** Cohesive devices - linkers, use of articles and zero article; prepositions.**Vocabulary:** Homonyms, Homophones, Homographs.

UNIT III

Lesson: BIOGRAPHY: Elon Musk

Listening: Listening for global comprehension and summarizing what is listened to.

Speaking: Discussing specific topics in pairs or small groups and reporting what isdiscussed

Reading: Reading a text in detail by making basic inferences -recognizing and interpretingspecific context clues; strategies to use text clues for comprehension.

Writing: Summarizing, Note-making, paraphrasing, Essay Writing, (The Power of Intrapersonal Communication) **Grammar:** Verbs - tenses; subject-verb agreement; Compound words, Collocations

Vocabulary: Compound words, Collocations

UNIT IV

Lesson: INSPIRATION: The Toys of Peace by Saki

Listening: Making predictions while listening to conversations/ transactional dialogues without video; listening with video.

Speaking: Role plays for practice of conversational English in academic contexts (formal and informal) - asking for and giving information/directions.

Reading: Studying the use of graphic elements in texts to convey information, reveal trends/patterns/relationships, communicate processes or display complicated data.

Writing: Letter Writing: Official Letters, Resumes & Report Writing

Grammar: Reporting verbs, Direct & Indirect speech, Active & Passive Voice

Vocabulary: Words often confused, Jargons & Technical Jargons

TEXT BOOKS

1. Pathfinder: Communicative English for Undergraduate Students, 1st Edition, OrientBlack Swan, 2023 (Units 1,2 & 3)
2. Empowering with Language by Cengage Publications, 2023 (Units 4 & 5)
3. English: Language, Context and Culture, 1st Edition, OrientBlack Swan, 2023 (Units5)

REFERENCE BOOKS

1. Dubey, Sham Ji & Co. English for Engineers, Vikas Publishers, 2020
2. Bailey, Stephen. Academic writing: A Handbook for International Students. Routledge,2014.
3. Murphy, Raymond. English Grammar in Use, Fourth Edition, Cambridge UniversityPress, 2019.
4. Lewis, Norman. Word Power Made Easy- The Complete Handbook for Building aSuperior Vocabulary. Anchor, 2014.

E-RESOURCES AND OTHER DIGITAL MATERIAL

Web Resources:

GRAMMAR:

1. www.bbc.co.uk/learningenglish
2. https://dictionary.cambridge.org/grammar/british-grammar/
3. www.eslpod.com/index.html
4. https://www.learngrammar.net/
5. https://english4today.com/english-grammar-online-with-quizzes/
6. https://www.talkenglish.com/grammar/grammar.aspx

VOCABULARY

1. https://www.youtube.com/c/DailyVideoVocabulary/videos
2. https://www.youtube.com/channel/UC4cmBAit8i_NJZE8qK8sfpA

23BS1151 / 23BS2151

ENGINEERING PHYSICS LAB (Common to all branches)

Course Category:	Institutional Core	**Credits:**	1
Course Type:	Lab	**Lecture -Tutorial-Practice:**	0 - 0 - 2
Prerequisites:		**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:

CO1	Test optical components using principles of interference and diffraction of light
CO2	Use spectrometer, travelling microscope and function generator in various experiments
CO3	Determine the V-I characteristics of photo cells and appreciate the accuracy in measurements

Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1				**H**								
CO2				**H**								
CO3	**M**			**H**								

COURSE CONTENT

1. Determination of radius of curvature of a given Plano-convex lens by Newton's rings.
2. Study the variation of B versus H by magnetizing the magnetic material (B-H curve).
3. Determination of wavelength of Laser light using diffraction grating.
4. Estimation of stopping potential and work function of a photo material using photoelectric effect.
5. Magnetic field along the axis of a current carrying circular coil by Stewart Gee's Method.
6. Determination of Hall voltage and Hall coefficient of a given semiconductor using Hall Effect.
7. Determination of Acceleration due to Gravity and radius of Gyration by using a compound pendulum.
8. Sonometer: Verification of laws of stretched string.

9. Determination of Dielectric constant of different solid materials.
10. Determination of Numerical Aperture of a given optical fiber.
11. Determination of Frequency of electrically maintained tuning fork by Melde's experiment.
12. Determination of Rigidity Modulus of the material of the given wire using Torsional pendulum.
13. Determination of wavelengths of different spectral lines in mercury spectrum using diffraction grating in normal incidence configuration.
14. Determination of Energy Gap of a semiconductor using p-n junction diode.
15. Determination of thickness of a thin foil by Wedge Method.
16. Estimation of Fill Factor of a given Solar Cell.
17. Study the frequency response and determination of resonating frequency of LCR Circuit.
18. Determination of Figure of merit of a Galvanometer.

Note: Any TEN of the listed experiments are to be conducted. Out of which any TWO experiments may be conducted in virtual mode.

TEXT BOOKS

[1] Madhusudhan Rao, "Engineering Physics Lab Manual", Ist ed., Scitech Publications, 2015
[2] Ramarao Sri, Choudary Nityanand and Prasad Daruka, "Lab Manual of Engineering Physics"., Vth ed., Excell Books, 2010

E-RESOURCES

[1] http://plato.stanford.edu/entries/physics-experiment
[2] http://www.physicsclassroom.com/The-Laboratory
[3] http://facstaff.cbu.edu/~jvarrian/physlabs.html

VIRTUAL LAB REFERENCES

[1] http://vlab.amrita.edu/?sub=1&brch=201&sim=366&cnt=1
[2] http://vlab.amrita.edu/?sub=1&brch=195&sim=840&cnt=1
[3] http://vlab.amrita.edu/?sub=1&brch=282&sim=879&cnt=1

23BS1151A
ENGINEERING CHEMISTRY LAB (Common to Civil and Mechanical Engineering branches)

Course Category:	Institutional Core	**Credits:**	1
Course Type:	Laboratory	**Lecture -Tutorial-Practice:**	0 - 0 - 2
Prerequisites:	Knowledge of chemistry practicals at Intermediate level	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:

CO1	Analyzewater samples and various commercial samples of acids, cement, coal, lubricants, etc. for their purity and quality.
CO2	Analyzesamples of water and cement through various instrumental methods like colorimetry, and pH metry.
CO3	Apply standard procedures for preparation of nanomaterials, polymers and blueprinting, as well as study the adsorption process.

Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	**M**	**H**										
CO2	**M**	**H**			**M**							
CO3	**H**											

COURSE CONTENT

List of Experiments

1. Determination of hardness of a groundwater sample
2. Determination of strength of an acid in Lead-acid battery
3. Determination of calcium in Portland cement
4. Determination of strength of a base using pH metric titration
5. Determination of percentage of iron in cement sample by colorimetry
6. Chemistry of blueprinting
7. Preparation of a polymer – Urea-formaldehyde resin

8. Preparation of nanomaterials by precipitation method
9. Adsorption of acetic acid by charcoal
10. Determination of percentage moisture content in a coal sample
11. Determination of viscosity of lubricating oil by Redwood viscometer
12. Determination of calorific value of gases by Junker's gas calorimeter

REFERENCE BOOKS

[1]."Vogel's quantitative chemical analysis", 6th Edition, by J. Mendham, R.C. Denney, J.D. Barnes and B. Sivasankar, Pearson Publications.

23BS1151B / 23BS2151B

CHEMISTRY LAB (Common to ECE, EEE, EIE, CSE, IT, AIDS and AIML)

Course Category:	Institutional Core	**Credits:**	1
Course Type:	Laboratory	**Lecture -Tutorial-Practice:**	0 - 0 - 2
Prerequisites:	Knowledge of chemistry practicals at Intermediate level	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:

CO1	Analyze acids from batteries and metal ions in solutions based on volumetric method.
CO2	Apply standard procedures for preparation of nanomaterials, polymers and blueprinting.
CO3	Analyze different solutions by applying various instrumental methods like conductometry, potentiometry, colorimetry, and chromatography.

Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	**M**	**H**										
CO2	**H**											
CO3	**M**	**H**			**M**							

COURSE CONTENT

List of Experiments

1. Determination of strength of acid in Lead-acid battery
2. Determination of ferrous iron by dichrometry
3. Determination of ferrous iron by permanganometry
4. Conductometric titration of a strong acid vs. strong base
5. Verification of Lambert-Beer’s law
6. Potentiometric titration of a redox reaction
7. Chemistry of blueprinting
8. Conductometric titration of a weak acid vs. strong base

9. Determination of cell constant and conductance of solutions
10. Preparation of nanomaterials – Precipitation method
11. Preparation of urea-formaldehyde resin
12. Separation of ions by paper chromatography

REFERENCE BOOKS

[1]. "Vogel's quantitative chemical analysis", 6th Edition, by J. Mendham, R.C. Denney, J.D. Barnes and B. Sivasankar, Pearson Publications.

23ES1152

COMPUTER PROGRAMMING LAB (Common to all branches)

Course Category:	Engineering Science	**Credits:**	1
Course Type:	Lab	**Lecture -Tutorial-Practice:**	0 - 0 - 2
Prerequisites:		**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:

CO1	Read, understand, and trace the execution of programs written in C language.
CO2	Select the right control structure for solving the problem.
CO3	Develop C programs which utilize memory efficiently using programming constructs like pointers.
CO4	Develop, Debug and Execute programs to demonstrate the applications of arrays, functions, basic concepts of pointers in C.

Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	**H**	**L**										
CO2		**M**	**H**									
CO3	**M**	**M**	**H**									
CO4		**M**	**H**									

COURSE CONTENT

WEEK 1
Objective: Getting familiar with the programming environment on the computer and writing the first program.
Suggested Experiments/Activities:
Tutorial 1: Problem-solving using Computers.
Lab1: Familiarization with programming environment
i) Basic Linux environment and its editors like Vi, Vim & Emacs etc.
ii) Exposure to Turbo C, gcc
iii) Writing simple programs using printf(), scanf()

WEEK 2
ective: Getting familiar with how to formally describe a solution to a problem in a series of finite steps both using

textual notation and graphic notation.
Suggested Experiments /Activities:
Tutorial 2: Problem-solving using Algorithms and Flow charts.
Lab 1: Converting algorithms/flow charts into C Source code.
Developing the algorithms/flowcharts for the following sample programs
i) Sum and average of 3 numbers
ii) Conversion of Fahrenheit to Celsius and vice versa
iii) Simple interest calculation

WEEK 3
Objective: Learn how to define variables with the desired data-type, initialize them with appropriate values and how arithmetic operators can be used with variables and constants.
Suggested Experiments/Activities:
Tutorial 3: Variable types and type conversions:
Lab 3: Simple computational problems using arithmetic expressions.
i) Finding the square root of a given number
ii) Finding compound interest
iii) Area of a triangle using heron's formulae
iv) Distance travelled by an object

UNIT II WEEK 4
Objective: Explore the full scope of expressions, type-compatibility of variables & constants and operators used in the expression and how operator precedence works.
Suggested Experiments/Activities:
Tutorial4: Operators and the precedence and as associativity:
Lab4: Simple computational problems using the operator' precedence and associativity
i) Evaluate the following expressions.
a. A+B*C+(D*E) + F*G
b. A/B*C-B+A*D/3
c. A+++B---A
d. J= (i++) + (++i)
ii) Find the maximum of three numbers using conditional operator
iii) Take marks of 5 subjects in integers, and find the total, average in float

WEEK 5
Objective: Explore the full scope of different variants of "if construct" namely if-else, null- else, if-else if*-else, switch and nested-if including in what scenario each one of them can be used and how to use them. Explore all relational and logical operators while writing conditionals for "if construct".
Suggested Experiments/Activities:
Tutorial 5: Branching and logical expressions:
Lab 5: Problems involving if-then-else structures.
i) Write a C program to find the max and min of four numbers using if-else.
ii) Write a C program to generate electricity bill.
iii) Find the roots of the quadratic equation.
iv) Write a C program to simulate a calculator using switch case.
v) Write a C program to find the given year is a leap year or not.

WEEK 6
Objective: Explore the full scope of iterative constructs namely while loop, do-while loop and
loop in addition to structured jump constructs like break and continue including when each of these statements is more appropriate to use.
Suggested Experiments/Activities:

Tutorial 6: Loops, while and for loops
Lab 6: Iterative problems e.g., the sum of series
i) Find the factorial of given number using any loop.
ii) Find the given number is a prime or not.
iii) Compute sine and cos series
iv) Checking a number palindrome
v) Construct a pyramid of numbers.

UNIT III WEEK 7:
Objective: Explore the full scope of Arrays construct namely defining and initializing 1-D and 2-D and more generically n-D arrays and referencing individual array elements from the defined array. Using integer 1-D arrays, explore search solution linear search.
Suggested Experiments/Activities:
Tutorial 7: 1 D Arrays: searching.
Lab 7:1D Array manipulation, linear search
i) Find the min and max of a 1-D integer array.
ii) Perform linear search on1D array.
iii) The reverse of a 1D integer array
iv) Find 2's complement of the given binary number.
v) Eliminate duplicate elements in an array.

WEEK 8:
Objective: Explore the difference between other arrays and character arrays that can be used as Strings by using null character and get comfortable with string by doing experiments that will reverse a string and concatenate two strings. Explore sorting solution bubble sort using integer arrays.
Suggested Experiments/Activities:
Tutorial 8: 2 D arrays, sorting and Strings.
Lab 8: Matrix problems, String operations, Bubble sort
i) Addition of two matrices
ii) Multiplication two matrices
iii) Sort array elements using bubble sort
iv) Concatenate two strings without built-in functions
v) Reverse a string using built-in and without built-in string functions

UNIT IV WEEK 9:
Objective: Explore pointers to manage a dynamic array of integers, including memory allocation & value initialization, resizing changing and reordering the contents of an array
memory de-allocation using malloc (), calloc (), realloc () and free () functions. Gain experience processing command-line arguments received by C
Suggested Experiments/Activities:
Tutorial 9: Pointers, structures and dynamic memory allocation
Lab 9: Pointers and structures, memory dereference.
i) Write a C program to find the sum of a 1D array using malloc()
ii) Write a C program to find the total, average of n students using structures
iii) Enter n students data using calloc() and display failed students list
iv) Read student name and marks from the command line and display the student details along with the total.
v) Write a C program to implement realloc()

WEEK 10:
Objective: Experiment with C Structures, Unions, bit fields and self-referential structures (Singly linked lists) and nested structures
Suggested Experiments/Activities:
Tutorial 10: Bitfields, Self-Referential Structures, Linked lists

Lab10 : Bitfields, linked lists
Read and print a date using dd/mm/yyyy format using bit-fields and differentiate the same without using bit-fields
i) Create and display a singly linked list using self-referential structure.
ii) Demonstrate the differences between structures and unions using a C program.
iii) Write a C program to shift/rotate using bitfields.
iv) Write a C program to copy one structure variable to another structure of the same type.

UNIT V WEEK 11:
Objective: Explore the Functions, sub-routines, scope and extent of variables, doing some experiments by parameter passing using call by value. Basic methods of numerical integration
Suggested Experiments/Activities:
Tutorial 11: Functions, call by value, scope and extent,
Lab 11: Simple functions using call by value, solving differential equations using Eulers theorem.
i) Write a C function to calculate NCR value.
ii) Write a C function to find the length of a string.
iii) Write a C function to transpose of a matrix.
iv) Write a C function to demonstrate numerical integration of differential equations using Euler's method

WEEK 12:
Objective: Explore how recursive solutions can be programmed by writing recursive functions that can be invoked from the main by programming at-least five distinct problems that have naturally recursive solutions.
Suggested Experiments/Activities:
Tutorial 12: Recursion, the structure of recursive calls
Lab 12: Recursive functions
i) Write a recursive function to generate Fibonacci series.
ii) Write a recursive function to find the lcm of two numbers.
iii) Write a recursive function to find the factorial of a number.
iv) Write a C Program to implement Ackermann function using recursion.
v) Write a recursive function to find the sum of series.

WEEK 13:
Objective: Explore the basic difference between normal and pointer variables, Arithmetic operations using pointers and passing variables to functions using pointers
Suggested Experiments/Activities:
Tutorial 13: Call by reference, dangling pointers
Lab 13: Simple functions using Call by reference, Dangling pointers.
i) Write a C program to swap two numbers using call by reference.
ii) Demonstrate Dangling pointer problem using a C program.
iii) Write a C program to copy one string into another using pointer.
iv) Write a C program to find no of lowercase, uppercase, digits and other characters using pointers.

WEEK14:
Objective: To understand data files and file handling with various file I/O functions. Explore the differences between text and binary files.
Suggested Experiments/Activities:
Tutorial 14: File handling
Lab 14: File operations
i) Write a C program to write and read text into a file.
ii) Write a C program to write and read text into a binary file using fread() and fwrite()
iii) Copy the contents of one file to another file.
iv) Write a C program to merge two files into the third file using command-line arguments.
v) Find no. of lines, words and characters in a file

vi) Write a C program to print last n characters of a given file.

TEXT BOOKS

[1] Ajay Mittal, Programming in C: A practical approach, Pearson.
[2] Byron Gottfried, Schaum' s Outline of Programming with C, McGraw Hill

E-RESOURCES

1] Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice- Hall of India

[2] C Programming, A Problem-Solving Approach, Forouzan, Gilberg, Prasad, CENGAGE

23HS1153/23HS2153

Communicative English Lab

(Common to All Branches**)**

Course Category:	Institutional Core	**Credits:**	1
Course Type:	Practical	**Lecture -Tutorial-Practice:**	0 - 0 - 2
Prerequisites:	Basic understanding of the language skills viz Listening, Speaking, Reading and Writing, including Sentence construction abilities	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:

CO1	Understand the different aspects of the English language proficiency with emphasis on LSRW skills.
CO2	Apply communication skills through various language learning activities.
CO3	Analyze the English speech sounds, stress, rhythm, intonation and syllable division for better listening and speaking comprehension.
CO4	Evaluate and exhibit professionalism in participating in debates and group discussions.

Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High)

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
CO1		M								H		M
CO2										H		M
CO3										H		M
CO4										H		M

COURSE CONTENT

List of Topics

1. Vowels and Consonants
2. Neutralizaton/Accent Rules
3. Communication Skills & JAM

4. Role Play or Conversational Practice
5. E-mail Writing
6. Resume Writing, Cover Letter, SOP
7. Group Discussions-methods & practice
8. Debates – Methods & Practice
9. PPT Presentations/Poster Presentations
10. Interview Skills

SUGGESTED SOFTWARE

1. WALDEN
2. SOFTX
3. VISIONET

23ES1154/23ES2154
ENGINEERING WORKSHOP

Course Category:	Engineering Sciences	**Credits:**	1.5
Course Type:	Laboratory	**Lecture -Tutorial-Practice:**	0 - 0 - 3
Prerequisites:		**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:

CO1	Understand the basic joints using wood and familiarize with various fundamental aspects of house wiring, fitting and foundry.
CO2	Prepare basic models using sheet metal and practice joining of metals using various types of welding.
CO3	Familiarize with various advanced manufacturing processes such as injection moulding and 3D printing.
CO4	Understand the preparation of PCB and simple IOT applications using Arduino

Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1			**M**		**H**							
CO2			**M**		**H**							
CO3			**M**		**H**							
CO4			**M**		**L**							

COURSE CONTENT

PART-A

1. **Demonstration:** Safety practices and precautions to be observed in workshop.

2. **Wood Working:** Familiarity with different types of woods and tools used in wood working and make following joints.

a) Half – Lap joint b) Bridle joint c) Demonstration of power tools. **(2 classes)**

3. **Sheet Metal Working:** Familiarity with different types of tools used in sheet metal working,

developmentsof following sheet metal job from GI sheets.

a) Tapered tray b) Conical funnel **(2 classes)**

4. **Fitting:** Familiarity with different types of tools used in fitting and do the following fitting exercises.
   a) V-fit b) Semi-circular fit c) Bicycle tire puncture and change of two-wheeler tyre **(2 classes)**

5. **Electrical Wiring:** Familiarity with different types of basic electrical circuits and make the following connections.
   a) Parallel and series b) Two-way switch c) Godown lighting d) Tube light **(1 class)**

6. **Foundry Trade:** Demonstration and practice on Moulding tools and processes, Preparation of Green Sandmoulds for given Patterns. **(1 class)**

7. **Welding Shop:** Demonstration and practice on Arc Welding and Gas welding. Preparation of Lap joint and Butt joint. **(1 class)**

8. **Advanced manufacturing processes:** Demonstration of injection moulding and 3 D printing processes.**(1 class)**

9. **Electronic Circuits:** Demonstration of preparation of simple electronic circuit (PCB) and testing its operation. **(1 class)**

10. **Basic IOT:** Demonstration of different components & pin configuration of Arduino board

a) Measure Temperature & Humidity b) Measure Distance **(1 class)**

PART-B

GROUP ACTIVITY (2 classes)

- Students must prepare a Working model / Assembly using the knowledge gained from the above trades.

TEXT BOOKS

[1] Basic Workshop Technology: Manufacturing Process, Felix W.; Independently Published,2019. Workshop Processes, Practices and Materials; Bruce J. Black, Routledge publishers, 5th Edn. 2015.

[2] A Course in Workshop Technology Vol I. & II, B.S. Raghuwanshi, DhanpathRai& Co., 2015 & 2017.

REFERENCE BOOKS

[1] Elements of Workshop Technology, Vol. I by S. K. Hajra Choudhury & Others, Media Promoters and Publishers, Mumbai. 2007, 14th edition.

[2] Workshop Practice by H. S. Bawa, Tata-McGraw Hill, 2004.

[3] Wiring Estimating, Costing and Contracting; Soni P.M. &Upadhyay P.A.; AtulPrakashan, 2021-22.

E-RESOURCES AND OTHER DIGITAL MATERIAL

1. https://dsceme.files.wordpress.com/2016/08/workshop-practice-manual-2016-17- 1.pdf

2. https://www.protosystech.com/rapid-prototyping.htm

3. https://www.arduino.cc/en/Tutorial/Foundations 4. https://www.tutorialspoint.com/arduino/

23BS1154B/23BS2154B
HEALTH AND WELLNESS, YOGA AND SPORTS
(Common to All Branches**)**

Course Category:	Basic Science	**Credits:**	0.5
Course Type:	Lab (Activity Based Course)	**Lecture -Tutorial-Practice:**	0 - 0 - 1
Prerequisites:	-	**Continuous Evaluation:** **Max.Activities:6** **Viva:** **Total Marks:**	Activity based course 6 x 15 = 90 10 100

COURSE OBJECTIVES

The main objective of introducing this course is to make the students maintain their mental and physical wellness by balancing emotions in their life. It mainly enhances the essential traits required for the development of the personality.

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:

CO1	Understand the importance of yoga and sports for Physical fitness and sound health
CO2	Demonstrate an understanding of health-related fitness components
CO3	Compare and contrast various activities that help enhance their health.
CO4	Assess current personal fitness levels.
CO5	Develop Positive Personality

COURSE CONTENT

UNIT – I :

Concept of health and fitness, Nutrition and Balanced diet, basic concept of immunity Relationship between diet and fitness, Globalization and its impact on health, Body Mass Index(BMI) of all age groups.

Activities:

i) Organizing health awareness programmes in community
ii) Preparation of health profile
iii) Preparation of chart for balance diet for all age groups

UNIT II

Concept of yoga, need for and importance of yoga, origin and history of yoga in Indian context, classification of yoga, Physiological effects of Asanas- Pranayama and meditation, stress management and yoga, Mental health and yoga practice.

Activities:

Yoga practices – Asana, Kriya, Mudra, Bandha, Dhyana, Surya Namaskar

UNIT III

Concept of Sports and fitness, importance, fitness components, history of sports, Ancient and Modern Olympics, Asian games and Commonwealth games.

Activities:

i) Participation in one major game and one individual sport viz., Athletics, Volleyball, Basketball, Handball, Football, Badminton, Kabaddi, Kho-kho, Table tennis, Cricket etc.
Practicing general and specific warm up, aerobics

ii) Practicing cardiorespiratory fitness, treadmill, run test, 9 min walk, skipping andrunning.

REFERENCE BOOKS

[1]. Gordon Edlin, Eric Golanty. Health and Wellness, 14th Edn. Jones & Bartlett Learning,2022
[2]. T.K.V.Desikachar. The Heart of Yoga: Developing a Personal Practice
[3]. Archie J.Bahm. Yoga Sutras of Patanjali, Jain Publishing Company, 1993
[4]. Wiseman, John Lofty, SAS Survival Handbook: The Ultimate Guide to SurvivingAny where Third Edition, William Morrow Paperbacks, 2014
[5]. The Sports Rules Book/ Human Kinetics with Thomas Hanlon. -- 3rd ed. HumanKinetics, Inc.2014

23ES1155 / 23ES2155

IT WORKSHOP **(Common to all branches)**

Course Category:	Engineering Science	**Credits:**	1
Course Type:	Lab	**Lecture -Tutorial-Practice:**	0 - 0 - 2
Prerequisites:		**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

COURSE OBJECTIVES

- To introduce the internal parts of a computer, peripherals, I/O ports, connecting cables
- To demonstrate configuring the system as Dual boot both Windows and other Operating Systems Viz. Linux, BOSS
- To teach basic command line interface commands on Linux.
- To teach the usage of Internet for productivity and self-paced life-long learning
- To introduce Compression, Multimedia and Antivirus tools and Office Tools such as Word processors, Spread sheets and Presentation tools.

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:

CO1	Perform Hardware troubleshooting.
CO2	Understand Hardware components and inter dependencies.
CO3	Safeguard computer systems from viruses/worms
CO4	Document/ Presentation preparation.
CO5	Perform calculations using spreadsheets.

Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1												
CO2												
CO3												
CO4												

COURSE CONTENT

PC Hardware & Software Installation

Task 1: Identify the peripherals of a computer, components in a CPU and its functions. Draw the block diagram of the CPU along with the configuration of each peripheral and submit to your instructor.

Task 2: Every student should disassemble and assemble the PC back to working condition. Lab instructors should verify the work and follow it up with a Viva. Also students need to go through the video which shows

the process of assembling a PC. A video would be given as part of the course content.

Task 3: Every student should individually install MS windows on the personal computer. Lab instructor should verify the installation and follow it up with a Viva.

Task 4: Every student should install Linux on the computer. This computer should have windows installed. The system should be configured as dual boot (VMWare) with both Windows and Linux. Lab instructors should verify the installation and follow it up with a Viva

Task 5: Every student should install BOSS on the computer. The system should be configured as dual boot (VMWare) with both Windows and BOSS. Lab instructors should verify the installation and follow it up with a Viva

Internet & World Wide Web

Task1: Orientation & Connectivity Boot Camp: Students should get connected to their Local Area Network and access the Internet. In the process they configure the TCP/IP setting. Finally students should demonstrate, to the instructor, how to access the websites and email.
If there is no internet connectivity preparations need to be made by the instructors to simulate the WWW on the LAN.

Task 2: Web Browsers, Surfing the Web: Students customize their web browsers with the LAN proxy settings, bookmarks, search toolbars and pop up blockers. Also, plug-ins like Macromedia Flash and JRE for applets should be configured.

Task 3: Search Engines & Netiquette: Students should know what search engines are and how to use the search engines. A few topics would be given to the students for which they need to search on Google. This should be demonstrated to the instructors by the student.

Task 4: Cyber Hygiene: Students would be exposed to the various threats on the internet and would be asked to configure their computer to be safe on the internet. They need to customize their browsers to block pop ups, block active x downloads to avoid viruses and/or worms.

LaTeX and WORD

Task 1 – Word Orientation: The mentor needs to give an overview of La TeX and Microsoft (MS) office or equivalent (FOSS) tool word: Importance of La TeX and MS office or equivalent (FOSS) tool Word as word Processors, Details of the four tasks and features that would be covered in each, Using La TeXand word - Accessing, overview of toolbars, saving files, Using help and resources, rulers, format painter in word.

Task 2: Using La TeX and Word to create a project certificate. Features to be covered:-
Formatting Fonts in word, Drop Cap in word, Applying Text effects, Using Character Spacing, Borders and Colors, Inserting Header and Footer, Using Date and Time option in both La TeX and Word.

Task 3: Creating project abstract Features to be covered:-Formatting Styles, Inserting table, Bullets and Numbering, Changing Text Direction, Cell alignment, Footnote, Hyperlink, Symbols, Spell Check, Track Changes.

Task 4: Creating a Newsletter: Features to be covered:- Table of Content, Newspaper columns, Images from files and clipart, Drawing toolbar and Word Art, Formatting Images, Textboxes, Paragraphs and Mail Merge in word.

EXCEL

Excel Orientation: The mentor needs to tell the importance of MS office or equivalent (FOSS) tool Excel as a Spreadsheet tool, give the details of the four tasks and features that would be covered in each. Using Excel - Accessing, overview of toolbars, saving excel files, Using help and resources.

Task 1: Creating a Scheduler - Features to be covered: Gridlines, Format Cells, Summation, auto fill, Formatting Text

Task 2: Calculating GPA -. Features to be covered:- Cell Referencing, Formulae in excel - average, std. deviation, Charts, Renaming and Inserting worksheets, Hyper linking, Count function.

LOOKUP/VLOOKUP
Task 3: Split cells, freeze panes, group and outline, Sorting, Boolean and logical operators, Conditional formatting

POWER POINT
Task 1: Students will be working on basic power point utilities and tools which help them create basic power point presentations. PPT Orientation, Slide Layouts, Inserting Text, Word Art, Formatting Text, Bullets and Numbering, Auto Shapes, Lines and Arrows in PowerPoint.

Task 2: Interactive presentations - Hyperlinks, Inserting -Images, Clip Art, Audio, Video, Objects, Tables and Charts.

Task 3: Master Layouts (slide, template, and notes), Types of views (basic, presentation, slide slotter, notes etc), and Inserting - Background, textures, Design Templates, Hidden slides.

AI TOOLS – ChatGPT
Task 1: Prompt Engineering: Experiment with different types of prompts to see how the model responds. Try asking questions, starting conversations, or even providing incomplete sentences to see how the model completes them.

- Ex: Prompt: "You are a knowledgeable AI. Please answer the following question:What is the capital of France?"

Task 2: Creative Writing: Use the model as a writing assistant. Provide the beginning of a story or a description of a scene, and let the model generate the rest of the content. This can be a fun way to brainstorm creative ideas

- Ex: Prompt: "In a world where gravity suddenly stopped working, people started floating upwards. Write a story about how society adapted to this new reality."

Task 3: Language Translation: Experiment with translation tasks by providing a sentence in one language and asking the model to translate it into another language. Compare the output to see how accurate and fluent the translations are.

- Ex:Prompt: "Translate the following English sentence to French: 'Hello, how are you doing today?'"

REFERENCE BOOKS

[1]. Comdex Information Technology course tool kit, Vikas Gupta, WILEY Dream tech, 2003
[2]. The Complete Computer upgrade and repair book, Cheryl A Schmidt, WILEY Dream tech,2013, 3rd edition
[3]. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education, 2012, 2nd edition
[4]. PC Hardware - A Handbook, Kate J. Chase, PHI (Microsoft)
[5]. LaTeX Companion, Leslie Lamport, PHI/Pearson.

[6]. IT Essentials PC Hardware and Software Companion Guide, David Anfins on and Ken Quamme. - CISCO Press, Pearson Education, 3rd edition
[7]. IT Essentials PC Hardware and Software Labs and Study Guide, Patrick Regan- CISCO Press, Pearson Education, 3rd edition

23BS1156/23BS2156
NSS/NCC/SCOUTS & GUIDES/COMMUNITY SERVICE
(Common to All Branches**)**

Course Category:	Basic Science	**Credits:**	0.5
Course Type:	Lab (Activity Based Course)	**Lecture -Tutorial-Practice:**	0 - 0 - 1
Prerequisites:	-	**Continuous Evaluation:** **Max.Activities:6** **Viva:** **Total Marks:**	Activity based course 6 x 15 = 90 10 100

COURSE OBJECTIVES

The objective of introducing this course is to impart discipline, character, fraternity, teamwork,social consciousness among the students and engaging them in selfless service.

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:

CO1	Understand the importance of discipline, character and service motto.
CO2	Solve some societal issues by applying acquired knowledge, facts, and techniques.
CO3	Explore human relationships by analyzing social problems.
CO4	Determine to extend their help for the fellow beings and downtrodden people.
CO5	Develop leadership skills and civic responsibilities.

COURSE CONTENT

UNIT I Orientation

General Orientation on NSS/NCC/ Scouts & Guides/Community Service activities, careerguidance.

Activities:

i) Conducting – ice breaking sessions - expectations from the course-knowing personaltalents and skills
ii) Conducting orientations programs for the students –future plans-activities-releasingroad map etc.
iii) Displaying success stories-motivational biopics- award winning movies on societalissues etc.
iv) Conducting talent show in singing patriotic songs-paintings- any other contribution.

UNIT II Nature & CareActivities:

i) Best out of waste competition.
ii) Poster and signs making competition to spread environmental awareness.
iii) Recycling and environmental pollution article writing competition.
iv) Organising Zero-waste day.
v) Digital Environmental awareness activity via various social media platforms.
vi) Virtual demonstration of different eco-friendly approaches for sustainable living.
vii) Write a summary on any book related to environmental issues.

UNIT III Community ServiceActivities:

i) Conducting One Day Special Camp in a village contacting village-area leaders- Survey in the village, identification of problems- helping them to solve via media- authorities-experts-etc.

ii) Conducting awareness programs on Health-related issues such as General Health,Mental health, Spiritual Health, HIV/AIDS,

iii) Conducting consumer Awareness. Explaining various legal provisions etc.

iv) Women Empowerment Programmes- Sexual Abuse, Adolescent Health and PopulationEducation.

v) Any other programmes in collaboration with local charities, NGOs etc.

REFERENCE BOOKS

1. Nirmalya Kumar Sinha & Surajit Majumder, *A Text Book of National Service Scheme* Vol;.I, Vidya Kutir Publication, 2021 (ISBN 978-81-952368-8-6)
2. *Red Book - National Cadet Corps* – Standing Instructions Vol I & II, DirectorateGeneral of NCC, Ministry of Defence, New Delhi
3. Davis M. L. and Cornwell D. A., "Introduction to Environmental Engineering",McGraw Hill, New York 4/e 2008
4. Masters G. M., Joseph K. and Nagendran R. "Introduction to EnvironmentalEngineering and Science", Pearson Education, New Delhi. 2/e 2007
5. Ram Ahuja. *Social Problems in India,* Rawat Publications, New Delhi.

23BS2101
DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS
(COMMON TO ALL BRANCHES)

Course Category:	Basic Science	**Credits:**	3
Course Type:	Theory	**Lecture -Tutorial-Practice:**	3 - 0- 0
Prerequisites:	23BS1101 LinearAlgebra & Calculus	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:

CO1	Solve first order linear differential equations
CO2	Solve higher order linear differential equations with constant coefficients
CO3	Solve Partial differential equations
CO4	Evaluate the work done against field, circulation and flux using vector calculus

Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	**H**	**M**			**L**							
CO2	**H**	**M**			**L**							
CO3	**H**	**M**			**L**							
CO4	**H**	**M**			**L**							

COURSE CONTENT

UNIT I Differential equations of first order and first degree

Linear differential equations – Bernoulli's equations- Exact equations and equations reducible to exact form, Applications: Newton's Law of cooling – Law of natural growth and decay- Electrical circuits.

UNIT II Linear differential equations of higher order (Constant Coefficients)

Definitions,homogenous and non-homogenous, complimentary function, general solution, particular integral, Wronskian, Method of variation of parameters, Simultaneous linear equations, Applications to L-C-R Circuit problems and Simple Harmonic motion**.**

UNIT III Partial Differential Equations

Introduction and formation of Partial Differential Equations by elimination of arbitrary constants and arbitrary functions, solutions of first order linear equations using Lagrange's method, Homogeneous Linear Partial differential equations with constant coefficients**.**

UNIT IV Vector Calculus

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

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

TEXT BOOKS

[1]. Higher Engineering Mathematics, B. S. Grewal, Khanna Publishers, 2017, 44th Edition

REFERENCE BOOKS

[1]. Advanced Engineering Mathematics, Erwin Kreyszig, John Wiley & Sons, 2018, 10th Edition.

[2]. Thomas Calculus, George B. Thomas, Maurice D. Weir and Joel Hass, Pearson Publishers, 2018, 14th Edition.

[3]. Advanced Engineering Mathematics, R. K. Jain and S. R. K. Iyengar, Alpha Science International Ltd., 2021 5th Edition(9th reprint).

[4]. Advanced Modern Engineering Mathematics, Glyn James, Pearson publishers, 2018, 5th Edition.

[5]. Advanced Engineering Mathematics, Micheael Greenberg, Pearson publishers, 9th Edition.

[6]. Higher Engineering Mathematics, H. K Das, Er. Rajnish Verma, S. Chand Publications,2014, 3rd Edition (Reprint 2021).

E-RESOURCES AND OTHER DIGITAL MATERIAL

1]. Prof. Srinivas Rao Manam, IIT Madras,Differential equations for engineers[English], Available: https://onlinecourses.nptel.ac.in/noc22_ma72/preview

[2]. Prof. Jitendra Kumar , IIT Kharagpur, Engineering Mathematics – I[English], Available:https://onlinecourses.nptel.ac.in/noc20_ma37/preview

[3]. Prof. Jitendra Kumar , IIT Kharagpur, Engineering Mathematics – II[English], Available: https://onlinecourses.nptel.ac.in/noc22_ma08/preview

[4]. Prof. Jitendra Kumar & Prof. Somesh Kumar, IIT Kharagpur, Advanced Calculus For Engineers[English], Available:https://onlinecourses.nptel.ac.in/noc22_ma75/preview

[5]. Prof. Denis Auroux, Massachusetts Institute of Technology: MIT Open Courseware,Multivariable Calculus,Available:https://ocw.mit.edu.

23PC2104A

DATA STRUCTURES (For CSE, AI&DS, AI&ML and IT Departments)

Course Category:	Professional Core	**Credits:**	3
Course Type:	Theory	**Lecture -Tutorial-Practice:**	3 - 0 - 0
Prerequisites:	23ES1104-Introduction to Programming	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:

CO1	Demonstrate the role of data structures in organizing and accessing data efficiently
CO2	Understand various techniques for searching, sorting and hashing algorithms used to solve complex problems
CO3	Demonstrate the operations on linear data structures like stack, queue and linked list.
CO4	Analyze various operations on nonlinear data structures – binary tree, and binary search tree.

Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	**M**			**M**								
CO2	**H**	**M**	**L**	**M**								
CO3	**M**	**M**	**L**	**M**								
CO4	**M**	**M**	**L**	**M**								

COURSE CONTENT

UNIT – I :

Basic Concepts: Overview: System life cycle. Algorithm Specification, Data Abstraction, Performance Analysis, the Abstract Data Type.

Searching: introduction to searching**,** Linear Search and Binary Search.

Sorting: Bubble Sort, Insertion Sort, Selection Sort.

UNIT – II :

Linked Lists: linked lists, programming details, doubly linked lists, circularly linked lists, Examples: polynomial addition.

Stacks: Stack Model, Implementation of Stacks (arays), Linked Stacks Applications: balancing the symbols, postfix expressions, infix to postfix conversion.

UNIT – III :

Queues: Queue Model, Array implementation of Queues, Applications of Queues: DFS, linked Queues, Types of Queues: Circular Queues, Dequeues.

Trees: Introduction, Binary Trees, Binary Tree traversals, Binary Search Tree – Definition, Search, Insertion, & Deletion.

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UNIT – IV :

Graphs: Graph Abstract Datatype, Elementary Graph Operations- DFS, BFS.

Hashing: General idea, Hash Functions, separate chaining, open addressing, rehashing, extendable hashing.

TEXT BOOKS

[1]. Mark Allen Weiss , "Data Structures and algorithm analysis in C", Pearson, 2nd Edition, 2016.
[2]. Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed , "Fundamentals of data structures in C", University Press, 2020

REFERENCE BOOKS

[1]. Reema Thareja , " Data Structures Using C ", Second Edition, 2014, Oxford University Press
[2]. Brad Miller and David Ranum , "Problem Solving with Algorithms and Data Structures" , 2013.
[3]. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein, "Introduction to Algorithms" , 3rd Edition, Mitpress.
[4]. YedidyahLangsam, Moshe J. Augenstein and Aaron M. Tenenbaum, "Data Structures using C and C++", 2nd edition, Pearson Education, 1999.
[5]. Jean Paul Trembley and Paul G. Sorenson, "An Introduction to Data Structures with Applications", 2nd edition, McGraw Hill, 2008.

E-RESOURCES AND OTHER DIGITAL MATERIAL

1. SudarshanIyengar: IIT Ropar, Data Structures and Algorithms, [NPTEL], (26, May, 2021) Available: http://nptel.ac.in/
2. Erik Demaine, Advanced Data Structures [MIT- OpenCourseWare], (26, May, 2021) Available: http://ocw.mit.edu/

3.Prof. Naveen Garg, IIT Delhi, Introduction to Data Structures and Algorithms, https://nptel.ac.in/courses/106102064

23PC2104B
ENGINEERING MECHANICS (For CE/ME Departments)

Course Category:	Engineering Science	**Credits:**	3
Course Type:	Theory	**Lecture -Tutorial-Practice:**	3 - 0 - 0
Prerequisites:	Basic Mathematics, Physics at (10 + 2) level	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:

CO1	Analyze coplanar concurrent , parallel forces and evaluate centroid for plane figures
CO2	Analyze coplanar general case forces and evaluate moment of inertia for plane figures
CO3	Analyze rectilinear and curvilinear motion of particles
CO4	Evaluate the moment of inertia of material bodies and analyze the fixed axis rotation of rigid bodies.

Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	**H**	**M**	**M**									
CO2	**H**	**M**	**M**									
CO3	**H**	**M**	**M**									
CO4	**H**	**M**	**M**									

COURSE CONTENT

UNIT – I

Equilibrium of Systems of Concurrent Forces: Composition and resolution of forces – Constraint, Action and Reaction, Types of supports and support reactions, Free body diagram, Equilibrium of concurrent forces in a plane – Method of Projections, Method of moments.

Equilibrium of Systems of Parallel Forces: Introduction, Types of parallel forces, Resultant, Couple, Resolution of Force into force and a couple, General case of parallel forces in a plane.

Centroid: Centroids of standard figures, Centroids of Composite Figures.

UNIT – II

Friction: Introduction, limiting friction and impending motion, Coulomb's laws of dry friction, coefficient of friction, Cone of static friction, Numerical problems.

Coplanar General case of force system: Equilibrium of forces in plane-Analysis of plane trusses: Method of joints.

Area Moments of Inertia: Definition– Polar Moment of Inertia, Transfer Theorem, Moments of Inertia of Composite Figures

UNIT – III

Kinematics of Rectilinear motion: Displacement, Velocity and acceleration, Motion of Uniform and Variable acceleration.

Kinetics of Rectilinear motion: D'Alembert's Principle **(Other principles not included)**

Kinematics of Curvilinear motion: Rectangular components of velocity and acceleration, Normal and tangential acceleration, Motion of projectiles.

Kinetics of Curvilinear motion: D'Alembert's Principle.**(Theory only)**

UNIT – IV

Mass Moment of Inertia: Moment of Inertia of Masses, Transfer Formula for Mass Moments of Inertia, Mass moment of inertia of slender rod, Circular disc. Mass Moment of Inertia of 3D bodies– Cone, Solid cylinder & Sphere **(Derivations only).**

Rigid body Motion: Kinematics of rotation: Linear & angular velocity, Linear & angular acceleration in uniformly accelerated motion.

Kinetics of a rigid body in rotation of about a fixed axis: Equation of motion for a rigid body rotating about a fixed axis- Rotation under the action of constant moment.

Kinematics of Rigid body: Plane motion: Method of Instantaneous center of rotation **(Theory only)**

TEXT BOOKS

[1]. Engineering Mechanics by S. Timoshenko & D. H. Young, 4th Edition, 2007, McGraw Hill International Edition. (For Concepts and symbolic Problems).
[2]. Engineering Mechanics Statics and dynamics by A. K. Tayal, 13th Edition, 2006, Umesh Publication, Delhi, (For numerical Problems using S.I.System of Units).
[3]. A Textbook of Engineering Mechanics, S.S Bhavikatti. New age international publications 2018

REFERENCE BOOKS

[1] Engineering Mechanics, P.C.Dumir- S.Sengupta and Srinivas V Veeravalli , University press. 2020. First Edition.
[2] Engineering Mechanics, Statics and Dynamics, I.H. Shames., PHI, 2002. 4th Edition.
[3] Engineering Mechanics, Volume-I: Statics, Volume-II: Dynamics, J. L. Meriam and L. G. Kraige., John Wiley, 2008. 6th Edition

E-RESOURCES AND OTHER DIGITAL MATERIAL

[1] http://emweb.unl.edu/
[2] https://nptel.ac.in/courses/122/104/122104015/
[3] Prof. U.S. Dixit, , IIT Guwahati, Engineering Mechanics [English], Web available: https://nptel.ac.in/courses/112103109
[4] Prop. K.Ramesh, IIT Madras, Engineering Mechanics, , [English], Web available: https://nptel.ac.in/courses/112106286

23PC2104C
NETWORK ANALYSIS (For ECE/ EIE Departments)

Course Category:	Engineering Science	**Credits:**	3
Course Type:	Theory	**Lecture -Tutorial-Practice:**	3 - 0 - 0
Prerequisites:	Basics of Electrical Engineering	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:

CO1	Analyse the electrical circuit using network simplification theorems. .
CO2	Find Transient response of a network .
CO3	Find Steady state response and Resonance of a network .
CO4	Compute the parameters of a two-port network .

Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2
CO1	**H**													
CO2	**H**	**M**												
CO3	**H**	**M**												
CO4	**H**	**L**												

COURSE CONTENT

UNIT – I :

Types of circuit components, Types of Sources and Source Transformations, Mesh analysis and Nodal analysis, problem solving with resistances only including dependent sources also. Principal of Duality with examples.

Network Theorems: Thevenin's, Norton's, Milliman's, Reciprocity, Compensation, Substitution, Superposition, Max Power Transfer, Tellegens - problem solving using dependentsources also.

UNIT – II : Transients: First order differential equations, Definition of time constants, R-L circuit, R-C circuit with DC excitation, evaluating initial conditions procedure, second order differential equations, homogeneous, non-homogenous, problem-solving using R-L-C elements with DC excitation and AC

excitation, Response as related to s-plane rotation of roots.

UNIT – III : Steady **State Analysis of A.C Circuits:** Impedance concept, phase angle, series R-L, R-C, R-L- C circuits problem solving. Complex impedance and phasor notation for R-L, R-C, R-L-C problem solving using mesh and nodal analysis, Star-Delta conversion, problem solving using Laplace transforms also.

Resonance: Introduction, Definition of Q, Series resonance, Bandwidth of series resonance, Parallel resonance, general case-resistance present in both branches, anti-resonance at all frequencies.

UNIT – IV :

Two-port Networks: Relationship of two port networks, Z-parameters, Y-parameters, Transmission line parameters, h- parameters, Relationships Between parameter Sets, Parallel & series connection of two port networks, cascading of two port networks, problem solving using dependent sources also.

TEXT BOOKS

1. Network Analysis – ME Van Valkenburg, Prentice Hall of India, revised 3rd Edition,2019.
2. Engineering Circuit Analysis by William H. Hayt, Jack Kemmerly, Jamie Phillips,Steven M. Durbin, 9th Edition 2020.
3. Network lines and Fields by John. D. Ryder 2nd Edition, PHI

REFERENCE BOOKS

1. D. Roy Choudhury, Networks and Systems, New Age International Publications, 2013.
2. Joseph Edminister and Mahmood Nahvi, Electric Circuits, Schaum's Outline Series,7th Edition, Tata McGraw Hill Publishing Company, New Delhi, 2017
3. Fundamentals of Electric Circuits by Charles K. Alexander and Matthew N. O. Sadiku,McGraw-Hill Education.

E-RESOURCES AND OTHER DIGITAL MATERIAL

1. http://nptel.iitm.ac.in/courses/Webcoursecontents/IIT-%20kharagpur/basic%20electrical%
2. https://onlinecourses.nptel.ac.in/noc23_ee54/preview
3. https://nptel.ac.in/courses/108105159

23PC2104D
ELECTRICAL CIRCUIT ANALYSIS -I
(For EEE Department)

Course Category:	Program Core	**Credits:**	3
Course Type:	Theory	**Lecture -Tutorial-Practice:**	3 - 0 - 0
Prerequisites:	Basic Electrical and Electronics Engineering	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:

CO1	**Apply** different techniques to solve DC circuits.
CO2	**Understand** the magnetic circuit concepts.
CO3	A**nalyze the** steady-state response, series, parallel AC circuits, mesh & nodal analysis, and resonance.
CO4	**Apply** network theorems for AC & DC circuits.

Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	**H**	**H**			**M**							
CO2	**H**	**H**										
CO3	**M**	**H**			**M**							
CO4	**M**	**H**										

COURSE CONTENT

UNIT – I : Introduction to Electrical Circuits

Basic concepts of passive elements of R, L, C and their V-I relations, Kirchoff Laws (K.V.L, K.C.L), Sources (dependent and independent), star-to-delta and delta-to-star transformation, source transformation techniques, nodal analysis and mesh analysis to DC networks with dependent and independent voltage and current sources.

UNIT – II : Magnetic Circuits

Basic definition of MMF, flux and reluctance, analogy between electrical and magnetic circuits, Faraday's laws of electromagnetic induction – concept of self and mutual inductance, Dot convention – coefficient of coupling and composite magnetic circuit, analysis of series and parallel magnetic circuits.

UNIT – III : Single Phase Circuits and Resonance

Single Phase Circuits

Characteristics of periodic functions- average value, R.M.S. value, form factor, representation of a sine function, concept of Phasor, Phasor diagrams, Steady state analysis of R, L and C circuits to sinusoidal excitations-response of pure resistance, inductance, capacitance, series RL circuit, series RC circuit, series RLC circuit, parallel RL circuit, parallel RC circuit - node and mesh analysis.

Resonance

Series Resonance: Characteristics of a series resonant circuit, Q-factor, selectivity, and bandwidth, the expression for half power frequencies; Parallel resonance: Q-factor, selectivity, and bandwidth.

UNIT – IV : Network Theorems (DC & AC Excitations)

Superposition theorem, Reciprocity theorem, Thevenin's theorem, Norton's theorem, Maximum Power Transfer theorem (for both DC and AC circuits)

TEXT BOOKS

[1]. Jack Kemmerly, William Hayt, and Steven Durbin, "Engineering Circuits Analysis", sixth edition, Tata Mc Graw Hill Education, 2005.
[2]. A. Chakrabarti, "Circuit Theory: Analysis and Synthesis", Seventh Revised Edition, Dhanpat Rai & Co., 2018.

REFERENCE BOOKS

[1]. Ravish R Singh, "Network Analysis and Synthesis", 1st edition, McGraw-Hill Education (India) Pvt. Ltd., Chennai, 2018.
[2]. Charles K. Alexander and Mathew N.O. Sadiku, "Fundamentals of Electrical Circuits", Fifth Edition, Mc Graw Hill Education (India), 2013.
[3]. Mahmood Nahvi, Joseph Edminister, and K. Rao, "Electric Circuits (Schaum's outline Series)", Fifth Edition, Mc Graw Hill Education, 2017.
[4]. David A. Bell, "Electric Circuits", Seventh Edition, Oxford University Press, 2009.
[5]. Robert L Boylestad, "Introductory Circuit Analysis", Fourteenth Edition, Pearson Publications, 2023.
[6]. M. E. Van Valkenburg, "Network Analysis", Revised Third Edition, Pearson Education, 2019.

E-RESOURCES AND OTHER DIGITAL MATERIAL

1. https://onlinecourses.nptel.ac.in/noc23_ee81/preview
2. https://nptel.ac.in/courses/108104139
3. https://nptel.ac.in/courses/108106172
4. https://nptel.ac.in/courses/117106108

23MC2106

DESIGN THINKING

[MANDATORY NON-CREDIT COURSE]

(COMMON TO ALL BRANCHES)

Course Category:	Skill Oriented Course	**Credits:**	0
Course Type:	Practice	**Lecture -Tutorial-Practice:**	1 - 0- 1
Prerequisites:	10+2 or Intermediate	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:

CO1	Understand the concepts of Design Thinking
CO2	Investigate a problem to determine its root cause.
CO3	Able to develop design thinking skills and experiment with different solutions.
CO4	Able to develop prototypes and can test

Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1		**H**	**H**			**M**			**H**	**H**		
CO2		**H**	**H**			**M**			**H**	**H**		
CO3		**H**	**H**	**H**	**H**	**M**			**H**	**H**		**H**
CO4	**H**	**H**	**H**	**H**	**H**			**M**	**H**	**H**	**M**	**H**

COURSE CONTENT

UNIT-I

Introduction to Design Thinking: Design Thinking Overview, Defining Design Thinking, Featuresand principles of Design thinking, Applications of Design Thinking

UNIT-II

Modules of Design Thinking – Inspiration – methods & tools used in Explore and Empathize phasesof Design Thinking, Case study-activity.

UNIT-III

Modules of Design Thinking – Ideation & Implementation – methods & tools used in Experiment, Engage and Evolve phases of Design Thinking, Case study-activity.

Unit-IV

Prototype and Test Techniques – Types of Prototypes, Exercise: Revise Franken Prototype to Refined Prototype, Forms of Testing in Design Thinking, Prepare and Test of the Prototype

TEXT BOOKS

1. Design Thinking: A guide to creative problem solving for everyone, Andrew Pressman, RoutledgeTaylor and Francis group, 2019, 1st edition.
2. "Design Thinking for Entrepreneurs and Small Businesses" by Beverly Rudkin Ingle, Apress.
3. "Design Thinking- The Guide Book" – Facilitated by the Royal Civil Service Commission, Bhutan.
4. Idris Mootee, "Design Thinking for Strategic Innovation", John Wiley & Sons (2013).

REFERENCE BOOKS

1. Karmic Design Thinking - A Buddhism-Inspired Method to Help Create Human-Centered Products& Services, Dr Bala Ramadurai
2. Design Thinking: A Beginners Perspective EB is written by Balagurusamy and published byMc Graw-Hill Education India
3. Design Thinking: A framework for applying Design Thinking in Problem Solving, AnujunaAgarwal Edition : 1st,2024

E-RESOURCES AND OTHER DIGITAL MATERIAL

1. https://www.arvindguptatoys.com/
2. https://honeybee.org/
3. https://dschool.stanford.edu/resources/getting-started-with-design-thinking
4. https://designthinking.ideo.com/

23PC2152A
DATA STRUCTURES LAB(Common to CSE, AI&DS, AI&ML, IT)

Course Category:	Professional core	**Credits:**	1.5
Course Type:	Lab	**Lecture -Tutorial-Practice:**	0-0-3
Prerequisites:	23ES1152 : Computer Programming Lab	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:

CO1	Analyze the role of linear data structures in organizing and accessing data efficiently in algorithms
CO2	Design, implement, and apply linked lists for dynamic data storage, demonstrating understanding of memory allocation
CO3	Develop programs using stacks to handle recursive algorithms, manage program states, and solve related problems
CO4	Apply queue-based algorithms for efficient task scheduling and breadth-first traversal in graphs and distinguish between deques and priority queues and apply them appropriately to solve data management challenges

Contribution of Course Outcomes towards achievement of Program Outcomes
(L – Low, M - Medium, H – High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	M	M	L									
CO2	M	M	L									
CO3	M	L	L									
CO4	M	M	M									

2

COURSE CONTENT

Week 1: Programs on Searching operation

Objective: Able to perform array manipulations like reversing the elements in an array and applying searching techniques like linear search and binary search.

i) Write a program to reverse an array.

ii) Write C Programs to implement the Searching Techniques – Linear & Binary Search

Week 2 : Sorting Techniques Implementation

Objective: Able to apply various sorting techniques like bubble sort, selection sort and insertion sort on an array of elements.

i. Write a C Program to implement sorting using Bubble sort.
ii. Write a C Program to implement sorting using Selection sort.
iii. Write a C Program to implement sorting using Insertion sort

Week 3: Linked List Implementation

Objective: Able to implement basic linked list operations like inserting a node, deleting a node, displaying data in the nodes of a linked list.

i) Implement a singly linked list and perform insertion, deletion and traversal operations

Week 4: Linked List Applications

Objective: Able to implement Linked list applications like polynomial addition, removal of duplicates.

i) Create a program to detect and remove duplicates from a linked list.
ii) Implement a linked list to represent polynomials and perform addition.

Week 5: Double Linked List and Circular Linked list Implementation

Objective: Able to implement various operations on doubly linked list and circular linked list.

i) Implement a doubly linked list and perform various operations to insert, delete, and traverse to understand its properties and applications.
ii) Implement a circular linked list and perform insertion, deletion, and traversal.

Week 6: Stack Operations

Objective: Able to implement various stack operations using arrays and linked lists.

i) Implement a stack using arrays and implement push, pop and traversal.
ii) Implement a stack using linked lists and implement push, pop and traversal

Week 7: Queue Operations

Objective: Able to implement various queue operations using arrays and linked lists.

i) Implement a queue using arrays to perform the insertion, deletion and traversal.
ii) Implement a queue using linked lists to perform the insertion, deletion and traversal.

Week 8: Stack and Queue Applications

Objective: Able to implement stack and queue applications

i) Use a stack to evaluate an infix expression and convert it to postfix.
ii) Create a program to determine whether a given string is a palindrome or not.
iii) Implement a stack or queue to perform comparison and check for symmetry

Week 9: Binary Search Tree Implementation

Objective: Able to construct a BST, and perform operations on it.

i) Implementing a BST using Linked List to create, insert and delete nodes.

ii) Implement BST Traversal techniques in-order, pre-order, and post-order.

Week 10: Programs on hashing

Objective: Able to implement hash tables and various collision resolution techniques.

i) Implement a hash table with collision resolution techniques.

ii) Write a program to implement a simple cache using hashing

Week 11: Programs on Graph data structures

Objective: Able to perform operations on graph.

i) Describe the operations on graph ADT and implement algorithm for Depth first search.

ii) Describe the operations on graph ADT and implement algorithm for Breath first search.

TEXT BOOKS

[1]. Data Structures and algorithm analysis in C, Mark Allen Weiss, Pearson, 2nd Edition.
[2]. Fundamentals of data structures in C, Ellis Horowitz, Sartaj Sahni, Susan Anderson- Freed, Silicon Press, 2008

REFERENCE BOOKS

[1]. Algorithms and Data Structures: The Basic Toolbox by Kurt Mehlhorn and Peter Sanders
[2]. C Data Structures and Algorithms by Alfred V. Aho, Jeffrey D. Ullman, and John E. Hopcroft
[3]. Problem Solving with Algorithms and Data Structures" by Brad Miller and David Ranum
[4]. Introduction to Algorithms by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein
[5]. Algorithms in C, Parts 1-5 (Bundle): Fundamentals, Data Structures, Sorting, Searching, and Graph Algorithms by Robert Sedgewick

E-RESOURCES AND OTHER DIGITAL MATERIAL

[1]. SudarshanIyengar: IIT Ropar, Data Structures and Algorithms, [NPTEL], (26, May, 2021) Available: http://nptel.ac.in/
[2]. Erik Demaine, Advanced Data Structures [MIT- OpenCourseWare], (26, May, 2021) Available: http://ocw.mit.edu/
[3]. Prof. Naveen Garg, IIT Delhi, Introduction to Data Structures and Algorithms, https://nptel.ac.in/courses/106102064
[4]. Data Structures and applications on, [Geeksforgeeks], (25, May, 2021) Available: https://www.geeksforgeeks.org/data-structures/

23PC2152B
ENGINEERING MECHANICS & BUILDING PRACTICES LAB (CE)

Course Category:	Engineering Science	**Credits:**	1.5
Course Type:	Laboratory	**Lecture -Tutorial-Practice:**	0 - 0 - 3
Prerequisites:	Basic Mathematics and Science.	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:

CO1	Verify the fundamentals involved in the applications of Engineering Mechanics.
CO2	Demonstrate the safety practices adopted in construction industry and documentation aspects of quality testing of civil engineering materials
CO3	Illustrate the purpose and working of different tools and materials used in construction along with understanding the plumbing services in building

Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	**L**	**H**	**H**	**H**					**M**			
CO2	**H**	**L**	**M**		**H**	**M**	**M**	**L**	**M**		**M**	**M**
CO3	**M**	**L**	**L**		**M**	**M**	**H**		**M**			**M**

COURSE CONTENT

List of Experiments

1. Examine the forces in Pin Jointed Trusses
2. Experimental Proof of Lami's Theorem
3. Verification of Law of Parallelogram of Forces.
4. You are appointed as a site engineer for constructing a small-scale project using various construction tools. You must carefully select the tools based on their functionality and efficiency to ensure the successful completion of the project.
5. You are a member of a research team assigned to investigate the feasibility and potential benefits of using alternative materials such as M-sand, fly ash, and sea sand in concrete production. Your objective is to evaluate the performance of these alternative materials as substitutes for traditional aggregates and cement in concrete mixes.
6. You are leading a research project investigating the compressive strength of different types of bricks

commonly used in construction. Your objective is to evaluate the performance of various brick types under compressive loading conditions and assess their suitability for different construction applications.

7. You, as a civil engineering student, are currently engaged in a field tour to a construction site where quality testing reports for concrete samples have been carried out. You must analyze and interpret quality testing findings to determine the concrete's performance in the construction project.
8. You have been appointed as a member of a safety task force with the objective of enhancing safety protocols at a construction site. Your objective is to perform a safety audit and implement methods to reduce risks and improve safety standards of the construction site.
9. You are a civil engineering student tasked with conducting non-destructive testing (NDT) techniques using rebound hammer and ultrasonic pulse velocity (UPV) methods to assess the quality and integrity of concrete structures. Your objective is to study the principles and applications of these NDT techniques and showcase their effectiveness in evaluating the strength and durability of concrete.
10. You are a civil engineering student tasked with designing the plumbing system for a residential building. Your objective is to ensure the efficient and reliable distribution of potable water and the safe disposal of wastewater throughout the building while complying with relevant codes and standards.

TEXT BOOKS

[1] S. Timoshenko, D. H. Young, J.V. Rao, S. Pati., Engineering Mechanics, 5th Edition, McGrawHill Education.

[2] Non-Destructive Testing for concrete-Method of test- IS 13311(Part- 2): 1992

[3] Khanna P. N., Civil Engineering Handbook, Engineers' Publishers.

REFERENCE BOOKS

[1] Hibbeler R.C., Engineering Mechanics: Statics and Dynamics, 14th Edition, Pearson Education,Inc., New Delhi, 2022

[2] Sandeep Mantri, The A to Z of Practical Building Construction and Its Management, Satya prakashan publishers, New Delhi.

23PC2152C
NETWORK ANALYSIS AND SIMULATION LABORATORY
(For ECE & EIE)

Course Category:	Engineering Science	**Credits:**	1.5
Course Type:	Practical	**Lecture -Tutorial-Practice:**	0 - 0 - 3
Prerequisites:	Basic Electrical & Electronics Engineering Workshop Lab	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:

CO1	Verify Kirchoff's laws and network theorems.
CO2	Measure time constants of RL & RC circuits.
CO3	Analyze behavior of RLC circuit for different cases.
CO4	Design resonant circuit for given specifications.
CO5	Characterize and model the network in terms of all network parameters

Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2
CO1	**H**				**H**				**H**					
CO2	**H**	**M**			**H**				**H**					
CO3	**H**	**M**			**H**				**H**					
CO4	**H**	**L**			**H**				**H**					
CO5	**H**				**H**				**H**					

COURSE CONTENT

The following experiments need to be performed using both Hardware and simulation Software.

1. Study of components of a circuit and Verification of KCL and KVL.
2. Verification of mesh and nodal analysis for AC circuits
3. Verification of Superposition, Thevenin's & Norton theorems for AC circuits
4. Verification of maximum power transfer theorem for AC circuits

5. Verification of Tellegen's theorem for two networks of the same topology.
6. Study of DC transients in RL, RC and RLC circuits
7. To study frequency response of various 1st order RL & RC networks
8. To study the transient and steady state response of a 2nd order circuit by varying its various parameters and studying their effects on responses
9. Find the Q Factor and Bandwidth of a Series and Parallel Resonance circuit.
10. Determination of open circuit (Z) and short circuit (Y) parameters
11. Determination of hybrid (H) and transmission (ABCD) parameters
12. To measure two port parameters of a twin-T network and study its frequency response.

TEXT BOOKS

1. Network Analysis – ME Van Valkenburg, Prentice Hall of India, revised 3rd Edition, 2019.
2. Engineering Circuit Analysis by William H. Hayt, Jack Kemmerly, Jamie Phillips, Steven M. Durbin, 9th Edition 2020.
3. Network lines and Fields by John. D. Ryder 2nd Edition, PHI

REFERENCE BOOKS

1. D. Roy Choudhury, Networks and Systems, New Age International Publications, 2013.
2. Joseph Edminister and Mahmood Nahvi, Electric Circuits, Schaum's Outline Series,7th Edition, Tata McGraw Hill Publishing Company, New Delhi, 2017
3. Fundamentals of Electric Circuits by Charles K. Alexander and Matthew N. O. Sadiku, McGraw-Hill Education.

E-RESOURCES AND OTHER DIGITAL MATERIAL

1. https://asnm-iitkgp.vlabs.ac.in/List%20of%20experiments.html

23PC2152D
ELECTRICAL CIRCUIT ANALYSIS LAB
(For EEE Department)

Course Category:	Program Core	**Credits:**	1.5
Course Type:	Practical	**Lecture -Tutorial-Practice:**	0 - 0 - 3
Prerequisites:	Basic Electrical and Electronics Engineering Workshop	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:

CO1	**Design** and conduct experiments.
CO2	**Analyze** and present experimental results**.**
CO3	**Exhibit** professional behavior.

Contribution of Course Outcomes towards the Achievement of Program Outcomes (L – Low, M - Medium, H – High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	**H**		**H**	**L**	**L**						**H**	
CO2			**H**							**H**	**H**	
CO3			**H**							**H**		

List of Experiments

1. Verification of Kirchhoff's circuit laws.
2. Verification of node and mesh analysis.
3. Verification of network reduction techniques.
4. Determination of cold and hot resistance of an electric lamp
5. Determination of Parameters of a choke coil.
6. Determination of self, mutual inductances, and coefficient of coupling
7. Series and parallel resonance
8. Locus diagrams of R-L and R-C series circuits
9. Verification of Superposition theorem
10. Verification of Thevenin’s and Norton’s Theorems

11. Verification of Maximum power transfer theorem
12. Verification of Compensation theorem
13. Verification of Reciprocity and Millman's Theorems

NOTE: A minimum of ten experiments are to be conducted.

REFERENCE BOOKS

[1]. Jack Kemmerly, William Hayt, and Steven Durbin, "Engineering Circuits Analysis", sixth edition, Tata Mc Graw Hill Education, 2005.
[2]. M. E. Van Valkenburg, "Network Analysis", Revised Third Edition, Pearson Education, 2019.

E-RESOURCES AND OTHER DIGITAL MATERIAL

1. http://vlabs.iitkgp.ac.in/asnm/
2. https://asnm-iitkgp.vlabs.ac.in/List%20of%20experiments.html

23PC2152E
ENGINEERING MECHANICS LAB
(Mechanical Engineering & allied branches)

Course Category:	Institutional Core	**Credits:**	1.5
Course Type:	Theory	**Lecture -Tutorial-Practice:**	0 - 0 - 3
Prerequisites:	10 + 2 level Physics	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:

CO1	Evaluate the coefficient of friction between two different surfaces and between the inclined plane and the roller.
CO2	Verify Law of Polygon of forces and Law of Moment using force polygon and bell crank lever.
CO3	Determine the Centre of gravity and Moment of Inertia of different configurations. CO4: Verify the equilibrium conditions of a rigid body under the action of different force systems.

Contribution of Course Outcomes towards achievement of Program Outcomes
(L – Low, M - Medium, H – High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	**H**	**M**										
CO2	**H**	**M**										
CO3	**H**											

COURSE CONTENT:

1. Verification of Law of Parallelogram of Forces.
2. Verification of Law of Triangle of Forces.
3. Verification of the Law of polygon for coplanar-concurrent forces acting on a particle in equilibrium and to find the value of unknown forces considering particle to be in equilibrium using universal force table.
4. Determination of coefficient of Static and Rolling Frictions
5. Determination of Centre of Gravity of different shaped Plane Lamina.
6. Verification of the conditions of equilibrium of a rigid body under the action of coplanar non-concurrent, parallel force system with the help of a simply supported beam.

7. Study of the systems of pulleys and draw the free body diagram of the system.
8. Determine the acceleration due to gravity using a compound pendulum.
9. Determine the Moment of Inertia of the compound pendulum about an axis perpendicular to the plane of oscillation and passing through its centre of mass.
10. Determine the Moment of Inertia of a Flywheel.
11. Verification of Law of Moment using Rotation Disc Apparatus and Bell Crank Lever.

REFERENCE BOOKS

[1]. S. Timoshenko, D. H. Young, J.V. Rao, S. Pati., Engineering Mechanics, 5th Edition, McGraw Hill Education.

[2]. Hibbeler R.C., Engineering Mechanics: Statics and Dynamics, 14th Edition, Pearson Education, Inc., New Delhi, 2022

VELAGAPUDI RAMAKRISHNASIDDHARTHA ENGINEERING COLLEGE

DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING

SCHEME OF INSTRUCTION FOR FOUR YEAR UG PROGRAMME

VR23

Second Year –Third & Fourth Semester Syllabus

Effective from 2023-24

Velagapudi Ramakrishna Siddhartha Engineering College

ELECTRONICS & INSTRUMENTATION ENGINEERING

Scheme of Instructions for Four Year B.Tech Programme-VR23

SEMESTER I **CONTACT HOURS: 26**

S. No	Course Code	Course	Subject	L	T	P	Credits
1.	23BS1101	Basic Science	Linear Algebra & Calculus	3	0	0	3
2.	23BS1102B	Basic Science	Engineering Chemistry	3	0	0	3
3.	23ES1103B	Engineering Science	Basic Electrical & Electronics Engineering	3	0	0	3
4.	23ES1104	Engineering Science	Introduction to Programming	3	0	0	3
5.	23ES1105	Engineering Science	Engineering Graphics	1	0	4	3
6.	23BS1151B	Basic Science	Chemistry Lab	0	0	2	1
7.	23ES1152	Engineering Science	Computer Programming Lab	0	0	3	1.5
8.	23HS1153	Engineering Science	Basic Electrical and Electronics Workshop	0	0	3	1.5
9.	23ES1154B	Basic Science	Health and wellness, Yoga and Sports	0	0	1	1.5
Total				**13**	**0**	**13**	**19.5**
10.	23MC1106	Mandatory Course	Induction Program				**-**

Category	Credits
Basic Science Courses	3+3+1+0.5=7.5
Engineering Science Courses	3+3+3+1.5+1.5=12
Humanities and Social Science	0
Mandatory Courses	0
TOTAL CREDITS	**19.5**

SEMESTER II **CONTACT HOURS: 27**

S.No	Course Code	Course	Subject	L	T	P	Credits
1.	23BS2101	Basic Science	Differential Equations & Vector Calculus	3	0	0	3
2.	23BS2102	Basic Science	Engineering Physics	3	0	0	3
3.	23ES2103	Engineering Science	Basic Civil and Mechanical Engineering	3	0	0	3
4.	23PC2104C	Professional Core	Network Analysis	3	0	0	3
5.	23HS2105	Basic Science	Communicative English	2	0	0	2
6.	23BS2151	Basic Science	Engineering Physics Lab	0	0	2	1
7.	23PC2152C	Professional Core	Network Analysis & Simulation Lab	0	0	3	1.5
8.	23HS2153	Basic Science	Communicative English Lab	0	0	2	1
9.	23EC2154	Engineering Science	Engineering Workshop	0	0	3	1.5
10.	23EC2155	Engineering Science	IT Work shop	0	0	2	1
11.	23EC2156	Basic Science	NSS/NCC/Community Service	-	-	1	0.5
Total				**14**	**0**	**13**	**20.5**

Category	Credits
Basic Science Courses	3+3+1+0.5=7.5
Engineering Science Courses	3+1.5+1=5.5
Humanities and Social Science	2+1=3
Mandatory Courses	0
Professional Core	3+1.5=4.5
TOTAL CREDITS	**19.5**

II Year I Semester (Semester III) **CONTACT HOURS: 28**

S.No	Course Code	Course	Subject	L	T	P	Credits
1.	23BS3101C	Basic Science	Complex Analysis and Numerical Methods	3	0	0	3
2.	23HS3102	Humanities and Social Sciences	Universal Human Values – Understanding Harmony	2	1	0	3
3.	23ES3103F	Engineering Science	Analog Electronic Circuits	2	0	0	2
4.	23EI3304	Professional Core	Digital Circuits and Systems	3	0	0	3
5.	23EI3305	Professional Core	Sensors and Transducers	3	0	0	3
6.	23TP3106	Soft Skills - 1	Logic and Reasoning	0	0	2	1
7.	23MC3107	Audit	Environmental Science	2	0	0	-
8.	23EI3651	Skill Enhancement	Numerical Computing using MATLAB	0	0	2	1
9.	23ES3152	Engineering Science	Electronic Circuits Lab	0	0	2	1
10.	23EI3353	Professional Core	Digital System Design Lab	0	0	3	1.5
11.	23EI3354	Professional Core	Transducers Lab	0	0	3	1.5
			Total	**15**	**1**	**12**	**20**

Category	Credits
Basic Science Courses	3
Engineering Science Courses	2+1=3
Humanities and Social Science	3
Mandatory Courses	-
Professional Core	3+3+1.5+1.5 =9
Elective: Skill Enhancement course	1+1= 2
TOTAL CREDITS	**20**

II Year II Semester (Semester IV) **CONTACT HOURS: 28**

S.No	Course Code	Course	Subject	L	T	P	Credits
1.	23HS4101	Humanities and Social Sciences	Engineering Economics and Management	2	0	0	2
2.	23ES4102C	Engineering Science	Linear Integrated Circuits and Applications	2	0	0	2
3.	23EI4303	Professional Core	Control Systems	3	0	0	3
4.	23EI4304	Professional Core	Industrial Instrumentation	3	0	0	3
5.	23EI4305	Professional Core	Electrical and Electronic Measurements	3	0	0	3
6.	23TP4106	Soft Skills - 2	English for Professionals	0	0	2	1
7.	23EI4651	Skill Enhancement course	Virtual Instrumentation Lab	0	0	2	1
8.	23ES4152	Engineering Science	Design Thinking & Innovation	1	0	2	2
9.	23EI4353	Professional Core	Linear Integrated Circuits Lab	0	0	3	1.5
10.	23EI4354	Professional Core	Control Systems Lab	0	0	2	1
11.	23EI4355	Professional Core	Measurements Lab	0	0	3	1.5
Total				**14**	**0**	**14**	**21**

Category	Credits
Basic Science Courses	-
Engineering Science Courses	2
Humanities and Social Science	2+2 =4
Mandatory Courses	-
Professional Core	3+3+3+1+1.5+1.5 =13
Elective: Skill Enhancement course	1+1= 2
TOTAL CREDITS	**21**

Second Year
(III Semester)

23BS3101C - Complex Analysis and Numerical Methods

Course Category:	Basic Science	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3 - 0- 0
Prerequisites:	23BS1101LinearAlgebra & Calculus 23BS2101DifferentialEquations& Vector Calculus	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

Course outcomes	Upon successful completion of the course, the student will be able to:														
	CO1	Determine analytic, non-analytic functions and evaluate complex integrals													
	CO2	Analyze Taylor, Laurent series and apply residue theorem for computing real definite integrals													
	CO3	Find solutions for algebraic, transcendental equations and estimate functions using polynomial interpolation													
	CO4	Solve initial value problems numerically													
Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
	CO1	3	2													
	CO2	3	2													
	CO3	3	2			2								L		
	CO4	3	2			2								L		

Course Content

UNIT- I

Complex Analysis: Introduction, Continuity, Cauchy-Riemann equations. Analytic functions, Harmonic functions, Orthogonal systems, Applications to flow problems, Complex integration, Cauchy's integral theorem, Cauchy's integral formula

UNIT- II

Taylor's series, Laurent's series, Zeros and Singularities of an analytic function, Residue theorem, Calculation of Residues, Evaluation of real definite integrals:(i) Integration around the unit circle (ii) Integration around a small semi-circle, Bilinear transformation

UNIT- III

Numerical Methods & Interpolation: Solution of Algebraic and Transcendental Equations with Newton - Raphson method, Interpolation Introduction, Finite Differences-Forward, Backward and Central differences, Symbolic Relations, Newton’s interpolation formulae-forward and backward differences, Central difference interpolation formulae-Gauss’s, Stirling’s, Bessel’s formulae, Interpolation with unequal intervals - Lagrange’s and Newton’s divided difference formulae

	UNIT- IV **Numerical Differentiation:** First and second order derivatives using Newton's forward and backward difference formulae, Numerical integration with Trapezoidal rule and Simpsons 1/3 Rule, Numerical Solutions of Differential Equations-Taylor's series method, Euler's method, Modified Euler's method and Runge - Kutta method of 4th order.
Text books and Reference books	**Text Book:** [T1] B.S.Grewal, "Higher Engineering Mathematics", 44th Ed., Khanna Publishers, 2019 **Reference Books:** [R1] Erwin Kreyzig, "Advanced Engineering Mathematics", 10th Ed., John Wiley & Sons, 2015. [R2] R.K.Jain, S.R.K.Iyengar, "Advanced Engineering Mathematics", 5th Ed., Narosa Publishers, 2016. [R3] N.P.Bali, Manish Goyal, "A Textbook of Engineering Mathematics", 9th Ed., Lakshmi Publications (P) Limited, 2016. [R4] H. K. Das, Er. Rajnish Verma, "Higher Engineering Mathematics", 3rd Revised Ed., S.Chand & Co., 2014. [R5] S. S. Sastry, "Introductory Methods of Numerical Analysis", 5th Ed., PHI Learning, 2012.
E-resources and other digital material	1. Prof.Pranav Haridas, Kerala School of Mathematics, Complex Analysis, Available: https://onlinecourses.nptel.ac.in/noc21_ma39/preview 2. Prof. Ameeya Kumar Nayak, Sanjeev Kumar, IIT Roorkee, Numerical methods, Available: https://onlinecourses.nptel.ac.in/noc21_ma45/preview 3. Jeremy Orloff, Massachusetts Institute of Technology: MIT Open Courseware, Complex Variables with Applications, Available: https://ocw.mit.edu. 4. Henrik Schmidt, Massachusetts Institute of Technology: MIT Open Courseware, Introduction to Numerical Analysis for Engineering, Available: https://ocw.mit.edu.

23HS3102 – Universal Human Values – Understanding Harmony

Course Category:	Humanities and Social Sciences	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	2 - 1- 0
Prerequisites:		**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

Course outcomes	Upon successful completion of the course, the student will be able to:														
	CO1	Understand and aware of themselves and their surroundings (family, society and nature).													
	CO2	Handle problems with sustainable solutions, while keeping human relationships and human nature in mind													
	CO3	Exhibit critical ability and become sensitive to their commitment towards their understanding of human values, human relationship and human society													
	CO4	Apply what they have learnt to their own self in different day-to-day settings in real life													
Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PSO 3
	CO1						1			1						
	CO2			3												
	CO3						2									
	CO4								3				2			
Course Content	**UNIT- I** **Course Introduction, Need, Basic Guidelines, Content and Process for Value Education:** **Part-1**: Purpose and motivation for the course, recapitulation from UHV-I, 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. **Part-2**: 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. (Practice sessions are to be included 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). **UNIT- II** **Understanding Harmony in the Human Being – Harmony in Myself:** **Part-1**: Understanding human being as a co-existence of the sentient 'I' and the material 'Body'. Understanding the needs of self ('I') and 'body' – Happiness and physical facility, Understanding the body as an instrument of 'I' (I being the doer, seer and enjoyer). **Part-2**: Understanding the characteristics and activities of 'I' and harmony in 'I'. Understanding the harmony of I with the body: Sanyam and health; Correct appraisal of physical needs, Meaning of prosperity in detail, Programs to ensure sanyam and health. (Practice sessions are to be included to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs. dealing with disease). **UNIT- III** **Understanding Harmony in the Family and Society – Harmony in Human-Human Relationship:** **Part-1:** 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, Understanding the meaning of trust; Difference between intention and competence, Understanding the meaning of respect, Difference between respect and differentiation; The other salient values in relationship. **Part-2**: Understanding 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. (Practice sessions are to be included to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education, etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives). **UNIT- IV** **Part-1: Understanding Harmony in Nature & 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. **Part-2: 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. (Part-1: Practice sessions are to be included to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology, etc. Part-2: Practice exercises and case studies are to be taken up in practice (tutorial) sessions eg. to discuss the conduct as an engineer or scientist, etc.).
Text books and Reference books	**Text Book:** [T1] R. R. Gaur, R. Sangal and G. P. Bagaria, "Human Values and Professional Ethics", Excel Books Private Limited, New Delhi (2010). **Reference Books:** [R1] A. Nagaraj, Jeevan Vidya Prakashan, Amarkantak, "Raman Jeevan Vidya: Ek Parichaya (1999). [R2] A. N. Tripathi, "Human Values", New Age International Publishers, New Delhi (2004). [R3] Annie Leonard, "The Story of Stuff: The Impact of Overconsumption on the Planet, our Communities, and our Health and how we can make it better",Free Press, New York (2010). [R4] Mohandas Karamchand Gandhi, "The Story of my Experiments with Truth: Mahatma Gandhi Autobiography", B. N. Publishing (2008). [R5] E. F. Schumacher, "Small is Beautiful: A Study of Economics as if People Mattered", Vintage Books, London (1993). [R6] Cecile Andrews, "Slow is Beautiful: New Visions of Community", New Society Publishers, Canada (2006). [R7] J. C. Kumarappa, "Economy of Permanence", Sarva-Seva-Sangh Prakashan Varanasi (2017). [R8] Angreji Raj, Pandit Sunderlal, Prabhath Prakashan, "Bharat Mein"Delhi (2018). [R9] Dharampal, "Rediscovering India Society for Integrated Development of Himilayas" (2003).

	[R10] M. K. Gandhi, "Hind Swaraj or Indian Home Rule",Navajivan Publishing House, Ahmedabad (1909) [R11] Maulana Abul Kalam Azad, "India Wins Freedom: The Complete Version",Orient Blackswan (1988). [R12] Romain Rolland, "The Life of Vivekananda and the Universal gospel",Advaitha Ashrama, India (2010). [R13] Romain Rolland, "Mahatma Gandhi: The Man who become one with the Universal Being", Srishti Publishers &Distributors, New Delhi (2002).
E-resources and other digital material	1. AICTE – SIP Youtube Channel https://www.youtube.com/channel/UCo8MpJB_aaVwB4LWLAx6AhQ 2. AICTE – UHV Teaching Learning Material https://fdp-si.aicte-india.org/download.php#1

23ES3103F – Analog Electronic Circuits

Course Category:	Engineering Science	**Credits:**	2
Course Type:	Theory	**Lecture - Tutorial - Practice:**	2 - 0- 0
Prerequisites:	Basic Electronics, Network Theory	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

Course outcomes	Upon successful completion of the course, the student will be able to:														
	CO1	Analyze various stability biasing techniques in BJT and FET													
	CO2	Analyze amplifier circuits at low frequencies													
	CO3	Design different oscillator circuits													
	CO4	Analyze various power amplifier circuits with respect to efficiency													
	CO5	Develop analog electronic circuits using modern tools													
Contribution of Course Outcomes towards achievement of Program Outcomes **(L – Low, M – Medium, H – High**		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
	CO1		3												2	
	CO2	3													2	
	CO3			2											2	
	CO4		2												2	
	CO5					2										2

Course Content

UNIT- I

Transistor & FET Biasing: Introduction**,** Operating point, Biasing circuits - Fixed bias, Collector to base bias, Self bias; Stability factors, Bias compensation circuits - Diode compensation for V_{BE} and I_{CO}, Thermistor and Sensistor compensation; Thermal runaway and thermal stability, JFET biasing circuits - Fixed bias, Voltage divider bias.

UNIT- II

Transistor Amplifiers at Low frequencies

BJT Amplifiers: Hybrid parameter model of transistor, Analysis of transistor amplifier using h parameter model, Simplified CE hybrid model, Simplified calculations for CC & CB configurations, Cascaded stage (CE-CE), Cascode (CE-CB), Darlington Pair(CC-CC).

FET Amplifiers: FET small signal model, Analysis of FET amplifiers at low frequencies - CS/CD/CG configurations.

UNIT- III

Feedback Amplifiers:

Feedback concepts, General characteristics of Negative feedback Amplifiers, Input resistance & output resistance, Method of analysis of feedback amplifiers - Voltage series, Current series, Voltage shunt, Current shunt feedback amplifiers.

Oscillators:
Classification of Oscillators, Sinusoidal oscillators, Barkhausen criteria, RC phase shift

	oscillator using BJT, Wein bridge oscillator, LC oscillators- Hartley and Colpitts Oscillator. **UNIT- IV** **Power Amplifiers**: Classification of Power amplifiers, Class A series fed and Transformer Coupled, Second Harmonic distortion, Class B Transformer coupled Push-Pull and Complementary Symmetry Push-Pull, Cross over distortion.
Text books and Reference books	**Text Book** [1] Jacob Millman and Christos C Halkias, "Integrated Electronics: Analog and Digital Circuits and Systems", 12th ed, TMH, 1991. [2] G.K.Mithal, "Electronic Devices and circuits", 23rd ed, Khanna Publishers 2010. **Reference books** [1]A.P.Godse and U.A.Bakshi "Electronic Circuit Analysis", 1st ed, fourth reprint, Technical Publications,2010. [2] Robert Boylestad and Louis Nashelsky, "Electronic Devices and Circuit Theory", 6th ed, PHI 2000.
E-resources and other digital material	http://nptel.iitm.ac.in/courses.php?branch=Ece

23EI3304 – Digital Circuits and Systems

Course Category:	Professional Core	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3 - 0- 0
Prerequisites:		**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course outcomes	Upon successful completion of the course, the student will be able to:														
	CO1	Analyze digital electronic circuits using analytical tools													
	CO2	Design digital electronic circuits with and without memory elements													
	CO3	Select suitable memories and logic families for digital system design													
	CO4	Use the spice software to design the digital electronic circuits													
Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
	CO1		3												1	
	CO2		3												2	
	CO3	2													1	
	CO4					2										2

Course Content

UNIT- I

Digital Fundamentals: 1's and 2's complements, Minterms and Maxterms, Canonical forms, Standard forms, Simplification of Boolean functions using algebraic techniques Karnaugh map minimization and Quine-McCluskey method of minimization.

UNIT- II

Combinational Logic Design: Parallel adder, Carry Look-ahead adder, Half - Subtractor, Full - Subtractor, BCD to 7 segment decoder, Design of a Binary to G++ray and Gray to Binary code converters

Combinational Logic Design Using MSI Circuits: Multiplexer, Combinational logic design using multiplexers, Demultiplexers / Decoders and their use in combinational logic design, Encoders, Priority encoder.

	UNIT- III **Flip-Flops**: Clocked S-R flip-flop, Preset and clear, J-K flip-flop, Race around condition, Master slave J-K flip-flop, D flip-flop, T flip-flop, Excitation table of a flip-flop, Flip-Flop conversions. **Sequential Logic Design**: Shift register, Bi-directional shift register, Applications of shift resisters: Ring counter, Twisted ring counter, Sequence generator. Asynchronous counters – Up/Down counters, Modulus of the counter, Design of synchronous counters. **UNIT- IV** **Memory Devices**: Functional block diagram and operation - ROM, PROM, EPROM, EEPROM, Flash memory, RAM: Static and dynamic RAM, ROM as a PLD, PAL and PLA Programming. **Digital Integrated Circuits**: Characteristics of Digital ICs, Logic Families: MOS and CMOS logic families
Text books and Reference books	**Text Book:** [T1] R P Jain "Modern Digital Electronics", 4th Ed., TMH **Reference Books:** [R1] M. Morris Mano, "Digital Logic and Computer Design", PHI,2003 [R2] A. Anand Kumar, "Fundamentals of Digital Circuits", PHI, 2006
E-resources and other digital material	

23EI3305 – Sensors and Transducers

Course Category:	Professional Core	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3 - 0- 0
Prerequisites:		**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

Course outcomes	Upon successful completion of the course, the student will be able to:															
	CO1	Analyze various performance characteristics of instrument and the quality of measurement.														
	CO2	Identify the type of transducer based on transduction principles														
	CO3	Select a relevant transducer for measurement of various physical parameters														
	CO4	Apply the concepts of signal conditioning circuit for various transducers														
Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
	CO1		2											1		
	CO2	2												1		
	CO3		3											2		
	CO4	2														1
Course Content	**UNIT- I** **Instrument Characteristics:** Block diagram of generalized instrument system, Static characteristics - Desirable & Undesirable characteristics; Dynamic characteristics - Transfer function, Dynamic response of Zero order, First order and Second order instruments to step input. **Measurement Errors and Statistical Analysis:** Definition of parameters, Combination of limiting error, Statistical treatment, Curve fitting methods **UNIT- II** **Transducers:** Classification of transducers, Characteristics of transducers. **Variable Resistance Transducers**: Principle of operation, Construction details, Characteristics and applications of Resistance potentiometers, Strain gauge, Resistance thermometer, Thermistors, Hot-wire anemometer, Resistive hygrometer and Signal conditioning of resistive transducers															

	UNIT- III **Reactance Transducers** **Variable Inductance Transducers**: Principle of operation, Construction, Characteristics and applications of LVDT - RVDT, Variable reluctance accelerometer, Signal conditioning of inductive transducers **Capacitive Transducers** – Principle of operation, Construction, Characteristics and applications of Variable air gap, Variable distance, Variable permittivity capacitive transducer, Frequency response, Signal conditioning of capacitive transducers **UNIT- IV** **Special Sensors:** Introduction, Smart sensors, Micro Sensors, IR radiation Sensors, Ultrasonic Sensors, Fiber optic sensors, Colour sensor, Proximity sensors, Chemical sensor, IC sensor, Bio Sensors.
Text books and Reference books	**Text Book:** [T1] A.K.Sawhney & Puneet Sawhney,"A Course In Electrical And Electronic Measurements And Instrumentation", 19th Ed., Dhanapat Rai & Co., 2015 [T2] D.V.S.Murty, "Transducers & Instrumentation", 2nd Ed., PHI, 2013 **Reference Books:** [R1]A.K.Ghosh, "Introduction to Measurements & Instrumentation",3rd Ed., PHI, 2009 [R2] Raman Pallas & John G.Webster, "Sensors & Signal Conditioning", 2nd Ed., J. Wiley,2012
E-resources and other digital material	1. https://nptel.ac.in/courses/108/108/108108147

23TP3106 – Logic and Reasoning

Course Category:	Soft Skills-1	**Credits:**	1
Course Type:	Learning by Doing	**Lecture - Tutorial - Practice:**	0 - 0- 2
Prerequisites:		**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	100 0 100

Course outcomes	Upon successful completion of the course, the student will be able to:														
	CO1	Think reason logically in any critical situation													
	CO2	Analyze given information to find correct solution													
	CO3	To reduce the mistakes in day to day activities in practical life													
	CO4	Develop time management skills by approaching different shortcut methods													
	CO5	Use mathematical based reasoning to make decisions													
	CO6	Apply logical thinking to solve problems and puzzles in qualifying exams for companies and in other competitive exams													
Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
	CO1						2									
	CO2		2													
	CO3								2							
	CO4									2						
	CO5	2														
	CO6	1														
Course Content	**UNIT- I** 1. Series Completion 2. Coding-Decoding 3. Blood Relation Blood 4. Puzzles test 5. Direction sense test **UNIT- II** 1. Logical Venn diagrams														

	2. Number test, Ranking test 3. Mathematical operations 4. Arithmetical Reasoning 5. Syllogism **UNIT- III** 1. Binary Logic 2. Inserting missing character 3. Data sufficiency 4. Analogy 5. Classification **UNIT- IV** 1. Water images, 2. Mirror images, 3. Paper folding, 4. Paper cutting, 5. Embedded Figures, 6. Dot situation, 7. Cubes & Dice
Text books and Reference books	**Text Book:** [T1] S. Aggarwal, "Verbal and Non-Verbal reasoning", S Chand Publication, 2017
E-resources and other digital material	1. https://www.indiabix.com/ 2. https://treeknox.com/ 3. https://www.examveda.com/

23MC3107 – Environmental Science

Course Category:	Audit Course	**Credits:**	-
Course Type:	Theory	**Lecture - Tutorial - Practice:**	2 - 0- 0
Prerequisites:		**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	100 0 100

Course outcomes	Upon successful completion of the course, the student will be able to:														
	CO1	Identify various factors causing degradation of natural resource and control measures													
	CO2	Identify various ecosystem and need for biodiversity													
	CO3	Realize and explore the problems related to environmental pollution and its management													
	CO4	Apply the information and technology to analyse social issues, use acts associated with environment													
Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
	CO1	1							1							
	CO2		1	1							1					
	CO3				1	1										
	CO4						1	1	1							

Course Content

UNIT- I

The multidisciplinary nature of environmental studies, Definition, Scope and importance, Need for public awareness.

Natural Resources :

Renewable and Non-renewable Resources: Natural resources and associated problems.

(a)**Forest resources**: Use and over-exploitation, Deforestation. Timber extraction, Mining, Dams and their effects on forests and tribal people.

(b) **Water Resources**: Use and over-utilization of surface and ground water, Floods, Drought, Conflicts over water, Dams-benefits and problems.

(c) **Mineral Resources**: Use and exploitation, Environmental effects of extracting and using mineral resources.

(d) **Food Resources:** World food problems, Changes caused by agriculture and overgrazing, Effects of modern agriculture, Fertilizer-pesticide problems, Water logging, Salinity.

	(e) Energy Resources: Growing energy needs, Renewable and non-renewable energy sources, Use of alternate energy sources. **(f) Land Resources:** Land as a resource, Land degradation, Man induced landslides, Soil erosion and desertification. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles **UNIT- II** **Ecosystems:** Concept of an ecosystem. Structure and function of an ecosystem. Producers, Consumers and decomposers. Energy flow in the ecosystem. Ecological succession. Food chains, Food webs and ecological pyramids. Introduction, Types, Characteristic features, Structure and function of the following ecosystem: (a) Forest ecosystem (b)Grassland ecosystem (c)Desert ecosystem (d)Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) **Biodiversity and its Conservation** Introduction, Definition: Genetic, Species and ecosystem diversity. Biogeographically classification of India. Value of biodiversity: Consumptive use, Productive use, Social, Ethical, Aesthetic and option values. Biodiversity at global, National and local levels. India as a mega-diversity nation. Hot-spots of biodiversity. Threats to biodiversity: Habitat loss, Poaching of wildlife, Man-wildlife conflicts. Endangered and endemic species of India. Conservation of biodiversity: in-situ and ex-situ conservation of biodiversity **UNIT- III** **Environmental Pollution:** Definition, Causes, Effects and control measures of (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards **Solid waste management:** Causes, Effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution. **Disaster management**: Floods, Earthquake, Cyclone and landslides **UNIT- IV** **Social Issues and the Environment:** From unsustainable to sustainable development. Urban problems related to energy. Water conservation, Rain water harvesting, Watershed management. Resettlement and rehabilitation of people; Its problems and concerns. **Environmental ethics** Issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Wasteland reclamation, Consumerism and waste products. **Environment Protection Act:** Air (Prevention and control of pollution) act. Water

	(Prevention and control of pollution) act. Wildlife protection act. Forest conservation act. Issues involved in enforcement of environmental legislation. **Public awareness:** Human population and the environment, Population growth, Variation among nations, Population explosion - Family Welfare Programme. **Environment and Human Health:** Human rights, Value education, HIV/AIDS, Women and child welfare, Role of information technology in environment and human health. **Field Work/ Case Studies:** Visit to a local area to document environmental assets – River/ Forest/ Grassland/ Hill/ Mountain. Visit to a local polluted site – Urban/Rural/Industrial/Agricultural. Study of common plants, insects, birds. Study of simple ecosystems - Pond, river, hill slopes, etc. **Self-Study**: Water resources, Threats to biodiversity, Solid waste management, Role of information technology in environment and human health
Text books and Reference books	**Text Book:** [T1] "Grants Commission", New Delhi, Bharati Vidyapeeth Institute of Environment Education and Research **Reference Books:** [R1]AnjaneyuluY. "Introduction to Environmental Sciences", B S Publications PVT Ltd, Hyderabad [R2].Anjireddy.M "Environmental Science & Technology", BS Publications PVT Ltd, Hyderabad. [R3]Benny Joseph, "Environmental Studies", The Tata McGraw- Hill publishing company limited, New Delhi, 2005. [R4]. P.VenuGopalaRao, "Principles of Environmental Science. &Engineering", Prentice-Hall of India Pvt. Ltd., New Delhi, 2006. [R5]Santosh Kumar Garg, RajeswariGarg, "Ecological and Environmental Studies", Khanna Publishers, New Delhi 2006. [R6] Kurian Joseph & R Nagendran, "Essentials of Environmental Studies",Pearson Education publishers, 2005. [R7] A.K Dee, "Environmental Chemistry",New Age India Publications. [R8] BharuchaErach, "Biodiversity of India", Mapin Publishing Pvt.Ltd
E-resources and other digital material	

23EI3651 – Numerical Computing using MATLAB

Course Category:	Skill Enhancement	**Credits:**	1
Course Type:	Learning by Doing	**Lecture - Tutorial - Practice:**	0 -0- 2
Prerequisites:		**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	100 0 100

23ES3152 – Electronic Circuits Lab

Course Category:	Engineering Science	**Credits:**	1
Course Type:	Lab	**Lecture - Tutorial - Practice:**	0 - 0- 2
Prerequisites:		**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Design various analog electronic circuits
	CO2	Analyze the outputs and intercept the data generated by electronic circuits, such as waveforms and characteristics of devices.
	CO3	Conduct experiments as an individual or team using discrete components and using spice software such as NI Multisim
	CO4	Prepare an effective report based on experiments.

Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1				3										3	
CO2				3										3	
CO3					3				1		1				3
CO4										1					

Course Content

List of Experiments

A. Hardware Module:

1. Characteristics of transistor in common emitter configuration.
2. Design of transistor self-bias circuit.
3. Drain and transfer characteristics of junction field effect transistor.
4. Design of unbiased clampers.
5. Design of clippers.
6. Characteristics of Uni Junction Transistor.
7. Characteristics of SCR Characteristics.
8. Frequency response of CE amplifier.
9. Frequency response of CS Amplifier.
10. Design of Hartley Oscillator.
11. Design of Wein Bridge oscillator.
12. CRO Operation and its Measurements

23EI3353 – Digital System Design Lab

Course Category:	Professional Core	**Credits:**	1.5
Course Type:	Lab	**Lecture - Tutorial - Practice:**	0 - 0- 3
Prerequisites:		**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course outcomes

Upon successful completion of the course, the student will be able to:

CO1	Construct scalar and wide combinatorial circuits using HDL and FPGA
CO2	Construct the sequential circuits using HDL and FPGA
CO3	Analyze outputs and interpret the data for a given problem
CO4	Conduct experiments as an individual or team by using modern tools
CO5	Prepare an effective report based on experiments.

Contribution of Course Outcomes towards achievement of Program Outcomes

(L – Low, M – Medium, H – High

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1			3		2										
CO2			3		2										
CO3				3											
CO4									3			2			
CO5										3					

Course Content

List of Experiments

1. Modeling Concepts- Write models to read switches and push buttons, and output on LEDs and 7-segment displays
2. Numbering Systems Create a 4-bit ripple carry adder using dataflow modeling.
3. Multi-Output Circuits-Design and implement a popular IC, 74138, functionality using dataflow modeling and the decoder.
4. Design an 8-to-3 priority encoder.
5. Design a 2-bit comparator that compares two 2-bit numbers.
6. Implement 2-bit by 2-bit multiplier using a ROM. Output the product in binary on four LEDs.
7. Tasks, Functions, and Testbench- Develop tasks for modeling a combinational circuit, develop functions for modeling a combinatorial circuit, develop a test bench to test and validate a design under test.
8. Modeling Latches and Flip-Flops.
9. Modeling Registers- Model a 4-bit register with synchronous reset, set, and loadsignals. Assign Clk, D input, reset, set, load, and output Q. Verify the design in hardware.
10. Modeling Counters
11. Behavioral Modeling and Timing Constraints- Use various language constructs using behavioral modeling, Communicate timing expectations through timing constraints.
12. Architectural Wizard and IP Catalog- Use the Architectural Wizard to configure clocking resource, Use the IP Catalog tool to configure and use counters and memories.
13. Counters, Timers, and Real-Time Clock- Generate several kinds of counters, timers, and

	real-time clocks. 14. Finite State Machines- Model Mealy FSMs, Model Moore FSMs. 15. Sequential System Design using Algorithmic State Machine (ASM) Charts.
Text books and Reference books	**Text Book** [T1] M. Rafiquzzaman, Steven A. McNinch, "Digital Logic: With an Introduction to Verilog and FPGA-Based Design", 1st Ed., Wiley, 2019. [T2] Cem Unsalan, Bora Tar, "Digital System Design with FPGA: Implementation Using Verilog and VHDL", 1st Ed., McGraw Hill Professional, 2017. [T3] Frank Bruno, "FPGA Programming for Beginners: Bring your ideas to life by creating hardware designs and electronic circuits with SystemVerilog", Packt Publishing Ltd., 2021
E-resources and other digital material	1.https://www.xilinx.com/ 2.https://digilent.com/reference/learn/programmable-logic/tutorials/start

23EI3354 – Transducers Lab

Course Category:	Professional Core	**Credits:**	1.5
Course Type:	Lab	**Lecture - Tutorial - Practice:**	0 - 0- 3
Prerequisites:	--	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

Course outcomes	Upon successful completion of the course, the student will be able to:														
	CO1	Use transducers for measurement of various parameters													
	CO2	Analyze the characteristics of various transducers													
	CO3	Conduct experiments as an individual or team.													
	CO4	Write an effective report based on experiments.													
Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
	CO1	3				1								3		
	CO2				3									2		
	CO3									1			1	2		
	CO4										2					
Course Content	**List of Experiments** 1. Characteristics of Resistance Temperature Detector (RTD) 2. Temperature measurement using Thermocouple 3. Characteristics of Light Dependent Resistor (LDR) and phototransistor 4. Measurement of magnetic flux density using Hall effect transducer 5. Speed measurement using magnetic pick-up and photoelectric pick-up 6. Flow measurement using Ultrasonic flow transmitter 7. Calibration of pressure gauges using dead weight tester. 8. Displacement measurement using Linear Variable Differential Transformer (LVDT) 9. Pressure measurement using strain gauge 10. Interfacing a Passive Infrared (PIR) sensor with Arduino for motion detection 11. Interfacing an inductive proximity sensor with Arduino for object detection 12. Interfacing a soil moisture sensor with Arduino Note: Any 10 of the experiments in the above list, need to be completed by the student for him/her to be eligible to write University Practical Examinations														

Text books and Reference books	[T1] A.K.Ghosh, "Introduction to Measurements & Instrumentation", 3rd Ed., PHI, 2009. [T2] A.K.Sawhney & Puneet Sawhney, "A Course in Mechanical Measurements & Instrumentation", 7th Ed., Dhanapat Rai & Co., 2012
E-resources and other digital material	https://create.arduino.cc/ https://www.allaboutcircuits.com/

Second Year
(IV Semester)

23HS4101 – Engineering Economics and Management

Course Category:	Humanities and Social Sciences	**Credits:**	2
Course Type:	Theory	**Lecture - Tutorial - Practice:**	2 - 0- 0
Prerequisites:		**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

Course outcomes	Upon successful completion of the course, the student will be able to:														
	CO1	Understand various forms of organizations and principles of management.													
	CO2	Understand the various aspects of business economics.													
	CO3	Perceive the knowledge on Human resources and Marketing functions.													
	CO4	Evaluate various alternatives economically.													
Contribution of Course Outcomes towards the achievement of Program Outcomes (1– Low, 2– Medium, 3 – High)		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
	CO1	2														
	CO2	2				3										
	CO3	2														
	CO4	2				3										
Course Content	**UNIT- I** **Forms of Business Organization:** Salient features of sole proprietorship, Partnership, Joint stock company, Co-operative society and public sector. **Management:** Introduction to management, Functions of management, Principles of scientific management, Modern principles of management. **UNIT – II** **Introduction to Economics:** Introduction to basic economic concepts, Utility analysis: Marginal utility and total utility, Law of diminishing marginal utility, Law of equi marginal utility. **Demand Analysis:** Theory of demand: Demand function, Factors influencing demand, Demand schedule and demand curve, Shift in demand, Elasticity of demand: Elastic and inelastic demand, Types of elasticity. **Supply Analysis:** Supply schedule and supply curve, Factors influencing supply, Supply function.														

	UNIT – III **Human Resource Management:** Meaning and difference between personnel management and human resource management, Functions of human resource management. **Marketing Management:** Concept of selling and marketing – Differences, Functions of marketing, Product life cycle, Concept of advertising, Sales promotion, Types of distribution channels, Marketing research, Break-Even analysis **UNIT – IV** **Financial Management:** Functions of financial management, Time value of money with cash flow diagrams, Concept of simple and compound interest. **Depreciation:** Causes of depreciation, Factors influencing depreciation, Common methods of depreciation: Straight line method, Declining balance method, Sum of year's digits method –Problems. **Economic Alternatives:** Methods of evaluating Alternatives under present worth method, Future worth method, Annual equivalent method - Problems.
Textbooks and Reference books	**Text Book:** [T1] M.Mahajan, "Industrial Engineering and Production Management", 2nd Ed., DhanpatRaiPublications [T2]MartandTelsang" Industrial & Business Management" S.Chand publications **Reference Books:** [R1] R.Paneerselvam "Production and Operations Management" PHI [R2]Philip Kotler & Gary Armstrong "Principles of Marketing", Pearson Prentice Hall,NewDelhi,2012 [R3] IM Pandey, "Financial Management", 11th Ed., Vikas Publications [R4]B.B.Mahapatro, "Human Resource Management",New Age International
E-resources and other digital material	1.https://www.toppr.com/guides/fundamentals-of-economics-and-management/supply/supply-function/ 2.https://keydifferences.com/difference-between-personnel-management-and-human-resource- management.html 3.http://productlifecyclestages.com/ 4.https://speechfoodie.com/cash-flow-diagrams/

23ES4102C – Linear Integrated Circuits and Applications

Course Category:	Engineering Science	**Credits:**	2
Course Type:	Theory	**Lecture - Tutorial - Practice:**	2 - 0- 0
Prerequisites:	Electronic Devices and Circuits, Network Theory	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

Course outcomes	Upon successful completion of the course, the student will be able to:														
	CO1	Understand the characteristics of 741IC.													
	CO2	Apply the concepts of 741IC to implement various linear and non-linear applications.													
	CO3	Design different IC circuits using 741,555 and 723 ICs.													
	CO4	Illustrate the operation of Special purpose ICs and their applications.													
Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
	CO1	2													2	
	CO2	3													2	
	CO3		3												3	
	CO4	2													2	
Course Content	**UNIT- I** **Operational Amplifier:** Integrated circuits - Package types and temperature ranges, Power supplies; Block diagram representation of Op amp, Ideal Op amp, Ideal and practical Op-amp specifications, 741 Op-amp features and specifications, Op-amp characteristics - DC and AC Characteristics of an Op Amp - Frequency Response, Slew Rate. **Linear applications of Op-Amp** - Inverting amplifier, Non-inverting amplifier, Voltage follower, Differential amplifier, Summing amplifier, Instrumentation amplifier, Integrator, Voltage to current converter and current to voltage converter. **UNIT- II** **Non-linear applications of Op-Amp:** Precision diode, Applications - Precision full wave rectifier, Clippers, clampers and Peak Detector; Sample and hold circuit. **Comparators and Waveform Generators:**Basic comparator, Applications – Zero crossing detector, Window detector, Voltage limiters; Schmitt trigger, Waveform generators - Square wave generator,Triangular wave generator. **UNIT- III** **Active Filters:** Active LP and HP filters, Sallen key LP and HP filters, Band pass filters - Wide band pass and Narrow band pass filters; Band stop filters - Wide band stop and														

	notch filters;All pass filter. **Analog to Digital and Digital to Analog Converters:**Introduction, Basic DAC techniques - Weighted resistor DAC, R-2R ladder D/A converter; A/D conversion - Parallel comparator type ADC, Successive approximation ADC and Dual slope ADC;DAC and ADC specifications **UNIT- IV** **Special Purpose ICs and Applications:** 555 Timer - 555 as Monostable and Astable operation, Applications, Schmitt trigger;IC 566 Voltage controlled oscillator; Phase locked loops - Operating principle,565 Monolithic PLL, 565 PLL Applications; IC voltage regulators- Fixed voltage regulators- LM78XX, LM79XX; Variable voltage regulators – LM 317, LM 723 IC.
Text books and Reference books	**Text Book:** [T1] D. Roy Choudhry and Shail B. Jain, "Linear Integrated Circuits"- (4/e), New Age International Pvt. Ltd, 2011. [T2] Rama Kant A. Gayakwad, "Op-Amps and Linear Integrated Circuits", 4th Ed,PHI, 2012. **Reference Books:** [R1] S. Franco, "Design with Operational Amplifiers and Analog Integrated Circuits", TMH, 2016. [R2] R. F. Coughlin & F. F. Driscoll, "Operational Amplifiers and Linear Integrated Circuits", 6thEd,PHI, 2012. [R3] Jacob, "Applications and Design with Analog Integrated Circuits", 2nd Ed., PHI 1996 [R4] Sanjay Sharma, "Op-Amps and Linear Integrated circuits",1st Ed, Katson educational series,2008. [R5] S.Salivahanan & V.S. KanchanaBhaskaran, Linear Integrated Circuits, TMH, 2nd edition, 2015.
E-resources and other digital material	1. www.analog.com 2. https://nptel.ac.in/courses/108106068/ 3. https://www.allaboutcircuits.com/ 4. https://www.linkwitzlab.com/filters.htm

23EI4303 – Control Systems

Course Category:	Professional Core	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3 - 0- 0
Prerequisites:	Laplace transforms and integral calculus, Network theory	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

Course outcomes	Upon successful completion of the course, the student will be able to:													
	CO1	Define and explain the concepts of control systems.												
	CO2	Model the transfer functions of physical systems using block diagram and signal flow graph approaches												
	CO3	Analyze the responses and stability of control systems using time and frequency domain approaches												
	CO4	Analyze the stability of the given control system using modern tools.												
Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 – Medium, 3 – High		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 3
	CO1													2	
	CO2	2												2	
	CO3		3												2
	CO4		2			2									2

Course Content

UNIT- I

Introduction: Control system terminology, Examples of simple control systems – Open loop and closed loop control systems, Effect of feedback on overall gain, Stability, Sensitivity and external noise.

Mathematical Models of Physical Systems: Formulation of differential equations for electrical, mechanical and electromechanical systems, Poles, Zeros, Characteristic equation, Block diagram representation of control systems, Signal flow graphs and Mason's gain formula.

UNIT – II

Time Domain Analysis: Standard test signals – Step, ramp, parabolic and impulse, Time response of first-order system to standard test signals, Step response of second order systems-undamped, under damped, critically damped and over damped systems, Time domain specifications, Expressions for time domain specifications, Steady state error and static and dynamic error constants, Proportional, Integral and derivative control actions

UNIT – III

Stability Analysis in Complex Plane: Stability definitions – Bounded Input and Bounded Output (BIBO) stability, Stability study based on poles of closed-loop transfer function, Absolute and relative stability, Routh–Hurwitz criterion.

	Root Locus Technique: The root locus concept, Magnitude and angle conditions, Properties and construction of the root loci (For positive K only),Effect of adding poles and zeros to root locus **UNIT – IV** **Frequency Domain Analysis:** Frequency domain specifications, Correlation between time and frequency response, Bode plot – Magnitude plot, Phase plot, Determination of phase margin and gain margin, Stability analysis from Bode plots, Polar plots, Nyquist stability criterion, Nyquist Plot.
Text books and Reference books	**Text Book:** [T1] A.Anand Kumar, "Control Systems", 2nd Ed., PHI, 2014 [T2] I J Nagrath& M Gopal, "Control Systems Engineering", 5th Ed., New Age International, 2008 **Reference Books:** [R1] Katsuhiko Ogata, "Modern Control Engineering", 4th Ed., Pearson Education, 2003 [R2] A.NagoorKani, "Control Systems", 2nd Ed., RBA Publications, 2006
E-resources and other digital material	1 http://www.nptelvideos.com/control_systems/ 2 https://nptel.ac.in/courses/108101037/

23EI4304 – Industrial Instrumentation

Course Category:	Professional Core	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3 - 0- 0
Prerequisites:	Sensors and Transducers	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course outcomes	Upon successful completion of the course, the student will be able to:													
	CO1	Explain the basic concepts of industrial process variables												
	CO2	Apply the concepts of industrial process variables to solve the engineering problems												
	CO3	Identify suitable transducer for measurement of industrial process variables												
	CO4	Analyze the performance of various measurement techniques in industrial process variables												
Contribution of Course Outcomes towards achievement of Program Outcomes **(L – Low, M - Medium, H – High**		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
	CO1														
	CO2	3													
	CO3	3													
	CO4		2												
Course Content	**UNIT- I** **Temperature Measurement:** Introduction, Classification of temperature sensors based on change in dimensions - Bimetals & Liquid-in-Glass thermometers; Change in electrical properties – RTD, Thermistor; Thermoelectricity – Thermocouples; IC sensors, Radiation pyrometers, Fiber-optic sensors, Quartz thermometer, Ultrasonic thermometer. . **UNIT- II** **Pressure Measurement:** Introduction, pressure standards, Manometers; Force summing devices – Diaphragms, Bellows, Bourdon tubes; Secondary transducers – Resistive, Inductive, Capacitive, Piezoelectric and Hall Effect; Low pressure measurement - Mcleod, Knudsen, Pirani & Ionization gauges**;** Calibration of pressure gauges using dead weight tester. **UNIT- III** **Flow Measurement**: Introduction, Head type flow meters - Orifice plate, Venturi tube and Pitot tube; Variable area type flow meters – Rotameter; Velocity measurement type flow meters - Electromagentic, Turbine, Ultrasonic flow meters, Anemometers; Mass flow measurement type – Coriolis and Thermal mass flow meters; Positive displacement flow meters - Nutating disc and lobed impeller; Open channel flow meters- Weirs, Flumes. **UNIT- IV**													

	Level Measurement: Introduction, Mechanical level indicators - Differential pressure type; Optical level sensors; Electrical type - Resistive, inductive and Capacitive; Acoustic Level Sensors – Ultrasonic; Radiative methods - Gamma ray and Radar Level Sensors. **Humidity, Density & Viscosity Measurement:** Introduction, Hygrometers-Wet and dry bulb, Electrolytic, piezoelectric hygrometers; Moisture Analyzer-Neutron back scatter Moisture analyzer; Densitometers- Ultrasonic and gamma ray densitometers; Viscometers-Say bolt, Rotational and Float viscometers.
Text books and Reference books	**Text Book:** [T1] A.K.Ghosh, "Introduction to Measurements & Instrumentation", IIIrd ed, PHI, 2009. [T2] A.K.Sawhney & Puneet Sawhney,"A Course in Mechnanical Measuremnets & Instrumentation", XIIth ed, Dhanapat Rai & Co., 2012. **Reference Books:** [R1] Ernest O Doebelin/Dhanesh, N Manik, "Measurement systems", VIth ed,Tata Mc Grawhill. [R2] C.S.Rangan, G.R.Sarma & V.S.V.Mani "Instrumentation Devices & Systems", IInd ed, TMH, 2011.
E-resources and other digital material	[1]http://nptel.ac.in/courses/108105064 [2]http://nptel.ac.in/courses/108106074

23EI4305 – Electrical and Electronic Measurements

Course Category:	Professional Core	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3 - 0- 0
Prerequisites:	Circuit analysis	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

Course outcomes	Upon successful completion of the course, the student will be able to:														
	CO1	Apply suitable Null or Deflection type technique to measure prescribed electrical parameter.													
	CO2	Select a suitable digital instrument to measure physical and electrical parameters.													
	CO3	Compare the operation of various oscilloscopes and probes.													
	CO4	Explain the principles of various signal generators and wave analyzers.													
Contribution of Course Outcomes towards achievement of Program Outcomes **(L – Low, M - Medium, H – High**		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
	CO1	3													
	CO2		3												
	CO3		2												
	CO4														
Course Content	**UNIT- I** **Electromechanical Indicating Instruments**: Suspension type galvanometer- Torque equation at steady state deflection, Dynamic behavior, Damping mechanisms; Permanent magnet moving coil mechanism – Torque equation, Taut-band suspension, Temperature compensation. **Electrical Measurements**: DC ammeters - Shunt resistor, Ayrton shunt, Multirange ammeters, The Ayrton shunt, DC voltmeters - Multiplier resistor, Multirange voltmeter, Ohms per volt rating, Loading effect, Series type ohmmeter, Shunt type ohmmeter, Calibration of dc instruments, Alternating current indicating instruments - Electrodynamometer, Thermo Instruments, Electrodynamometers in power measurements, Watt hour meter, Power factor meters. **UNIT- II** **Bridges:** Wheatstone bridge, Kelvin bridge, Maxwell bridge, Hay bridge, Schering bridge, Wien bridge, Wagner ground connection. **Electronic Instruments**: AC Voltmeter using rectifiers, True RMS voltmeter, Digital voltmeters - Ramp technique, Dual slope integrating type DVM, Staircase ramp DVM, Successive approximation type DVM, Q Meter - Impedance measurement using Q Meter, Analog pH meter – pH measurement using hydrogen electrode.														

	UNIT- III **Oscilloscopes:** Block diagram of oscilloscope, Cathode Ray Tube, Vertical amplifier, Horizontal deflecting system, Typical CRT connections, Delay line in triggered sweep, Dual beam CRO, Dual trace oscilloscope (basic block diagram), Sampling oscilloscope, Digital storage oscilloscope, Probes for CRO - Direct probes, Passive voltage probe, Active probes, Attenuators - Uncompensated attenuators, Simple compensated attenuator **UNIT- IV** **Signal Generators**: Basic standard sine wave generator, Standard signal generator, Function generator, Laboratory square wave and pulse generator. **Wave Analyzers:** Basic wave analyzer, Frequency selective wave analyzer, Heterodyne wave analyzer, Harmonic distortion analyzers, Spectrum analyzer. **Frequency Counters And Time-Interval Measurements**: Digital frequency meter - Principle of operation, Basic circuit of a digital frequency meter, Digital measurement of time - Principle of operation, Time base selector, Period measurement..
Text books and Reference books	**Text Book:** [T1] W D Cooper & A D Helfrick, "Electronic Instrumentation and Measurement Techniques", PHI, 1998 (Unit-I) [T2] H.S.Kalsi, "Electronic Instrumentation", 2ndEd., TMH. (Units-II, III and IV) **Reference Books:** [R1] A.K. Sawhney, "A Course in Electrical and Electronic Measurements and Instrumentation",Dhanpat Rai & Co [R2] Oliver & Cage, "Electronic Measurements and Instrumentation", Mc Graw Hill, 1975
E-resources and other digital material	https://www.youtube.com/watch?v=3eYmFjHnQjY&list=PLbRMhDVUMngcoKrA4sH-zvbNVSE6IpEio

23TP4106 – English for Professionals

Course Category:	Soft Skills-2	**Credits:**	1
Course Type:	Learning by Doing	**Lecture - Tutorial - Practice:**	0 - 0- 2
Prerequisites:		**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	100 0 100

Course outcomes	Upon successful completion of the course, the student will be able to:														
	CO1	Present themselves effectively in the professional world by shedding off their inhibitions about communicating in English													
	CO2	Introduce themselves as well as others appropriately													
	CO3	Use vocabulary to form sentences and narrate stories by using creative thinking skills													
	CO4	Involve in practical activity-oriented sessions and respond positively by developing their analytical thinking													
	CO5	Learn about various expressions to be used in different situations													
Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
	CO1										3	3				
	CO2									3	3	3				
	CO3										3	3				
	CO4								2		3	3				
	CO5										3	3				
Course Content	**UNIT- I** 1. Beginners, Functional, Situational conversations 2. Practicing on functional conversations **UNIT- II** 1. Errors in usage of parts of speech with a thrust on verbs, adjectives and conjunctions, idioms/phrases. 2. Introducing basic grammar 3. Practicing on functional conversations **UNIT- III** 1. Introducing self & Others 2. Structures and forming sentences														

	3. Telephonic etiquette, Social etiquette and table manners 4. Practicing on functional conversations **UNIT- IV** 1. Direct, Indirect/Reporting speech 2. Public speaking basics 3. Versant test preparation 4. Practicing on situational conversations
Text books and Reference books	**Text Books:** [T1] Swaroopa, Polineni, "Practicing on Situational Conversations - Strengthen Your Communication Skills", 1st Ed., Maruthi Publications, 2013. [T2] Mamta Bhatnagar & Nitin Bhatnagar, "Communicative English", 1st Ed., Pearson India, 2010.
E-resources and other digital material	

23EI4651 – Virtual Instrumentation Lab

Course Category:	Skill Enhancement	**Credits:**	1
Course Type:	Learning by Doing	**Lecture - Tutorial - Practice:**	0 - 0- 2
Prerequisites:		**Continuous Evaluation:**	100
		Semester end Evaluation:	0
		Total Marks:	100

Course outcomes

Upon successful completion of the course, the student will be able to:

CO1	Understand the graphical programming terminology and able to create a virtual instrument for simple problems
CO2	Able to use the various looping constructs, arrays, matrices and clusters
CO3	Able to use various data plotting techniques and structures
CO4	Able to use the data acquisition device to acquire the measurement data from real world into PC

Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	3				3										
CO2				2	3										
CO3				2	3										
CO4				2	3										

Course Content

List of Experiments

1.Introduction to Virtual Instrumentation and LabVIEW
2.Programs on controls and indicators
3.Programs on arithmetic operations
4.Programs on Boolean operations
5.Programs on sub VI's
6.Programs on repetition and loops
7.Programs on arrays
8.Programs on matrices
9.Programs on clusters
10. Programs on data plotting
11. Programs on structures
12. Programs on formula nodes and math script nodes
13.. Programs on strings, file I/O
14. Temperature acquisition using 3-wire RTD.
15. Programs on data logging
16.Programs using NI myDAQ.

	Note: Any 10 of the experiments in the above list need to be completed by the student, by choosing a minimum of 3 experiments from part- A and 7 from part-B for him/her to be eligible to write University Practical Examinations
Text books and Reference books	**Text Books:** [T1] Jovitha Jerome, "Virtual Instrumentation using LabVIEW", 1st Ed., PHI, 2013. **Reference Books:** [R1] Sanjay Gupta, Joseph John, "Virtual Instrumentation using LabVIEW", 1st Ed., TataMcGraw-Hill, 2005 [R2] Gary Johnson, Richard Jennings, "LabVIEW Graphical Programming", Tata McGraw-Hill, 2006
E-resources and other digital material	http://www.ni.com

23ES4152 – Design Thinking & Innovation

Course Category:	Humanities and Social Sciences	**Credits:**	2
Course Type:	Theory	**Lecture - Tutorial - Practice:**	1 - 0- 2
Prerequisites:		**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

23EI4353 – Linear Integrated Circuits Lab

Course Category:	Professional Core	**Credits:**	1.5
Course Type:	Lab	**Lecture - Tutorial - Practice:**	0 - 0- 3
Prerequisites:		**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

Course outcomes	Upon successful completion of the course, the student will be able to:														
	CO1	Design linear applications of op-amp circuits,													
	CO2	Design non-linear applications of op-amp circuits,													
	CO3	Design applications of 555 timer and IC voltage regulators													
	CO4	Conduct the experiment as well as analyze the outputs for given specifications as an individual or a team.													
	CO5	Prepare an effective report based on experimental results.													
Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO 11	PO 12	PS O 1	PS O 2	PSO 3
	CO1				3										2	
	CO2				3										2	
	CO3				3											
	CO4				3					2		1			2	
	CO5										2				2	
Course Content	**List of Experiments** **<u>Analog ICs Experiments using discrete components</u>** 1. Basic applications of 741IC –Inverting amplifier, Non Inverting amplifier and summing amplifier. 2. Design of Instrumentation Amplifier using 741IC 3. Design of Integrator using 741IC 4. Precision Full wave rectifiers using Op-Amp 741IC 5. Basic applications of comparator using 741IC 6. Waveform generation using 741IC (square, triangular) 7. Design of Wein bridge Oscillator using 741IC 8. Design of First order Active Low pass and high pass filter using 741IC 9. Design of IC 555 Timer Astable circuit 10. Design of Schmitt trigger using IC 555 Timer 11. Design of a voltage Regulator using IC 723 12. D/A Converters using 741IC 4 bit R-2R ladder circuit.														
Note:	Any 10 of the experiments in the above list need to be completed by the student to be eligible to write University Practical Examinations.														

23EI4354 – Control Systems Lab

Course Category:	Professional Core	**Credits:**	1
Course Type:	Lab	**Lecture - Tutorial - Practice:**	0 - 0- 2
Prerequisites:		**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

Course outcomes	Upon successful completion of the course, the student will be able to:														
	CO1	Apply control system techniques/approaches to solve problems													
	CO2	Analyze the responses and stability of the given control system													
	CO3	Conduct the experiments as individual or team													
	CO4	Make an effective report based on experiments													
Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
	CO1	2				2										1
	CO2				3	2										2
	CO3									2			1			
	CO4										2					
Course Content	**List of Experiments** **Part-A** 1.Determination of transfer functions of first order systems. 2.Time response P, PI and PID controllers of second order systems. 3.Characteristics of synchro transmitter and receiver. 4.DC motor position control using PI controller 5.Characteristics of Magnetic Amplifier **Part-B** **1.** Using MATLAB/SIMULINK for control systems Part I: Introduction to MATLAB/SIMULINK/LabVIEW Part II: Polynomials in MATLAB Part III: Scripts, Functions & flow control in MATLAB **2.** Block diagram reduction techniques for determination of transfer function of a given system using MATLAB/LabVIEW. **3.** Simulation of standard test signals using MATLAB/LabVIEW **4.** Determination of step, impulse and ramp responses for first order unity feedback system using MATLAB/LabVIEW **5.** Determination of step, impulse and ramp responses for second order unity feedback system using MATLAB/LabVIEW **6.** Determination of step and impulse responses for a type ‘0’,type ‘1’ and type ‘2’ systems **7.** Root locus plot for a given transfer function using MATLAB/LabVIEW														

	8. Stability studies using Bode and Nyquist plots for a given transfer function using MATLAB/LabVIEW **Note**: Any 10 of the experiments in the above list need to be completed by the student, by choosing a minimum of 3 experiments from part- A and 7 from part-B for him/her to be eligible to write University Practical Examinations
Text books and Reference books	**Text Book:** [T1] A.Ananda Kumar, "Control Systems", PHI Learning, 2nd Ed. [T2] I.J.Nagrath & M.Gopal, "Control systems Engineering", New Age publisher, 5th Ed **Reference Books:** [R1] B.C.Kuo, "Automatic Control Systems", 7th Ed., PHI.
E-resources and other digital material	1. www.linearcontrolsystems.com 2. www.linearcontrols.net

23EI4355 – Measurements Lab

Course Category:	Professional Core	**Credits:**	1.5
Course Type:	Lab	**Lecture - Tutorial - Practice:**	0 - 0- 3
Prerequisites:		**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

Course outcomes	Upon successful completion of the course, the student will be able to:														
	CO1	Apply the basic measurement techniques to measure the parameters such as resistance, capacitance, inductance, etc													
	CO2	Analyze the outputs and integrate the data generated from the bridge measurements													
	CO3	Conduct the experiments as individual or team													
	CO4	Make an effective report based on experiments													
Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
	CO1	3														
	CO2				3											
	CO3									1	2					
	CO4											1				
Course Content	**List of Experiments** 1.DC meters using D'Arsonval galvanometer and their range extension. 2. AC meters using D'Arsonval galvanometer and their range extension. 3. Measurement of voltage, frequency, phase angle and phase shift using a CRO. 4. Simulation of CRO, Function generator using Analog discovery kit. 5. Measurement of resistance of small resistors using Kelvin double bridge. 6. Measurement of inductance using Maxwell bridge. 7. Measurement of capacitance using Shearing bridge. 8. Simulation of Spectrum analyzer using Analog discovery kit. 9. Measurement of resistance, inductance and capacitance using a LCR meter. 10.Measurement of amplitude and frequency of different types of waveforms using function generator. 11.Measurement of amplitudes of different types of waveforms using True RMS voltmeter. 12.Measurement of inductance of high Q coils using Hay bridge. 13.Measurement of frequency using a Wien bridge. 14.Calibration of voltmeter using potentiometer. 15.Calibration of ammeter using potentiometer														

	Note: Any 10 of the experiments in the above list need to be completed by the student, by choosing a minimum of 3 experiments from part- A and 7 from part-B for him/her to be eligible to write University Practical Examinations
Text books and Reference books	
E-resources and other digital material	

VELAGAPUDI RAMAKRISHNASIDDHARTHA ENGINEERING COLLEGE

DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING

SCHEME OF INSTRUCTION FOR FOUR YEAR UG PROGRAMME

VR23

V & VI Semester SOI
V Semester Syllabus

Effective from 2023-24

Velagapudi Ramakrishna Siddhartha Engineering College

ELECTRONICS & INSTRUMENTATION ENGINEERING

Scheme of Instructions for Four Year B.Tech Programme-VR23

SEMESTER I **CONTACT HOURS: 26**

S. No	Course Code	Course	Subject	L	T	P	Credits
1.	23BS1101	Basic Science	Linear Algebra & Calculus	3	0	0	3
2.	23BS1102B	Basic Science	Chemistry	3	0	0	3
3.	23BS1103B	Basic Science	Basic Electrical & Electronics Engineering	3	0	0	3
4.	23ES1104	Engineering Science	Introduction to Programming	3	0	0	3
5.	23ES1105	Engineering Science	Engineering Graphics	1	0	4	3
6.	23BS1151B	Basic Science	Chemistry Lab	0	0	2	1
7.	23ES1152	Engineering Science	Computer Programming Lab	0	0	3	1.5
8.	23ES1153	Engineering Science	Electrical and Electronic Engineering Lab	0	0	3	1.5
9.	23BS1154B	Basic Science	Health and wellness, Yoga and Sports	0	0	1	0.5
Total				**13**	**0**	**13**	**19.5**
10.	23MC1106	Mandatory Course	Induction Program				-

Category	Credits
Basic Science Courses	3+3+3+1+1.5= 11.5
Engineering Science Courses	3+3+1.5+0.5=8
Humanities and Social Science	0
Mandatory Courses	0
TOTAL CREDITS	**19.5**

SEMESTER II **CONTACT HOURS: 27**

S.No	Course Code	Course	Subject	L	T	P	Credits
1.	23BS2101	Basic Science	Differential Equations & Vector Calculus	3	0	0	3
2.	23BS2102	Basic Science	Engineering Physics	3	0	0	3
3.	23ES2103A	Engineering Science	Basic Civil and Mechanical Engineering	3	0	0	3
4.	23PC2104C	Professional Core	Network Analysis	3	0	0	3
5.	23HS2105	Basic Science	Communicative English	2	0	0	2
6.	23BS2151	Basic Science	Engineering Physics Lab	0	0	2	1
7.	23PC2152C	Professional Core	Network Analysis & Simulation Lab	0	0	3	1.5
8.	23HS2153	Basic Science	Communicative English Lab	0	0	2	1
9.	23ES2154	Engineering Science	Engineering Workshop	0	0	3	1.5
10.	23ES2155	Engineering Science	IT Work shop	0	0	2	1
11.	23BS2156	Basic Science	NSS/NCC/Community Service	-	-	1	0.5
Total				**14**	**0**	**13**	**20.5**

Category	Credits
Basic Science Courses	3+3+2+1+1+ 0.5=10.5
Engineering Science Courses	3+1.5+1=5.5
Humanities and Social Science	-
Mandatory Courses	-
Professional Core	3+1.5=4.5
TOTAL CREDITS	**20.5**

II Year I Semester (Semester III) **CONTACT HOURS: 28**

S.No	Course Code	Course	Subject	L	T	P	Credits
1.	23BS3101C	Basic Science	Complex Analysis and Numerical Methods	3	0	0	3
2.	23HS3102	Humanities and Social Sciences	Universal Human Values – Understanding Harmony	2	1	0	3
3.	23ES3103F	Engineering Science	Analog Electronic Circuits	2	0	0	2
4.	23EI3304	Professional Core	Digital Circuits and Systems	3	0	0	3
5.	23EI3305	Professional Core	Sensors and Transducers	3	0	0	3
6.	23TP3106	Soft Skills - 1	Logic and Reasoning	0	0	2	1
7.	23MC3107	Audit	Environmental Science	2	0	0	-
8.	23EI3651	Skill Enhancement	Numerical Computing using MATLAB	0	0	2	1
9.	23ES3152	Engineering Science	Electronic Circuits Lab	0	0	2	1
10.	23EI3353	Professional Core	Digital System Design Lab	0	0	3	1.5
11.	23EI3354	Professional Core	Transducers Lab	0	0	3	1.5
			Total	**15**	**1**	**12**	**20**

Category	Credits
Basic Science Courses	3
Engineering Science Courses	2+1=3
Humanities and Social Science	3
Mandatory Courses	-
Professional Core	3+3+1.5+1.5 =9
Elective: Skill Enhancement course	1+1=2
TOTAL CREDITS	**20**

II Year II Semester (Semester IV) **CONTACT HOURS: 28**

S.No	Course Code	Course	Subject	L	T	P	Credits
1.	23HS4101	Humanities and Social Sciences	Engineering Economics and Management	2	0	0	2
2.	23ES4102C	Engineering Science	Linear Integrated Circuits and Applications	2	0	0	2
3.	23EI4303	Professional Core	Control Systems	3	0	0	3
4.	23EI4304	Professional Core	Industrial Instrumentation	3	0	0	3
5.	23EI4305	Professional Core	Electrical and Electronic Measurements	3	0	0	3
6.	23TP4106	Soft Skills - 2	English for Professionals	0	0	2	1
7.	23EI4651	Skill Enhancement course	Virtual Instrumentation Lab	0	0	2	1
8.	23ES4152	Engineering Science	Design Thinking & Innovation	1	0	2	2
9.	23EI4353	Professional Core	Linear Integrated Circuits Lab	0	0	3	1.5
10.	23EI4354	Professional Core	Control Systems Lab	0	0	2	1
11.	23EI4355	Professional Core	Measurements Lab	0	0	3	1.5
Total				**14**	**0**	**14**	**21**

Category	Credits
Engineering Science Courses	2+2=4
Humanities and Social Science	2
Mandatory Courses	-
Professional Core	3+3+3+1.5+1+1.5=13
Skill Enhancement course, Soft Skills Course	1+1=2
TOTAL CREDITS	**21**

III Year I Semester (Semester V) **CONTACT HOURS: 28**

S.No	Course Code	Course	Subject	L	T	P	Credits
1.	23EI5301	Professional Core	Microcontrollers	3	0	0	3
2.	23EI5302	Professional Core	Process Control	3	0	0	3
3.	23EI5403	Professional Elective - I	• Sensor Signal Conditioning • Robotics and Control • Industrial Electronics • VLSI Design	3	0	0	3
4.	23EI5204	Open Elective - I	• Essential Principles of Image Sensors • PC Based Instrumentation • Transducers and Measurement Systems	3	0	0	3
5.	23EI5205	Open Elective - II	• MOOCS for 12 weeks	3	0	0	3
6.	23TP5106	Soft Skills - 3	Personality Development	0	0	2	1
7.	23EI5651	Skill Enhancement course	Advanced Digital System Design with FPGA	0	0	2	1
8.	23EI5352	Professional Core	Microcontrollers Lab	0	0	3	1.5
9.	23EI5353	Professional Core	Process Control Lab	0	0	3	1.5
10.	23EI5354	Evaluation of Community Service Internship	EPICS	-	-	-	2
11.	23HS5107	Mandatory Course Humanities Elective	Humanities Elective	3	0	0	-
Total				**18**	**0**	**10**	**22**

Category	Credits
Mandatory Courses	-
Professional Core	3+3+1.5+1.5=9
Skill Enhancement course ,Soft Skills	1+1=2
Professional Elective	3
Open Elective	3+3=6
Project & Internship	2
TOTAL CREDITS	**22**

III Year II Semester (Semester VI) **CONTACT HOURS: 30**

S.No	Course Code	Course	Subject	L	T	P	Credits
1.	23EI6301	Professional Core	Embedded Systems	3	0	0	3
2.	23EI6302	Professional Core	Digital Signal Processing	3	0	0	3
3.	23EI6303	Professional Core	Industrial Automation	3	0	0	3
4.	23EI6404	Professional Elective - II	• Biomedical Instrumentation • Drives and Control for Industrial Automation • Process Modeling and Simulation • Industrial Communication Networks	3	0	0	3
5.	23EI6405	Professional Elective - III	• Power Plant Instrumentation • Instrumentation and Control in Food Processing • Industrial Internet of Things • Wireless Sensor Networks	3	0	0	3
6.	23EI6206	Open Elective - III	• Artificial Intelligence and Machine Learning in Healthcare • Safety Instrumentation Systems • Principles of Process Control	3	0	0	3
7.	23TP6107	Soft Skills - 4	Quantitative Aptitude	0	0	2	1
8.	23EI6651	Skill Enhancement course	Advanced Communication Skills Lab	0	0	2	1
9.	23EI6352	Professional Core	Embedded Systems Lab	0	0	3	1.5
10.	23EI6353	Professional Core	Advanced Instrumentation Lab I	0	0	3	1.5
11.	23MC6108	Audit Course	Technical Paper Writing & IPR	2	0	0	-
Total				**20**	**0**	**10**	**23**
Mandatory Industry Internship of 08 weeks duration during summer vacation							

Category	Credits
Audit Course	-
Professional Core	3+3+3+1.5+1.5=12
Skill Enhancement course, Soft Skills	1+1=2
Professional Elective	3+3 =6
Open Elective	3
TOTAL CREDITS	**23**

IV Year I Semester (Semester VII) **CONTACT HOURS: 26**

S.No	Course Code	Course	Subject	L	T	P	Credits
1.		Professional Core	Analytical Instrumentation	3	0	0	3
2.		Professional Core	Computer Control of Processes	3	0	0	3
3.		Professional Elective - IV	• Advanced Sensors • Intelligent Systems and Control • Digital Image Processing • Database Management Systems	3	0	0	3
4.		Professional Elective - V	• Real World Instrumentation with Python • Instrumentation and Control in Paper Industries • HMI & SCADA • Computer Networks	3	0	0	3
5.		Open Elective - IV	• MOOCS- 12 weeks	3	0	0	3
6.		Professional Core	Industrial Automation Lab	0	0	3	1.5
7.		Professional Core	Advanced Instrumentation Lab II	0	0	3	1.5
8.		Skill Enhancement course	Real Time Operating Systems	0	0	2	2
9.		Audit Course	Constitution of India	2	0	0	-
10.		Internship	Evaluation of Industry Internship	-	-	-	2
Total				**17**	**0**	**8**	**22**

Category	Credits
Audit Course	-
Professional Core	3+3+1.5+1.5=9
Skill Enhancement course	2
Professional Elective	3+3=6
Open Elective	3
Internship	2
TOTAL CREDITS	**22**

IV Year II Semester (Semester VIII) **CONTACT HOURS: 24**

S.No	Course Code	Course	Subject	L	T	P	Credits
1		Internship & Project Work	Full semester Internship & Project Work	0	0	24	12
Total				**0**	**0**	**24**	**12**

Category	Credits
Project & Internship	12
TOTAL CREDITS	**12**

Semester	Credits
I	19.5
II	20.5
III	20
IV	22
V	22
VI	21
VII	23
VIII	12
Total	**160**

Third Year
(V Semester)

23EI5301- Microcontrollers

Course Category:	Professional Core	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3 - 0- 0
Prerequisites:		**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

Course outcomes	Upon successful completion of the course, the student will be able to:														
	CO1	Describe the architecture of 8051 microcontroller.													
	CO2	Use the instruction set of 8051 to solve problems.													
	CO3	Select and use various interfacing peripherals along with microcontroller.													
	CO4	Select and use various digital and analog interfacing methods.													
Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
	CO1	3														
	CO2	3														
	CO3		2													
	CO4	3														
Course Content	**UNIT – I** **Introduction:** Introduction to microcontrollers, Comparison between microprocessors and microcontrollers The 8051 Architecture: 8051 Microcontroller hardware, Input/output pins, Ports & circuits, External memory, Counters and timers, Serial data input/ output, Interrupts. **UNIT – II** **Instruction Set:** Addressing modes of 8051, Data Transfer operations, Arithmetical operations, Logical operations, Jump and call op-codes, Simple Programs. **Microcontroller Design:** A Microcontroller design, Testing the design, Timing Subroutines, Lookup tables for the 8051, Serial Data Transmission. **UNIT – III** **System Design: Peripherals and Interfacing:** Serial IO, USART Communication Interface 8251, ADC circuit interfacing, DAC interfacing, Stepper motor interfacing, LED, Array of LEDs, Keyboard-cum-Display controller 8279, Interfacing with external memory														

	UNIT – IV **Systems Design: Digital and Analog Interfacing Methods:** Programmable DMA controller 8257, Programmable Interrupt Controller 8259, Interfacing to high power devices, Analog input interfacing, Analog output interfacing, Optical motor shaft encoders, Industrial control, Industrial process control.
Text books and Reference books	**Text Book:** [T1] Kennth J. Ayala, "The 8051 Microcontroller Architecture, Programming and Applications", 3rd Ed., West Publishing Company. (Unit I & II). [T2] Raj Kamal, "Microcontrollers Architecture, Programming, Interfacing and System Design" Pearson Education. (Unit III & IV). **Reference Books:** [R1] Muhammad Ali Mazidi, Janice Gillispie Mazidi, Rolin D. McKinlay "The 8051 Microcontroller and Embedded Systems using assembly and C", 2nd Ed., Printice Hall.
E-resources and other digital material	1. http://nptel.iitg.ernet.in (Unit I, Unit II, Unit III, Unit IV)

23EI5302- Process Control

Course Category:	Professional Core	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3 - 0- 0
Prerequisites:		**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course outcomes	Upon successful completion of the course, the student will be able to:														
	CO1	Explain the concepts associated with process control													
	CO2	Built mathematical models and model based control schemes for various physical systems													
	CO3	Select suitable controller, mode, final control element and control schemes for a given application													
	CO4	Analyze various control schemes and tuning methods													
	CO5	Use simulation software to analyze the control system													
Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
	CO1															
	CO2	2														1
	CO3			2												2
	CO4		1													1
	CO5					2										1
Course Content	**UNIT – I** **Introduction to Physical Processes and Dynamics:** Need for process control, Hierarchy of process control activities, An overview of control system design, Degrees of freedom, Introduction to process control, Process control block diagram, Definition, Servo and regulatory operation **UNIT – II** **Modeling and Control of Physical Systems:** Need of mathematical modeling, Characteristics of physical systems, Mathematical modeling of liquid systems, Gas and thermal systems, Mathematical modeling of binary distillation column														

	UNIT – III **Basic Controller Modes**: Introduction to feedback control, Basic control actions, Characteristic of on-off, proportional, Integral and derivative control modes **Controlling Elements**: Pneumatic controllers, Hydraulic controllers, Electrical controllers and electronic controllers **Controller Tuning:** PID controller design and tuning, Criteria for good control, Tuning methods - Ziegler-Nichols method of tuning, Cohen-Coon method of tuning. **UNIT – IV** **Advanced Control Strategies**: Cascade control, Feed forward control, Ratio control, Smith predictor control, and internal model control. **Control Valves**: Sliding stem control valves, Rotating shaft control valves, Control valve sizing**.**
Text books and Reference books	**Text Book:** [T1] Seborg, D E., Mellichamp, D.A. Edger, T.F., "Process Dynamics and Control", 2nd Ed., John Wiley, 2009 [T2] Donald P. Eckman, "Automatic Process Control", Wiley India Pvt. Ltd [T3] Donald R. Coughanowr, "Process Systems Analysis and Control", 2nd Ed., Mc Graw-Hill International Edition **Reference Books:** [R1] Stephanopoulos G, "Chemical Process Control", 3rd Ed., PHI, 1994 [R2] D Patranabis, "Principles of Process Control", 2nd Ed., TMH, 2007
E-resources and other digital material	1. www.freevideolectures.com /Course/3126/Process-Control-and-Instrumentation 2. www.nptel.ac.in/courses/103105064/

23EI5403A- Sensor Signal Conditioning

Course Category:	Professional Elective - I	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3 - 0- 0
Prerequisites:		**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course outcomes	Upon successful completion of the course, the student will be able to:														
	CO1	Develop the signal conditioning circuits for resistive sensors.													
	CO2	Select suitable signal conditioning circuits for reactance variation sensors.													
	CO3	Identify suitable signal conditioning circuits for self-generating sensors.													
	CO4	Illustrate the operation of resonant and semiconductor sensors with communication system.													
Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
	CO1	3														3
	CO2		3													3
	CO3		2													2
	CO4		2											2		

Course Content

UNIT – I

Signal Conditioning for Resistive Sensors: Overview of resistive sensors, Measurement of resistance, Voltage dividers, Wheatstone bridge: Balance measurements, Deflection measurements, Differential and instrumentation amplifiers, Interference, Problems.

UNIT – II

Signal Conditioning for Reactance Variation Sensors: Overview of reactance variation sensors, Problems and alternatives, AC bridges, Carrier amplifiers and coherent detection, Specific signal conditioners for capacitive sensors, Resolver to Digital and Digital to resolver converters, Problems

UNIT – III

Signal Conditioning for Self-Generating Sensors: Overview of self-generating sensors, Chopper and low drift amplifiers, Electrometer and Transimpedance amplifiers, Charge amplifiers, Noise in amplifiers, Noise and drift in resistors, Problems.

UNIT – IV

Resonant Sensors and Other Sensing Methods: Sensors based on quartz resonators,

	SAW sensors, Vibrating wire strain gauges, Digital flowmeters, Sensors Based on Semiconductor Junctions, Sensors Based on MOSFET Transistors, Charge-Coupled and CMOS Image Sensors, Communication system for sensors
Text books and Reference books	**Text Book:** [T1] Roman Pallas Areny and John G Webster, "Sensor and Signal Conditioning", 2nd Ed., John Wiley & Sons, Inc. 2001 **Reference Books:** [R1] Fred Schraff, Steve Lekas, Mike Fraser, Paul Holland "Signal Conditioning and PC based Data Acquisition Handbook", 3rd Ed., Measurement Computing corporation, USA, 2012 [R2] Daniel H Sheingold "Transducers Interfacing Handbook", 1st Ed., Analog Devices, Inc., USA, 1980
E-resources and other digital material	1. https://nptel.ac.in/courses/108105064/22 2. https://nptel.ac.in/courses/112105232/27

23EI5403B- Robotics and Control

Course Category:	Professional Elective – I	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3 - 0- 0
Prerequisites:		**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course outcomes	Upon successful completion of the course, the student will be able to:														
	CO1	Understand the fundamental concepts and working principles of robot anatomy													
	CO2	Describe the kinematics and inverse kinematics of manipulators													
	CO3	Select various control strategies to manipulator design													
	CO4	Identify the use of robots in industrial applications													
	CO5	Select various types of sensors in the field of robotics													
Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
	CO1															
	CO2	3														3
	CO3		2													2
	CO4	2														2
	CO5	2														2

Course Content

UNIT – I

Introduction to Robotics: Evolution of robots and robotics. Laws of robotics, Robot anatomy, Manipulators, Links, Types of joints, Degrees of freedom, Required DOF in a manipulator, Arm and wrist configuration, End effectors, Robot actuators, Sensors and vision

UNIT – II

Robot Kinematics: Coordinate Frames, Mapping and Transformations: Coordinate frames, Description of objects in space, Transformation of vectors, Homogeneous transformation matrices, Fundamentals of rotation matrices.

Direct Kinematic Model: Mechanical structure and notations, Description of links and joints, Kinematic modeling of the manipulator, Denavit Hartenberg (DH) notation. Kinematic relationship between adjacent links, Manipulator transformation matrix, Case study - 3DOF articulated arm kinematic model, 3 DOF RPY wrist kinematics. Inverse kinematics- Manipulator work space, Solvability of inverse kinematic model, Solution

	techniques, Closed form solution, Case study - 3DOF articulated arm inverse kinematics. **UNIT – III** **Control of Manipulators**: Block diagram of manipulator control system, Open and closed loop control system, Manipulator control problem, Linear control schemes, Linear second order SISO model of a manipulator joint, Model of a DC motor, Partition PD and PID control schemes. Force control of robotic manipulator, Hybrid position/ force control, Impedance force/torque control **UNIT – IV** **Robot Sensors and Vision**: Sensors in robotics, kinds of sensors used in robotics, industrial applications of vision controlled robotic systems, process of imaging, architecture of robotic vision systems. **Applications of Robots:** Industrial applications: Material handling - Material transfer applications, Machine loading and unloading application, Picking and placing, Palletizing and depalletizing, Processing applications - Welding assembly applications, Peg in hole assembly, Inspection applications, An overview of non-industrial applications, Work place design considerations for safety.
Text books and Reference books	**Text Book:** [T1] R.K.Mittal &, I.J.Nagarath, "Robotics and Control", Tata McGraw Hill Pvt. Ltd, 15th Ed., 2010 [T2] S.R.Deb, "Robotics Technology and Flexible Automation", Tata McGraw Hill Pvt. Ltd., 2002 **Reference Books:** [R1] R.D.Klafter, T.A.Chimielewski & M. Negin, "Robotic Engineering - An Integrated Approach", Prentice Hall of India, New Delhi, 1994 [R2] P.J.McKerrow, "Introduction to Robotics", Addison Wesley, USA, 1991
E-resources and other digital material	1. http://nptel.ac.in/courses/112103174/4 2. http://nptel.ac.in/courses/112103174/3

23EI5403C- Industrial Electronics

Course Category:	Professional Elective – I	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3 - 0- 0
Prerequisites:		**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course outcomes	Upon successful completion of the course, the student will be able to:														
	CO1	Understand the principles and characteristics of different power electronic devices.													
	CO2	Analyze the operation of SCR converters, Inverters ,Choppers and Cyclo Converters.													
	CO3	Outline the operation of DC amplifiers and Regulated power supplies, UPS and SMPS for industrial applications.													
	CO4	Illustrate various industrial applications of SCR													
Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
	CO1														2	
	CO2		2												2	
	CO3		2												2	
	CO4	3													2	

Course Content

UNIT – I

Thyristors: SCR structure and operation, Characteristics of SCR: Static V-I characteristics, Switching characteristics and gate characteristics, SCR turn on methods, SCR commutation techniques

Modern Semi-Conductor Power Electronic Devices: DIAC, TRIAC, PUT, SUS, SBS, SCS & LASCR

UNIT – II

AC-DC Converters – Thyristor Converters: Introduction, Single phase converters: Half wave converters, Full wave converters, Bridge converters

DC-AC Converters – Thyristor Inverters: Introduction, Single phase inverters, MacMurray inverter, MacMurray Bedford inverter

UNIT – III

DC-DC Converters – Thyristor Choppers: Introduction, Principle of step-down chopper, Principle of step-up chopper, Chopper configurations

AC-AC Converters – Thyristor Cyclo Converters: Introduction, Single phase cyclo

	converters, Single phase centre tapped cyclo converters, Single phase bridge type cyclo converters **UNIT – IV** **Amplifiers and Regulated Power Supplies:** DC Amplifier, Differential amplifier as a DC amplifier, Regulated power supplies, Uninterrupted power supply (UPS), Switched Mode Power Supplies (SMPS) **Industrial Applications:** Industrial timing circuits, Electric welding methods and types, Induction and dielectric heating: Principle, Theory and applications, Ultrasonic generators and applications
Text books and Reference books	**Text Book:** [T1] G.K.Mithal and Dr.Maneesh Gupta, "Industrial and Power Electronics," 9th Ed., Khanna Publications, 2007 **Reference Books:** [R1] M.Ramamurthy, "Thyristors and their Applications", East-West Press, 2nd Ed., 1998 [R2] M.H.Rashid, Power Electronics Devices, Circuits and Application, Prentice Hall of India, 2003 [R2] P.S.Bimbra, "Power Electronics," 4th Ed., Khanna Publications,2010
E-resources and other digital material	1. www.nptel.ac.in/downloads/108105066/ 2. http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-334-powernelectronics-spring-2007/lecture-notes/ **3.** http://www.nptelvideos.in/2012/11/power-electronics.htmlhttp://onlinevideolecture.com/?course_id=510

23EI5403D- VLSI Design

Course Category:	Professional Elective – I	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3 - 0- 0
Prerequisites:		**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course outcomes	Upon successful completion of the course, the student will be able to:														
	CO1	Understand VLSI fabrication processes and CMOS logic design													
	CO2	Analyze basic electrical properties of MOSFET													
	CO3	Apply the design rules of Mask layout for MOS, CMOS and BiCMOS circuits													
	CO4	Understand the basic circuit concepts, scaling of MOS circuits and subsystem design approach													
Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
	CO1	3													2	
	CO2		2												2	
	CO3		3												2	
	CO4	2													2	
Course Content	**UNIT – I** **Introduction to MOS Technology**: Introduction to IC technology, The IC Era, MOS and related VLSI technology, Basic MOS transistors, Enhancement and Depletion modes of transistor action, NMOS fabrication, CMOS fabrication, BiCMOS technology **UNIT – II** **Basic Electrical Properties of MOS and BICMOS Circuits:** Drain-to-Source Current Ids versus Voltage (Vds) relationships, Aspects of MOS Transistor Threshold voltage (Vt), Transconductance (gm) and Output Conductance (gds), Figure of Merit (ωo), The Pass Transistor, NMOS inverter, Pull-up to Pull-down ratio for an NMOS inverter driven by another NMOS inverter, Alternative forms of pull-up, The CMOS Inverter, MOS transistor circuit model, BiCMOS inverter, Latch-up in CMOS circuits and BiCMOS latch-up susceptibility. **UNIT – III** **MOS Circuit Design Processes**: MOS Layers, Stick Diagrams, Design Rules and Layout. General observations on the Design rules, 2μm Double metal, Double poly, CMOS/BiCMOS Rules, Layout Diagrams of CMOS inverter, NAND and NOR gates,														

	Symbolic Diagrams - Translation to Mask Form **UNIT – IV** **Basic Circuit Concepts**: Sheet Resistance Rs, Sheet Resistance Concept Applied to MOS Transistors and Inverters, Area Capacitances of Layers, Standard Unit of Capacitance, The Delay Unit, Inverter Delays, Propagation Delays. **Scaling of MOS Circuits**: Scaling Models and Scaling Factors, Scaling Factors for Device Parameters. **Subsystem Design and Layout**: Architectural Issues, Switch Logic, Gate Logic, Examples of Structured Design (Combinational Logic) - A Parity Generator, Multiplexers (Data Selectors).
Text books and Reference books	**Text Book:** [T1] Douglas A. Pucknell, "Basic VLSI Systems and Circuits", Prentice Hall of India, 3rd Ed., Reprint 2008. [T2] Neil H. E. Weste, David Harris, Ayan Banerjee, "CMOS VLSI Design", 3rd Ed., Pearson Education 2009. [T3] John F Wakerly, "Digital Design Principles & Practices", 3rd Ed., Pearson Education, 2002 **Reference Books:** [R1] Weste & Eshraghian, "Principles of CMOS VLSI Design", Addison-Wesley 1993. [R2] John P. Uyemura, "Introduction to VLSI Circuits and Systems", John Wiley & Sons, Reprint 2009
E-resources and other digital material	

23EI5204A- Essential Principles of Image Sensors

Course Category:	Open Elective – I	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3 - 0- 0
Prerequisites:		**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course outcomes	Upon successful completion of the course, the student will be able to:														
	CO1	Understand the characteristics of image sensors													
	CO2	Describe the general design and limitations of various image sensors													
	CO3	Analyze the effect of sampling on image quality													
Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
	CO1		2													
	CO2	3														
	CO4		2													

Course Content

UNIT – I

Imaging and Role of Image Sensors: Factors Constructing Image Information, Image types, Functional Elements of Image Sensors, Circuit Components for image sensors.

Dynamic Range: Low-Light Imaging Limitations, Bright-Light Imaging Limitations, Signal-to-Noise Ratio, Dynamic Range Gaps, Optical limitations

UNIT – II

Hardware Methods to Extend Dynamic Range: Integrating Linear Pixels, Multilinear Pixels, Multiple Sampling, Multiple-Sensing Nodes, Logarithmic Photovoltaic Pixel, Time to Saturation, Gradient-Based Image

Software Methods to Extend Dynamic Range: General Structure of a Software Approach, High Dynamic Range Image Data Merging, Noise Removal, Tone Mapping

UNIT – III

CCD Sensors: Principle of CCD Sensors, Pixel Technology, Progress, Electronic Shutter

MOS Sensors: Principle of MOS Sensors, Pixel Technology, Progress, Electronic Shutter

CMOS sensors: Principle of CMOS Sensors, Pixel Technology, Progress, Electronic Shutter

UNIT – IV

	Image Information Quality: Deteriorating Elements of Image Information Quality, Impacts of Digitization, Sampling in Space Domain, Sampling in Time Domain, Sampling in Wavelength Domain and Color Information, Technologies to Improve Image Information Quality
Text books and Reference books	**Text Book:** [T1] Takao Kuroda, "Essential Principles of Image Sensors", CRC Press, 2015. [T2] Arnaud Darmont, "High dynamic range imaging: sensors and architectures", 1st Ed., SPIE Press, 2013 **Reference Books:** [R1] Jun Ohta, "Smart CMOS Image Sensors and Applications", CRC Press,2008. [R2] Junichi Nakamura, "Image Sensors and Signal Processing for Digital Still Cameras", Taylor & Francis, 2006.
E-resources and other digital material	

23EI5204B- PC Based Instrumentation

Course Category:	Open Elective – I	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3 - 0- 0
Prerequisites:	Digital Circuits and Systems	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course outcomes	Upon successful completion of the course, the student will be able to:															
	CO1	Identify the generalized and PC based Instrumentation system and Explain the principles of Data Acquisition														
	CO2	Elucidate the hardware organization of IBM PC														
	CO3	Design the plug-in data acquisition and control boards and explain the data acquisition using GPIB														
	CO4	Explain the data acquisition using serial interface and networked data acquisition														
Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
	CO1	3												1		
	CO2	3												2		
	CO3		2													2
	CO4		2											2		

Course Content

UNIT – I

Introduction: Generalized instrumentation system - Measurement system, Control system. Features of personal computers - Expansion slots, Ports, Monitor, Storage devices, Software. PC-based instrumentation system - Data acquisition systems, PC interfaces, Software, Features

Principles of Data Acquisition: Sampling Concepts-Sampling and reconstruction, Shannon sampling theorem, Aliasing, Oversampling, Interpolation, Data acquisition systems - Analog input, Analog output, Digital 1/0 , Timing I/O data acquisition configurations - Local data acquisition, GPIB data acquisition, Data acquisition using serial interfaces, Networked data acquisition

UNIT – II

Hardware Organization of IBM PC: System resources - Interrupt request lines, DMA channels, I/0 space, Utilization of system resources. System and peripheral control chips- System control chips, Peripheral control chips. Expansion buses and I/O ports - Expansion buses, I/0 ports. Peripherals - Drives, Keyboard and Mouse, Monitors, Printers

UNIT – III

	Plug-In Data Acquisition and Control Boards: Plug-in boards- Digital I/0 board, Timing I/0 board. General purpose plug-in DAQ board, PIC plug-in DAQ board **Data Acquisition Using GPIB:** Overview or GPIB-GPIB System, GPIB implementation, GPIB pins and signals, GPIB handshake protocol, Service requests, GPIB capabilities; IEEE 488.2 - Commands and queries, Control sequences, Control protocol, Status reporting structure. SCPI - SCPF generalized instrument model, the SCPI command structure **UNIT – IV** **Data Acquisition using Serial Interfaces:** Microcontroller serial interfaces - UART interface, SPI Bus, Microwire. USB 500 - Features of USB, USB system, USB transfer, USB descriptors, USB microcontrollers. IEEE1349 - Features of 1349, IEEE1349 Signal transmission, IEEE1349 protocol transfer modes, Remote I/O modules **Networked Data Acquisition:** Network data communication- Analog transmission, Hybrid communication, Digital communication, Comparison of communication protocols. Local area networks - OSI model, LAN Characteristics, LAN types, TCP/IP, Network devices, Wireless LAN. Fieldbuses - MODBUS, PROFIBUS, 43 Device net and Control net, FOUNDATION Fieldbus, Industrial Ethernet, IEEE1394 for industrial Automation
Text books and Reference books	**Text Book:** [T1] "Pc-based Instrumentation" Concepts And Practice by N.Mathivanan, PHI Publication **Reference Books:** [R1] PC-based Instrumentation and Control" By. Mike Tooley [R2] Govindarajulu, IBM PC & Clones, TMH, 1996 [R3] Krishna Kant, Computer based Industrial Control, PHI
E-resources and other digital material	

23EI5204C- Transducers and Measurement Systems

Course Category:	Open Elective – I	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3 - 0- 0
Prerequisites:		**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course outcomes	Upon successful completion of the course, the student will be able to:														
	CO1	Identify the type of transducer based on transduction principles													
	CO2	Select a relevant transducer for measurement of various physical parameters													
	CO3	Select a suitable digital instrument to measure physical and electrical parameters													
	CO4	Compare the operation of various oscilloscopes and probes and principles of various signal generators and wave analyzers													
Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
	CO1															
	CO2															
	CO3															
	CO4															
Course Content	**UNIT – I** **Transducers:** Classification of transducers, Characteristics of transducers**.** **Variable Resistance Transducers:** Principle of operation, Construction details, Characteristics and applications of Resistance potentiometers, Strain gauge, Resistance thermometer, Thermistors, Hot-wire anemometer, Resistive hygrometer and Signal conditioning of resistive transducers **UNIT – II** **Reactance Transducers** **Variable Inductance Transducers:** Principle of operation, Construction, Characteristics and applications of LVDT - RVDT, Variable reluctance accelerometer, Signal conditioning of inductive transducers **Capacitive Transducers –** Principle of operation, Construction, Characteristics and applications of Variable air gap, Variable distance, Variable permittivity capacitive transducer, Frequency response, Signal conditioning of capacitive transducers **UNIT – III** **Electromechanical Indicating Instruments:** Suspension type galvanometer- Torque														

	equation at steady state deflection, Dynamic behavior, Damping mechanisms; Permanent magnet moving coil mechanism – Torque equation, Taut- band suspension, Temperature compensation. **Electrical Measurements:** DC ammeters - Shunt resistor, Ayrton shunt, Multirange ammeters, The Ayrton shunt, DC voltmeters - Multiplier resistor, Multirange voltmeter, Ohms per volt rating, Loading effect, Series type ohmmeter, Shunt type ohmmeter, Calibration of dc instruments, Alternating current indicating instruments - Electrodynamometer, Thermo Instruments, Electrodynamometers in power measurements, Watt hour meter, Power factor meters**.** **Bridges:** Wheatstone bridge, Kelvin bridge, Maxwell bridge, Hay bridge, Schering bridge, Wien bridge, Wagner ground connection**.** **UNIT – IV** **Oscilloscopes:** Block diagram of oscilloscope, Cathode Ray Tube, Vertical amplifier, Horizontal deflecting system, Typical CRT connections, Delay line in triggered sweep, Dual beam CRO, Dual trace oscilloscope (basic block diagram), Sampling oscilloscope, Digital storage oscilloscope, Probes for CRO - Direct probes, Passive voltage probe, Active probes, Attenuators - Uncompensated attenuators, Simple compensated attenuator
Text books and Reference books	**Text Book:** [T1] A.K.Sawhney & Puneet Sawhney,"A Course In Electrical And Electronic Measurements And Instrumentation", 19th Ed., Dhanapat Rai & Co., 2015 [T2] W D Cooper & A D Helfrick, "Electronic Instrumentation and Measurement Techniques", PHI, 1998 [T3] H.S.Kalsi, "Electronic Instrumentation", 2nd Ed., TMH. **Reference Books:** [R1] A.K.Ghosh, "Introduction to Measurements & Instrumentation",3rd Ed., PHI, 2009 [R2] Oliver & Cage, "Electronic Measurements and Instrumentation", Mc Graw Hill, 1975
E-resources and other digital material	1. https://nptel.ac.in/courses/108/108/108108147 2. https://www.youtube.com/watch?v=3eYmFjHnQjY&list=PLbRMhDVUMngcoKrA4sH-zvbNVSE6IpEio

23EI5205- MOOCS for 12 weeks

Course Category:	Open Elective – II	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3 - 0- 0
Prerequisites:		**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

23TP 5106- Personality Development

Course Category:	Soft Skills-3	**Credits:**	1
Course Type:	Practical	**Lecture - Tutorial - Practice:**	0 - 0- 2
Prerequisites:	Basic understanding of the language skills viz Listening, Speaking, Reading and Writing	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	100 0 100

Course outcomes	Upon successful completion of the course, the student will be able to:														
	CO1	Recall the fundamentals of developing a positive attitude using verbal and nonverbal communication													
	CO2	Understand how to listen, reflect, and speak while communicating with others using Management skills, team building and leadership qualities													
	CO3	Apply language skills and etiquettes in professional and social contexts with clarity and accuracy													
	CO4	Analyze ideas with coherence, cohesion and precision in formal communication through group discussion & Interviews													
Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
	CO1	2									3		2			
	CO2	2								2	3		2			
	CO3	2									3		2			
	CO4	2									3		2			
Course Content	1**) Positive Attitude** Benefits of positive attitude – Cultivation of positive attitude – Building resilience – Self Confidence – Inspiring others. 2) **Communication** Verbal Communication – Non – verbal Communication. 3**) Management Skills** Anger Management – Stress Management – Time Management. **4) Team Building & Leadership** Team Building traits: Forming – Storming – Norming – Performing – Adjourning Leadership traits: Vision – Integrity – Decisiveness – Confidence – Empathy – Resilience – Flexibility –Innovation.														

	5) Etiquettes Social Etiquette – Business Etiquette – Telephone Etiquette – Dining Etiquette – Conclusion. **6) Mastering Note-Making & Note-Taking** Note - Making: Linear Method – Zettelkasten Method – Digital Gardening – Mind Mapping Tips Note - Taking: Cornell Note Taking Method. **7) Pre-Placement Tests** Synonyms – Antonyms – One-word Substitutes – Correction of Sentences – Vocabulary Analogies – spotting Errors – Sentence Correction. **8) Corporate Grooming** Personal attire – Personal Hygiene – Professional Conduct – Personal Branding – Networking Skills – Workplace Diversity. **9) Group Discussions** Communication Skills – Subject Knowledge – Listening Power – Attitude – Confidence – Leadership Skills – Ways of Presentation – views – Interaction Skills – Decision making ability – Problem solving ability –Critical Thinking ability – Analytical Thinking – Open-mindedness. **10) Interview Skills** Preparation – Professionalism – Communication – Body Language – Problem Solving skills Motivational Enthusiasm – Closing the interview
Text books and Reference books	**Text Book:** [T1] Personality Development Lab Manual **Reference Books:** [R1] Barun K. Mitra, Personality Development and Soft Skills, Oxford University Press, 2011. [R2] S.P. Dhanavel, English and Soft Skills, Orient Blackswan, 2010. [R3] R. S. Aggarwal, A Modern Approach to Verbal & Non-Verbal Reasoning, S. Chand & Company Ltd., 2018. [R4] Raman, Meenakshi & Sharma, Sangeeta, Technical Communication Principles and Practice, Oxford University Press, 2011
E-resources and other digital material	1. www.Udemy.com 2. www.skillshare.com 3. www.coursera.com

23EI5651- Advanced Digital System Design with FPGA

Course Category:	Skill Enhancement course	**Credits:**	1
Course Type:	Theory	**Lecture - Tutorial - Practice:**	0 - 0- 2
Prerequisites:		**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

Course outcomes	Upon successful completion of the course, the student will be able to:														
	CO1	Design, simulate and synthesize complex digital system													
	CO2	Analyze and fix the timing violations													
	CO3	Design ASIC based digital systems using industry standard EDA tools													
	CO4	Generate test patterns and perform fault simulation for digital logic and memory circuits.													
	CO4	Apply DFT techniques viz. scan based testing, BIST and boundary scan for improving testability using EDA tools													
Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
	CO1															
	CO2															
	CO3															
	CO4															
	CO5															
Course Content	**List of Experiments** 1. Design of Digital Architecture for given specification 2. Logical Synthesis of Digital Architecture 3. Netlist Optimization, GLS and Formal Verification 4. Physical Synthesis of Digital Architecture 5. Physical Verification of Digital Architecture 6. Fault Simulation and Test generation for combination circuits 7. Clock and reset rule check at RTL 8. Scan Chain Insertion, DRC and ATPG 9. At-Speed Patterns and On-Chip Clock Controllers (LoS and LoC) 10. Advanced fault modelling 11. SDF annotated simulation 12. Boundary scan test **13.** Testing of memories (BIST insertion, validation and BIST repair) **Any 10 experiments from the above list**														

Text books and Reference books	**Text Book:** [T1] Laung-Terng Wang, Cheng-Wen Wu, and Xiaoqing Wen, VLSI Test Principles and Architectures, 2013, The Morgan Kaufmann. [T2] M. Bushnell, Vishwani Agrawal - Essentials of Electronic Testing for Digital, Memory, and Mixed-Signal VLSI Circuits, 2006, Springer **Reference Books:** [R1] Laung-Terng Wang, Charles E. Stroud, Nur A. Touba, "System-on-chip Test Architectures: Nanometer Design for Testability", 2008, Morgan Kaufmann Publishers
E-resources and other digital material	

23EI5352 - Microcontrollers Lab

Course Category:	Professional Core	**Credits:**	1.5
Course Type:	Theory	**Lecture - Tutorial - Practice:**	0 - 0- 3
Prerequisites:		**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course outcomes	Upon successful completion of the course, the student will be able to:															
	CO1	Describe the architecture of 8051 microcontroller														
	CO2	Use the instruction set of 8051 to solve problems														
	CO3	Select and use various interfacing peripherals along with microcontroller														
Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
	CO1	3														
	CO2			3	3											
	CO3			3	3	3										
Course Content	**List of Experiments** **PART A** Programs on Data Transfer Instructions Programs on Arithmetic and logical Instructions Programs on subroutines Programs on stack operations Program on Serial data transmission **PART B** Interfacing of stepper motor Interfacing of DAC Interfacing of LED Interfacing of LCD Interfacing of Keyboard Interfacing of DC Motor Interfacing of DAC for ADC & Temperature sensor Interfacing of Elevator Interfacing of traffic signals Interfacing of logic controller **Any 10 experiments from the above list**															

Text books and Reference books	**Text Book:** [T1] Kenneth J. Ayala, "The 8051 Microcontroller Architecture, Programming and Applications", 3rd, Ed., West Publishing Company. [T2] Raj Kamal, "Microcontrollers Architecture, Programming, interfacing and system design" Pearson Education **Reference Books:**
E-resources and other digital material	1. http://nptel.iitg.ernet.in.

23EI5353 - Process Control Lab

Course Category:	Professional Core	**Credits:**	1.5
Course Type:	Theory	**Lecture - Tutorial - Practice:**	0 - 0- 3
Prerequisites:		**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course outcomes	Upon successful completion of the course, the student will be able to:														
	CO1	Demonstrate the characteristics of major components of process control loop													
	CO2	Analyze the performance of different control schemes in various process stations													
	CO3	Conduct experiments as individual or team on various process stations													
	CO4	Write an effective report based on experiments													
Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
	CO1	3														
	CO2				3											
	CO3				3	1				1		1				
	CO4										2					
Course Content	**List of Experiments** 1. Characteristics of Chromel – Alumel thermo couple and temperature transmitter 2. Characteristics of PID controller in temperature process station. 3. Characteristics of level transmitter and I/P converter. 4. Characteristics of ON/OFF controller in level process station. 5. Characteristics of flow transmitter and control valve. 6. Characteristics of PI controller in flow process station. 7. Characteristics of pressure transmitter and I/P converter. 8. Comparison of P, PI & PID control modes in pressure process station. 9. Characteristics of cascade control. 10. Characteristics of ratio control. 11. Characteristics of feed forward control. 12. Study of pH control system. 13. Study of temperature control in heat exchanger. 14. Characteristics of PID controller in flow process station using LABVIEW. 15. Characteristics of PID controller in level process station using LABVIEW **Any 10 experiments from the above list**														

Text books and Reference books	**Text Book:** [T1] Process control lab manual. [T2] Donald P. Eckman, "Automatic Process Control', Wiley India Pvt. Ltd. [T3] Donald R. Coughanowr, "Process Systems Analysis and Control, 2nd Ed., McGraw-Hill international edition **Reference Books:**
E-resources and other digital material	1. www.freevideolectures.com /Course/3126/Process-Control-and-Instrumentation 2. www.nptel.ac.in/courses/103105064

23EI5354 - EPICS

Course Category:	Internship/Project Work	**Credits:**	2
Course Type:	Internship/Project Work	**Lecture - Tutorial - Practice:**	0 - 0- 0
Prerequisites:		**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

23HS5107 - Humanities Elective

Course Category:	Mandatory Course	**Credits:**	-
Course Type:	Mandatory Course	**Lecture - Tutorial - Practice:**	3 - 0- 0
Prerequisites:		**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	100 0 100