SIDDHARTHA ACADEMY OF HIGHER EDUCATION

(Deemed to be University)

V R SIDDHARTHA SCHOOL OF ENGINEERING

DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING

SCHEME OF INSTRUCTION FOR FOUR YEAR UG PROGRAMME

SU24

Semester-I to Semester-V Syllabus

Effective from 2025-26

VR SIDDHARTHA SCHOOL OF ENGINEERING

ELECTRONICS & INSTRUMENTATION ENGINEERING

Scheme of Instructions for Four Year B.Tech Programme-SU24

SEMESTER I **CONTACT HOURS: 29**

S. No	Course Code	Course Category	Course Name	L	T	P	Credits
1.	24MA101	BS	Mathematics – I (Linear Algebra, Series and Calculus)	3	0	2	4
2.	24CY102	BS	Engineering Chemistry	3	0	0	3
3.	24BY101	BS	Biology for Engineers	3	0	0	3
4.	24CS101	ES	Problem Solving with Python	3	0	3	4.5
5.	24ME181	ES	Engineering Graphics	1	0	3	2.5
6.	24CY181	BS	Chemistry lab	0	0	2	1
7.	24ME182	ES	Workshop Practice	0	0	3	1.5
8.	24UC183	MC	Sports & Yoga / NSS/ NCC	0	0	3	0
Total				**13**	**0**	**16**	**19.5**

Category
BS-Basic Science
ES-Engineering Science Courses
MC-Mandatory Courses

SEMESTER II **CONTACT HOURS: 29**

S.No	Course Code	Course Category	Course Name	L	T	P	Credits
1.	24MA102	BS	Mathematics – II (Differential equations & Computational methods)	3	0	2	4
2.	24PH102	BS	Engineering Physics	3	0	0	3
3.	24EN101	HS	Communicative English	3	0	3	4.5
4.	24EE101	ES	Electrical Network Analysis	3	0	0	3
5.	24IT101	ES	Programming using C	2	0	2	3
6.	24UC181	ES	Design Thinking	0	0	2	1
7.	24PH181	BS	Physics lab	0	0	2	1
8.	24UC182	ES	AI Tools and Applications	0	0	2	1
9.	24UC101	MC	Essence of Indian Knowledge Tradition	2	0	0	
Total				**16**	**0**	**13**	**20.5**

Category
BS-Basic Science
ES-Engineering Science Courses
HS-Humanities and Social Science
MC-Mandatory Courses

II Year I Semester (Semester III) **CONTACT HOURS: 26**

S.No	Course Code	Course Category	Course Name	L	T	P	Credits
1.	24MA202	BS	Complex Variables, Transform Techniques & Statistics	4	0	0	4
2.	24EI201	ES	Electronics Devices & Circuits	3	0	0	3
3.	24EI202	PC	Electrical & Electronic Measurements	3	0	0	3
4.	24EI203	PC	Digital Electronics	3	0	2	4
5.	24EI204	PC	Sensors and Transducers	3	0	0	3
6.	24EI281	PC	Measurements Lab	0	0	3	1.5
7.	24EI282	ES	Electronic Devices & Circuits Lab	0	0	3	1.5
8.	24UC201	MC	Universal Human Values-II	2	1	0	3
Total				**18**	**1**	**8**	**23**

Universal Human Values-I Course is covered in Induction Program

Category
BS-Basic Science
ES-Engineering Science Courses
PC- Professional Core
HS-Humanities and Social Science
MC-Mandatory Courses

II Year II Semester (Semester IV) **CONTACT HOURS: 29**

S.No	Course Code	Course Category	Course Name	L	T	P	Credits
1.	24EI205	ES	Electrical Technology	3	0	0	3
2.	24EI206	PC	Control Systems	3	0	0	3
3.	24EI207	PC	Industrial Instrumentation	3	0	0	3
4.	24EI208	PC	Linear Integrated Circuits	3	0	0	3
5.	24EI209	PC	Microprocessors & Interfacing	3	0	0	3
6.	24EI283	PC	Transducers Lab	0	0	3	1.5
7.	24EI284	PC	Linear Integrated Circuits Lab	0	0	3	1.5
8.	24EI285	PC	Microprocessors & Interfacing Lab	0	0	2	1
9.	24EI286	PC	Control Systems Lab	0	0	2	1
10.	24EN281	HS	English for Professionals	0	0	2	1
11.	24UC202	MC	Professional Ethics	2	0	0	0
Total				**17**	**0**	**12**	**21**

Category
ES-Engineering Science Courses
PC- Professional Core
HS-Humanities and Social Science
MC-Mandatory Courses

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. **III Year I Semester (Semester V)** **CONTACT HOURS: 30**

S.No	Course Code	Course Category	Course Name	L	T	P	Credits
1.	24EI301	PC	Process Control	3	0	0	3
2.	24EI302	PC	Digital Signal Processing	3	0	0	3
3.	24EI303	PC	VLSI Design	3	0	0	3
4	24EI310 A,B,C,D	PE	**Professional Elective -1** A. Optoelectronics and Laser Instrumentation B. Sensor Signal Conditioning C. Robotics and Control D. Industrial Electronics	3	0	0	3
5.	24EI360 A , B	IE	**Inter disciplinary Elective – 1 / (Industry offered course)** A. Principles of Process Control B. Programmable Logic Controllers (Basket of courses from other engineering departments)	3	0	0	3
6.	24EI383	PC	Process Control Lab	0	0	3	1.5
7.	24EI384	PC	Virtual Instrumentation Lab	0	0	3	1.5
8.	24EI381	PR	EPICS	0	0	4	2
9.	24EI382	PC	**Skill Course-I (Program specific)** Digital System Design Using Verilog	1	0	2	2
10.	24UC302	MC	Environmental Science	2	0	0	0
Total				**18**	**0**	**12**	**22**

Category
PC- Professional Core
IE - Inter disciplinary Elective – 1 / Industry offered course
PE - Professional Elective
PR - EPICS
UC- University Common
MC-Mandatory Courses

Inter disciplinary Elective Courses (Basket of courses from other Engineering Departments)		
S. No	**Name of the Dept.**	**Inter disciplinary Elective -1**
1	CSE CSE CSE (AI & ML) CSE (AI & DS)	1. Internet of Things (IoT) - 60 2. Web Programming - 60 3. Introduction to AI & ML - 60 4. Programming in Data Science - 60
2	IT	1. Artificial Intelligence Techniques - 60 2. Data Structures - 60 3. Data Visualization - 60
3	ECE	1. Introduction to Embedded Systems - 120 2. Introduction to Communication Engineering – 120
4	CE	1. Geospatial Technologies - 60 2. Building Services Engineering - 60
5	EEE	1. Renewable Energy – 60 2. Fundamentals of Electric Vehicles – 60
6	**EIE**	**Inter disciplinary Elective - 1** **1. Principles of Process Control – 60** **2. Programmable Logic Controllers – 60** **Inter disciplinary Elective -2** 1. Instrumentation for Process Industries 2. PC based Instrumentation
7	ME	1. Systems Engineering – 120 2. Elements of Mechanical Engineering – 180 3. Manufacturing Technology – 180

Interdisciplinary courses offered by the EIE Department to all students, except EIE students.

III Year II Semester (Semester VI) **CONTACT HOURS: 29**

S.No	Course Code	Course Category	Course Name	L	T	P	Credits
1.	24EI304	PC	Microcontrollers & Embedded Systems	3	1	0	4
2.	24EI305	PC	**Industrial Automation**	3	1	0	4
3.	24EI370 A,B	IE	**Inter disciplinary Elective – 2 / Industry offered Course** A. Instrumentation for Process Industries B. PC based Instrumentation (Basket of courses from other engineering departments)	3	0	0	3
4.	24EI320 A, B,C,D	PE	**Program Elective -2** **A. Biomedical Instrumentation** B. Industrial Communication Networks C. Process Modeling and Simulation D. Power Plant Instrumentation	3	0	0	3
5.	24EI330 A,B,C,D	PE	**Program Elective -3** A. Instrumentation and Control in Food Processing B. Industrial Internet of Things C. Wireless Sensor Networks D. Drives and Control for Industrial Automation	3	0	0	3
6.	24EI386	PC	Microcontrollers & Embedded Systems Lab	0	0	3	1.5
7.	24EI387	PC	**Industrial Automation Lab**	0	0	3	1.5
8.	24EN381	HS	Advanced communication skills	0	0	2	1
9.	24EI383	PC	**Skill Course-II (Program specific)** Advanced Instrumentation Lab	0	0	2	1
10	34UC301	MC	Constitution of India	2	0	0	0
Total				**17**	**02**	**10**	**22**

**** SDG Mapped Courses**

IV Year I Semester (Semester VII) **CONTACT HOURS: 24**

S.No	Course Code	Course Category	Course Name	L	T	P	Credits
1.	24EI401	PC	Computer Control of Processes	3	0	0	3
2.	24OE410 A, B,	OE	**Open Elective – 1** (OE Basket) A. B.	3	0	0	3
3.	24EI440 A,B,C,D	PE	**Program Elective -4** A. Advanced Sensors B. **AI & ML in Healthcare** C. Intelligent Systems and Control D. Digital Image Processing	3	0	0	3
4.	24HE410 A,B,C,D	HE	**Humanities Elective – 1** (HE Basket)	3	0	0	3
5.	24EI481	PR	Summer Internship	0	0	4	2
6.	24EI482	PC	**Advanced Skill Course (Program specific)** RTOS Lab	0	0	2	1
7.	24EI483	PR	Mini Project	0	0	6	3
Total				**12**	**0**	**12**	**18**

Open Elective Courses (OE Basket) **Open Elective – 1**
• Foreign Language
• Music
• Law
OR
Any course offered by SAHE/Online (Swayam/NPTEL) and approved by department BOS
• German-I (IIT Madras)
• Copyright and Related Rights Law (NALSAR University of Law)
• Indian Art: Materials, Techniques and Artistic Practices (IIT Kanpur)
• Right to Information and Good Governance (National Law School of India University)

IV Year I Semester (Semester VIII) **CONTACT HOURS: 22**

S.No	Course Code	Course Category	Course Name	L	T	P	Credits
1.	24HE420 A,B,C,D	HE	**Humanities Elective – 2** (HE Basket)	3	0	0	**3**
2.	24OE420 A,B,C,D	OE	**Open Elective – 2** (OE Basket)	3	0	0	**3**
3.	24EI484	PR	**Major Project**	0	0	16	**8**
Total				**06**	**0**	**16**	14

Humanities Elective Courses (HE Basket)
• Project Management
• Engineering Economics and Management
• Innovation, IPR & Entrepreneurship
• Operations Research
• Industrial Psychology
• Finance & Accounting
• Organizational Behavior
OR
Any management course offered by SAHE/Online (Swayam/NPTEL) and approved by department BOS
• Fundamentals of Entrepreneurship (IIT Bombay)
• Understanding Incubation and Entrepreneurship (IIT Bombay)
• Organizational behaviour (IIT Tirupathi)
• E-Business (IIT Kharagpur

First Year
(I Semester)

24MA101
Mathematics – I
(Linear Algebra, Series and Calculus)

Course Category:	**Basic Sciences**	**Credits:**	**4**
Course Type:	**Theory**	**Lecture-Tutorial-Practice:**	**3-0-2**
Pre-requisites:	**10+2 Mathematics**	**Continuous Assessment:** **Summative Assessment:** **Total Marks:**	**40** **60** **100**

Course Description: An overview of the fundamental concepts of linear algebra, infinite series, Differential calculus, multiple integrals and vector calculus, with a focus on the applications in solving engineering problems.

Course Objectives:

- Introduce techniques for solving systems of linear equations, determining Eigen values and eigenvectors, and performing matrix diagonalization.
- Explain methods to analyze the convergence and divergence of an infinite series and to expand functions using Taylor's or Maclaurin's series
- Familiarize differentiation rules and theorems to solve problems related to rates of change and optimization
- Explain the concept of double and triple integrals to calculate areas and volumes for two-dimensional and three-dimensional objects
- Teach operations on vector-valued functions, including line and surface integrals, as well as the concepts of curl and divergence, and their applications in engineering

Course Outcomes:

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

CO	Course Outcomes	BTL
CO1	Solve the systems of equations and analyze engineering problems using linear algebra techniques	K3
CO2	Apply the convergence tests of an infinite series to solve engineering problems	K3
CO3	Use differential calculus to solve optimization problems and analyze rates of change in engineering applications	K3
CO4	Calculate areas and volumes using double and triple integrals.	K3
CO5	Apply vector calculus concepts to solve problems involving work done by force fields and analyze related physical phenomena	K3

Course articulation matrix

	POs											PSOs	
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	**2**	**2**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO2	**2**	**2**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO3	**2**	**2**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO4	**2**	**2**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO5	**2**	**2**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

(1-Low, 2 -Medium, 3–High)

Course Content

Unit-I

Linear Algebra **[T2]**

Rank of a matrix (Echelon form), Finding the inverse by Gauss-Jordan method, System of linear equations: Homogeneous and Non-Homogeneous, Linear transformations, Orthogonal transformation, Eigen values and Eigenvectors, Reduction to Diagonal form

Unit-II

Infinite Series **[T2]**

Infinite Sequence (Definition), Infinite Series, Comparison Tests, Integral Test, Ratio and Root Test, Alternating Series, Absolute and Conditional convergence.

Unit-III

Differential Calculus **[T2]**

Mean value theorems: Rolle's theorem (without proof), Lagrange's mean value theorem (without proof), Taylor's and Maclaurin's theorems with Lagrange's form of remainder (without proof), Expansions of functions: Taylor's and Maclaurin's series Functions of Several Variables: Maxima and Minima of functions of two variables, Lagrange's method of undetermined multipliers

Unit-IV

Multiple Integral **[T2]**

Double integrals (Cartesian coordinates), Change of order of integration, Triple integrals, Change of variables to polar, cylindrical and spherical coordinates, Areas as double integration and Volumes as triple integration

Unit-V

Vector Calculus **[T2]**

Introduction to Gradient of a scalar field, Divergence and Curl of a vector field, Line integral, Green's theorem in the plane (without proof), Surface integrals, Stoke's theorem (without proof) and Gauss divergence theorem (without proof)

Text Books:

1. Weir Maurice D., Hass Joel & Giodano Frank R. (2013). *Thomas' Calculus*. (11th Edition). Pearson Education,inc..
2. Grewal B. S. (2017). *Higher Engineering Mathematics*. (44th Edition). Khanna Publishers.

Reference Books:

1. Kreyszig Erwin. (2013). *Advanced Engineering Mathematics*.(9th Edition).Wiley Publishers.
2. Ramana B.V.(2007). *Higher Engineering Mathematics*.Tata Mc.Graw Hill

Web Resources:

MIT OpenCourseWare: Linear Algebra
https://ocw.mit.edu/courses/18-06-linear-algebra-spring-2010/
NPTEL: Linear Algebra
https://archive.nptel.ac.in/courses/111/104/111104137/
MIT OpenCourseWare: Multivariable Calculus
https://ocw.mit.edu/courses/18-02sc-multivariable-calculus-fall-2010/
NPTEL: Engineering Mathematics-I
https://archive.nptel.ac.in/courses/111/105/111105121/

24MA101
LINEAR ALGEBRA, SERIES AND CALCULUS

Course Category:	**HS**	**Credits:**	**1C**
Course Type:	**Integrated Lab**	**Lecture-Tutorial-Practice:**	**0L-0T-2P**
Pre-requisites:	**Mathematics-I**	**Continuous Assessment:** **Summative Assessment:** **Total Marks:**	**40** **60** **100**

Course Description:

An overview of the functions of MathWorks Symbolic Math Tool Box to solve problems in Matrix algebra, differential calculus, multiple integrals, vector calculus and to test the nature of series.

Course Objectives:

1. Find inverse, rank, eigen values, eigen vectors of a matrix and solution of system of linear equations.
2. Analyze the convergence and divergence of infinite series.
3. Find ordinary and partial derivatives
4. Expand functions as Taylor's and Maclaurin's series.
5. Determine extreme values of multi-variable function with and without constraints.
6. Calculate areas and volumes using double and triple integrals.
7. Find gradient, divergent and curl.

Course Outcomes:

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

CO	Course Outcomes:	BTL
CO1	Find rank, eigen values, eigen vectors of a matrix, solution of system of linear equations.	(K3)
CO2	Examine the convergence/divergence of infinite series	(K3)
CO3	Determine derivatives, series expansion and extreme values of a function	(K3)
CO4	Calculate areas and volumes using double and triple integrals	(K3)
CO5	Find gradient of scalar field, divergence and curl of vector field	(K3)

Course articulation matrix

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

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

Course Content

Unit-I

`inv()` function to find inverse of a matrix
`rank()` function to find rank of a matrix
`rref()` function to solve system of linear equations
`eig()` function to find eigen values and eigen vectors of a matrix

Unit-II

`vpa()` function to evaluate numerically each term of series
`symsum()` function to test the nature of the series

Unit-III

`diff()` function to find ordinary and partial derivatives
`taylor()` function to expand functions as Taylor's and Maclaurin's series
`fmincon()` function to find minimum of a function with constraints

Unit-IV

`int()` function to find double and triple integrals

Unit-V

`gradient()` function to find gradient of a scalar point function
`divergence()` function to find divergence of a vector point function
`curl()` function to find curl of a vector point function

Text Books:

Matlab Lab Manual

Web Resources:

- MathWorks Linear Algebra Documentation
  Linear Algebra - MATLAB & Simulink - MathWorks India
- MathWork Symbolic Calculus Tool Box
  Calculus - MATLAB & Simulink - MathWorks India
- MathWork Symbolic Math Tool Box
  Symbolic Math Toolbox Documentation - MathWorks India
- MathWork Optimization Tool Box
  Optimization Toolbox Documentation - MathWorks India
- MathWork Symbolic Calculus Tool Box
  Calculus - MATLAB & Simulink - MathWorks India

24CY102
Engineering Chemistry

Course Category:	**Basic Sciences**	**Credits:**	**3**
Course Type:	**Theory**	**Lecture-Tutorial-Practice:**	**3-0-0**
Pre-requisites:	**10+2 Chemistry**	**Continuous Assessment:** **Summative Assessment:** **Total Marks:**	**40** **60** **100**

Course Description:

The course is designed for B.Tech. Electrical, Electronics and Communications and Instrumentation Engineering students, providing essential and applied knowledge of Chemistry relevant to their fields. Understanding the specific application of materials based on their characteristic properties, which are determined by their structural and bonding aspects, is crucial for appropriate utilization. With this focus, the course covers the working of electrodes, sensors, batteries, fuel cells and super capacitors which are application of principles of electrochemistry. Also, the course enlightens the students on mechanistic aspects of corrosion and its control, chemical aspects of materials useful in electrical and electronics engineering. Further, it focuses on the principles and instrumentation of various instrumental techniques.

Course Objectives:

1. Impart knowledge on the functioning of electrodes, potentiometric and conductometric sensors.
2. Discuss construction and working of different types of batteries, fuel cells and super capacitors based on the principles of electrochemistry.
3. Analyse various corrosion processes and propose control methods depending on the principles of corrosion.
4. Explore the chemical aspects of various materials used in electrical, electronics and communications engineering.
5. Explain the principles, instrumentation of different instrumental techniques and their applications

Course Outcomes:

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

CO	Course Outcomes	BTL
CO1	Apply the principles of electrochemistry to analyse working of electrodes and sensors	**K3**
CO2	Analyse various electrochemical energy systems for their application in engineering	**K4**
CO3	Assess the challenges arising due to corrosion of electronic devices	**K5**
CO4	Demonstrate the knowledge of materials for their use in manufacture of electrical and electronic devices	**K3**
CO5	Compare different analytical techniques and their instrumentation for their application in qualitative and quantitative analysis	**K4**

Course articulation matrix

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

(1-Low, 2 -Medium, 3–High) (WK1)

Course Content

Unit-I
Electrochemistry

- Electrodes, electrode potentials and electrochemical cells
- The Nernst equation with numerical problems for calculating electrode potential and emf
- Reference electrodes – Calomel and Ag/AgCl electrodes, Ion-selective electrodes, glass electrode - construction, working, advantages, and disadvantages
- Potentiometry – redox titrations
- Conductometry (acid-base reactions)
- Electrochemical sensors – principle and applications

Unit-II
Electrochemical Energy Systems

- Types of electrochemical energy systems – charging vs. discharging
- Primary vs. secondary batteries
- Lithium-ion batteries – Lithium iron phosphate and lithium cobalt oxide – construction and working of the batteries including cell reactions
- Fuel cells – hydrogen-oxygen fuel cell and polymer electrolyte membrane fuel cell
- Super capacitors – principle, classification and applications
- Chemistry of fast charging EVs

Unit-III
Corrosion and Its Control

- Introduction to corrosion, causes and examples
- Electrochemical corrosion: hydrogen evolution and oxygen absorption corrosion

- Differential aeration corrosion
- Galvanic corrosion and its control, including the galvanic series
- Corrosion in microelectronic devices
- Factors influencing corrosion
- Electroplating and electroless plating

Unit-IV
Chemistry of Electrical and Electronic Materials

- Conducting polymers: Types of conducting polymers, mechanisms of conduction in undoped, doped polyacetylene and engineering applications of conducting polymers.
- Other materials of conduction: Production of electronic grade silicon from quartz and its applications, metal compounds as semiconductors, applications of carbon nanotubes and graphene in electrical and electronic industry.

Unit-V
Analytical Instrumentation Techniques

- Electromagnetic spectrum, Interaction of radiation with matter.
- UV-Visible spectroscopy: principle, electronic transitions, various shifts in UV-Visible spectroscopy, Lambert-Beer's law, Instrumentation, qualitative and quantitative applications of UV-Visible spectroscopy.
- Infrared spectroscopy: principle, types of vibrations, selection rule for vibrations in diatomic molecules, Instrumentation, qualitative and quantitative applications of IR spectroscopy.

Text Books:

1. Ramesh, S. (2013). *Engineering chemistry* (2nd ed.). Wiley India.
2. ShikhaAgarwal, (2015). *Engineering chemistry: fundamentals and applications*(1st ed.). Cambridge University Press.
3. Jain, P.C.(2018).*Engineering chemistry* (17th ed.). DhanpatRai.

Reference Books:

1. PrasanthaRath, &ArunaKumari, S. (2023).*Engineering chemistry* (1st ed.). Cengage.
2. ArunBahl, Bahl, B. S., &Tuli, G. D. (2020). *Essentials of physical chemistry* (28th ed.). S. Chand.
3. Haghi, A. K., Mercader, A. G., Balkoese, D., &Mukbaniani, O. V. (2021).*Applied chemistry and chemical engineering*, (1st ed.). CRC Press, Taylor & Francis Group.

4. Skoog, D. A., West, D. M., Holler, F. J.,&Crouch, S. R. (2022).*Fundamentals of analytical chemistry* (10th ed.). Cengage.
5. Fontana, M. G. (2017). *Corrosion engineering* (3rd ed.). McGraw-Hill Education.
6. Swaminathan, P. (2017). *Semiconductor materials, devices, and fabrication*. Wiley.
7. Banwell, C. N., &McCash, E. M. (2017). *Fundamentals of molecular spectroscopy* (4th ed.). McGraw-Hill Education.

Web Resources:

- https://www.sciencedirect.com/topics/chemistry/electrochemistry
- https://wme-z1.pwr.edu.pl/wp-content/uploads/2017/05/Basics-of-Electrochemistry.pdf
- https://ocw.mit.edu/courses/10-626-electrochemical-energy-systems-spring-2014/pages/lecture-notes/
- https://pressbooks.online.ucf.edu/chemistryfundamentals/chapter/batteries-and-fuel-cells-2/
- https://pesjournal.net/journal/v3-n1/2.pdf
- https://www.researchgate.net/publication/275028997_Corrosion_and_Corrosion_Control
- https://pubs.rsc.org/en/content/articlehtml/2021/ra/d0ra07800j
- https://nanografi.com/blog/application-areas-of-nanotechnology-in-display-and-communication-technology/
- https://personal.utdallas.edu/~goeckner/plasma_tech_class/AgilentSpectroPub4.pdf
- https://personal.utdallas.edu/~scortes/ochem/OChem_Lab1/recit_notes/ir_presentation.pdf

24CY103
Chemistry for Engineers

Course Category:	**Basic Sciences**	**Credits:**	**3**
Course Type:	**Theory**	**Lecture-Tutorial- Practice:**	**3-0-0**
Pre-requisites:	**10+2 Chemistry**	**Continuous Assessment:** **Summative Assessment:** **Total Marks:**	**40** **60** **100**

Course Description:

The course is designed for Civil and Mechanical Engineering first year students, providing essential and applied knowledge of Chemistry relevant to their fields. Understanding the specific application of materials based on their characteristic properties, which are determined by their structural and bonding aspects, is crucial for appropriate utilization. With this focus, the course covers the working principles of electrodes, sensors, batteries, and fuel cells, applying principles of electrochemistry. Additionally, it delves into the mechanistic aspects of lubricants and the composition of cement, concrete, composites, refractories, glasses, and alloy steels. Furthermore, the course emphasizes the principles and control methods of corrosion in various metal structures.

Course Objectives:

1. Impart knowledge on the functioning of electrodes, batteries and fuel cells, grounded in electrochemical principles.
2. Analyse various corrosion processes and propose control methods based on corrosion principles.
3. Discuss structural and compositional aspects of engineering materials such as polymers, glasses, and alloy steels.
4. Explore the composition, nature, properties, and applications of different types of cements, concrete, and refractories.
5. Explain the mechanisms and properties of lubricants, and the composition of composite materials, highlighting their engineering applications.

Course Outcomes:

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

CO	Course Outcomes	BTL
CO1	Apply the knowledge of basic electrochemistry principles to electrodes, batteries and fuel cells	**K3**
CO2	Analyse various corrosion processes and control methods	**K4**
CO3	Analyse the dependence of applications of polymers, glasses and alloy steels on their composition, bonding and structures	**K4**
CO4	Correlate the characteristic features of cements, concrete and refractories with chemical composition and chemical reactions involved	**K4**

CO5	Apply the chemical aspects of lubricants and composite materials to assess their engineering applications	**K3**

Course articulation matrix

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

(1-Low, 2 -Medium, 3–High) (WK1)

Course Content

Unit-I
Electrochemistry

- Electrodes, electrode potentials and electrochemical cells
- The Nernst equation with numerical problems for calculating electrode potential and emf
- Reference electrodes – Calomel and Ag/AgCl electrodes, Ion-selective electrodes, glass electrode - construction, working, advantages, and disadvantages
- Conductometric analysis (acid-base reactions)
- Batteries, with a focus on lithium-ion ($LiCoO_2$)battery
- Fuel cells, specifically the hydrogen-oxygen fuel cell

Unit-II
Corrosion and its control

- Introduction to corrosion and its causes
- Electrochemical corrosion: hydrogen evolution and oxygen absorption corrosion
- Differential aeration corrosion
- Scaling and corrosion in boilers and their control
- Galvanic corrosion and its control, including the galvanic series
- Surface coatings: types of metallic coatings
- Hot dipping processes: galvanizing and tinning

Unit-III
Polymer Chemistry, Glasses and Alloy Steels

- Polymer chemistry: Introduction, types of polymerization, thermoplastics and thermosetting plastics, preparation, properties and applications of PVC, Nylon-6,6, Urea-formaldehyde and Polyurethane.
- Glasses: Composition, types of glasses, properties and engineering applications.
- Alloy Steels: Types of steels, specific effects of alloying elements, industrial applications of alloy steels.

Unit-IV
Chemistry of Cement and Refractories

- Cement: Composition, manufacture of Portland cement, setting and hardening of cement and chemical reactions involved, concrete and RCC, reactions involved in corrosion of reinforcement steel, degradation and protection of concrete.
- Refractories: Classification and properties – refractoriness, RUL test, porosity, and applications of refractories.

Unit-V
Lubricants and Composite Materials

- Lubricants: Friction and effects of frictional heat, lubricants, mechanisms of lubrication, types of lubricants based on physical state, properties of lubricants – viscosity, flash and fire points, mechanical stability.
- Composite materials: Constituents of composites, types of composites and engineering applications of composites.

Text Books:

1. Ramesh, S. (2013). *Engineering chemistry* (2nd ed.). Wiley India.
2. ShikhaAgarwal, (2015). *Engineering chemistry: fundamentals and applications*(1st ed.). Cambridge University Press.
3. Jain, P.C.(2018).*Engineering chemistry* (17th ed.). DhanpatRai.

Reference Books:

1. PrasanthaRath, &ArunaKumari, S. (2023).*Engineering chemistry* (1st ed.). Cengage.
2. ArunBahl, Bahl, B. S., &Tuli, G. D. (2020). *Essentials of physical chemistry* (28th ed.). S. Chand.

3. BillmeyerJr, F. W. (2007).*Textbook of polymer science* (3rd ed.). John Wiley & Sons.
4. Haghi, A. K., Mercader, A. G., Balkoese, D., &Mukbaniani, O. V. (2021).*Applied chemistry and chemical engineering*, (1st ed.). CRC Press, Taylor & Francis Group.
5. Skoog, D. A., West, D. M., Holler, F. J.,&Crouch, S. R. (2022).*Fundamentals of analytical chemistry* (10th ed.). Cengage.
6. Fontana, M. G. (2017). *Corrosion engineering* (3rd ed.). McGraw-Hill Education.
7. Taylor, H. F. W. (1997). *Cement chemistry* (2nd ed.). Thomas Telford.

Web Resources:

- https://www.sciencedirect.com/topics/chemistry/electrochemistry
- https://chem.libretexts.org/Bookshelves/General_Chemistry/Map%3A_Chemistry 20.7: Batteries and Fuel Cells - Chemistry LibreTexts
- https://pesjournal.net/journal/v3-n1/2.pdf
- https://www.researchgate.net/publication/275028997_Corrosion_and_Corrosion_Control
- https://www.snexplores.org/article/explainer-what-are-polymers
- https://books.google.co.in/books/about/Glass_Chemistry.html?id=2yTyCAAAQBAJ&redir_esc=y
- https://kdmfab.com/alloy-steel/
- https://www.mdpi.com/2076-3417/13/1/203
- https://www.rhimagnesitaindia.com/blog/major-types-of-refractories,-characteristics,-and-their-applications-/26
- https://tameson.com/pages/lubricants
- https://www.toppr.com/guides/geography/mineral-and-energy-resources/composite-materials-definition-and-its-types/

24BY101
Biology for Engineers

Course Category:	**Basic Sciences**	**Credits:**	**3**
Course Type:	**Theory**	**Lecture-Tutorial-Practice:**	**3-0-0**
Pre-requisites:	**-**	**Continuous Assessment:** **Summative Assessment:** **Total Marks:**	**40** **60** **100**

Course Description:

The course introduces engineering students to key concepts in biology essential for understanding biological systems and their integration into engineering practices. It covers a wide range of topics from basic biological principles to advanced applications in biomedical engineering, bio materials, synthetic biology, and bioinformatics.

Course Objectives:

1. Introduce engineers to foundational concepts in biology essential for understanding biological systems and their relevance to engineering applications.
2. Explore the properties and behavior of biomaterials and biomechanics principles that influence the design and functionality of biomedical devices.
3. Investigate bio-inspired design principles, synthetic biology techniques, and biotechnological applications for engineering innovation.
4. Explore bioinformatics tools and systems biology approaches to analyse complex biological data and understand biological systems at a molecular and cellular level.
5. Investigate advanced topics in biological engineering, such as Nano biotechnology, regenerative medicine, or emerging biotechnologies, to expand students' knowledge and skills.

Course Outcomes:

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

CO	Course Outcomes	BTL
CO1	demonstrate a fundamental understanding of basic biological principles, such as cell biology, genetics, and physiology, and their application in engineering contexts.	K3
CO2	analyse and evaluate biomaterials based on their mechanical properties and design biomedical devices using biomechanical principles.	K4
CO3	apply bio-inspired design principles and synthetic biology techniques to propose innovative engineering solutions and understand their practical applications in biotechnology.	K3
CO4	develop proficiency in using bioinformatics tools, constructing computational models, and applying systems biology approaches to study and interpret biological data and systems.	K3
CO5	critically analyse and evaluate current research trends and innovations in advanced areas of biological engineering, demonstrating the ability to apply advanced concepts in real-world engineering scenarios.	K4

Course articulation matrix

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

(1-Low, 2 -Medium, 3–High) (WK1)

Course Content

Unit-I
Introduction to Biology for Engineers

- Overview of interdisciplinary nature and importance of biology for engineers
- Basic biological concepts relevant to engineering applications
- Introduction to engineering challenges addressed by biology-inspired solutions
- Introduction to the structure and functions of Biomolecules

Unit-II
Biomaterials and Biomechanics

- Properties and applications of biomaterials in engineering (e.g., tissue engineering, drug delivery systems)
- Biomechanical principles applied to engineering (e.g., mechanics of bones and joints, biomechanics of tissues)
- Case studies: Design and development of biomaterials for medical implants, prosthetics, and tissue engineering

Unit-III
Bio inspired Design, Synthetic Biology and Biotechnology

- Introduction to bioinspired design, biomimicry, synthetic biology and genetic engineering (Genetically modified Crops & Animals)
- Examples of biological systems inspiring engineering innovations (e.g., bird flight, gecko adhesion, shark skin, human eye camera)
- Applications of biotechnology in engineering (e.g., bioprocessing, bioremediation, biosensors)

- Case studies: Biomimetic design in robotics, materials science, architecture, Development of biofuels, bioplastics, and biopharmaceuticals

Unit-IV
Bioinformatics and Systems Biology

- Introduction to bioinformatics tools and databases
- Engineering applications of bioinformatics (e.g., genome sequencing, protein structure prediction, drug discovery)
- Systems biology approaches to understanding complex biological systems and networks
- Case studies: Computational modelling of biological systems, personalized medicine, and synthetic biology

Unit-V
Advanced Topics in Biology for Engineers

- Emerging trends and cutting-edge research in biology for engineers
- Advanced applications and case studies in specific engineering fields (e.g., nanotechnology, energy, environmental engineering)
- Ethical considerations (Bio-Safety) and societal implications (Biopiracy & Bio patent)

Text Books:

1. Johnson, A. T. (2011). Biology for Engineers. CRC Press.
2. Renneberg, R. (2017). Biotechnology for Engineers: Biological Processes and Technologies (1st ed.). Elsevier.
3. Mount, D. W. (2004). Bioinformatics: Sequence and Genome Analysis (2nd ed.). Cold Spring Harbor Laboratory Press.

Reference Books:

1. Enderle, J., & Bronzino, J. (2011). Introduction to Biomedical Engineering (3rd ed.). Academic Press.
2. Ratner, B. D., Hoffman, A. S., Schoen, F. J., & Lemons, J. E. (2012). Biomaterials Science: An Introduction to Materials in Medicine (3rd ed.). Academic Press.
3. Benyus, J. M. (2002). Biomimicry: Innovation Inspired by Nature. Harper Perennial.

Web Resources:

1: Introduction to Biology for Engineers (https://archive.org/details/biologyforengine0000john)

2: The Interdisciplinary Role of Biology in Engineering (https://onlinecourses.nptel.ac.in/)
3: Biomaterials in Engineering (https://link.springer.com/book/10.1007/978-3-031-35832-6)
4:Biomechanics Principles (https://www.cambridge.org/core/books/introductory biomechanics/79733231375F00B75C84A47CCABB9386)
5: Bioinspired Design (https://link.springer.com/article/10.1007/s00163-020 00333-w)
6:BiomimicryApplications(https://www.cambridge.org/core/books/abs/bioinspired-structures-and design/bioinspired-and-biomimetic-design-of-multilayered-and-multiscale structures/D14F3C8BD06061B5983B7DAB55D6B1FA)
7: Fundamentals of Synthetic Biology (https://www.nature.com/subjects/synthetic-biology) Resource 8: Biotechnology Applications (https://open.umn.edu/opentextbooks/textbooks/820)
8: Bioinformatics Tools and Databases (https://microbenotes.com/bioinformatics-databases-software-tools/)
9: Systems Biology Approaches (https://link.springer.com/protocol/10.1007/978-981-99-6913-5_9)
10: Emerging Trends in Bioengineering (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7392392/)
11: Advanced Applications in Bioengineering (https://ibecbarcelona.eu/about-us/applications-in-bioengineering/)
12: Ethical Considerations in Biotechnology (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6612373/)

COURSE CODE: 24CS102
PROGRAMMING USING C

Course Category:	Engineering Science (ES)	**Credits:**	3
Course Type:	Theory	**Lecture -Tutorial-Practice:**	3-0-0
Pre-requisites:		**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	40 60 100

Course Description

This course introduces foundational programming concepts, covering algorithms, flowcharts, and pseudo code. It explores the C language structure, data types, operators, control structures, loops, arrays, strings, and functions. Advanced topics include pointers, dynamic memory allocation, structures, unions, enumerations, and file handling. Students gain hands-on experience with inter-function communication, recursion, sorting/searching techniques, and memory management. The course emphasizes practical coding skills, problem-solving, and program design, providing a solid foundation for software development using the C language.

Course Objectives

- *To introduce students to the fundamentals of computer programming.*
- *To provide hands-on experience with coding and debugging.*
- *To foster logical thinking and problem-solving skills using programming.*
- *To familiarize students with programming concepts such as data types, control structures, functions, and arrays.*
- *To encourage collaborative learning and teamwork in coding projects.*
- *To evaluate and apply C programming techniques proficiently for searching and sorting.*

Course Outcomes

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

	Course Outcomes	BTL	POI
CO1	Understand fundamental programming concepts in C through algorithms, flowcharts, and selection statements.	**K2**	1.7.1,2.5.1, 2.5.2, 2.7.1
CO2	Develop efficient C programs using loops, arrays, and strings using control structures.	**K3**	1.7.1,2.5.1, 2.5.2, 2.6.3,3.5.1
CO3	Implement modular C programs using functions, pointers, and memory optimizations.	**K3**	1.7.1, 2.5.2, 2.6.3, 3.5.1, 5.4.1
CO4	Develop C programs using structures and unions for user defined data types.	**K3**	2.5.2, 2.6.3,3.5.1
CO5	Analyze the use of enumerations and file handling techniques in C to manage data efficiently and solve real-world programming problems.	**K4**	1.7.1,2.5.1, 2.5.2, 2.6.3,3.5.1

Contribution of Course Outcomes towards achievement of Program Outcomes

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

(1- Low, 2 - Medium, 3 – High)

Unit-I : Introduction to C & Problem solving

Introduction to the C Language: Introduction to Programming Languages, Basics of a Computer Program, Algorithms, flowcharts (Using Dia Tool), pseudo code. Introduction to Compilation and Execution, Background of C program, Identifiers, Types, Variables, Constants, Memory Layout, Input/Output, Programming Examples.

Structure of a C Program: Logical Data and Operators, Expressions, Precedence and Associatively, Evaluating Expressions, Type Conversion, Statements, Storage Class.

Selection: Two-way Selection, Multiway selection, More Standard Functions.

Unit-II: Repetition, Arrays & Strings

Repetition: Concept of Loops in C, Loop Examples, the Calculator Program.

Arrays: Array Concepts in C, Inter-Function Communication, Array Applications, One Dimensional Arrays, Linear Search and Binary Search Techniques, Selection Sort, Bubble Sort, Two Dimensional Arrays, Multidimensional Arrays.

Strings: String Concepts, C Strings, String Input/output Functions, Arrays of Strings, String Manipulation Functions, String- Data Conversion.

Unit-III: Functions, Pointers & Memory Allocations

Functions: Functions in C, User Defined Functions, Call by Value, Call Value Reference, Inter-Function Communication, Standard Functions, Scope, Recursion and advantages.

Pointers: Introduction to Pointers, Pointers for Inter-Function Communications, Pointers to Pointers, Compatibility, Lvalue and Rvlaue. Arrays and Pointers, Pointers Arithmetic and Arrays, Passing an Array to a Function, Array of Pointers.

Memory Allocation: Need of dynamic memory allocation, malloc(), calloc(), free(), realloc(), NULL, Stack vs. Heap Allocation.

Unit-IV: Structures & Unions

Structures: Structure Type Declaration, Initialization, Accessing Structures, Operations on Structures, Complex Structures, Structures and Functions, Sending the Whole Structure, Passing individual structure members, passing structure via pointer, nested structure.

Unions: Referencing Unions, Initializers, Unions and Structures, Internet Address, Programming Applications.

Unit-V: Enumerations & Files

Enumerations: The Type Definition (Typedef), Enumerated Types: Declaring an Enumerated Type, Operations on Enumerated Types, Enumeration Type Conversion, Initializing Enumerated Constants, Anonymous Enumeration: Constants, Input/Output Operators.

Files: introduction to the files, Uses of Files, Text files Vs. Binary files, Opening and closing FILE , Modes of FILE operation, Command line arguments, Standard Library Input /Output functions ,Character i/o functions, File Handling functions.

Text Books:

1. "The C Programming Language", Brian W. Kernighan and Dennis M. Ritchie, Prentice-Hall, 1988
2. Behrouz A. Forouzan and Richard F. Gilberg, “Computer Science A Structured Programming Approach Using C”, CENGAGE Learning, Third Edition.
3. 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.
2. Programming in C, Rema Theraja, Oxford, 2016, 2nd edition
3. C Programming, A Problem Solving Approach, Forouzan, Gilberg, Prasad, CENGAGE, 3rd edition
4. Horowitz Sahni and Anderson-Freed, “Fundamentals of Data Structures in C”, 2nd edition, Universities Press, 2011

Web Resources:

1. NPTEL, "NOC: Introduction to Programming in C," [Online]. Available: https://nptel.ac.in/courses/106/104/106104128/. [Accessed: Feb. 25, 2025].
2. Coursera, "C for Everyone: Structured Programming," [Online]. Available: https://www.coursera.org/learn/c-structured-programming/. [Accessed: Feb. 25, 2025].
3. GeeksforGeeks, "Arrays, Pointers and Functions in C," [Online]. Available: https://www.geeksforgeeks.org/arrays-and-pointers-functions-in-c/. [Accessed: Feb. 25, 2025].
4. GeeksforGeeks, "C Enumerations," [Online]. Available: https://www.geeksforgeeks.org/enumeration-enum-c/. [Accessed: Feb. 25, 2025].

5. Codeforwin, "Understanding malloc, calloc, realloc, and free," [Online]. Available: https://codeforwin.org/2018/07/malloc-calloc-realloc-free-functions-c-programming.html. [Accessed: Feb. 25, 2025].
6. GeeksforGeeks, "Unions in C," [Online]. Available: https://www.geeksforgeeks.org/union-c/. [Accessed: Feb. 25, 2025].
7. Programiz, "Structures in C," [Online]. Available: https://www.programiz.com/c-programming/c-structures. [Accessed: Feb. 25, 2025].
8. TutorialsPoint, "Formatting Input/Output Functions and Character Input/Output Functions," [Online]. Available: https://www.tutorialspoint.com/cprogramming/c_file_io.htm. [Accessed: Feb. 25, 2025].
9. Programiz, "Command-Line Arguments," [Online]. Available: https://www.programiz.com/c-programming/c-command-line-arguments. [Accessed: Feb. 25, 2025].
10. W3Schools, "C Programming Language," [Online]. Available: https://www.w3schools.com/c/index.php. [Accessed: Feb. 25, 2025].

COURSE CODE: 24CS181
PROGRAMMING USING 'C' LAB

Course Category:	Engineering Science (ES)	**Credits:**	1.5
Course Type:	Practical	**Lecture -Tutorial-Practice:**	0-0-3
Pre-requisites:		**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	60 40 100

Course Description

This hands-on course introduces students to the foundational principles of the C programming language, integrating essential Linux command-line skills and compiler tools such as GCC and Turbo C. The course emphasizes problem-solving, logical thinking, and algorithm development. Students will work through a structured progression from simple input/output to complex file operations and data structures, including practical projects and assignments.

Course Objectives

The primary objective of this C Programming Lab course is to provide hands-on practical experience in writing, debugging, and executing C programs. It aims to develop students' understanding of fundamental programming concepts such as input/output operations, control structures, arrays, strings, functions, and pointers through practical exercises. By the end of the course, students will be proficient in using essential C programming tools, developing logical problem-solving skills, and applying programming concepts to build efficient programs in a Linux environment using compilers like Turbo C and GCC.

Course Outcomes

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

	Course Outcomes	BTL	POI
CO1	Understand basic Linux shell commands to compile and run C programs using GCC.	**K2**	1.7.1,2.5.1, 2.5.2, 2.7.1
CO2	Select the right control structure for solving the problem.	**K3**	1.7.1, 2.5.1,2.5.2, 2.6.3,3.5.1
CO3	Develop C programs which utilize memory efficiently using programming constructs like pointers.	**K3**	1.7.1, 2.5.2, 2.6.3,3.5.1 5.4.1
CO4	Develop, Debug and Execute programs to demonstrate the applications of arrays, functions, basic concepts of pointers in C.	**K3**	2.5.2, 2.6.3,3.5.1
CO5	Analyze the use of enumerations and file handling techniques in C to manage data efficiently and solve real-world programming problems.	**K4**	1.7.1, 2.5.1,2.5.2, 2.6.3,3.5.1

Contribution of Course Outcomes towards achievement of Program Outcomes

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

(1- Low, 2 - Medium, 3 – High)

Course Content:

WEEK- 1

1. Basic Linux environment and its editors like Vi, Vim & Emacs etc.

2. Exposure to Turbo C, gcc

3. Write a C program to print the following output Input:

Enter a Character: *
Enter a Number: 1
Output:

```
* * * * * * *
*       1     *
*       1     *
*       1     *
*       1     *
*     1 1 1   *
* * * * * * *
```

4. Write a C program that takes two numbers and an arithmetic operator (+, -, *, or /) as input from the user using scanf(), performs the corresponding operation, and displays the result using printf().

5. Write a C program that reads two numbers from the user using `scanf()`, and then swaps their values using both methods:

1. With a third variable 2.Without using a third variable

Finally, display the swapped values using `printf()`.

.

6. Declare three variables of integer data type. User has to input three valid numbers. Display Sum and average of user entered numbers.
Approach is to take three numbers and find their sum and average using the formula given below-

Sum: a+b+c
Average: (a+b+c)/3
Where a,b,c are the three numbers.
Sample Input:
Enter 3 Values: 10 20 30
Sample Output: Sum: 60 Average: 20

WEEK-2

1. Input the temperature in Fahrenheit and output the equivalent temperature in Celsius and Vice – Versa. Input two numbers. The first is for a Celsius value, and the second is for a Fahrenheit value. Input Celsius value, convert it to Fahrenheit. Use the formula F = C*9/5 + 32 for conversion. In case of decimals, show up to 1 decimal value.
Input the Fahrenheit value, convert it to Celsius.
Use the formula C= (F−32)×5/9 for conversion. In case of decimals, show up to 1 decimal value.
Sample Input: 0 100
Sample Output: 32 37.7

2. You can calculate a Simple Interest by just providing the Principle Amount, Rate of Interest and Time or Periods provided by the user input. We can calculate the Simple Interest by the using the below Formula.

Simple Interest = (Principal*Rate*Time)/100

Principal (P): The principal is the amount that was initially borrowed (loan) from the bank or invested.

Rate (R): It is the rate of interest at which the principal amount is given to someone for a certain time; the rate of interest can be 5%, 10%, or 13%, etc.

Time (T): Time is the duration for which the principal amount is given to someone.

Constraints: 1<=Principal<=10000 1<=Rate<=10

1<=T<=30

Sample Input: 100 3 10

Sample Output: 30

3. You are working on a program that tracks the daily sales of a small bookstore. The owner wants to calculate the total sales and average sales for three consecutive days to better understand business trends. Write a program that takes the sales figures for three days as input, calculates the total sales, and finds the average sales. How will you implement this in C?

4. Write a C program to evaluate and display the result of the following expressions. Use the given variable declarations and initialize them with appropriate values. Also, print the results of each expression.

- A+B*C+(D*E) + F*G
- A/B*C-B+A*D/3
- A+++B---A
- J= (i++) + (++i)

5. Write a C program to calculate electricity bill according to the given condition:

For first 50 units Rs. 0.50/unit

For next 100 units Rs. 0.75/unit

For next 200 units Rs. 1.20/unit

For unit above 250 Rs. 1.50/unit

An additional surcharge of 20% is added to the bill.

WEEK- 3

1. To find factorial of the any given positive number. The factorial of a positive number n is given by: 1*2*3*4 ...Note: This program should take a positive integer from the user as the factorial of a negative number doesn't exist and, the factorial of 0 is 1. Compute the factorial using any loop. Since the factorial of a number
may be very large, the type of factorial variable is declared as unsigned long. If the user enters a negative number, the program should display a custom error message.

2. Input a number, check the given number is a prime or not. A prime number should be a natural number greater
than 1 that has no positive divisors other than 1 and itself.
Test Data and Output: Enter n: 5
Output: Prime
Enter n: 6
Output: Not Prime

3. Checking a number palindrome. Number should be a positive integer having more than one digit as all the single digits are palindromes.
Test Data and output:
Input : 2002 Input: 1234
Output: true Output: false

4. Construct a pyramid of numbers. A pyramid of numbers represents the number of individuals per unit area of various trophic areas where producers are kept at the base and the tip is occupied by top carnivores.

The pyramid of numbers is mostly upright. The members of successive higher trophic levels are higher than the previous one.

1. A higher trophic level has fewer individuals than that of the lower trophic levels.

1

2 2 2

3 3 3 3 3

4 4 4 4 4 4 4

5 5 5 5 5 5 5 5 5

5.Develop a C program that takes an integer as input from the user and prints 'Yes' if the number is an Armstrong number, and 'No' otherwise.(This adds specific input/output requirements.)

WEEK- 4

1. Write a C program to delete all duplicate elements from an array.
The program should:

- Ask the user to enter the number of elements in the array.
- Accept the array elements from the user.
- Remove all duplicate values from the array.
- Display the new array with only unique elements.

2. Write a C program to insert an element into a specific position in an array.
The program should:

- Ask the user to enter the size of the array and its elements.
- Ask the user to enter the element to insert and the position at which it should be inserted.
- Insert the element at the specified position by shifting the existing elements.
- Display the updated array.

3. Find 2's complement of the given binary number.
To get 2's complement of a binary number, simply invert the given number and add 1 to the least significant bit (LSB) of given result.
Test Data and Output:
Find 2's complement of binary number 10101110.
Simply invert each bit of given binary number, which will be 01010001. Then add 1 to the LSB of this result, i.e., 01010001+1=01010010 which is answer.
Find 2's complement of binary number 10001.001.
Simply invert each bit of given binary number, which will be 01110.110 Then add 1 to the LSB of this result, i.e., 01110.110+1=01110.111 which is answer.

4. Write a C program to sort array elements in ascending or descending order.

5. Given an array of integers **nums** and an integer **target,** return indices of the two numbers such that they add up to target. You may assume that each input would have exactly one solution and you may not use the same element twice. You can return the answer in any order.
Sample Input:
Enter the size of an array: 4
Enter array elements: 2 7 11 15
Enter target: 9
Output: [0,1]

WEEK- 5

1. A matrix can only be added to another matrix if the two matrices have the same dimensions. To add two matrices, just add the corresponding entries, and place this sum in the corresponding position in the matrix which results.
Input elements in 3x3 matrix1: 1 2 3
4 5 6
7 8 9
Input elements in 3x3 matrix2: 9 8 7
6 5 4
3 2 1
Sum of both matrix = 10 10 10
10 10 10
10 10 10

2. Matrix multiplication is a binary operation that produces a matrix from two matrices. For matrix multiplication, the number of columns in the first matrix must be equal to the number of rows in the second matrix. The resulting matrix, known as the **matrix product**, has the number of rows of the first and the number of columns of the second matrix. The product of matrices **A** and **B** is denoted as AB.

3. Concatenate two strings without using built-in functions
Note: User would be asked to enter two strings and then the program would concatenate them. For concatenation we have not used the standard library function strcat(), instead we have written a logic to append the second string at the end of first string.
Test Data and Output:
Str1: Good Str2: Morning Output: Good Morning

4. Reverse a string using built-in and without built-in string functions
Using built-in function: The function is used for reversing a string. The reversed string will be stored in the same string.

5. Input two strings **str1** in lowercase**, str2** in uppercase**.** Print the lower case string **str1** in uppercase and the uppercase string **str2** in lowercase.

WEEK- 6

1. Write a C program using a user-defined function to find the biggest number given any three numbers.

2. Write a **C program** to calculate the **factorial of a given number** using recursion. The program should prompt the user to enter a number and then compute its factorial using a recursive function.

3. Write a **C program** to generate the **Fibonacci series up to N terms** using a recursive function. The program should prompt the user to enter a number **N**, then compute and display the first **N Fibonacci numbers**.

4. Write a **C program** to swap two numbers using **call by value and call by reference**. The program should demonstrate that changes made inside the function do not affect the original values in the main function.

5. How can recursion be used to calculate NCR? Write a C program to demonstrate this.

WEEK- 7

1. String is a sequence of characters. Input two strings str1 and str2. Copy the contents of str1 to str2 using functions and pointers. Define a function copystr() with two pointer arguments copystr(*str1,*str2) Approach :
1. Scan string str from 0 to length-1.
2. check one character at a time based on ASCII values
- if(str[i] >= 65 and str[i] <=90), then it is uppercase letter,
- if(str[i] >= 97 and str[i] <=122), then it is lowercase letter,
- if(str[i] >= 48 and str[i] <=57), then it is number,
- else it is a special character

3. Print all the counters
Sample Input:
Enter a string: Programming
Sample Output:
String1: Programming
String2: Programming

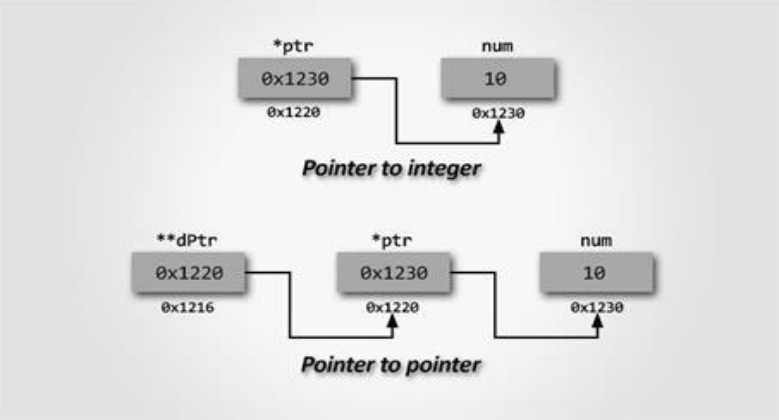
2. Given a string, write a program to count the occurrence of Lowercase characters, Uppercase characters, Special characters, and Numeric values. Define a function to count.
Input : #CseAi01dOr@gAIml07
Output :
Upper case letters : 5
Lower case letters : 8
Numbers : 4
Special Characters : 2
Input : *AiMlC4AiDsS*

Output :
Upper case letters : 6
Lower case letters : 4
Numbers : 1
Special Characters : 2

3. Write a c program to perform simple pointer arithmetic operations in c.

4. Write a c program to find sum of array elements by using array of pointers in c

5. When a pointer holds the address of another pointer then such type of pointer is known as pointer-to-pointer or double pointer. ptr is a normal pointer that holds the address of an integer variable num. There is another pointer **dptr in the diagram that holds the address of another pointer ptr, the pointer dptr here is a pointer-to-pointer (or double pointer). Demonstrate double pointers using the following representation.



WEEK- 8

1. Write a C program to define a structure named Student that contains the following members:

- name (character array)
- rollNumber (integer)
- age (integer)

Using a structures concept, store and display the details of two students.

.

2. Write a C program to define a structure named Student with the following members:

- name (character array) – to store the student's name.
- rollNumber (integer) – to store the roll number.
- marks (array of 3 integers) – to store marks obtained in 3 subjects.

Using an array of structures, read the details of two students from the keyboard. Calculate and display:

- Name of the student
- Roll number
- Marks in 3 subjects
- Total marks obtained

3. Write a C program to define a structure named Book with the following members:

- title (character array) – to store the book's title.
- author (character array) – to store the author's name.
- price (float) – to store the price of the book.

Using an array of structures, read the details of **five books** from the keyboard and display them in a formatted output.

4. Write a C program to define a structure **Student** that includes the following details:

- Name (character array)
- Roll Number (integer)
- Age (integer)
- Date of Birth (another structure with day, month, and year as integers)

Note: Student Details (with Date of Birth as a Nested Structure)

5. Write a C program to define a structure **Employee**, which contains the following details:

- **Employee Name** (character array)
- **Employee ID** (integer)
- **Salary** (float)

Additionally, the structure **Employee** should have a **nested structure Address**, which includes:

- **City** (character array)
- **State** (character array)
- **Pin Code** (integer)

The program should:

- Accept details of an employee, including their address.
- Display the entered details in a proper format.

Write the complete C program, including structure definition, input, and output statements.
Note: Employee Records (with Address as a Nested Structure)

WEEK- 9

1. Write a C program to demonstrate **passing individual structure members** to a function. Define a structure for a student with members: name, roll number, and marks. Pass individual members to a function to display the details.

2. Explain the concept of **passing an entire structure** to a function in C. Write a program to define a structure for an Employee with members: name, ID, and salary. Pass the entire structure to a function to display the details.

3. Define a union Data with members: i (integer), f (float), str (string). Write a program to assign and print values to each member of the union one by one. Observe what happens to the values.

4. Explain the concept of **passing a structure through pointers** in C. Write a program to define a structure for a Student with members: name, roll number, and marks. Pass the address of the structure to a function and display the student details using pointers.

5. Write a C program to **add two complex numbers**.

- Define a **structure** Complex with two members: real (to store the real part)
- imag (to store the imaginary part)
- Take input for two complex numbers from the user.

Perform the addition of the two complex numbers: Add the **real parts** separately.

- Add the **imaginary parts** separately.
- Display the **sum** of the two complex numbers in the form **(a + bi)**.

Sample output:
Enter first complex number: 3 2
Enter second complex number: 1 7
Sum: 4 + 9i

WEEK- 10

1. Write a C program that defines an enumeration for different car brands and asks the user to enter a number. Display the corresponding car brand.

2. Create an enum for traffic signals (Red, Yellow, Green). Write a function that takes an enum value as input and prints its meaning (e.g., Red → Stop).

3. Write a C program to store and process student data using dynamic memory allocation with calloc(). The program should:

- Allow the user to enter the number of students (n).
- Dynamically allocate memory for n students using calloc().
- For each student, input details such as **roll number, name, and marks**.
- Display the list of students who have **failed** (consider marks less than 40 as failed).

4. Write a C program to print the corresponding weekday name for a given integer value (1 to 7) using enumeration constants. The program should define an enum for the weekdays, take an integer input from the user, and display the corresponding weekday name. If the input is out of range, display an appropriate error message.

5. Write a C program to write and read text into a file.The program should prompt the user to enter a string and write it to a text file. Then, it should open the same file, read the content, and display it on the screen.

6. Write a C program to copy the contents of one file to another using command-line arguments. The program should accept the source filename and the destination filename as command-line arguments. It should read the contents from the source file and write them to the destination file. If the source file does not exist or an error occurs, display an appropriate error message.

Web Resources:

1. LinuxCommand.org, "Basic Linux Environment, Editors, Turbo C, GCC," [Online]. Available: https://linuxcommand.org/. [Accessed: Feb. 25, 2025].
2. Programiz, "Pattern Printing & Block Letters in C," [Online]. Available: https://www.programiz.com/c-programming/examples/pattern-printing. [Accessed: Feb. 25, 2025].
3. GeeksforGeeks, "Arithmetic Operations & Swapping Numbers," [Online]. Available: https://www.geeksforgeeks.org/swap-two-numbers-without-using-temporary-variable/. [Accessed: Feb. 25, 2025].
4. CodingCompiler, "Sum and Average of Numbers," [Online]. Available: https://codingcompiler.com/c-program-find-sum-average-three-numbers/. [Accessed: Feb. 25, 2025].
5. TutorialsPoint, "Reading and Printing Multiple Integers," [Online]. Available: https://www.tutorialspoint.com/cprogramming/c_arrays.htm. [Accessed: Feb. 25, 2025].
6. Programiz, "Mixed Data Types Input & Format Specifiers," [Online]. Available: https://www.programiz.com/c-programming/c-input-output. [Accessed: Feb. 25, 2025].
7. GeeksforGeeks, "Files in C," [Online]. Available: https://www.geeksforgeeks.org/basics-file-handling-c/. [Accessed: Feb. 25, 2025].

24ME181
ENGINEERING GRAPHICS

Course Category:	Engineering Sciences (ES)	**Credits:**	**2.5**
Course Type:	Tutorial & Practice	**Lecture-Tutorial-Practice:**	**0-1-3**
Pre-requisites:	**Nil**	**Continuous Assessment:** **Summative Assessment:** **Total Marks:**	**60** **40** **100**

Course Description:

This course introduces students to the principles and practices of engineering graphics using Computer- Aided Design (CAD) tools. This course covers Plane and Descriptive geometry, orthographic and isometric projections. Students will learn to create, modify, and analyze 2D and 3D drawings, focusing on applications in engineering.

Course Objectives:

- To familiarize students with CAD software and its application in technical drawing.
- To make students proficient in creating and editing 2D and 3D engineering drawings.
- To teach the drawing of plane curves and their applications
- To explain the projection of points, lines, Planes, and solids.
- To enable students to visualize and represent 3D objects through orthographic projections, isometric views and development of surfaces.
- To cultivate skills in preparing engineering drawings following standard conventions and practices.

Course Outcomes:

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

CO	Course Outcomes	BTL
CO1	Construct plane curves and identify their applications.	K3
CO2	Draw orthographic projections of points, lines and planes	K3
CO3	Develop 2D drawings of solids and surfaces.	K3
CO4	Demonstrate proficiency in creating isometric projections.	K4
CO5	Identify the 3D objects through orthographic projections.	K4

Course articulation matrix

	POs											PSOs	
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2		2		2				2				1
CO2	2		2		2				2				1
CO3	2		2		2				2				1
CO4	2		2		2				2				1
CO5	2		2		2				2				1

(1-Low, 2 -Medium, 3–High)

Course Content

Unit-I

Plane Curves

- Construction of **Ellipse, Parabola and Hyperbola** (General method only)
- Construction of **cycloids & Involutes.**

Unit-II

Orthographic Projections:

- Projections of **Points.**
- Projections of **Lines** (First Angle Projection only)
- Projections of **Plane regular geometric figures**. (First Angle Projection only)

Unit-III

Projection of Solids and Development of Surfaces

- Projections of simple solids such as Cubes, Prisms, Pyramids, Cylinders and Cones with varying positions (Limited to Solid Inclined to one of the Reference planes)
- Development of surfaces of Right Regular Solids of Prism, Pyramid, Cylinder and Cone.

Unit-IV

Conversion to orthographic Projection

- Orthographic projection conventions.
- Conversion of Isometric views into orthographic projections

Unit-V

Conversion to Isometric Projection

- Isometric Projection Principles, Isometric Views of Objects.
- Conversion of Orthographic Projections into Isometric Views

Text Books:

1. Kulkarni, D. M., Rastogi, A. P., & Sarkar, A. K. (2009). Engineering graphics with AutoCAD, (revised ed.). PHI Learning Pvt. Ltd.

2. N.D. Bhatt "Engineering Drawing", Charotar Publishing House, Anand. 53rd Edition – 2019.

Reference Books:

1. Bethine. A. Fishel, Jay D. Helsel, (2014). Engineering Graphics with AutoCAD, Pearson Education.
2. CADFolks, (2023). AutoCAD 2023 for Beginners, CAD Folks Publications.
3. BasanthAgrawal& C M Agrawal," Engineering Drawing", McGraw Hill Education Private Limited, New Delhi.

Web Resources:

[1] https://www.onlinecourses.nptel.ac.in/noc20_me79/preview
[2] https://www.autodesk.com/education
[3] https://www.freecad.org
[4] https://ocw.mit.edu/

24CY181
Chemistry Lab

Course Category:	**Basic Sciences**	**Credits:**	**1**
Course Type:	**Practical**	**Lecture-Tutorial-Practice:**	**0-0-2**
Pre-requisites:	**10+2 Chemistry**	**Continuous Assessment:** **Summative Assessment:** **Total Marks:**	**60** **40** **100**

Course Description:

The course is designed for students of B.Tech., providing essential practical knowledge of Chemistry concepts relevant to their fields. This hands-on laboratory course provides the students with practical experience in applied chemical techniques and experiments. The course is useful for students to develop essential skills of proper handling of instruments and apparatus, accurate measurements and recording data, as well as interpretation of data to arrive at the correct conclusion. The course includes the experiments based on different instrumental techniques for the quantitative analysis of different solutions. Also, the course enlightens the students on preparation of polymers, and corrosion related experiments. Further, it focuses on the conventional method of quantitative determination of samples using volumetric method.

Course Objectives:

1. Enhance understanding of chemical principles involved in instrumental methods of chemical analysis.
2. Develop skills in handling analytical instruments that can measure various chemical parameters.
3. Promote critical thinking and problem-solving through the interpretation of data obtained from the instruments.
4. Familiarize students with advantages and limitations of instrumental methods of analysis compared to conventional volumetric analysis.
5. Explore the practical aspects of chemical processes involved in preparation of polymers, metallic coatings, etc.

Course Outcomes:

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

CO	Course Outcomes	BTL
CO1	Demonstrate a comprehensive understanding of various instrumental methods of chemical analysis	**K3**
CO2	Analyse quantitatively different redox systems and neutralization systems using volumetric analysis	**K4**
CO3	Compare corrosion tendencies of different metals and their protection by surface coatings	**K4**

CO4	Apply theoretical knowledge and skills of preparation of polymers, complexes on substrates, adsorption processes, porosity, viscosity, etc.	**K3**

Course articulation matrix

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

(1-Low, 2 -Medium, 3–High) (WK1)

Course Content

Experiments common to all branches:

1. Determination of strength of acid in a lead-acid battery
2. Determination of strength of base using pH metric titration
3. Conductometric analysis of a base using a standard acid
4. Determination of ferrous iron by permanganometry
5. Comparison of corrosion rates of different metals/alloys
6. Preparation of Urea-formaldehyde resin
7. Determination of amount of iron in a solution by colorimetry
8. Chemistry of blueprinting
9. Adsorption of acetic acid on charcoal

Experiments for CE and ME branches:

1. Determination of total hardness of a water sample
2. Determination of calcium in Portland cement
3. Determination of porosity of a refractory material
4. Determination of viscosity of lubricating oil by Redwood viscometer

Experiments for ECE, EEE and EIE branches:

10. Determination of ferrous iron by dichrometry
11. Determination of ferrous iron by potentiometry
12. Verification of Lambert-Beer's law
13. Electroplating of copper on iron article

Experiments for CSE, AI and IT branches:

10. Determination of ferrous iron by dichrometry
11. Determination of ferrous iron by potentiometry
12. Conductometric analysis of mixture of acids
13. Preparation of conducting polyaniline from aniline

Text Books:

1. Mendham, J. (2009). *Vogel's Quantitative Chemical Analysis* (6th ed.). Pearson Education.
2. Theodore, J., & George Pope, F. (2021). *Elementary Practical Chemistry. Inorganic and Organic*(1st ed.). Legare Street Press.

Reference Books:

1. Akhil, N., Deepak, L., Atul, B.,&Chaudari, P.B. (2023).*Practical Manual of Inorganic, Organic and Medicinal Chemistry* (1st ed.). IP Innovative.
2. Venkateswaran, V.(2012). *Basic Principles of Practical Chemistry* (2nd ed.). S. Chand& Sons.

Web Resources:

1. https://nitm.ac.in/ckfinder/userfiles/files/CY%20151_Labmanual%20Chemistry%20B_Tech%201st%20year.pdf
2. http://icv-au.vlabs.ac.in/inorganic-chemistry/Water_Analysis_Determination_of_Physical_Parameters/
3. http://pcv-au.vlabs.ac.in/physical-chemistry/EMF_Measurement/
4. http://pcv-au.vlabs.ac.in/physical-chemistry/Determination_of_Viscosity_of_Organic_Solvents/
5. http://vlabs.iitb.ac.in/vlabs-dev/labs/nitk_labs/Environmental_Engineering_1/experiments/determination-of-chloride-nitk/simulation.html
6. https://chemcollective.org/vlabs

24ME182
WORKSHOP PRACTICE
(ME)

Course Category:	Engineering Science (ES)	**Credits:**	**1.5**
Course Type:	**Laboratory**	**Lecture-Tutorial-Practice:**	**0-0-3**
Pre-requisites:	**10+2 Physics**	**Continuous Assessment:** **Summative Assessment:** **Total Marks:**	**60** **40** **100**

Course Description: (Part-A)

This part of the course provides first-year engineering students with comprehensive hands-on experience in electrical systems, electronics, and computer science fundamentals. The course covers practical exercises in electrical wiring and circuit design, electronics component handling, and computer hardware and software configuration. Students will engage in activities such as electrical switching circuits, distribution board assembly, electronic component identification, and basic IoT (Internet of Things) projects. The course is designed to equip students with essential skills for diagnosing and constructing electrical and electronic systems, as well as understanding computer hardware and IoT applications.

Course Description: (Part-B)

This part of workshop practice course provides first-year mechanical engineering students with hands-on experience across multiple fundamental areas of engineering, including carpentry, welding, and mechanical components. The course is designed to develop practical skills and technical proficiency through targeted exercises in woodworking, metalworking, and mechanical assembly. Students will gain familiarity with essential tools and techniques, including woodworking tools and joinery, welding processes, and mechanical component handling. By engaging in these practical exercises, students will enhance their ability to apply theoretical concepts in real-world scenarios, laying a strong foundation for advanced engineering studies.

Course Objectives:

1. Understand the fundamentals of house wiring.
2. Familiarize with the various electronic components and PCB preparation
3. Apply the concepts of internet of things (IOT)
4. Familiarize with the modern manufacturing methods.
5. Understand the basic joints using wood and practice joining of metals using various types of welding and familiarize with various mechanical components such as gears,

Nuts and bolts.

Course Outcomes:

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

CO	Course Outcomes	BTL
	PART -A	
CO1	Design, assemble, and test various electrical circuits, including stair case, two-way, and fan connections, and accurately measure electrical parameters such as voltage, current, power, and energy using digital meters.	**K3**
CO2	Identify and use electronic components (resistors, capacitors, diodes, switches) to construct and test a simple calling bell circuit, demonstrating understanding of circuit design and component functionality.	**K3**
CO3	Install and configure peripheral devices on a desktop system and apply basic IoT principles using an Arduino board to measure and interpret environmental data such as temperature, humidity, and distance.	**K3**
	PART -B	
CO4	Effectively use woodworking hand and power tools, and apply joinery techniques such as cross half lap and dovetail joints to produce precise and durable wood assemblies.	**K3**
CO5	Proficiently perform arc welding on lap, butt, and corner joints, as well as gas welding processes, while producing high-quality welds with proper safety and technique; additionally, carry out bench work operations such as drilling and tapping, and assemble mechanical components including gears, bearings, and springs, demonstrating competency in precision machining and mechanical assembly.	**K3**

Course articulation matrix

	POs										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1			**2**		**3**						
CO2			**2**		**3**						
CO3			**2**		**3**						
CO4			**2**		**3**						
CO5			**2**		**3**						

(1-Low, 2 -Medium, 3–High)

Course Content

PART –A

1. **Electrical Workshop Practice Exercises: (3hrs)**
   a) Stair case/Two-way /Gowdown Switching/Fan connection
   b) 3Φ Distribution board with fuse, MCB, two way switches, light indicator, 4 switches, fan regulator
   c) Measurement of voltage, current, power, Energy by using digital meters.

2. **Electronics Workshop Practice Exercises: (1 hr)**
   a) Familiarization of electronic components such as resistors, capacitors, diodes, and switches.
   b) Preparation of a simple calling bell circuit board and testing its operation.

3. **Computer science Workshop Practice Exercises: (2 hrs)**
   a) **Hardware components of a desktop system:** Peripheral Installation: Install and configure peripheral devices such as printers, scanners, and external hard drives.
   b) **Basics of Internet of things (IOT):** Demonstration of different components and pin configuration of Arduino board.
   c) To measure Temperature, humidity and distance using Arduino board.

4. **Modern Manufacturing methods:** Demonstration of 3-D printing process.

PART –B Branch specific (For ME students only)

5. **Carpentry Workshop Practice Exercises: (2 hrs)**
   a) Woodworking Tools Familiarization: Practice to work with woodworking hand tools and operations using power tools.
   b) **Joinery Techniques:** Practice various joinery techniques such as cross half lap and Dove tail joints.
   c) Practice to work with various wood adhesives and fasteners.
6. **Welding workshop practice exercises: (2 hrs)**
   a) Preparation of Lap, Butt & Corner joints using Arc Welding.
   b) Practice of Gas welding process.

7. **Introduction to Mechanical Components & operations: (3hrs)**

a) **Bench Work Techniques:** Practice to work with various materials like metals and plastics.
b) Practice of drilling, tapping, and reaming operations on the above materials.
c) **Mechanical Components:** Practice of assembling lap and butt joints with various types of bolts, nuts, screws and single, double studs.

- Practice to work with various types of mechanical components such as

d) Gears - Bevel, Spur, Helical and Worm.
e) Bearings – Ball, roller, plain, needle and flexure.
f) Springs – Compression, Extension, Conical, Torsion and leaf.

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, Dhanpath Rai& 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.

Web Resources:

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/

24UC183
Sports and Yoga

Course Category:	**Mandatory (MC)**	**Credits:**	**0**
Course Type:	**Practical**	**Lecture-Tutorial-Practice:**	**0-0-3**
Pre-requisites:	**-**	**Continuous Assessment:** **Summative Assessment:** **Total Marks:**	**100** **-** **100**

Course Description:

The course is designed for first year B.Tech. students of all branches. It provides essential and applied knowledge of physical and mental health. Introducing the course is more crucial in the present days, particularly undergraduate students, who require awareness on their physical and mental health. With this focus, the course covers various aspects of physical fitness, wellness and lifestyle, fundamental aspects of anatomy, physiology in physical education, yoga and lifestyle, different types of sports, etc. Although, the basic theoretical aspects of sports and yoga are discussed, major focus will be on the practice of yoga asanas and participation in various sports by the students.

Course Objectives:

1. Make the students understand the importance of sound health and fitness principles as they relate to better health.
2. Expose the students to a variety of physical and yogic activities aimed at stimulating their continued inquiry about yoga, physical education, health and fitness.
3. Create a safe, progressive, methodical and efficient activity-based plan to enhance improvement and minimize risk of injury.
4. Develop among students an appreciation of physical activity as a lifetime pursuit and a means to better health.

Course Outcomes:

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

CO	Course Outcomes	BTL
CO1	Apply the knowledge of physical activities and Hatha Yoga on himself/herself and practice them	**K3**
CO2	Understand basic skills associated with yoga and physical activities including strength, flexibility, balance and coordination	**K2**
CO3	Practice yoga asanas, pranayama and meditation in daily life for the health of body and balance of mind	**K3**
CO4	Apply correctly the biomechanical and physiological principles elated to exercise and training	**K3**

CO5	Practice techniques for increasing concentration and decreasing anxiety which leads to stronger academic performance	**K3**

Course articulation matrix

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

(1-Low, 2 -Medium, 3–High) (WK8)

Course Content

Unit-I
Introduction to physical education, physical fitness, wellness and life style

- Meaning and definition of physical education, aims and objectives, changing trends in physical education.
- Meaning and importance of physical fitness and wellness, components of physical fitness.
- Components of health related fitness, components of wellness.
- Preventing health threats through lifestyle change and concept of positive lifestyle.
- Awards and honours in the field of sports in India (Dronacharya Award, Arjuna Award, Dhayanchad Award, Rajiv Gandhi Khel Ratna Award, etc.)

Unit-II
Fundamentals of anatomy, physiology, kinesiology, biomechanics and sports

- Meaning of anatomy, physiology and their importance in the context of physical education and sports.
- Effect of exercise on the functioning of various body systems like circulatory system, respiratory system, neuromuscular system, etc.
- Meaning and importance of kinesiology and biomechanics in physical education and sports, Newton's law of motion and its application in sports, friction and its effects in sports.
- Concept of postures, causes of bad posture, advantages of correct posture, advantages and disadvantages of weight training, common postural deformities – knock knee, flat foot, round shoulders, lordosis, kyphosis, bow legs and scoliosis.

Unit-III
Psychology in Sports

- Definition and importance of psychology in physical education and sports, differentiation between growth and development.
- Adolescent problems and their management, concept and types of emotions, control of emotions, meaning and types of aggressions in sports, psychological benefits of exercise.
- Anxiety and fear and their effects on sports performance, motivation – types and techniques, understanding stress and coping strategies.
- Concept and meaning of doping, prohibited substances and methods, side effects of prohibited substances.
- First aid – definition and objectives, sports injuries – classification, causes and prevention, management of injuries – soft tissue injuries and bone and joint injuries.

(Following subtopics related to any one game/sport of choice of student out of: Athletics, Badminton, Basketball, Chess, Cricket, Kabaddi, Lawn Tennis, Swimming, Table Tennis, Volleyball, etc.: History of the game/sport, latest general rules of the game/sport, specifications of play fields and related sports equipment, important tournaments and venues, sports personalities, proper sports gear and its importance.)

Unit-IV
Theoretical aspects of Yoga and practice of Asanas

- Meaning, history and basic concepts of yoga, three bodies of human system, panchakoshas, trigunas, and ashtanga yoga.
- Meaning of asanas, practice of sukshma vyayama (warm up for asanas), asanas as preventive measures, practice of various asanas in the four categories – standing, sitting, prone and supine – at least 5 postures from each category, variations, contraindications and benefits of the asanas, Sun salutations.
- Asanas for hypertension, back pain, diabetes, asthama, obesity, etc.

Unit-V
Theory and practice of pranayama and meditation

- Meaning of pranayama, instructions for practice of pranayama, practice of various pranayama techniques – abdominal breathing, kapalabhati, anulom-vilom pranayama, bhramari, etc.
- Relaxation techniques for improving concentration – Yognidra
- Meaning of meditation, difference between concentration and meditation, various meditation methods, heartfulness meditation practice, benefits of meditation.

Text Books:

1. Modern trends and physical education – Prof. Ajmer Singh.
2. Light on Yoga – B.K.S. Iyengar.

Reference Books:

1. Health and Physical Education – NCERT (11^{th} and 12^{th} Classes).
2. Light on Pranayama – B.K.S. Iyengar.

Web Resources:

1. https://ncert.nic.in/textbook/pdf/iehp103.pdf
2. https://www.physio-pedia.com/Biomechanics_In_Sport
3. https://en.wikipedia.org/wiki/Sport_psychology
4. https://www.physio-pedia.com/Principles_of_Yoga
5. https://ncert.nic.in/pdf/publication/otherpublications/tiyhwlups1.pdf
6. https://heartfulness.org/global
7. https://www.biharyoga.net/asana-and-pranayama.php

First Year
(II Semester)

24MA102
Mathematics-II
(DIFFERENTIAL EQUATIONS AND NUMERICAL METHODS)
COMMON TO ALL BRANCHES

Course Category:	**Basic Sciences (BS)**	**Credits:**	**4**
Course Type:	**Theory**	**Lecture-Tutorial-Practice:**	**3-0-2**
Pre-requisites:	**10+2 Mathematics**	**Continuous Assessment:** **Summative Assessment:** **Total Marks:**	**40** **60** **100**

Course Description:

An overview of the fundamental concepts and methods to solve differential equations, Numerical methods to solve algebraic and transcendental equations, initial, boundary value problems and polynomial estimation using interpolation technique with a focus on the applications in solving engineering problems

Course Objectives:

- Introduce techniques for solving differential equations
- Explain methods to solve algebraic and transcendental equations and estimate function values through interpolation /extrapolation
- Acquaint the knowledge of solving initial and boundary value problems

Course Outcomes:

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

CO	Course Outcomes	BTL
CO1	Apply suitable approaches to solve first order and first-degree ordinary differential equations with engineering applications	**K3**
CO2	Solve higher order ordinary linear differential equations with engineering applications	**K3**
CO3	Solve the partial differential equations	**K3**
CO4	Use iterative methods for solving algebraic & transcendental equations and compute the functional values by polynomial interpolation	**K3**
CO5	Apply numerical methods to solve initial and boundary value problems	**K3**

Course articulation matrix

	POs											PSOs	
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	**2**	**2**			**1**								
CO2	**2**	**2**			**1**								
CO3	**2**	**2**			**1**								
CO4	**2**	**2**			**1**								
CO5	**2**	**2**			**1**								

(1-Low, 2 -Medium, 3–High)

Course Content

Unit-I

Differential Equations of First Order[T1]

Linear equations, Bernoulli's equation, Exact equations, Equations reducible to exact equations, Newton's Law of cooling, Law of growth and decay.

Unit-II

Higher Order Linear Differential Equations with Constant Coefficients [T1]

Definitions, Working procedure to solve the equation, Wronskian, Method of variation of

parameters, Simultaneous linear equations, Electrical circuits.

Unit-III

Partial Differential Equations **[T1]**

Introduction, Formation of partial differential equations, Solutions of a linear equation of the first order using Lagrange's method, Homogeneous linear partial differential equations with constant coefficients: Working procedure to solve the equation.

Unit-IV

Numerical Methods and Interpolation[T1]

Root finding methods: Bisection method,Method of Iteration,Newton-Raphson method

Interpolation: Introduction, Finite Differences, relation between the operators, Newton's interpolation formulae: forward and backward differences, Interpolation with unequal intervals: Lagrange's and Newton's divided difference formulae.

Unit-V

Initial and Boundary value problems **[T1]**

Numerical Solution of ordinary differential equations: Taylor's series, Euler's, modified Euler's and 4th order Runge-Kutta methods, Elliptic partial differential equations: Laplace's and Poisson's equations.

Text Books:

[1]. Grewal B. S. (2017). Higher Engineering Mathematics. (44th Edition).Khanna Publishers.
[2]. SankaraRao K (2014). Numerical Methods for Scientists and Engineers.(3rd Edition). PHI Learning Private Limited.

Reference Books:

[1].KreyszigErwin. (2013). Advanced Engineering Mathematics.(9th Edition).Wiley Publishers.
[2].RamanaB.V.(2007). Higher Engineering Mathematics.TataMc.Graw Hill.
[3].Sastry S.S. (2012). Introductory Methods of Numerical Analysis.(5th Edition). PHI Learning Private Limited.

Web Resources:

[1]. NPTEL:Differential Equations For Engineers
https://nptel.ac.in/courses/111106100
[2].NPTEL: Numerical Analysis
https://nptel.ac.in/courses/111101165
[3].MITOpenCourseware: Differential Equations
https://ocw.mit.edu/courses/18-03-differential-equations-spring-2010/
[4].MITOpenCourseWare: Introduction to Partial Differential Equations
https://ocw.mit.edu/courses/18-152-introduction-to-partial-differential-equations-fall-2011/
[5].MITOpenCourseware: Introduction to Numerical Analysis
https://ocw.mit.edu/courses/18-330-introduction-to-numerical-analysis-spring-2012/

24MA102

DIFFERENTIAL EQUATIONS AND NUMERICAL METHODS

CourseCategory:	**HS**	**Credits:**	**1C**
CourseType:	**Integrated Lab**	**Lecture-Tutorial-Practice:**	**0L-0T-2P**
Pre-requisites:	**Mathematics-II**	**Continuous Assessment:** **Summative Assessment:** **TotalMarks:**	**40** **60** **100**

CourseDescription:

AN OVERVIEW OF THE FUNCTIONS OF MATHWORKS SYMBOLIC MATH TOOL BOX TO SOLVE FIRST ORDER DIFFERENTIAL EQUATIONS, HIGHER ORDER LINEAR PARTIAL DIFFERENTIAL EQUATIONS WITH CONSTANT COEFFICIENTS, ELLIPTIC PARTIAL DIFFERENTIAL EQUATIONS WITH INITIAL AND BOUNDARY CONDITIONS AND FIND ROOT OF TRANSCENDENTAL EQUATIONS.

CourseObjectives:

1. Find solution of first order differential equations.
2. Solve higher order linear differential equations with constant coefficients.
3. Solve elliptic partial differential equations with initial and boundary conditions
4. Find root of transcendental equations.
5. Solve numerically first order initial value problems.

CourseOutcomes:

At theendofthecourse,thestudents willbeable to

CO	CourseOutcomes:	BTL
CO1	Find solution of first order differential equations	(K3)
CO2	Solve higher order linear differential equations with constant coefficients.	(K3)
CO3	Solve elliptic partial differential equations with initial and boundary conditions.	(K3)
CO4	Find root of transcendental equations.	(K3)
CO5	Solve numerically first order initial value problems.	(K3)

Coursearticulationmatrix

ContributionofCourseOutcomestowardsachievementofProgramOutcomes(1 – Low,2-- Medium, 3 -- High)

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

CourseContent

Unit-I

`dsolve()`function to solve first order differential equations**.**

Unit-II

`dsolve()`function to solve higher order linear differential equations with constant coefficients

Unit-III

Laplace's pde solution using finite difference method
Poisson's pde solution using finite difference method

Unit-IV

`fzero()` function to find roots of an algebraic and transcendental equations
`interp1()` function for interpolation

Unit-V

Euler's method to solve first order initial value problem
Runge-Kutta 4^{th} order method to solve first order initial value problem
`Ode78()` function to solve first order initial value problems

TextBooks:

MatlabLabManual

WebResources:

- MathWorksOrdinary Differential Equations Documentation
  Solve nonstiff differential equations — medium order method - MATLAB ode45 - MathWorks India
- MathWork Symbolic Calculus Tool Box
  Solve system of differential equations - MATLAB dsolve - MathWorks India
- MathWorks Linear Algebra Documentation
  Linear Algebra - MATLAB & Simulink - MathWorks India
- MathWork Tool Box
  Root of nonlinear function - MATLAB fzero - MathWorks India
- MathWork Tool Box
  1-D data interpolation (table lookup) - MATLAB interp1 - MathWorks India
- MathWork ODE Tool Box
  https://in.mathworks.com/help/matlab/ref/ode78.html#d126e1197289

24PH102

ENGINEERING PHYSICS (Common to ECE,EEE & EIE)

Course Category:	**Basic Sciences**	**Credits:**	**3**
Course Type:	**Theory**	**Lecture-Tutorial-Practice:**	**3-0-0**
Pre-requisites:	**10 + 2**	**Continuous Assessment: Summative Assessment:** **Total Marks:**	**40** **60** **100**

Course Description:

Engineering physics refers to the study of the combined disciplines of science and engineering, particularly electrical, electronic, aerospace, materials or mechanical engineering and it bridges the gap between basic science and engineering. The concepts of physics such as electrostatics, magnetostatics, semiconductors, lasers, optical fibers and quantum mechanics play an important role in identifying and solving engineering problems.

Course Objectives:

1. Discuss the physical laws of electrostatics to compute problems related to static electric fields.
2. Discuss the physical laws of magnetostatics to solve various problems involving static magnetic fields.
3. Explain the basic concepts of quantum mechanics and formalization of Schrodinger's equations.
4. Elucidate the basic concepts of lasers and optical fibers and their diverse applications in science and technology.
5. Explain the basic concepts of semiconductors with respect to energy bands and their applications.

Course Outcomes:

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

CO	Course Outcomes	BTL
CO1	Explain the fundamental principles of electrostatics and their applications.	K3
CO2	Illustrate the laws of magnetostatics and their applications.	K3
CO3	Describe the basic concepts of quantum mechanics and its mathematical frame.	K2
CO4	Identify different types of lasers & optical fibers and their applications.	K2
CO5	Apply the concepts of semiconductors towards the classification of materials based on energy band.	K3

Course articulation matrix

COs	POs											PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	**3**	**1**											
CO2	**3**	**1**											
CO3	2												
CO4	**3**		**2**										
CO5	**3**		**1**										

(1-Low, 2-Medium, 3-High)

Course Content

UNIT-I

Electrostatics

Electrostatics: Coulomb's law and electric field intensity, Gauss's law in electricity, applications of Gauss law - line of charge, sheet of charge, sphere of charge, electric potential, relation between E and V, potential and electric field due to electric dipole, application of electrostatics.

UNIT-II

Magnetostatics

Magnetostatics: Biot-Savart's Law, Ampere's circuit law, applications of Ampere's law, infinite line of current, infinite sheet of current, Maxwell's equation for static magnetic field, Faraday's law in electromagnetic induction, force due to magnetic field on a current element, force between two parallel current elements, Maxwell's equations in integral and differential forms.

UNIT-III

Quantum Mechanics

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 physical significance of wave function – Schrodinger's time independent wave equation–particle in a one-dimensional infinite potential box.

UNIT-IV

Lasers and Optical Fibers

- **Lasers**: Introduction, characteristics of laser, basic principles of lasers (absorption, spontaneous emission and stimulated emission), requirements of lasers (pumping, population inversion, and resonance cavity), solid state laser (Ruby), applications of lasers.
- **Optical Fibers**: Introduction, fundamentals of optical fiber, propagation of light through optical fiber, types of optical fiber, numerical aperture, fractional refractive index change, losses in optical fibers, optical fibers in communication and its advantages.

UNIT-V

Semiconductor physics

Semiconductors: Introduction, formation of energy bands, classification of crystalline solids, Fermi level in intrinsic semiconductors, Fermi level in extrinsic semiconductors, large band gap semiconductors, drift, and diffusion currents, Einstein's equation, Hall effect and its applications.

Text Books:

1. Avadhanulu, M. N. (2019). A textbook of engineering physics (11th ed.). S. Chand Publishing.
2. R.K. Gaur and S.L. Gupta (2008),"Engineering Physics", Dhanpat Rai Publications (P) Ltd.
3. Halliday, D. Resnick, R., & Walker, J. (2020). Fundamentals of physics (10th ed.). John Wiley & Sons.
4. Matthew N. O. Sadiku, "Principles of Electromagnetics", 4thedition, Oxford University Press, New Delhi, 2009.

Reference Books:

1. Pandey, B. K., & Chaturvedi, S. (2021). *Engineering Physics* (1st ed.). Cengage Learning.
2. S.L.Gupta and Sanjeev Gupta.(2007),"Electricity,Magnetism & Electronics", J.Prakashnath & Co.
3. Srinivasan, M. R. (2009). *Physics for Engineers* (1st ed.). New Age International.
4. Bhattacharya, D. K., & Poonam Tandon. (2015). *Engineering Physics* (1st ed.). Oxford press.

Web Resources:

1. https://www.geeksforgeeks.org/physics/electrostatics/
2. https://www.geeksforgeeks.org/physics/biot-savart-law/
3. Introduction to LASER, NPTEL – M. R. Shenoy, Professor, IIT – Delhi, https://onlinecourses. nptel.ac.in/noc21_ph01/preview
4. Fiber Optics, NPTEL – Vipul Rastogi, Professor, IIT, https://onlinecourses.nptel.ac.in/ noc20_ph07/preview
5. Quantum Mechanics, NPTEL – S. Lakshmi Bala, Professor, IIT – Madras, https://nptel.ac.in/ courses/ 115106066.

24PH103 PHYSICS FOR ENGINEERS			
Course Category: Physics (PH)	**Program Core (PC)**	**Credits:**	**3**
Course Type:	**Theory**	**Lecture-Tutorial-Practice:**	**3-0-0**
Pre-requisites: 10+2 Physics		**Continuous Assessment:** **Summative Assessment:** **Total Marks:**	**40** **60** **100**

Course Description:

Physics is an interdisciplinary field that serves as a bridge between basic science and engineering, applying physical principles to solve engineering problems. This course encompasses modern concepts such as crystallography, X-ray diffraction, and crystal structure determination. It also covers the principles and applications of lasers and optical fibers. Additionally, the course delves into the mechanics, synthesis, characterization, and application of Nanomaterials, including carbon nanotubes.

Course Objectives:

1. Introduce the fundamentals of crystal structure and the techniques for its characterization using X-ray diffraction.
2. Elucidate the core principles of lasers and optical fibers, highlighting their diverse applications in science and technology.
3. Discuss the foundational concepts of mechanics and their formalization for various mechanical applications.
4. Develop skills to understand and apply the principles of physical properties of solids to solve engineering problems.
5. Explain how the dimensionality of materials at the Nanoscale influences their properties, along with exploring numerous industrial applications.

Course Outcomes:

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

CO	Course Outcomes	BTL
CO1	Describe various types of crystal structures and their characterization methods.	K2
CO2	Identify different types of lasers and optical fibers, and their applications.	K2
CO3	Explain the basic concepts of mechanics as applicable to engineering problems.	K2
CO4	Demonstrate the physical properties of solids and their interrelationships.	K3
CO5	Identify the fabrication methods of Nanomaterials and carbon nanotubes, along with their applications in engineering and technology.	K4

Course articulation matrix

COs	POs											PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3												
CO2	3		2										
CO3	3	1											
CO4	3												
CO5	3				1								

(1-Low,2-Medium,3-High)

Course Content

UNIT-I

Crystallography and Characterization of Materials

Crystallography: Space lattice, basis, unit cell and lattice parameters, Bravais lattices, crystal systems (3 Dimensional), coordination number, packing fraction of SC, FCC, and BCC – Miller indices – separation between successive (hkl) planes.

Characterization of Materials: Introduction, diffraction of X – rays, derivation of Bragg's law, and Bragg's X – ray spectrometer, determination of crystal structure by powder crystal method.

UNIT-II

Lasers and Optical Fibers

Lasers: Introduction, characteristics of laser, basic principles of lasers (absorption, spontaneous emission and stimulated emission), requirements of lasers (pumping, population inversion, and resonance cavity), solid state laser (Ruby), applications of lasers.

Optical Fibers: Introduction, fundamentals of optical fiber, propagation of light through optical fiber, types of optical fiber, numerical aperture, fractional refractive index change, losses in optical fibers, optical fibers in communication and its advantages.

UNIT-III

Kinematics of Particle Motion

Kinematics of Rectilinear Motion: Displacement, velocity, and acceleration, uniform motion, motion with uniform acceleration, and motion with variable acceleration.

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

UNIT-IV

Properties of Solids

Properties of Solids: Motion of a particle in a central force field, Kepler's laws (qualitative) and applications, Hooke's law, stress – strain relation, elastic moduli, relation between elastic constants, Poisson's ratio, expression for Poisson's ratio in terms of elastic constants, determination of rigidity modulus by static torsion.

UNIT-V

Nanomaterials

Nanomaterials: Introduction to Nanomaterials, general properties of Nanomaterials, significance of the Nanoscale (surface to volume ratio, quantum confinement effect), fabrication of Nanomaterials using plasma arcing and chemical vapour deposition methods, characterization of Nanomaterials using SEM and TEM, Carbon nano tubes, SWNT, MWNT, formation of Carbon nanotubes by arc discharge, laser ablation, properties of Carbon nano tubes, Applications of CNTs & nanotechnology.

Text Books:

1. Avadhanulu, M. N. (2019). A textbook of engineering physics (11th ed.). S. Chand Publishing.
2. Tayal, A. K. (2006). Engineering Mechanics: Statics and Dynamics (13th ed.). Umesh Publications.

Reference Books:

1. Halliday, D. Resnick, R., & Walker, J. (2020). Fundamentals of Physics (10th ed.). John Wiley & Sons.
2. Pandey, B.K., & Chaturvedi, S. (2021). Engineering Physics (1st ed.). Cengage Learning.
3. Sharma, S., & Sharma, J. (2018). Engineering Physics (1st ed.). Pearson Education India.
4. Srinivasan, M. R. (2009). Physics for Engineers (1st ed.). New Age International.

Web Resources:

1. X – ray crystallography and Diffraction, NPTEL– Ranjit Kumar Ray, Professor, IIEST Shibpur, IIT Madras, https://onlinecourses.nptel.ac.in/noc22_mm39/preview
2. Introduction to LASER, NPTEL – M. R. Shenoy, Professor, IIT – Delhi, https://onlinecourses. nptel.ac.in/noc21_ph01/preview
3. Fiber Optics, NPTEL – Vipul Rastogi, Professor, IIT – Roorkee, https://onlinecourses.nptel.ac.in/ noc20_ph07/preview
4. Mechanics, NPTEL – Anjani Kumar Tiwari, Professor, IIT – Roorkee, https://onlinecourses.nptel.ac.in/ noc24_me148/preview.
5. Mechanics of Solids, NPTEL – Priyanka Ghosh, Professor, IIT Kanpur, https://onlinecourses.nptel.ac.in/noc22_ce46/preview.
6. Introduction to Nanoscience and Nanotechnology, NPTEL – Swayam, Swapna Nair, Professor, Central University of Kerala, https://onlinecourses.swayam2.ac.in/cec24_cy03/preview

24EN101
COMMUNICATIVE ENGLISH

Course Category:	**HS**	**Credits:**	**4.5C**
Course Type:	**Theory**	**Lecture-Tutorial-Practice:**	**3L-0T-3P**
Pre-requisites:	**Intermediate English**	**Continuous Assessment:** **Summative Assessment:** **Total Marks:**	**40** **60** **100**

Course Description:

Communicative English course covers Intercultural Communication, AI in higher education , and Natural Language Processing. It emphasizes effective listening, presentation techniques, innovation, creativity, advanced reading, and technical writing skills, addressing verbal and nonverbal communication fundamentals, processes, barriers, and strategies for confidence and fluency, preparing students for career readiness and leadership.

Course Objectives:

1. Explain the verbal and nonverbal processes of Communication.
2. Familiarize active listening skills and explain the traits of a good listener.
3. Introduce speaking skills for effective presentations.
4. Teach reading techniques to enhance employability skills.
5. Instruct writing techniques to enhance employability skills.

Course Outcomes:

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

CO	Course Outcomes:	BTL
CO1	Relate and recall the verbal and nonverbal processes of Communication.	(K1)
CO2	Demonstrate active listening skills and acquire the traits of good listener	(K2)
CO3	Apply English speaking skills to deliver effective presentations	(K3)
CO4	Appraise reading techniques like skimming and scanning to enhance employability skills	(K4)
CO5	Assess writing techniques like outlining and clustering to enhance employability skills	(K5)

Course articulation matrix

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

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

Course Content

Unit-I

Introduction to Communication:

Basics of Communication, Process of Communication, Levels of Communication, Verbal and Nonverbal Communication, Channels of Communication, Barriers to Communication, ***Intercultural Communication.***

Unit-II

Listening Skills:

Effective Listening, Active Traits of a Good Listener, Listening Modes, Types of Listening, Barriers to Effective Listening, Listening for general content, ***AI in Higher Education: Opportunities, Challenges, and Ethical Considerations.***

Unit-III

Speaking Skills:

Achieving Confidence, Clarity & Fluency, Effective Presentation Strategies, Meetings, Conferences, Paralinguistic Features, Barriers to Speaking, ***Natural Language Processing.***

Unit-IV

Reading Skills:

Reading Techniques, Techniques for Good Comprehension, Study Skills, Reading and Interpretation, Intensive, Extensive & Critical Reading, Reading for Different Purposes, ***Innovation and Human Creativity.***

Unit-V

Writing Skills:

Technical Writing, Importance and Characteristics, Techniques for Good Technical Writing ,Paragraph Construction, Essays, Reports, ***Communication for Career-readiness and Leadership.***

Text Books:

1) Raman,M., & Sharma,S.(2012).*Technical Communication* (2nd ed.). Oxford University Press.

Reference Books:

1) Pushplata, & Kumar, S.(2011).*Communication Skills*. Oxford University Press.
2) Rizvi,A.(2005).Eff*ective Technical Communication*. Tata Mc Graw- Hill Publishing Company Limited.
3) Mishra,S, & Muralikrishna,C.(2006). *Communication Skills for Engineers*. Pearson.

Web Resources:

http://ndl.iitkgp.ac.in/he_document/ekumbh/ekumbh/85?e=5|text%20books%20on%20technical%20communication||| Kulbhushan Kumar. *English for Technical Professionals.*

https://www.gtuelibrary.edu.in/publication/Technical%20communication%205th%20June'09.pdfProf. (Dr.) M. D. Desai, *Technical Communication.*

https://gnindia.dronacharya.info/CSE-AI-ML/Common-Subjects/Downloads/Technical-Communication/Books/Technical-Communication-Book-1.pdf

Technical Communication Principles and Practice
Meenakshi Raman and Sangeeta Sharma

Laboratory Exercises

1) Phonetics.

Introduction – Articulatory Phonetics (The Sounds of Speech Production) – Phonological Concepts (Sound Patterns and Rules) – Practical Applications.

2) Listening Comprehension

Introduction – Strategies for Effective Listening – Types of Listening (Discriminative, Comprehensive, Evaluative, and Appreciative) – Improving Listening Comprehension (Note-taking and Summarizing) – Overcoming Distractions and Misunderstandings – Practice Activities.

3) Conversation Starters- Introducing Self and others

Icebreakers – Introducing Yourself – Introducing Others – Accepting – Declining – Agreeing – Disagreeing – Seeking Clarification – Seeking Permission – Expressing Interest – Offering Help.

4) Just A Minute

Introduction – Rules of the Game (No Hesitation, No Deviation, No Repetition)– Strategies for Success – Benefits of JAM – Common Challenges – Practice Sessions.

5) Situational Dialogues & Role Plays

Introduction – Benefits – Planning and Structuring a Role Play – Everyday Scenarios – Tips for Effective Role Playing – Role Play Practice.

6) Reading Comprehension

Understanding Reading Comprehension – Strategies for Effective Reading – Types of Reading Comprehension Questions – Improving Vocabulary and Context Clues – Practice Exercises – Techniques to Master.

7) Vocabulary

Vocabulary Building –Exploring Prefixes– Discovering Suffixes– Uncovering Roots– Selected Word List (500 Essential Words for Vocabulary Development) – Practical Application.

8) Grammar

Introduction to Grammar Essentials – Understanding Tenses – Mastering Articles – Navigating Prepositions – Practice Exercises – Tips for Improving Grammar Skills.

9) Describing People, Places, Objects and Events

Introduction to Descriptive Language –Describing People – Describing Places – Describing Objects – Describing Events – Practice Activities.

10) Poster Presentation

Introduction – Designing an Effective Poster – Content Development – Presenting Information Visually – Effective Delivery – Tips for Engaging Your Audience.

11) Letter Writing

Introduction – Structure of a Letter – Types of Letters – Writing Techniques – Addressing Envelopes –Practice Activities.

12) Email Writing

Introduction – Parts of an Email – Tone, Style and Language – Email Etiquette – Dos and Don'ts of Professional Email Communication – Organizing Inbox and Responding Promptly – Practice Activities.

Textbook:

Communicative English Lab Manual

References:

1) D. Sudha Rani. (2011). *A Manual for English Language Laboratories*. Pearson, Noida,
2) Nira Konar. (2011). *English Language Laboratories*. PHI Learning Private Limited, New Delhi.

English Language Communication Skills Lab Software:

1) Walden
2) Softx
3) Visionet Spears Digital Language Lab software Advance Pro
4) ODll Language Learner's Software, Orell Techno Systems

24ME101
ENGINEERING MECHANICS
(CE & ME)

Course Category:	**Programme Core (PC)**	**Credits:**	**3**
Course Type:	**Theory**	**Lecture-Tutorial-Practice:**	**3-0-0**
Pre-requisites:	**10+2 Mathematics & Physics**	**Continuous Assessment:** **Summative Assessment:** **Total Marks:**	**40** **60** **100**

Course Description:

Engineering Mechanics is a fundamental course that builds the analytical foundation required for understanding the behavior of bodies under the influence of forces and motion. It prepares students for advanced mechanical engineering subjects by developing essential problem-solving skills in statics, dynamics, and structural analysis, enabling them to model and evaluate real-world engineering systems effectively.

Course Objectives:

1. Develop a strong foundation in engineering mechanics for analyzing coplanar concurrent, parallel, and general force systems, including forces in plane trusses.
2. Enable students to determine centroids and moments of inertia of various plane figures and material bodies.
3. Provide understanding of mass moments of inertia and their evaluation for different bodies.
4. Build competency in analyzing rectilinear and curvilinear motion of particles.
5. Apply principles of dynamics to analyze the fixed-axis rotation of rigid bodies.

Course Outcomes:

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

CO	Course Outcomes	BTL
CO1	*Apply* the principles of statics to determine the resultant and equilibrium of coplanar concurrent and parallel force systems.	**K3**
CO2	*Compute* the centroid and moment of inertia for standard and composite plane figures.	**K3**
CO3	*Analyze* coplanar general force systems and plane trusses.	**K3**
CO4	*Apply* the principles of dynamics to solve problems in rectilinear and curvilinear motion of particles.	**K3**
CO5	*Understand* the basic concepts of rigid-body rotation about a fixed axis.	**K2**

Course articulation matrix

COs	POs										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2									
CO2	3	2									
CO3	3	2									
CO4	3	2									
CO5	3	2									

(1-Low, 2 -Medium, 3–High) (WK8)

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

Unit-II

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

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

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

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.

Unit-III

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

Coplanar General case of force system: Equilibrium of forces in plane-

Analysis of plane trusses: Method of joints

Unit-IV

Kinetics of Rectilinear motion: D'Alembert's Principle, Work energy principle, Impulse and Momentum principle.

Kinetics of Curvilinear motion: D'Alembert's Principle, Work energy principle

Unit-V

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

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

Web Resources:

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

24EE101
ELECTRICAL NETWORK ANALYSIS
(Common to EEE/ECE/EIE branches)

Course Category:	**Engineering Science (ES)**	**Credits:**	**3**
Course Type:	**Theory**	**Lecture-Tutorial-Practice:**	**3-0-0**
Pre-requisites:	**10+2 Physics**	**Continuous Assessment:** **Summative Assessment:** **Total Marks:**	**40** **60** **100**

Course Description:
This course covers essential principles of electrical circuits and their applications. It begins with D.C. circuits, exploring various circuit components, sources, and key theorems such as Superposition, Thevenin's, and Norton's. It progresses to understanding alternating quantities, involving RMS and average values, and phasor representations in AC circuits. Transient analysis of first and second-order differential equations, time constants, and RLC circuits with D.C. excitations are also examined. This course also covers resonance in series and parallel circuits, and parameters like bandwidth and Q factor. Finally, it addresses two-port networks, including impedance, admittance, and hybrid parameters, and their interrelationships.

Course Objectives:

- To introduce basic analysis techniques and theorems for solving electrical circuits
- To impart knowledge on single phase AC circuits
- To explain transient behavior of circuits in time and frequency domain
- To teach concepts of Resonance
- To introduce two port parameters and their inter relationship

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

CO	Course Outcomes	BTL
CO1	Analyze DC Circuits by applying network theorems.	K4
CO2	Find the response of series and parallel RC, RL and RLC circuits.	K3
CO3	Analyze the transient response of RL, RC and RLC circuits.	K4
CO4	Design series and Parallel resonance circuits for the given specification.	K4
CO5	Evaluate two port network parameters.	K3

Course articulation matrix

	POs											PSOs	
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	**3**	**3**		**3**	**3**						**3**		
CO2	**3**	**3**		**3**	**3**						**3**		
CO3	**3**	**3**		**3**	**3**						**3**		
CO4	**3**	**3**		**3**	**3**						**3**		
CO5	**3**	**3**		**3**	**3**						**3**		

(1-Low, 2 -Medium, 3–High)

Course Content

Unit-I

D.C Circuits & Network Theorems:

- Types of circuit components, Types of Sources, Source Transformations, Star-Delta Transformation, Kirchhoff's Laws, Mesh and Nodal analysis, Super Mesh and Super Node analysis.
- Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum Power Transfer Theorem, Reciprocity theorem, Millman's theorem, Tellegen's theorem.

Unit-II

Single Phase AC Circuits:

- Generation of Alternating Voltages, Terms Related to Alternating Quantities, Root Mean Square (rms) Value, Average Value, Phasor Representations of Alternating Quantities, Mathematical Representations of Phasors, Behaviour of a Pure Resistor, Pure Inductor, Pure Capacitor in an ac Circuit, Series RL, RC and RLC Circuit, Parallel ac Circuits.

Unit-III

Transient Analysis:

- First order differential equations, definition of time constant, RL circuit, RC circuit with DC excitation, evaluating initial condition procedure, second order differential equations, homogeneous and non-homogeneous problem solving using RLC elements with DC excitation.

Unit-IV

Resonance:

- Introduction, Series resonance, Parallel resonance, Concept of band width and Q factor, Comparison between series and parallel resonant circuits, Tank Circuit, Parallel RL-RC Branch Circuit.

Unit-V

Two-port Networks:

- Open circuit impedance parameters, Short circuit admittance parameters, Transmission line parameters, Hybrid parameters, Inter Relationships Between parameters, Parallel & series connection of two port networks, cascading of two port networks.

Text Books:

- Hayt. William H.,& Kemmerly Jack., & Phillips Jack., & Steven M.Durbin. (2020), *Engineering Circuit Analysis* (9thed.).McGraw Hill Education.
- Ravish R Singh,(2013), *Network Analysis and Synthesis* (1st ed.). McGraw-Hill Education,

Reference Books:

- Roy Choudhury, D., (2013). *Networks and Systems* (2nded.). New Age International Publications
- Edminister, Joseph., & Nahvi, Mahmood. (2017). *Electric Circuits, Schaum's Outline Series* (7th ed.), Tata McGraw Hill Publishing Company, New Delhi.
- Alexander, Charles. K., & Matthew .N., & Sadiku .O.(2021). *Fundamentals of Electric Circuits* (5th ed.).McGraw-Hill Education.
- A.Chakrabarti.,(2010), *Circuit Theory (Analysis and Synthesis)* (6th ed.). Dhanpat Rai & Co.,

Web Resources:

- https://onlinecourses.nptel.ac.in/noc23_ee54/preview
- https://onlinecourses.nptel.ac.in/noc25_ee91/preview

24IT103 PROBLEM SOLVING WITH PYTHON			
Course Category:	**Engineering Science (ES)**	**Credits:**	**3**
Course Type:	**Integrated Course**	**Lecture-Tutorial-Practice:**	**2-0-2**
Pre-requisites:	Programming through C	**Continuous Assessment:** **Summative Assessment:** **Total Marks:**	**40** **60** **100**

Course Description:

This course introduces fundamental programming and problem-solving concepts using Python. It provides students with a solid foundation for computational thinking, program design, and logical reasoning. Students will learn Python syntax, data handling, and modular design techniques. The course emphasizes problem-solving through programming constructs, functions, data structures, and object-oriented principles.

Course Objectives:

- Introduce the foundational concepts of Python programming, syntax, and control structures for computational problem solving. (K1)
- Explain the use of iteration (for, while, nested loops) and loop control statements (break, continue, pass) along with Python string operations for effective sequential processing. (K2)
- Develop proficiency in manipulating strings and core data structures such as lists, tuples, sets, and dictionaries for effective data handling. (K3)
- Demonstrate modular program design using user-defined functions, modules, and exception handling for reliable and reusable software development. (K3)
- Apply object-oriented programming principles — abstraction, encapsulation, inheritance, and polymorphism — to design efficient and scalable applications. (K4)

Course Outcomes:

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

CO	Course Outcomes	BTL
CO1	Explain the syntax, semantics, and control structures of Python programming for solving computational problems. (K1)	K1
CO2	Explain iteration constructs and loop control statements, with Python string operations for sequential processing. (K2)	K2
CO3	Implement Python's built-in functions and data structures (lists, tuples, sets, dictionaries) for structured data processing. (K3)	K3
CO4	Develop modular and reusable programs using functions, packages, and exception handling mechanisms to improve code efficiency and reliability. (K3)	K3
CO5	Design object-oriented Python solutions applying abstraction, encapsulation, inheritance, and polymorphism for real-world problem-solving. (K4)	K4

Course Articulation Matrix

	POs											PSOs	
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	2	3	2								1	3	2
CO2	3	2	2								2	2	2
CO3	2	2	3								2	2	2
CO4	1	3	3								2	3	1
CO5	1	2	3								2	1	2

(1-Low, 2 -Medium, 3–High)

Course Content

Unit-I

Introduction to Python Programming

- **Overview of Python**: Features, installation, execution model, Literals, variables, identifiers, and data types, Input/Output operations and indentation, Operators and expressions
- **Control structures**: Conditional and looping statements: Selection: if, if–else, nested if, if–elif–else

Unit-II

Iterative Statements & String Handling

- **Iterative Statement**: while, for, nested loops, break, continue, pass, else in loops
- **Strings**: Creation, indexing, slicing, concatenation, String formatting, f-strings, and escape sequences, String methods (upper(), lower(), replace(), split(), join()), Membership operators (in, not in) and iteration, String comparison and manipulation

Unit-III

Python Data Structures

- **Lists**: Creation, indexing, slicing, mutability, methods (append(), insert(), sort(), remove()), nested lists
- **Tuples**: Creation, immutability, packing/unpacking, tuple operations
- **Sets**: Creating sets, uniqueness, set operations (union(), intersection(), difference()), set comprehension
- **Dictionaries**: Key-value pairs, insertion, deletion, traversal, dictionary methods (items(), keys(), values())

Unit-IV

Functions, Modules, and Exception Handling

- **Functions**: Definition, parameters, arguments, and return values, Variable scope and lifetime, Recursion and lambda functions
- **Modules and Packages**: Importing and creating modules and their usage.
- **Exception handling**: try, except, finally, and custom exceptions

Unit-V

Object-Oriented Programming(OOP) in Python

- **OOP concepts**: Classes, objects, attributes, and methods, Constructors, destructors, and encapsulation, Inheritance, polymorphism, Aggregation and composition, Real-world applications of OOP to solve engineering problems(Case Study)

List of experiments

Unit 1:

1. Install Python on Windows / Ubuntu.
2. Print two strings with custom separator and suppress newline; then print "ENDLINE".
3. Check whether number is Odd or Even.
4. Solve a Quadratic Equation using formula.
5. Find Area of a Triangle.
6. Swap two variables.
7. Convert kilometres to miles.
8. Check Leap Year.
9. Check Armstrong Number.
10. Check if number is Positive, Negative or Zero.
11. Attendance percentage program:
    Input working days, absent days
    Calculate attendance and check eligibility (<75%).
12. Road tax calculation based on cost of bike (Slab-based conditional).
13. Grade calculation based on score range (0.0–1.0).
14. Interactive integer reading:
    i. Print binary for positive numbers
    ii. Ignore negative
    iii. Exit when input = 999

Unit 2:

1. Nested-loop patterns:
2. Print Multiplication Table using format().
3. Count how many times a number can be divided by 3 until ≤10.
4. Sum of first 20 terms of sequence 1 + 2 + 4 + 8 + 16 + … using while True + break.
6. Modify 0–100 summation code to use continue and sum only odd numbers.
7. Create student name, roll no, marks inputs and print formatted output using %s, %d, %f.
8. Extract substring between two given substrings.
9. Split each word into two halves based on a given percentage.

10. Find all adverbs and their positions in the given string.
11. Extract date from a string using regex (re.search, strptime).

Unit 3:

1. Accept comma-separated numbers → generate list and tuple.
2. Find tuples divisible by k from list of tuples.
3. Find tuples with all positive elements.
4. Remove duplicate tuples from a list.
5. Row-wise custom addition in a tuple matrix**.**
6. Extract digits from tuple list → return flat list.
7. Sort dictionary by value (ascending & descending).
8. Convert dictionary string values → int / float.
9. Map each element of list to each item of dictionary (nested dictionary).
10. Convert list → dictionary (odd elements = keys, even = values).
11. Create dictionary from two equal-length lists (keys, values).
12. Input string & pattern → check if characters follow same order.
13. Perform and display union, intersection, difference, and symmetric difference
14. Check whether A is a subset or superset of B
15. Remove Duplicate Words from a Sentence using sets

Unit 4:

1. Two functions:
    - Area of circle
    - Perimeter of circle
2. Rectangle: area & perimeter via functions.
3. Recursive functions for:
    - GCD
    - LCM
    - Factorial
    - Fibonacci
4. showEmployee(name, salary=10000) — default argument.
5. Function to accept variable number of subject marks (variable-length args).
6. Find day of the week given date (use datetime).
8. Program to perform x / y and handle ZeroDivisionError with message.
9. Input list & n — sum first n values; if n invalid → raise IndexError.
10. Student class:
    - Method: check_marks
    - Raise custom exception NotEligibleException if marks < 90.
11. Create a module mymath.py with functions:
    - add(a, b)
    - mul(a, b)

    Write a main program that imports the module and calls these functions.
12. Create a Custom Module With Constants

    Task:
    File: const.py
    Contains:
    PI = 3.14
    GRAVITY = 9.8
    Import it and print both constants.

Unit 5:

1) Design a class **Person** that contains the public attributes:
    - name
    - age

    Create an object and display the stored values.
2) Create a class **Person** with the private attributes:

- __name
- __age

Implement:

- A constructor to initialize the attributes
- A __str__() method to return a formatted representation of the object

3) Develop a class **Person** with:

- Private attributes: __first_name, __last_name, __age
- A **class variable** domain_name used to auto-generate the email
- A method fullname() returning "First Last"
- A __str__() method showing full details including the generated email ID

4) Create an abstract class **AbstractStall** with an abstract method display(). Implement three derived classes:

- **Stall**
- **ExecutiveStall**
- **PremiumStall**

Each subclass should override display() to show details relevant to its type (demonstrating polymorphism).

5) Inheritance with Constructor Execution Order (Employee → Developer)

Define a base class **Employee** and a derived class **Developer**.

Tasks:

- Demonstrate the sequence of constructor calls when the child class is instantiated.
- Print and compare the class attributes of Employee and Developer.

6) Multi-Level OOP with @property and Aggregation (Employee → Developer, Manager)

Build a class hierarchy:

- **Employee** class with @property for the name attribute
- **Developer** class derived from Employee with an additional attribute (e.g., programming language)
- **Manager** class derived from Employee containing a list of employees managed

Include:

- Methods to addEmployee() and removeEmployee()
- A separate **Utility** class to generate a formatted report of employees under each manager

7) Operator Overloading (Bank Entry Counter)

Implement a **Bank** class that tracks the number of persons inside a bank.

Overload operators:

- + to increment count when a person enters
- - to decrement count when a person leaves

This demonstrates operator overloading in a real-world context.

Text Books:

1. R. Thareja, *Python Programming: Using Problem Solving Approach*, 2nd ed., Oxford University Press, 2019

Reference Books:

1. John Guttag, Introduction to Computation and Programming Using Python, MIT Press, 2016.
2. K. Beecher, Computational Thinking: A Beginner's Guide to Problem-Solving and Programming, BCS Learning, 2017.
3. L. Ramalho, Fluent Python, 2nd ed., O'Reilly Media, 2022.
4. B. Downey, Think Complexity: Complexity Science and Computational Modeling, 2nd ed., O'Reilly Media, 2018.
5. S. Hall, Effective Python: 90 Specific Ways to Write Better Python, 2nd ed., Addison-Wesley, 2019.

Web Resources: [Internet]

1. NPTEL. *The Joy of Computing using Python* . Available from: https://archive.nptel.ac.in/courses/106/106/106106182/
2. GeeksforGeeks. *Python Programming Language – Basics* . Available from: https://www.geeksforgeeks.org/python-programming-language/
3. W3Schools. *Python Basics Tutorial* . Available from: https://www.w3schools.com/python/
4. GeeksforGeeks. *Memory Management in Python* . Available from: https://www.geeksforgeeks.org/memory-management-in-python/

5. RealPython. *Understanding Python Objects and Memory Management* . Available from: https://realpython.com/python-memory-management/
6. W3Schools. *Python Strings* . Available from: https://www.w3schools.com/python/python_strings.asp
7. GeeksforGeeks. *Python Data Structures* . Available from: https://www.geeksforgeeks.org/python-data-structures/
8. W3Schools. *Python Lists, Tuples, Sets, and Dictionaries* . Available from: https://www.w3schools.com/python/python_lists.asp
9. RealPython. *Python Functions and Exceptions* . Available from: https://realpython.com/python-functions/
10. W3Schools. *Python Exception Handling* . Available from: https://www.w3schools.com/python/python_try_except.asp
11. AlgoDaily. *Association, Aggregation, and Composition in Python OOP* . Available from: https://algodaily.com/lessons/association-aggregation-composition-casting
12. GeeksforGeeks. *Python OOP Concepts* . Available from: https://www.geeksforgeeks.org/python-oops-concepts/

Designation	Name in Capitals	Signature with Date
Course Coordinator	Dr. G KALYANI Dr. C S PAVAN KUMAR	
Head of the Department	Dr. M SUNEETHA	

24UC181
DESIGN THINKING
(CE, ECE, EEE, EIE & ME)

Course Category:	**Engineering Sciences (ES)**	**Credits:**	**1**
Course Type:	**Laboratory**	**Lecture-Tutorial-Practice:**	**0-0-2**
Pre-requisites:		**Continuous Assessment:** **Summative Assessment:** **Total Marks:**	**60** **40** **100**

Course Description:

This course introduces first-year undergraduate engineering students to the principles and practices of design thinking, emphasizing user-centred problem-solving and innovation. Students will learn to empathize with users, define problems, ideate solutions, develop prototypes, and test these solutions. The course will also explore the application of design thinking across various engineering disciplines, including Civil Engineering (CE), Electronics and Communication Engineering (EC), Electrical Engineering (EE), Mechanical Engineering (ME), and Information Technology (IT).

Course Objectives:

1. To introduce the fundamental concepts and process of design thinking.
2. To develop students' ability to empathize with users and accurately define engineering problems.
3. To encourage creativity and the generation of a wide range of ideas.
4. To enable students to prototype and test their design solutions.
5. To illustrate the application of design thinking to solve core engineering design problems.

Course Outcomes:

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

CO	Course Outcomes	BTL
CO1	Explain the principles of design thinking.	**K2**
CO2	Apply empathy and problem-defining techniques in engineering contexts.	**K3**
CO3	Employ innovative ideas using various ideation techniques.	**K3**
CO4	Model and test prototypes to validate engineering solutions.	**K4**
CO5	Practice design thinking strategies in civil, electronic, electrical, mechanical, and IT engineering projects	**K3**

Course articulation matrix

	POs										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1								3	3		3
CO2								3	3		3

CO3			3		3	3		3	3		3
CO4					3			3	3		3
CO5					3			3	3		3

(1-Low, 2 -Medium, 3–High) (WK8)

Course Content

Unit-I

Description: This unit introduces the foundational concepts of design thinking and its importance in solving complex engineering problems.

Introduction to Design Thinking: Introduction to Design Thinking, History and Evolution of Design Thinking, Key Principles and Mindsets, The Design Thinking Process: An Overview, The Role of Design Thinking in Engineering.

Examples/Applications/Case Studies:

- Case Study: How IDEO uses design thinking to innovate.
- Example: Apple's design thinking approach in product development.

Lab/Practice Exercises:

1. Identifying and analyzing engineering problems.
2. Group discussions on real-world design thinking examples.
3. Role-playing to understand user perspectives.

Unit-II

Description: This unit focuses on understanding users through empathy and accurately defining engineering problems to guide the design process.

Empathize and Define: The Importance of Empathy in Design Thinking, Techniques for Empathy: Interviews, Observations, and Surveys, Defining the Problem: Point of View Statements, Tools for Problem Definition: Journey Maps, Personas, Translating Empathy into Insights.

Examples/Applications/Case Studies:

- Example: Empathy maps in understanding customer needs.
- Case Study: How Airbnb uses empathy in design thinking.

Lab/Practice Exercises:

1. Conducting user interviews.
2. Creating personas and journey maps.
3. Developing problem statements.

Unit-III

Description: This unit explores creative techniques for generating a wide range of ideas to solve defined engineering problems.

Ideate: The Ideation Phase in Design Thinking, Brainstorming Techniques, Creative Thinking and Innovation, Selecting and Refining Ideas, Overcoming Creative Blocks.

Examples/Applications/Case Studies:

- Example: Brainstorming session in a tech startup.
- Case Study: Google's "20% time" policy for innovation.

Lab/Practice Exercises:

1. Group brainstorming sessions.
2. Idea selection and refinement exercises.
3. Sketching and visualizing ideas.

Unit-IV

Description: This unit covers the creation of prototypes and the methods for testing and

iterating on these prototypes to develop viable engineering solutions.

Prototype and Test: Prototyping Basics and Importance, Types of Prototypes: Low-fidelity vs. High-fidelity, Tools and Materials for Prototyping, Testing Prototypes: Methods and Techniques, Iterating Based on Feedback.

Examples/Applications/Case Studies:

- Example: Prototyping in the automotive industry.
- Case Study: Iterative prototyping at Dyson.

Lab/Practice Exercises:

1. Building low-fidelity prototypes.
2. Conducting user testing sessions.
3. Analyzing feedback and iterating designs

Unit-V

Description: This unit examines the application of design thinking across various engineering disciplines, including CE, EC, EE, ME, and IT, to solve engineering design problems.

Design Thinking in Civil Engineering (CE) , Applying Design Thinking in Electronics and Communication Engineering (EC), Design Thinking for Electrical Engineering (EE) , Innovation in Mechanical Engineering (ME), Design Thinking in Information Technology (IT).

Examples/Applications/Case Studies:

- Case Study: Design thinking in sustainable building design (CE).
- Example: Innovation in wearable technology (EC).
- Case Study: Smart grid solutions (EE).
- Example: Prototyping in automotive design (ME).
- Case Study: User-centric software development (IT).

Lab/Practice Exercises:

1. Developing design thinking strategies for a civil engineering project.
2. Prototyping an electronic device solution.
3. Creating user-centric IT solutions

Text Books:

1. Brown, T. (2009). Change by Design: How Design Thinking Creates New Alternatives for Business and Society. Harper Business.
2. Cross, N. (2011). Design Thinking: Understanding How Designers Think and Work.
    1. Berg.

Reference Books:

1. Liedtka, J., & Ogilvie, T. (2011). Designing for Growth: A Design Thinking Tool Kit for Managers. Columbia University Press.
2. Kelley, T., & Kelley, D. (2013). Creative Confidence: Unleashing the Creative Potential Within Us All. Crown Business.
3. Martin, R. L. (2009). The Design of Business: Why Design Thinking is the Next Competitive Advantage. Harvard Business Press.

Web Resources:

1. https://onlinecourses.swayam2.ac.in/aic26_ge05/course

24PH181
PHYSICS LAB

Course Category:	**Programme Core (PC)**	**Credits:**	**1**
Course Type:	**Practical**	**Lecture-Tutorial-Practice:**	**0-0-2**
Pre-requisites:	**10+2 Physics**	**Continuous Assessment:** **Summative Assessment:** **Total Marks:**	**60** **40** **100**

Course Description:

The Engineering Physics laboratory for B. Tech students is designed to provide hands on experience in basic concepts of optics, lasers, optical fibers, waves and oscillators, electricity and magnetism, quantum mechanics, and semiconductors. This course aims to foster the practical skills essential through experimentation, measurement, and analysis for the students of computer science allied branches like CSE, AI-ML, AI-DS, and Information Technology, ECE, EEE, EIE, CE and ME branches. Students will work with advanced equipment under the guidance of experienced faculty to explore various physical phenomena and their engineering applications.

Course Objectives:

1. Demonstrate the basic concepts of wave optics and the experimental evidence of wave nature of light by interference and diffraction phenomena.
2. Provide the experimental knowledge of understanding the properties of semiconductors and their applications.
3. Elucidate the basic concepts of Lasers and Optical fibers and their diverse applications in Science and Technology.

Course Outcomes:

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

CO	Course Outcomes	BTL
CO1	Identify the wave nature of light by the concepts like interference and diffraction of light.	**K4**
CO2	Distinguish the semiconductors based on carrier concentration and Hall coefficient.	**K4**
CO3	Calculate the specific charge of an electron and work function of a photocell.	**K4**
CO4	Demonstrate a comprehensive understanding of wave phenomena, resonance, and their application across various physical systems.	**K3**
CO5	Apply the laser principles, optical fiber transmission characteristics, and their practical applications in telecommunications and photonics.	**K4**

Course articulation matrix

COs	POs										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	**3**										
CO2	**3**										
CO3	**3**				**2**						
CO4	**3**										
CO5	**3**				**2**						

(1-Low, 2 -Medium, 3–High)

Course Content with CO mapping

A. Experiments common to all branches:

1. Solar cell – Determination of fill factor (Common to all branches). (CO2)
2. Hall effect – Hall coefficient measurement (Common to all branches). (CO2)

B. Experiments for CSE, IT, AIDS, and AIML branches:

3. Newton's Rings – Radius of Curvature of a plano convex lens (CO1)
4. Diffraction grating – Wavelength of laser light (CO1,CO5)
5. Photocell – Study of V – I characteristics and determination of work function (CO3)
6. Compound pendulum – Measurement of 'g' (CO4)
7. Specific charge (e/m) of an electron – J. J. Thomson method (CO3)
8. AC Sonometer – Verification of vibrating laws (CO4)
9. Optical Fiber – Determination of Numerical Aperture (CO5)
10. Figure of Merit of a Galvanometer (CO4)
11. Variation of Magnetic field along the axis of current – carrying circular coil (CO3)
12. Diffraction grating – Measurement of wavelength of mercury source (CO1,CO5)

C. Experiments for ECE, EEE, and EIE branches:

3. Figure of Merit of a Galvanometer. (CO4)
4. LCR circuit – Study of Resonance. (CO4)
5. Variation of Magnetic field along the axis of current – carrying circular coil (CO3)
6. Wedge method – Measurement of thickness of a foil. (CO1)
7. Specific charge (e/m) of an electron – J. J. Thomson method (CO3)
8. B-H Curve Unit- Determination of hysteresis loss (CO3)
9. Diffraction grating – Wavelength of laser light (CO1,CO5)
10. Photocell – Study of V – I characteristics, determination of work function. (CO3)
11. Optical Fiber – Determination of Numerical Aperture (CO5)
12. Torsional pendulum-Measurement of Rigidity Modulus (CO4)

D. <u>Experiments for CE and ME branches:</u>

3. AC Sonometer – Verification of vibrating laws (CO4)
4. Wedge method – Measurement of thickness of a foil (CO1)
5. Diffraction grating – Wavelength of laser light. (CO1, CO5)
6. Photocell – Study of V – I characteristics and determination of work function (CO3)
7. Torsional pendulum-Measurement of Rigidity Modulus (CO4)
8. Determination of Dielectric constant of a sample (CO2, CO3)
9. Optical Fiber – Determination of Numerical Aperture (CO5)
10. Compound pendulum – Measurement of 'g' (CO4)
11. Variation of Magnetic field along the axis of current – carrying circular coil (CO3)
12. Figure of Merit of a Galvanometer. (CO4)

Text Books:

1. Panigrahi, S., & Mallick, B. (2015), Engineering Practical Physics (1st ed.). Cengage Learning.
2. Madhusudhana Rao, C. V., & Vasanth Kumar, V. (2015), Engineering Physics Lab Manual (4th ed.). Scitech publications.
3. Ramarao Sri, Choudary Nityanand and Prasad Daruka, "Lab Manual of Engineering Physics"., Vth ed., Excell Books, 2010.

Virtual Lab References:

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

Web Resources:

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

24UC182
AI TOOLS & APPLICATIONS
(CE/ECE/EEE/EIE/ME)

Course Category:	**Engineering Science**	**Credits:**	**1**
Course Type:	**Practical**	**Lecture-Tutorial-Practice:**	**0-0-2**
Pre-requisites:	**Nil**	**Continuous Assessment:** **Summative Assessment:** **Total Marks:**	**60** **40** **100**

Course Description:

This course introduces fundamental concepts and practical tools of Artificial Intelligence relevant to all engineering disciplines. It emphasizes the effective and ethical use of AI for productivity, analytical reasoning, research, and real-world engineering applications.

Course Objectives:

1. To provide an overview of AI and its applications in various engineering fields.
2. To demonstrate the use of AI as a personal assistant for productivity enhancement.
3. To explore AI as a tool for logical reasoning and mathematical analytics.
4. To utilize generative AI for literature review, gap analysis, ideation, and article writing.
5. To discuss detailed applications of AI in CE, Electronics, and ME.

Course Outcomes:

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

CO	Course Outcomes	BTL
CO1	Explain the basic concepts of AI and its historical evolution	**K2**
CO2	Apply AI tools for productivity enhancement	**K3**
CO3	Develop logical reasoning and analytical skills using AI tools	**K3**
CO4	Conduct literature reviews and write articles using generative AI	**K3**
CO5	Implement AI solutions in their respective engineering branches	**K3**

24UC101
Essence of Indian Knowledge Tradition

Course Category:	**Mandatory (MC)**	**Credits:**	**0**
Course Type:	**Theory**	**Lecture-Tutorial-Practice:**	**2-0-0**
Pre-requisites:	**-**	**Continuous Assessment:** **Summative Assessment:** **Total Marks:**	**100** **-** **100**

Course Description:

This course provides an in-depth exploration of the rich Indian knowledge tradition spanning philosophy, scientific advancements, cultural perspectives, educational heritage, and contemporary relevance. Students will delve into foundational texts, philosophical schools, scientific contributions, cultural artefacts, and the impact of Indian knowledge systems on global thought.

Course Objectives:

1. To introduce students to the major philosophical schools (Darshanas) of India and their foundational principles.
2. To familiarize students with significant scientific contributions in mathematics, astronomy, medicine, and technology from ancient India.
3. To explore the cultural perspectives of India through its literature, arts, architecture, and political systems.
4. To understand the educational heritage of ancient India and its impact on holistic learning and societal evolution.
5. To analyse the influence and contemporary relevance of Indian knowledge systems globally.

Course Outcomes:

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

CO	Course Outcomes	BTL
CO1	Analyse and differentiate between the various philosophical schools of India	**K4**
CO2	Assess the contributions of ancient Indian scientists and their impact on global knowledge systems.	**K4**
CO3	Interpret and discuss the cultural and societal norms depicted in Indian literature, arts, and architecture.	**K3**
CO4	Assess critically the educational methods and institutions of ancient	**K4**

	India and their relevance today.	
CO5	Identify the challenges and opportunities in reviving and adapting traditional Indian knowledge systems in contemporary contexts.	**K3**

Course articulation matrix

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

(1-Low, 2 -Medium, 3–High) (WK9)

Course Content

Unit-I
Foundations of Indian Philosophy

Introduction to Darshanas; detailed study of Nyaya, Vaisheshika, Sankhya, Yoga, Mimamsa and Vedanta.

Unit-II
Scientific Advancements

Mathematical theorems of Aryabhata, Astronomical discoveries of Brahmagupta, Principles of Ayurveda, Techniques in Metallurgy and Chemistry.

Unit-III
Cultural Perspectives

Analysis of Ramayana and Mahabharata, Study of classical texts (Puranas and Shastras), Evolution of temple architecture, Ethical governance principles.

Unit-IV
Educational Heritage of Ancient India

Gurukul system, Nalanda and Takshashila Universities, Role of women scholars, Influence of Southeast Asian education.

Unit-V
Influence and Contemporary Relevance

Spread of Indian philosophies to the West, Modern adaptations of Ayurveda, Challenges in preserving oral traditions.

Text Books:

1. Radhakrishnan, S., & Moore, C.A. (Eds.). (1957) *A Source Book in Indian Philosophy*. Princeton University Press.

Reference Books:

1. Basham, A. L. (1954). *The Wonder That Was India: A Survey of the Culture of the Indian Sub-Continent Before the Coming of the Muslims.* Sidgwick & Jackson.

Web Resources:

1. https://iep.utm.edu/category/traditions/indian/
2. https://www.britannica.com/biography/Aryabhata-I
3. https://sacred-texts.com/hin/dutt/index.htm
4. https://nalandauniv.edu.in/
5. https://www.vidhyanjaliacademy.com/gurukul-education-system-in-ancient-india/
6. https://brownhistory.substack.com/p/how-indian-philosophies-influenced

Second Year
(III Semester)

24MA202- Complex Variables Transform Techniques & Statistics

Course Category:	Basic Science	**Credits:**	4
Course Type:	Theory	**Lecture - Tutorial - Practice:**	4 - 0- 0
Prerequisites:		**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	40 60 100

Course outcomes	Upon successful completion of the course, the student will be able to:														
	CO1	Employ methods to construct analytic functions													
	CO2	Determine the series expansions of complex variable function and evaluate contour integration													
	CO3	Apply Laplace transform techniques to convolute functions													
	CO4	Use Fourier series and Fourier transforms to solve periodic and non-periodic functions													
	CO5	Find line and parabola of best fit, correlation coefficient and regression lines													
Contribution of Course Outcomes towards achievement of Program Outcomes		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	2	2			1										
	CO3	2	2			1										
	CO4	2	2			1										
	CO5	2	2			1										

Course Content

UNIT- I

Analytic Functions: Limit of a complex function, Derivative of f(z), Cauchy-Riemann equations in Cartesian and Polar coordinates, Analytic functions, Harmonic functions, Orthogonal systems

UNIT- II

Complex Integration: Complex integration, Line Integral, Series of complex terms: Taylor and Laurent Series (without proofs), Zeros and Singularities of analytic function, Residues, Calculation of residues, Residue theorem, Bilinear transformation

UNIT- III

Laplace Transforms: Introduction, Definition, Condition for existence, Transform of elementary functions Properties of Laplace transforms, Transforms of periodic functions, integrals, multiplication by tn and division by t, Evaluation of integrals by Laplace

	transforms, Inverse transforms, Method of partial fractions, Convolution theorem **UNIT- IV** **Fourier Series and Transforms:** **Fourier Series**: Euler's Formulae, Conditions for a Fourier Expansion, Functions having point of discontinuity, Change of interval, Even and Odd functions. **Fourier transforms**: Fourier Integral Theorem (without proof & No problems), Fourier sine and cosine integrals (without proof & No problems), Fourier Transforms, Fourier sine and cosine transforms **UNIT- V** **Statistics:** Curve fitting, Method of least squares, working procedure to fit straight line and parabola, Correlation, Coefficient of correlation, Lines of Regression
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] Ramana B V, "Higher Engineering Mathematics", 1st Ed., Tata MC Graw Hill.
E-resources and other digital material	1. MIT OpenCourseWare: Complex Variables with Applications https://ocw.mit.edu/courses/18-04-complex-variables-with-applications-spring-2018/pages/lecture-notes/ 2. NPTEL: Complex Analysis https://archive.nptel.ac.in/courses/111/103/111103070/ 3. MIT OpenCourseWare: Differential Equations https://ocw.mit.edu/courses/18-03sc-differential-equations-fall-2011/pages/unit-iii-fourier-series-and-laplace-transform/laplace-transform-basics/ https://ocw.mit.edu/courses/18-03sc-differential-equations-fall-2011/pages/unit-iii-fourier-series-and-laplace-transform/partial-fractions-and-inverse-laplace-transform/ 4. NPTEL: Transform Techniques for Engineers https://archive.nptel.ac.in/courses/111/106/111106111/ 5. Introduction to Fourier Analysis 6. Introduction to Fourier Analysis – Course 7. MIT OpenCourseWare: Computational Science and Engineering https://ocw.mit.edu/courses/18-085-computational-science-and-engineering-i-fall-2008/resources/lecture-33-filters-fourier-integral-transform/ 8. NPTEL: Transform Techniques for Engineers https://archive.nptel.ac.in/courses/111/106/111106111/ **9.** NPTEL: Mathematics - Regression Analysis

24EI201- Electronics Devices & Circuits

Course Category:	Engineering Science	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3 - 0- 0
Prerequisites:	Engineering Physics	**Continuous Evaluation:**	40
		Semester end Evaluation:	60
		Total Marks:	100

Course outcomes	Upon successful completion of the course, the student will be able to:														
	CO1	Analyze the operation and V I characteristics of semiconductor diodes													
	CO2	Design diode circuits for various applications													
	CO3	Analyze the operation and characteristics of transistors													
	CO4	Analyze the operation and V I characteristics of optoelectronic devices													
	CO5	Use the SPICE simulator to implement an electronic circuit using various semiconductor devices													
Contribution of Course Outcomes towards achievement of Program Outcomes		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										2		1
	CO3		3											1		
	CO4		3											1		
	CO5					3										

Course Content

UNIT- I

Semiconductor Diodes: Review of Semiconductors, p-n Junction as a Diode, The Volt Ampere Characteristics, The temperature dependence of P-N Characteristics, Diode Resistance, Space Charge or Transition Capacitance, Diffusion capacitances. Breakdown mechanisms, Zener diode

UNIT- II

Diode Applications: Diode approximations, Clippers, Clampers. Diode as a rectifier, Half wave, Full wave - Centre-tapped, Bridge rectifiers without filter and with filters - Inductor filter, Capacitor filter, L section, Zener voltage regulator

UNIT- III

Bipolar Junction Transistor: The Junction Transistor, Transistor Current components Characteristics of Common Base, Common Emitter and Common Collector Configuration, Relation between α, β, and γ, Transistor as a Switch, Transistor as an amplifier, Operating Point, Factors affecting the operating point

	UNIT- IV **Field Effect Transistors**: Introduction to FET, Construction, and Characteristics of JFETs, Drain and Transfer Characteristics of JFET, FET parameters, FET as an amplifier, JFET biasing circuits - Fixed bias, Voltage divider bias. Depletion-type MOSFET and Enhancement-type MOSFET, Drain and Transfer Characteristics of MOSFET **UNIT- V** **Special Semiconductor Devices:** Tunnel diode, Varactor Diode, PIN Diode, IMPATT diode, Solar Cell, LED, LCD, Photodiode, Phototransistor, UJT, SCR.
Text books and Reference books	**Text Book:** [T1] Jacob Millman, Christos C Halkias & Satyabrata JIT, "Millman's Electronic Devices and Circuits", 4th Ed., TMH, 2015. [T2] Ryder, John Douglas "Electronic Fundamental and Applications", 5th Ed., PHI. **Reference Books:** [R1] GK Mithal," Electronic Devices and Circuits", 23rd ED., Khanna Publishers [R2] Robert L Boylested and Louis Nashelsky, "Electronic Devices and Circuit Theory", 10th Ed., Pearson India, 2009 [R3] David A Bell., "Electronic Devices and Circuits", 5th Ed., Oxford University Press, 2008
E-resources and other digital material	1. http://www.nptelvideos.in/2012/12/basic-electronics-drchitralekha-mahanta.html 2. http://nptel.ac.in/courses/117103063/ 3. http://nptel.ac.in/courses/117106033/ 4. http://nptel.ac.in/courses/117102061/

24EI202- Electrical & Electronic Measurements

Course Category:	Professional Core	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3 - 0- 0
Prerequisites:	Circuit analysis	**Continuous Evaluation:**	40
		Semester end Evaluation:	60
		Total Marks:	100

Course outcomes	Upon successful completion of the course, the student will be able to:														
	CO1	Design and calibrate electronic measurement Systems for the measurement AC & DC voltage, current and power													
	CO2	Analyze the bridge circuits to measure the unknown values of R, L and C.													
	CO3	Compare the operation of various oscilloscopes and probes.													
	CO4	Explain the principles of various signal generators and wave analyzers.													
	CO5	Study of electronic counters, digital systems and digital display devices.													
Contribution of Course Outcomes towards achievement of Program Outcomes		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															
	CO5															

Course Content

UNIT- I

Electromechanical Indicating Instruments: Suspension galvanometer; Torque and deflection of the galvanometer - Steady state deflection, Dynamic behaviour; Permanent magnet moving coil mechanism - D'Arsonval movement, Temperature compensation

Electrical Measurements: DC ammeters - Shunt resistor, Ayrton shunt, Multirange ammeters, The Ayrton shunt, DC voltmeters - Multiplier resistor, Multirange voltmeter, Voltmeter sensitivity - Ohms per volt rating, Loading effect, Calibration of dc instruments, Alternating current indicating instruments - Electrodynamometer, Rectifier type instruments, Electrodynamometers in power measurements, Watt hour meter, Power factor meters

UNIT- II

Bridges: Wheatstone's bridge (Measurement of resistance), Kelvin's double bridge, Maxwell's bridge, Hay's bridge, Schering bridge, Wien's bridge, Wagner's ground connection

	Electronic Instruments: AC Voltmeter using rectifiers, True RMS voltmeter, Digital voltmeters - Ramp technique, Staircase ramp DVM, Successive approximation type DVM, Dual slope integrating type DVM, Q Meter - Impedance measurement using Q Meter **UNIT- III** **Oscilloscopes**: Block diagram of oscilloscope, Vertical amplifier, Horizontal deflecting system, Delay line in triggered sweep, Dual beam CRO, Dual trace oscilloscope (basic block diagrams), Sampling 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 Analyzer- Tuned circuit type, Basic Spectrum analyzer **UNIT- V** **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, Electronic Counter - Totalizing, Frequency mode, Ratio mode, Period mode, Time interval mode. **Digital Display Devices:** Segmental Display - 7 segment, Dot Matrix, LED and LCD, Typical applications of digital display
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", 2nd Ed., 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	1. https://www.youtube.com/watch?v=3eYmFjHnQjY&list=PLbRMhDVUMngcoKrA4sH-zvbNVSE6IpEio

24EI203- Digital Electronics

Course Category:	Professional Core	**Credits:**	4
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3 - 0- 2
Prerequisites:		**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	40 60 100

Course outcomes	Upon successful completion of the course, the student will be able to:														
	CO1	Demonstrate proficiency in codes and number system converting circuits													
	CO2	Select suitable logic families and minimization methods for digital system design													
	CO3	Design and Analyze Combinational and Sequential logic circuits													
	CO4	Use the spice software to design the digital electronic circuits													
Contribution of Course Outcomes towards achievement of Program Outcomes		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										2

Course Content

UNIT- I

Number Systems: Number systems representation, Conversion of bases, Binary Arithmetic, Representation of Negative numbers, Codes: Binary, BCD, Excess 3, Gray.

Boolean Algebra: Basic Theorems and properties, Boolean Functions, Canonical and standard forms.

Digital Logic Gates- AND, OR, NAND, NOR, XOR, XNOR

Exercises:

1. Realization of logic gates using universal gates
2. Simplify the given Boolean function and Implement using NAND gates

UNIT- II

Logic Families: Introduction, Characteristics of Digital ICs, Transistor-Transistor Logic (TTL), Emitter Coupled Logic (ECL), CMOS Logic.

Gate Level Minimization: The K-Map Method: 4-variable maps, Don't Care conditions, NAND and NOR implementation, Quine-McCluskey method

Exercises:

1. Implement the given Boolean function using logic gates in SOP and POS forms
2. Simplify the given Boolean function and Implement using NOR gates

	UNIT- III **Combinational Logic Design:** Combinational circuits, Adders & Subtractors, Magnitude comparator, Binary to Gray and Gray to Binary code converters, Multiplexers, De-Multiplexers, Decoders, BCD to 7 Segment decoder, Encoders, Priority encoder **Exercises:** 1. Implement Adders & Subtractors 2. Design of MUX and DEMUX 3. Design and implementation of code converters 4. Design BCD-to 7 segment decoder **UNIT- IV** **Flip-Flops**: Clocked S-R flip-flop, Preset and clear, J-K flip-flop, Race around condition, Master slave J-K flip-flop, D & T flip-flops, Excitation tables of flip-flops, Flip-Flop conversions. **Shift Registers:** Types, Bi-directional shift register, Universal Shift Register, Applications of shift resisters: Ring counter, Twisted ring counter **Exercises:** 1. Verification of Flip-Flops using gates 2. Realization of shift registers **UNIT- V** **Counters:** Asynchronous counters – Up/Down counters, Modulus of the counter, Design of Synchronous counters, Finite State Machines: Mealy, Moore. **Memory Devices:** Functional block diagram and operation - ROM, PROM, EPROM, EEPROM, Flash memory, RAM: Static and dynamic RAM, PAL, PLA. Exercises: 1. Design of synchronous counters using IC 74163 2. Implementation of Boolean functions using PLA and PAL
Text books and Reference books	**Text Book:** [T1] M. Morris Mano, "Digital Logic and Computer Design", PHI, 2003 [T2] R P Jain "Modern Digital Electronics", 4th Ed., TMH **Reference Books:** [R1] A. Anand Kumar, "Fundamentals of Digital Circuits", PHI, 2006 [R2] Thomas L. Floyd "Digital Fundamentals", 11th Ed., Pearson Education, 2015
E-resources and other digital material	1. https://nptel.ac.in/courses/117/106/117106086/

24EI204- 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:**	40 60 100

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	Apply various types of resistive and reactance variation sensors in real time applications
	CO3	Interpret the design aspects of signal conditioning circuits for resistive and reactance variation sensors
	CO4	Comprehend the principles of piezoelectric and optical transducers
	CO5	Illustrate the operation of miscellaneous transducers

Contribution of Course Outcomes towards achievement of Program Outcomes

	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		3													
CO4	2														
CO5	2														

Course Content

UNIT- I

Instrument Characteristics: Block diagram of generalized instrument system, Calibration and Standards, Static characteristics - Desirable & Undesirable characteristics; Dynamic characteristics.

Errors in Measurement and Statistical Analysis: Classification of errors, Limiting error and probable error, Statistical analysis of measurement data

UNIT- II

Transducers: Classification of transducers, Characteristics of transducers.

Variable Resistance Transducers: Principle of operation, Construction and Characteristics of Resistance potentiometers, Strain gauge, Resistance thermometer, Thermistors, Resistive hygrometer, Signal conditioning of resistive transducers

	UNIT- III **Inductance Transducers**: Principle of operation, Construction and Characteristics of Variable reluctance sensors, Eddy current sensors, Linear variable differential transformers (LVDTs), Magneto elastic sensors, Signal conditioning of inductive transducers **Capacitive Transducers** – Principle of operation, Construction and Characteristics of Capacitive sensors using change in area of plates, distance between plate and change of dielectric constant **UNIT- IV** **Piezoelectric Sensors**: Principle of operation, Expression for output, Piezoelectric materials, Equivalent circuit of Piezo-electric Transducers, Loading effects and frequency response. **Optical Transducers**: Principle of operation of Photo-emissive cells, Semi-conductor Photoelectric transducers **UNIT- V** **Miscellaneous Sensors**: Digital sensor, IR radiation Sensors, Ultrasonic Sensors, Fiber optic sensors, Smart sensors, Colour sensor, Bio Sensors
Text books and Reference books	**Text Book:** [T1] Sawhney A. K., and Sawhney, Puneet, A Course in Electrical and Electronic Measurements and Instrumentation, 2016, 19th Ed., Dhanpat Rai & Company [T2] D. Patranabis, Sensors and Transducers, 2nd Ed., Prentice Hall of India, 2011. **Reference Books:** [R1] Doebelin, E. O., and Manik, D. N., Measurement systems: application and design, 2020, 7th Ed., McGraw Hill Education [R2] Murty, D. V. S, Transducers and Instrumentation, 2nd Ed., PHI Learning Pvt.Ltd, 2012 [R3] Dr. D.S. Kumar, " Mechanical Measurements & Control", 3rd Ed., Metropolitan Book Co. Pvt. Ltd. 2015
E-resources and other digital material	1. https://nptel.ac.in/courses/108/108/108108147

24EI281- Measurements Lab

Course Category:	Professional Core Lab	**Credits:**	1.5
Course Type:	Theory	**Lecture - Tutorial - Practice:**	0 - 0- 3
Prerequisites:		**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	40 60 100

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,													
	CO2	Analyze the outputs and interpreted the data generated from the bridge measurements													
	CO3	Conduct experiments as individual or team by using different types of bridges													
	CO4	Make an effective report based on experiments													
Contribution of Course Outcomes towards achievement of Program Outcomes		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 and their range extension.
2. AC meters and their range extension.
3. Measurement of voltage, frequency and phase angle using a CRO.
4. Measurement of resistance of small resistors using Kelvin double bridge.
5. Measurement of inductance using Maxwell bridge.
6. Measurement of capacitance using Shearing bridge.
7. Measurement of resistance, inductance and capacitance using a LCR meter.
8. Measurement of amplitude and frequency of different types of waveforms using function generator.
9. Measurement of inductance of high Q coils using Hay bridge.
10. Measurement of frequency using a Wien bridge.
11. Calibration of voltmeter using potentiometer.
12. Simulation of CRO, Function generator using Analog discovery kit.

Note: Any 10 experiments from the above list

24EI282- Electronic Devices & Circuits Lab

Course Category:	Engineering Science Lab	**Credits:**	1.5
Course Type:	Theory	**Lecture - Tutorial - Practice:**	0 - 0- 3
Prerequisites:		**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	40 60 100

Course outcomes	Upon successful completion of the course, the student will be able to:														
	CO1	Analyze the operation of diodes, by evaluating their I-V characteristics and circuit configurations													
	CO2	Analyze the operation of transistors by evaluating their I-V characteristics and circuit configurations													
	CO3	Design basic diode circuits related to various applications using PSPICE tools													
	CO4	Analyze the working of BJT, FET and its application as an amplifier virtually (using NI Multisim) and infer their salient parameters													
Contribution of Course Outcomes towards achievement of Program Outcomes		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				2	1		1			1	
	CO2		3		3				2	1		1			1	
	CO3			2	3	3			2	1		1			2	2
	CO4		3		3	3			2	1		1			1	2

Course Content

List of Experiments

A. Electronic Devices Module:

1. Characteristics of PN junction diode
2. Characteristics of Zener diode
3. Characteristics of a transistor in common emitter configuration
4. Drain and transfer characteristics of the junction field effect transistor
5. Characteristics of a Uni Junction Transistor
6. Analyze the effects of operation point location on amplifier response

B. P-Spice Module:

7. Design of unbiased clampers.
8. Design voltage regulator using Zener.
9. Analyze the performance of full-wave rectifier operation with and without a filter.
10. Frequency response of CE amplifier.
11. Frequency response of CS Amplifier.
12. Design of UJT Relaxation Oscillator

Note: Any 10 experiments from the above list

24UC201- Universal Human Values-II

Course Category:	Mandatory Course	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	2 - 1- 0
Prerequisites:		**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	40 60 100

Course outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Apply the right understanding of the concepts of value education and basic human aspirations through self-exploration for the fulfillment of human aspirations [K3].
	CO2	Analyse various aspects of the human being as the combination of Self and Body for attaining harmony at the level of human being (individual) [K4].
	CO3	Apply the knowledge of nine universal values in human-human relationship for harmony at the level of family, and appreciate all the essential factors that help in attaining harmony at the level of society [K3].
	CO4	Differentiate the characteristics and activities of various orders of Nature and study the mutual fulfillment among them, and also identify the existence as co-existence at all levels [K4].
	CO5	Present sustainable solutions to various challenges in society and Nature, and identify that the solutions are practicable [K3].

Contribution of Course Outcomes towards achievement of Program Outcomes

	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

UNIT- I

Course Introduction, Need, Basic Guidelines, Content and Process for Value Education Contents: Purpose and motivation for the course, recapitulation from UHV-I, Self-exploration: what is it? Its content and process, 'Natural acceptance' and experimental validation – as the process for self-exploration, Continuous happiness and prosperity – a look at basic human aspirations.

Right understanding, relationship and physical facility – the basic requirements for fulfillment of aspirations of every human being with their correct priority, understanding

	happiness and prosperity correctly – a critical appraisal of the current scenario, method to fulfill the above human aspirations: understanding and living in harmony at various levels **UNIT- II** **Understanding Harmony in the Human Being – Harmony in Myself**: 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). 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 **UNIT- III** **Understanding Harmony in the Family and Society – Harmony in Human-Human Relationship:** Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfillment to ensure mutual happiness; Trust and Respect as the foundational values of relationship, 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. 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 **UNIT- IV** **Understanding Harmony in Nature & Existence – Whole existence as Coexistence:** Understanding the harmony in the Nature, Inter-connectedness 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 Understanding Existence as Co-existence of mutually interacting units in all-pervasive **UNIT- V** **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

Text books and Reference books	**Text Book:** [T1] Gaur, R.R., Sangal, R, & Bagaria, G.P. "A Foundation Course in Human Values and Professional Ethics", Excel Books Private Limited, New Delhi, 2010. [T2] Gaur, R.R., Sangal, R, & Bagaria, G.P. "A Foundation Course in Human Values and Professional Ethics", Excel Books Private Limited, New Delhi, 2019 **Reference Books:** [R1] Jeevan Vidya: Ek Parichaya, A. Nagaraj, Jeevan Vidya Prakashan, Amarkantak , 1999 [R2] Human Values, A. N. Tripathi, New Age International Publishers, New Delhi, 2004 [R3] The Story of Stuff: The impact of overconsumption on the planet, our communities, and our health and how we can make it better, Annie Leonard, Free Press, New York 2010 [R4] The story of my experiments with truth: Mahatma Gandhi Autobiography, Mohandas Karamchand Gandhi, B. N. Publishing 2008 [R5] Small is beautiful: A study of economics as if people mattered, E. F. Schumacher, Vintage Books, London 1993 [R6] Slow is beautiful: New Visions of Community, Cecile Andrews, New Society Publishers, Canada 2006 [R7] Economy of Permanence, J. C. Kumarappa, Sarva-Seva-Sangh Prakashan, Varanasi 2017 [R8] Bharat Mein Angreji Raj, Pandit Sunderlal, Prabhath Prakashan, Delhi 2018 [R9] Rediscovering India, Dharampal, Society for Integrated Development of Himilayas 2003 [R10] Hind Swaraj or Indian Home Rule, M. K. Gandhi, Navajivan Publishing House, Ahmedabad 1909 [R11] India Wins Freedom: The Complete Version, Maulana Abul Kalam Azad, Orient Blackswan 1988) [R12] The Life of Vivekananda and the Universal gospel, Romain Rolland, Advaitha Ashrama, India 2010 [R13] Mahatma Gandhi: The Man who become one with the Universal Being, Romain Rolland, Srishti Publishers & Distributors, New Delhi 2002.
E-resources and other digital material	1. Textbook-1: https://dokumen.pub/a-foundation-course-in-human-values-and-professional-ethics-firstnbsped-9788174467812.html 2. AICTE – SIP Youtube Channel: https://www.youtube.com/channel/UCo8MpJB_aaVwB4LWLAx6AhQ 3. AICTE – UHV Teaching Learning Material: https://fdp-si.aicte-india.org/download.php#1

Second Year
(IV Semester)

24EI205 – Electrical Technology

Course Category:	Engineering Science	**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:**	40 60 100

Course outcomes	Upon successful completion of the course, the student will be able to:													
	CO1	Explain the construction, working, and performance of DC machines												
	CO2	Analyze the characteristics and applications of transformers												
	CO3	Understand the operation of induction and synchronous machines												
	CO4	Evaluate the performance of special electrical machines and drives												
	CO5	Apply electrical technology concepts in instrumentation and control systems												
Contribution of Course Outcomes towards achievement of Program Outcomes		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
	CO1	3											2		
	CO2		3										2		
	CO3	3											2		
	CO4			2									1		
	CO5	2											2		

Course Content

UNIT- I

DC Machines: Construction, EMF equation, Types of DC machines, Armature reaction, commutation, Characteristics of DC generators. Working of DC motors, Torque equation, Types of DC motors, Speed control of DC motors

UNIT- II

Transformers: Principle, Construction, EMF equation, Ideal transformer and practical transformer. Equivalent circuit, Losses, Efficiency, voltage regulation, Open circuit and short circuit tests.

UNIT- III

Induction Machines: Construction and principle of 3-phase induction motor, Slip, torque equation, torque–slip characteristics, Types of rotors, starting methods, Speed control methods

	UNIT- IV **Synchronous Machines**: Construction and principle of alternators, EMF equation, regulation methods, Synchronous motors – Principle of operation, Torque equation **UNIT- V** **Special Electrical Machines & Drives**: Stepper motor – types, Principle, Applications in CNC and instrumentation, Servo motor – AC and DC servo motors, Applications and automation in robotics **Introduction to Electrical Drives** – Concept, Types, Industrial applications.
Text books and Reference books	**Text Book:** [T1] P.S. Bimbhra, "Electrical Machinery", 1st Ed., Khanna Publishers, New Delhi,2024 [T2] E.G. Janardanan, "Special Electrical Machines", 3rd Ed., PHI Learning, New Delhi, 2014. [T3] B L Theraja and A K Theraja, A Textbook of Electrical Technology Volume 2 : AC and DC Machines (In S.I. Units) , 24th Ed., S Chand and Company Ltd, 2024 **Reference Books:** [R1] G.K. Dubey, "Fundamentals of Electrical Drives", 2nd Ed., Narosa Publishing, New Delhi, 2010 [R2] D.P. Kothari & I.J. Nagrath, "Electrical Machines", 5th Ed., Tata McGraw Hill Education, New Delhi, 2017.
E-resources and other digital material	1. https://www.nptelprep.in/courses/108105017/materials 2. https://www.ocw.mit.edu/courses/6-685-electric-machines-fall-2013/resources/lecture-notes/

24EI206 – 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:**	40 60 100

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		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
	CO1														
	CO2	2													
	CO3		3												
	CO4		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, Time domain specifications, Steady state error and error constants

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.

	UNIT- IV **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- V** **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.Nagoor Kani, "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/

24EI207- Industrial Instrumentation

Course Category:	Professional Core	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3 - 0- 0
Prerequisites:	Sensors and Transducers	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	40 60 100

Course outcomes	Upon successful completion of the course, the student will be able to:													
	CO1	Apply fundamental measurement principles to examine sensor operation for major industrial process variables												
	CO2	Select appropriate sensors for measuring various industrial process variables												
	CO3	Compare the working characteristics and applications of mechanical, electrical and smart transducers												
	CO4	Apply standard calibration methods to ensure accurate and reliable measurement of process variables												
Contribution of Course Outcomes towards achievement of Program Outcomes		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
	CO1	3											3		
	CO2		3										3		
	CO3		3										3		
	CO4	2											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; Radiation pyrometers, Ultrasonic thermometer, Smart IC Temperature Sensors, Calibration of Temperature Transmitter-RTD **UNIT- II** **Pressure Measurement**: Introduction, pressure standards, Force summing devices – Diaphragms, Bellows, Bourdon tubes; Secondary transducers – Resistive, Inductive, Capacitive, Piezoelectric; Calibration of pressure gauges using dead weight tester; A Smart Hall Sensor **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 - Electromagnetic, Turbine, Ultrasonic flow meters; Mass flow measurement type – Coriolis flow meters; Open channel flow meters- Weirs. Calibration of Flow meters- Master Meter and Gravimetric methods **UNIT- IV** **Level Measurement**: Introduction, Optical type – Laser sensors, IR and visible light sensors; Electrical type - Resistive, inductive and Capacitive; Ultrasonic and Radar level measurement; Calibration of Level Instruments- Capacitive and Ultrasonic. **UNIT- V** **Humidity, Density & Viscosity Measurement**: Introduction, Psychrometers - Wet and dry bulb; Hygrometers - Electrolytic, Optical and Oscillating hygrometers; Moisture Analyzer-Neutron back scatter Moisture analyzer; Densitometers- Ultrasonic densitometer; Viscometers - Saybolt and Float viscometers
Text books and Reference books	**Text Book:** [T1] A.K.Ghosh, "Introduction to Measurements & Instrumentation", 4th Ed., PHI, 2021 [T2] A.K.Sawhney & Puneet Sawhney, "A Course in Mechanical Measurements & Instrumentation", 12th Ed., Dhanapat Rai & Co., 2012. [T3] Gerard Meijer, Michiel Pertijis, "Smart Sensor Systems -Emerging Technologies and Applications", IEEE Press, 2014 **Reference Books:** [R1] Ernest O Doebelin/Dhanesh, N Manik, "Measurement systems", 6th Ed., Tata Mc Grawhill [R2] Mike Cable, "Calibration- A Technician Guide", Technician Series, ISA Publishers, 2005
E-resources and other digital material	1. http://nptel.ac.in/courses/108105064 2. http://nptel.ac.in/courses/108106074

24EI208- Linear Integrated Circuits

Course Category:	Professional Core	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3 - 0- 0
Prerequisites:	Electronic Devices and Circuits, Network Theory	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	40 60 100

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 741,555,723 ICs												
	CO4	Illustrate the operation of Special purpose ICs and their applications												
Contribution of Course Outcomes towards achievement of Program Outcomes		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
	CO1	2												2	
	CO2	3												2	
	CO3		3											3	
	CO4	3												2	

Course Content

UNIT- I

Operational Amplifiers: Introduction to Integrated circuits, 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 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 Low Pass and High Pass filters, Second order Sallen key Low Pass

	and High Pass filters, Band pass filters - Wide band pass and Narrow band pass filters; Band stop filters - Wide band stop and notch filters **UNIT- IV** **Data Converters**: Introduction, Basic DAC techniques - Weighted resistor DAC, R-2R ladder D/A converter; A/D conversion - Parallel comparator type ADC, Successive approximation ADC, Dual slope ADC, DAC and ADC specifications. **UNIT- V** **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-Linear IC Voltage Regulators -78XX, 79XX Series; Adjustable Regulators LM723.
Text books and Reference books	**Text Book:** [T1] D. Roy Chowdhury, Shail B. Jain "Linear Integrated Circuits", 6th Ed., New Age International Pvt. Ltd, 2021. [T2] Rama Kant A. Gayakwad, "Op-Amps and Linear Integrated Circuits", 4th Ed., PHI Learning, New Delhi, 2015. **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", 6th Ed., PHI Learning, New Delhi,2012. [R3] Jacob,J. Michael "Applications and Design with Analog Integrated Circuits", 2nd Ed., PHI Learning, New Delhi, 2008.
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

24EI209- Microprocessors & Interfacing

Course Category:	Professional Core	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3 - 0- 0
Prerequisites:	Digital Electronics	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	40 60 100

Course outcomes	Upon successful completion of the course, the student will be able to:													
	CO1	Understand the fundamental concepts, architecture, and operations of microprocessor-based systems												
	CO2	Apply assembly language programming skills to develop and execute programs for various computational and control tasks												
	CO3	Analyze system organization, timing, and interrupt mechanisms for efficient data processing and control												
	CO4	Analyze system organization, timing, and interrupt mechanisms for efficient data processing and control												
Contribution of Course Outcomes towards achievement of Program Outcomes		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
	CO1	3											3		
	CO2		3											3	
	CO3		3										3		
	CO4	3		3									3	3	
Course Content	**UNIT- I** **Introduction to Microprocessors:** Overview of Microcomputer structure and operation, Overview of 8086 family, 8086 Internal Architecture, Pin diagram, Instruction set, Addressing modes, assembler directives, Program development steps. **UNIT- II** **Assembly Language Programming**: Constructing machine code for 8086 Instructions, Assembly language program development tools, Simple Assembly language programs on data movement, arithmetic, logical, sequence, jump and loop instructions, sorting, bit manipulation and string manipulation operations **UNIT- III** **8086 System connections Timing, Interrupts**: 8086 Basic system timing, minimum mode and maximum mode configuration; Procedures, Macros, Interrupts and interrupt responses, Types of Interrupts- Hardware, Software; 8259A Priority Interrupt controller.													

	UNIT- IV **8086 Peripherals and Interfacing**: Intel 8255A Programmable parallel port device block diagram and its modes of operation, Intel 8251 USART architecture, 8254 Software Programmable timer /counter, Delay subroutines, Display and keyboard interfacing with 8279 **UNIT- V** **Memory Interfacing to 8086**: Basic DMA operation and Intel 8237 DMA controller, Address decoding techniques, Interfacing ROM, static and dynamic RAM to 8086 processor, Cache memory, 8087 Math Co-processor
Text books and Reference books	**Text Book:** [T1] Douglas V Hall, SSSP Rao, "Microprocessors and Interfacing – Programming and Hardware", 3rd Ed., Tata McGraw Hill Education Private Limited, 2020 [T2] Barry B. Brey, "The Intel Microprocessors-Architecture, Programming and Interfacing", 8th Ed., PHI, 2008 **Reference Books:** [R1] Mathur Sunil, "Microprocessor 8086: Architecture, Programming and Interfacing", 1st Ed., PHI, 2015 [R2] Walter A. Triebel & Avtar Singh, "The 8088 and 8086 Microprocessors: Programming, Interfacing, Software, Hardware, and Applications", 4th Ed., Prentice Hall , 2000
E-resources and other digital material	1. https://onlinecourses.nptel.ac.in/noc24_ee40/ 2. https://www.coursera.org/courses?query=microprocessor 3. www.teach-sim.com/cpu-2

24EI283 - Transducers Lab

Course Category:	Professional Core Lab	**Credits:**	1.5
Course Type:	Practical	**Lecture - Tutorial - Practice:**	0 - 0- 3
Prerequisites:	Sensors and transducers	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	60 40 100

Course outcomes	Upon successful completion of the course, the student will be able to:													
	CO1	Use various sensors and transducers for measuring physical parameters. /analyze the working principles of various sensors and transducers												
	CO2	Perform calibration of sensors using standard instruments for accurate measurements												
	CO3	Design and implement basic signal conditioning circuits for sensors												
	CO4	Develop sensor systems using Arduino and ESP8266 for real-time monitoring and IoT applications												
Contribution of Course Outcomes towards achievement of Program Outcomes		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
	CO1	3				1							3		
	CO2				3								2		
	CO3									1			2		
	CO4										2				
Course Content	**List of Experiments** 1. Comparative analysis of Resistance Temperature Detector (RTD) and Thermistor 2. Temperature measurement using AD590 temperature sensor 3. Characteristics of Light Dependent Resistor (LDR) and phototransistor for distance measurement 4. Measurement of magnetic flux density using Hall effect sensor 5. Speed measurement using magnetic and photoelectric pick-up sensors 6. Flow measurement using Ultrasonic flow transmitter 7. Displacement measurement using Linear Variable Differential Transformer (LVDT) 8. Pressure measurement using strain gauge 9. Calibration of a pressure gauge using dead weight tester 10. Design of signal conditioning circuit for resistive sensor 11. Calibration of Thermocouple using a standard thermometer 12. Interfacing a Passive Infrared (PIR) sensor with Arduino for motion detection 13. Interfacing an inductive proximity sensor with Arduino for object detection													

	14. Interfacing a soil moisture sensor with Arduino for monitoring soil condition 15. IoT-Based Temperature and Humidity Monitoring Using DHT11 and ESP8266 **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	**Text Book:** [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	1. https://create.arduino.cc/ 2. https://www.allaboutcircuits.com/

24EI284- Linear Integrated Circuits Lab

Course Category:	Professional Core Lab	**Credits:**	1.5
Course Type:	Practical	**Lecture - Tutorial - Practice:**	0 - 0- 3
Prerequisites:		**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	60 40 100

Course outcomes	Upon successful completion of the course, the student will be able to:													
	CO1	Design various linear application of op-amp												
	CO2	Design various non-linear application of op-amp												
	CO3	Design Waveform generators, Timer circuits, D/A Converter and voltage regulators using ICs												
	CO4	Design various linear and nonlinear applications of 741IC, IC 555 using PSPICE												
Contribution of Course Outcomes towards achievement of Program Outcomes		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
	CO1		3		3					2	2	1		2	
	CO2		3		3					2	2	1		2	
	CO3		3		3					2	2	1		2	
	CO4				3	3				2	2	1		2	
Course Content	**List of Experiments** **<u>Experiments Using Discrete Components</u>** 1. Basic applications of IC741 – Inverting, Non-inverting amplifiers and summing amplifier. 2. Design of Integrator using 741IC 3. Precision Full wave rectifiers using Op-Amp 741IC. 4. Waveform generation using 741IC (square, triangular). 5. Design of IC 555 Timer Astable circuit. 6. Voltage Controlled Oscillator Using LM 566. 7. Design of a voltage Regulator using IC 723. **<u>Experiments using Multisim Module</u>**: 8. Design of Instrumentation Amplifier using 741IC. 9. Design of Clipper circuit using 741IC. 10. Basic applications of comparator using 741IC 11. Design of square wave generator using 741IC 12. Design of Wein bridge Oscillator using 741IC. 13. Frequency response of First Order Low pass and High pass filters using 741IC. 14. Applications of IC 555 Timer													

	15. 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, by choosing a minimum of 5 experiments from each Module for him/her to be eligible to write University Practical Examinations.
Text books and Reference books	**Text Book:** [T1] D. Roy Chowdhury, Shail B. Jain "Linear Integrated Circuits", 6th Ed., New Age International Pvt. Ltd, 2021 [T2] Rama Kant A. Gayakwad, "Op-Amps and Linear Integrated Circuits", 4th Ed., PHI Learning, New Delhi, 2015 **Reference Books:** [R1] S. Franco, "Design with Operational Amplifiers and Analog Integrated Circuits", TMH, 2016 [R2] Jacob,J. Michael "Applications and Design with Analog Integrated Circuits", 2nd Ed., PHI Learning, New Delhi, 2008
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

24EI285- Microprocessors & Interfacing Lab

Course Category:	Professional Core Lab	**Credits:**	1
Course Type:	Practical	**Lecture - Tutorial - Practice:**	0 - 0- 2
Prerequisites:		**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	60 40 100

Course outcomes	Upon successful completion of the course, the student will be able to:													
	CO1	Apply assembly language programming concepts to perform data transfer, arithmetic, logical, and string operations using the 8086 microprocessor												
	CO2	Develop and implement 8086 assembly programs for solving problems.												
	CO3	Interface peripheral devices with the 8086 microprocessor to demonstrate real-time control and data acquisition												
Contribution of Course Outcomes towards achievement of Program Outcomes		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
	CO1			3	3					2	2				3
	CO2			3	3					2	2				3
	CO3			3	3					2	2				3

Course Content

List of Experiments

Part A

1. Programming for Data Transfer Operations
2. Programming for Arithmetical & Logical Operations
3. Programming for String Operations.
4. Programming for Sorting (Ascending & Descending Order)
5. Code Conversion programs
6. Read a Character and Display the string.
7. Programming on Procedures (Train of pulses)

PART-B

8. Key board Interfacing
9. Display Interfacing
10. Stepper motor Interfacing
11. DAC Interfacing (Sine, Square, Saw tooth, Triangular)
12. ADC Interfacing
13. Traffic light controller
14. Temperature monitoring
15. Lighting an LED matrix

	Note: Any 10 of the experiments in the above list need to be completed by the student, by choosing a minimum of 5 experiments from each Module for him/her to be eligible to write University Practical Examinations
Text books and Reference books	**Text Book:** [T1] Douglas V Hall, SSSP Rao, "Microprocessors and Interfacing – Programming and Hardware", 3rd Ed., Tata McGraw Hill Education Private Limited, 2020 [T2] Barry B. Brey, "The Intel Microprocessors-Architecture, Programming and Interfacing", 8th Ed., PHI, 2008 **Reference Books:** [R1] Walter A. Triebel & Avtar Singh, "The 8088 and 8086 Microprocessors: Programming, Interfacing, Software, Hardware, and Applications", 4th Ed., Prentice Hall, 2000 [R2] Atul P. Godse and Deepali A. Godse, " Microprocessors and Interfacing: 8, 16, 32, 64-bit Intel Processors", Technical publications ,2020.
E-resources and other digital material	

24EI285- Control Systems Lab

Course Category:	Professional Core Lab	**Credits:**	1
Course Type:	Practical	**Lecture - Tutorial - Practice:**	0 - 0- 2
Prerequisites:		**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	60 40 100

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

6. 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
7. Block diagram reduction techniques for determination of transfer function of a given system using MATLAB/LabVIEW.
8. Simulation of standard test signals using MATLAB/LabVIEW
9. Determination of step, impulse and ramp responses for first order unity feedback system using MATLAB/LabVIEW
10. Determination of step, impulse and ramp responses for second order unity feedback

	system using MATLAB/LabVIEW 11. Determination of step and impulse responses for a type '0',type '1' and type '2' systems 12. Root locus plot for a given transfer function using MATLAB/LabVIEW 13. Stability studies using Bode and Nyquist plots for a given transfer function using MATLAB/LabVIEW 14. Determine the state model for a given transfer function using MATLAB/LabVIEW. 15. Determine the stability for a given state model using MATLAB/LabVIEW **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	**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

24EN281- English for Professionals

Course Category:	Humanities Course	**Credits:**	1
Course Type:	Theory	**Lecture - Tutorial - Practice:**	0 - 0- 2
Prerequisites:		**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	

Course outcomes	Upon successful completion of the course, the student will be able to:													
	CO1	Recall the fundamentals of language in terms of grammar and lexical resource in communication												
	CO2	Understand how to listen, reflect and speak while communicating with others.												
	CO3	Apply language skills, Etiquettes, Team Building and Leadership in professional and social contexts with clarity and accuracy												
	CO4	Analyze ideas with coherence, cohesion and precision in formal written communication												
	CO5	Evaluate grammar and vocabulary using Versant Test												
Contribution of Course Outcomes towards achievement of Program Outcomes		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
	CO1	2							2	3		2			
	CO2	2							2	3		2			
	CO3	2							2	3		2			
	CO4	2							2	3		2			
	CO5	2							2	3		2			
Course Content	**UNIT- I** **Versant Test** Overview of the Versant Test – Purpose and Importance – Format of the Test – Types of Questions – Practice. (2 Hours). **UNIT- II** **Elocution** Define – Discuss the Importance – Key Components – Voice Modulation – Articulation – Posture and Gestures – Practice. (2 Hours) **UNIT- III** **Extempore**													

	Introduction – Significance – Developing Quick Thinking – Communication Skills – Confidence –Strategies for Effective Speaking – Practice. (2 Hours). **UNIT- IV** **Story Telling** Definition – Narratives through Spoken Words – Gestures and Expressions – Importance of Culture – Story Telling Techniques – Vocal Modulation – Pacing – Gestures and Facial Expressions – Practice. (2 Hours) **UNIT- VI** **Short Story Writing** Introduction – Key Characteristics – Brevity – Theme – Types – Creating Relatable Characters. (2 Hours) **UNIT- VII** **Blog Writing** Introduction – Purpose in Digital World – Different types of Blogs – Benefits – Building Online Presence – Sharing Knowledge – Connecting with Others. (2 Hours) **UNIT- VIII** **Biographical Sketch** Purpose – Overview of Person's Life – Key Events – Conclusion. (2 Hours) **UNIT- IX** **Vocabulary** Idiomatic Expressions – Idioms with Body Parts – Animal Idioms – Colour Idioms – Phrasal Verbs – One-word Substitutes – Analogies – Practice. (2 Hours) **UNIT- X** **Functional English Grammar** Modal Verbs – Subject-Verb Agreement – Active & Passive Voice – Reported Speech – Question Tags – Practice Exercises. (2 Hours) **UNIT- XI** **Team Building & Leadership** Team Building traits: Forming – Storming – Norming – Performing – Adjourning. Leadership traits: Vision – Integrity – Decisiveness – Confidence – Empathy – Flexibility Innovation. (2 Hours) **UNIT- XII** **Corporate Etiquette** Social Etiquette – Business Etiquette – Telephone Etiquette – Dining Etiquette – Summary. (2 Hours)

Text books and Reference books	**Text Book:** [T1] English for Professionals Lab Manual **Reference Books:** [R1] Wren & Martin. (2023). English Grammar and Composition. S. Chand & Company. [R2] Dale Carnegie. (2016). The Quick and Easy way to Effective Speaking. Rupa Publications, [R3] Richard A. Spears. (2005). McGraw-Hill's Dictionary of American Idioms and Phrasal Verbs.McGraw Hill. [R4] Jon M. Ericson, James J. Murphy, Raymond Bud Zeuschner. (2003). The Debater's Guide. (Third Edition). Southern Illinois University Press, Carbondale. [R5] S. P. Dhanavel. (2010). English and Soft Skills. Orient Blackswan. [R6] Barun K. Mitra. (2011). Personality Development and Soft Skills. Oxford University Press
E-resources and other digital material	1. https://www.pearson.com/languages/hr-professionals/versant.htmlSoftx **AI Tools** 1) Grammar and Syntax Mastery: Wordvice, Bussu 2) Speaking Fluency and Clarity: Forvo, ELSA Speak 3) Communication Strategies: Speechace, Rosetta Stone 4) Story Telling Techniques: Plot Generator, Narrativa 5) Vocabulary Acquisition: Quizlet, Anki 6) Writing Proficiency: EAngel, Scribens, Grammarly

24UC202- Professional Ethics

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

Course outcomes	Upon successful completion of the course, the student will be able to:													
	CO1	Explain the moral and ethical theories related to engineering practice												
	CO2	Apply ethical reasoning for professional dilemmas and responsibilities												
	CO3	Analyze case studies to evaluate ethical decision-making and safety practices												
	CO4	Assess global and environmental issues affecting engineering ethics.												
	CO5	Apply and interpret the principles of the Indian Contract Act in professional contexts												
Contribution of Course Outcomes towards achievement of Program Outcomes		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
	CO1	2						3							
	CO2					3		3							
	CO3			3			3	3							
	CO4							3			2	2			
	CO5							3			2				

Course Content

UNIT- I

Engineering Ethics: Senses of 'Engineering Ethics', variety of moral issues, types of inquiry, moral dilemmas, moral autonomy: Kohlberg's theory; Gilligan's theory, consensus and controversy, Models of Professional Roles, Theories about right action, Self-interest- customs and religion, Use of ethical theories.

UNIT- II

Engineering as Social Experimentation: Engineering as experimentation, Learning from past, Engineers as responsible experimenters, Codes of ethics, A balanced outlook on law, The challenger disaster a case study

UNIT- III

Safety, Responsibilities and Rights: Safety and risk, Assessment of safety and risk, Risk benefit analysis, reducing risk, The three-mile island and Chernobyl case studies,

	Collegiality and loyalty, Respect for authority, Collective bargaining, Confidentiality, Conflicts of interest, Occupational crimes, Professional rights, Employee rights, Intellectual Property Rights (IPR), Discrimination. **UNIT- IV** **Global Issues**: Multinational corporations, Environmental ethics, Computer ethics, Weapons development, Engineers as managers, Engineers as Professionals, Managing Conflicts, Consulting engineers, Engineers as expert witnesses and advisors, Moral leadership, Sample code of Ethics (Specific to a particular Engineering Discipline). **UNIT- V** **General Principles of Contracts Management**: Indian contract act, Contract, Essential elements of a valid contract, Types of contract – valid contract; invalid contract; other types of contracts, Offer – types of offer; legal rules for offer, Acceptance – legal rules for acceptance, Consideration – legal rules as to consideration, Stanger to contract, Capacity to contract
Text books and Reference books	**Text Book:** [T1] Mike Martin and Roland Schinzinger, "Ethics in engineering", McGraw Hill, New York (1996). [T2] Govindarajan M, Natarajan S, Senthil Kumar V. S., "Engineering Ethics", Prentice Hall of India, New Delhi (2004). **Reference Books:** [R1] Baum, R.J. and Flores, A., "Ethical Problems in Engineering, Center for the study of the Human Dimensions of Science and Technology", Rensellae Polytechnic Institute, Troy, New York, 335 pp. eds. (1978) [R2] Beabout, G.R., Wennemann, D.J., "Applied Professional Ethics: A Developmental Approach for Use with Case Studies", University Press of America Lanham, MD, 175 pp (1994). [R3] Dutt(1994) Indian Contract Act, Eastern Law House.
E-resources and other digital material	1. https://www.scribd.com/document/552528071/professional-development-with-applied-ethics-module-1-docx 2. https://grace.unodc.org/grace/uploads/documents/academics/Integrity_and_Ethics_Module_14_Professional_Ethics.pdf 3. https://onlineethics.org/cases/three-mile-island-nuclear-accident 4. https://www.tutorialspoint.com/engineering_ethics/index.htm 5. https://www.slideshare.net/slideshow/indian-contract-act-1872-14444088/14444088

Third Year
(V Semester)

24EI301- Process Control

Course Category:	Professional Core	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3 - 0- 0
Prerequisites:		**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	40 60 100

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	Analyse various control schemes and tuning methods													
	CO5	Use simulation software to analyze the performance of control schemes													
Contribution of Course Outcomes towards achievement of Program Outcomes		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	2														1
	CO3			2												2
	CO4		1													1
	CO5					2										1

Course Content

UNIT- I

Introduction to Physical Processes and Dynamics: 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: 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

	UNIT- IV **Controller Tuning:** PID controller design and tuning, Criteria for good control, Tuning methods - Ziegler-Nichols method of tuning, Cohen-Coon method of tuning. **Control Valves**: Sliding stem control valves, Rotating shaft control valves, Control valve sizing's **UNIT- V** **Advanced Control Strategies:** Cascade control, Feed forward control, Ratio control, smith predictor control, Internal model control and Model predictive Control
Text books and Reference books	**Text Book:** [T1] Dale E. Seborg, Thomas F. Edgar, Duncan A. Mellichamp, Fransis J. Doyle III., "Process Dynamics and Control" John Wiley, 4th Edition, 2016 [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	

24EI302- Digital Signal Processing

Course Category:	Professional Core	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3 - 0- 0
Prerequisites:		**Continuous Evaluation:**	40
		Semester end Evaluation:	60
		Total Marks:	100

Course outcomes	Upon successful completion of the course, the student will be able to:														
	CO1	Understand and classify signals and systems, perform signal operations, and apply sampling theorem concepts													
	CO2	Analyze discrete-time signals using the Z-transform and solve linear constant-coefficient difference equations.													
	CO3	Apply DFT and FFT techniques for frequency domain analysis and efficient computation of convolutions.													
	CO4	Design IIR digital filters using analog filter approximations and transformation methods.													
	CO5	Design linear phase FIR filters using windowing and frequency sampling methods, and compare FIR & IIR systems.													
Contribution of Course Outcomes towards achievement of Program Outcomes		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	1											1	
	CO2	3	3	2	1										1	
	CO3	3	3	2	2	1										1
	CO4	3	3	3	2	1										2
	CO5	3	3	3	2	1										2
Course Content	**UNIT- I** Classification of signals and systems, Representation of signals, Basic operations on signals, Basic elements of digital signal processing system, Advantages, Disadvantages, Applications, Sampling of analog signals, Sampling theorem **UNIT- II** **Z-Transform**: The Z-transform, Region of convergence(ROC), ROC of finite and infinite duration signals, Evaluation of Z –transform, Properties of Z-transform, Evaluation of Inversion of the Z-transform, The one sided Z-transform, Solution of linear constant-coefficient difference equations **UNIT- III** **The Fourier Representation of Finite Duration Sequences** - The Discrete Fourier Transform (DFT), Properties of DFT, Linear convolution using DFT, Fast Fourier														

	Transforms (FFT) - Radix-2 Decimation in time and Decimation in frequency FFT algorithms, Inverse FFT **UNIT- IV** **Analog Filter Approximations**- Butter worth and Chebyshev, Design of IIR digital filters from analog filters - Impulse invariance method, Bilinear transformation method, Design Examples, Basic Structures for IIR systems: Direct-Form structures, Cascade-Form structures and Parallel-Form structures **UNIT- V** Design of linear phase FIR filters using Windows, Design of Linear phase FIR filters by the Frequency Sampling method, Comparison of FIR and IIR filters, Basic structures for FIR systems: Direct-Form structures and Cascade-Form structures
Text books and Reference books	**Text Book:** [T1] J. G. Proakis and D. G. Manolakis, "Digital Signal Processing: Principles, Algorithms, and Applications", 5th Ed., Pearson, 2022 [T2] A.V. Oppenheim and R.W. Schafer, "Digital Signal Processing", 1st Ed., Pearson, 2015 **Reference Books:** [R1] A Nagoor Kani, "Digital Signal Processing", 3rd Ed., CBS Publishers & distributors Pvt. Ltd., 2022 [R2] P Ramesh Babu, "Digital Image Processing", 7th Ed., Sci tech, 2021
E-resources and other digital material	1. http://ocw.mit.edu/resources/res-6-008-digital-signal-processing-spring-2011. 2. nptel.ac.in/digital signal processing/

24EI303- VLSI Design

Course Category:	Professional Core	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3 - 0- 0
Prerequisites:	Electronic Devices and Circuits, Digital Electronics	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	40 60 100

Course outcomes	Upon successful completion of the course, the student will be able to:														
	CO1	Understand VLSI fabrication processes and MOS based technologies.													
	CO2	Analyze electrical characteristics of MOSFET.													
	CO3	Apply the Design rules of Mask layout for MOS, CMOS and BiCMOS circuits.													
	CO4	Understand basic circuit concepts and performance parameters.													
	CO5	Apply scaling techniques and subsystem design approaches.													
Contribution of Course Outcomes towards achievement of Program Outcomes		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										2		
	CO4		2											2		
	CO5			3												3
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, Driving large capacitive loads, Propagation Delays. **UNIT- V** **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 and Kamran Eshraghian, "Basic VLSI Systems and Circuits", Prentice Hall of India, 3rd Ed., Reprint 2008. [T2] Neil H. E. Weste, David Harris, and Ayan Banerjee, "CMOS VLSI Design: A Circuits and Systems Perspective", Pearson Education, 3rd Ed., 2009. [T3] John F. Wakerly, "Digital Design Principles & Practices", Pearson Education, 4th Ed., 2005 **Reference Books:** [R1] Neil H. E. Weste and Kamran 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	1. https://onlinecourses.nptel.ac.in/noc26_ee85/preview 2. https://www.youtube.com/playlist?list=PLCmoXVuSEVHlEJi3SwdyJ4EICffuyqpjk

24EI310A - Optoelectronics and Laser Instrumentation

Course Category:	Professional Elective-1	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3 - 0- 0
Prerequisites:		**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	40 60 100

Course outcomes	Upon successful completion of the course, the student will be able to:														
	CO1	Describe optical fibre principles, types, losses, dispersion, sources and detectors.													
	CO2	Apply fibre optic sensors for measurement of physical parameters such as pressure, temperature, strain, current, voltage and liquid level													
	CO3	Describe laser fundamentals and types.													
	CO4	Apply lasers in measurement and material processing.													
	CO5	Apply holography techniques and laser principles in non-destructive testing and medical applications.													
Contribution of Course Outcomes towards achievement of Program Outcomes		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												3		
	CO4		3											3		
	CO5		3											3		

Course Content

UNIT- I

Optical Fibres and their Properties: Introduction to optical fibers, Light guidance, numerical aperture, Dispersion, Different losses in fibers, Different types of optical fibers, Optical fibers for communication and instrumentation

Opto Electronic Components: LED, LD, PIN & APD, Electro optic, Magneto optic and acoustic optic modulator.

UNIT- II

Industrial Application of Optical Fibres: Fibre optic sensors, Fibre optic instrumentation system, Different types of modulators, Detectors, Application in instrumentation, Interferometric method of measurement of length, Moire fringes, Measurement of pressure, Temperature, Current, Voltage, Liquid level and strain, Fibre optic gyroscope, Polarization, Maintaining fibres

	UNIT- III **Laser Fundamentals**: Fundamental characteristics of laser, Three level and four level lasers, Properties of lasers, Laser modes, Resonator configuration, Q-switching and mode locking, Cavity dumping, Types of laser, Gas laser, Solid laser, Liquid laser, Semiconductor laser **UNIT- IV** **Industrial Application of Laser**: Laser for measurement of distance, Length, Velocity, Acceleration, Current, Voltage and atmospheric effect, Material processing, Laser heating, Welding, Melting and trimming materials, Removal and vaporization **UNIT- V** **Hologram and Medical Application:** Holography, Basic principle, Methods, Holographic interferometry and applications, Holography for nondestructive testing, Holographic components, Medical application of lasers, Laser and tissue interaction, Laser instruments for surgery, Removal of tumors of vocal cords, Brain surgery, Plastic surgery, Gynecology and oncology
Text books and Reference books	**Text Book:** [T1] Gerd Keiser, "Optical Fibre Communications", McGraw-Hill, International Edition, 2000 [T2] John and Harry, "Industrial Lasers and their Applications", McGraw Hill, 1974 **Reference Books:** [R1] John F Ready, "Industrial Applications of Lasers", Academic press, 1978 [R2] Monte Ross, "Laser Applications", McGraw Hill, 1968 [R3] Jasprit Singh, "Semiconductor Optoelectronics", McGraw Hill, 1995.
E-resources and other digital material	1. http://www.marktechopto.com/ 2. http://electronics-electrical.exportersindia.com/optoelectronics/

24EI310B - Sensor Signal Conditioning

Course Category:	Professional Elective-1	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3 - 0- 0
Prerequisites:	Sensors and Transducers, Industrial Instrumentation	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	40 60 100

Course outcomes	Upon successful completion of the course, the student will be able to:														
	CO1	Understand the fundamentals of signal conditioning circuits													
	CO2	Design the signal conditioning circuits for resistive sensors													
	CO3	Select suitable signal conditioning circuits for reactance variation sensors													
	CO4	Develop suitable signal conditioning circuits for self-generating sensors													
	CO5	Understand the principles of digital and intelligent sensors and its interfacing with intelligent system													
Contribution of Course Outcomes towards achievement of Program Outcomes		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			1												3
	CO3			2												3
	CO4			2												2
	CO5	3														2

Course Content

UNIT- I

Fundamentals of Signal Conditioning: Introduction to data acquisition and signal conditioning, Amplification, Instrumentation amplifiers, Filtering, Attenuation, Isolation, Linearization, Circuit protection.

UNIT- II

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- III

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- IV **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- V** **Digital and Intelligent sensors and its interfacing:** Position encoders, Resonant sensors, charge coupled and CMOS image sensors, direct sensor-Microcontroller interfacing, communication system for sensors, Intelligent sensors
Text books and Reference books	**Text Book:** [T1] Fred Schraff, Steve Lekas, Mike Fraser, Paul Holland "Signal Conditioning and PC based Data Acquisition Handbook", 3rd Ed., Measurement Computing Corporation, USA, 2012. (Unit-I) [T2] Roman Pallas Areny and John G Webster, "Sensor and Signal Conditioning", 2nd Ed., John Wiley & Sons, Inc. 2001 (Units - II, III, IV and V) **Reference Books:** [R1] 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

24EI310C - Robotics and Control

Course Category:	Professional Elective-1	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3 - 0- 0
Prerequisites:	Control Systems	**Continuous Evaluation:**	40
		Semester end Evaluation:	60
		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		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** **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. **UNIT- V** **Robot Sensors and Vision** : Sensors in robotics, Kinds of sensors used in robotics, Industrial applications of vision controlled robotic systems, Process of imaging, and architecture of robotic vision systems
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

24EI310D – Industrial Electronics

Course Category:	Professional Elective-1	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3 - 0- 0
Prerequisites:	Basics of Electrical Engineering, Electronic Devices and Circuits	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	40 60 100

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, structure, operation, and characteristics of thyristor devices													
	CO2	Analyze the operation of SCR converters, Inverters ,Choppers, Cyclo Converters,, AC–DC converters (rectifiers) and DC–AC converters (inverters)**.**													
	CO3	Outline the principles and the operation, configurations, and performance of DC–DC converters (choppers) and AC–AC converters (cycloconverters).													
	CO4	Apply the operation of DC amplifiers and Regulated power supplies,UPS and SMPS for industrial applications.													
	CO5	Illustrate various industrial applications of SCR.													
Contribution of Course Outcomes towards achievement of Program Outcomes		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		2												2	
	CO3		2												2	
	CO4	3													3	
	CO5											2				2
Course Content	**UNIT- I** **Thyristors:** SCR structure and operation, Characteristics of SCR:StaticV-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 and LASCR. **UNIT- II** **AC-DC converters – Thyristor Converters:** Introduction, Single phase converters: Halfwave converters, Fullwave converters, Bridge converters. **DC-AC converters –Thyristor Inverters:** Introduction, Single phase inverters, McMurray														

	Inverter, McMurray 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 cycloconverters, Single phase centre tapped cycloconverters, Single phase bridge type cycloconverters **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). **UNIT- V** **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," Khanna Publications, 9th Ed., 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," Khanna Publications, 4th Ed., 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

24EI360A- Principles of Process Control

Course Category:	Inter disciplinary Elective–1	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3 - 0- 0
Prerequisites:		**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	40 60 100

Course outcomes	Upon successful completion of the course, the student will be able to:															
	CO1	Understand the technical terms and concepts associated with process control domain.														
	CO2	Understand the concepts of transient responses, controllability and stability.														
	CO3	Select suitable controller mode for a given application.														
	CO4	Select suitable controller and control schemes for a given application.														
	CO5	Analyse various control schemes and recommend the right control strategy in an industry.														
Contribution of Course Outcomes towards achievement of Program Outcomes		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												3	
	CO4		3											3		
	CO5		3											3		

Course Content

UNIT- I

Introduction to Processes: Introduction to processes, Control loop study, Sources of disturbances, Control actions, Block diagram representation, Transient response of systems, Controlled process block diagrams and transfer functions

UNIT- II

Transient Response, Controllability and Stability: System analysis and studies of system response, Controllability, Self -regulation, Stability studies, Compensators

UNIT- III

Basic control schemes and Controllers: Introduction to feedback control, Basic control actions - Characteristic of on-off, Proportional, Time proportional control, Typical PID controller characteristics, Control actions comparison

	UNIT- IV **Controlling Elements:** Pneumatic controllers, Hydraulic controllers, Electronic controllers and programme controllers, Programmable logic controller. **Complex Control Schemes:** Cascade control, Feed forward control, Ratio control **UNIT- V** **Final Control Elements, Process Control Systems:** Pneumatic actuator, Electric actuators, Boiler control, Steel plant control system, Control in paper industry, Distillation column, Belt conveyor control
Text books and Reference books	**Text Book:** [T1] D Patranabis, "Principles of Process Control" 2nd Ed., TMH, 2007 [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] Seborg, D E., Mellichamp, D.A, Edger, T.F., "Process Dynamics and Control" John Wiley, 2nd Ed., 2009.
E-resources and other digital material	1. www.freevideolectures.com /Course/3126/Process-Control-and-Instrumentation 2. www.nptel.ac.in/courses/103105064/

24EI360B - Programmable Logic Controllers

Course Category:	Inter disciplinary Elective–1	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3 - 0- 0
Prerequisites:		**Continuous Evaluation:**	40
		Semester end Evaluation:	60
		Total Marks:	100

Course outcomes	Upon successful completion of the course, the student will be able to:														
	CO1	Explain PLC concepts, components, and applications.													
	CO2	Describe PLC hardware and system architecture.													
	CO3	Apply number systems and logic fundamentals in control applications.													
	CO4	Analyze PLC programming concepts and ladder logic instructions.													
	CO5	Develop PLC ladder logic programs for industrial automation.													
Contribution of Course Outcomes towards achievement of Program Outcomes		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			2							3	1		3
	CO2	3	2			2							3	2		3
	CO3	2	3			2							2	2		2
	CO4	2	3	2		3							2	2	1	2
	CO5	2	2	3		3							3	3	2	2
Course Content	**UNIT- I** **Programmable Logic Controllers:** Introduction, Parts of a PLC, Principles of operation, Modifying the operation, PLCs versus computers, PLC size and application **UNIT- II** **PLC Hardware Components**: The I/O section, Discrete I/O modules, Analog I/O modules special I/O modules, I/O specifications, Typical discrete I/O module specifications, Typical analog I/O module specifications, The central processing unit (CPU), Memory design, Memory types, Programming terminal devices, Recording and retrieving data, Human machine interfaces (HMIs) **UNIT- III** **Number Systems and Codes:** Decimal system, Binary system, Octal system, Hexadecimal system, Binary coded decimal (BCD) system, Gray code, **Fundamentals of Logic:** The binary concept, AND, OR, and NOT functions, The AND function, The OR function, The NOT, The Exclusive-OR (XOR) Function, Boolean														

	algebra, Developing logic gate circuits from Boolean expressions **UNIT- IV** **Basics of PLC Programming:** Processor memory organization, Program files, Data files, Program scan, PLC programming languages, Relay-type instructions, Instruction addressing, Branch instructions, Internal relay instructions, Programming examine If closed and examine If open instructions, Entering the ladder diagram, Modes of operation **UNIT- V** **Developing Fundamental PLC Ladder Logic Programs:** Electromagnetic control relays, Contactors, Motor starters, Magnetic reed switch, ON delay timer, OFF delay timer, Up counter, Down counter
Text books and Reference books	**Text Book:** [T1] Frank D.Petruzella, "Programmable Logic Controllers", 4th Ed., Glencoe McGraw Hill [T2] Michael P. Lucas, "Distributed Control Systems-Their Evaluation and Design", Van Nostrand Reinhold Company Inc.1986 **Reference Books:** [R1] B R Mehtha, Y J Reddy, "Industrial Process Automation Systems", Butterworth Heinmann imprint of Elsevier, 2015 [R2] R. Bliesener, F. Ebel, C. Löffler, "Programmable Logic Controllers" Learning System for Automation and Technology
E-resources and other digital material	1. http://ee.sharif.edu/~industrialcontrol/LADDER_LOGIC_Tutorial.pdf 2. https://www.elprocus.com/distributed-control-system-features-and-elements/Reference

24EI383 - Process Control Lab

Course Category:	Professional Core Lab	**Credits:**	1.5
Course Type:	Lab	**Lecture - Tutorial - Practice:**	0 - 0- 3
Prerequisites:	Control Systems	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	40 60 100

Course outcomes	Upon successful completion of the course, the student will be able to:														
	CO1	Demonstrate the characteristics of major elements in process control loop.													
	CO2	Analyse the performance of different control schemes in various process stations.													
	CO3	Analyse the performance of the Heat exchanger using Multi variable Control system.													
	CO4	Analyse the behaviour of cascade and pH control system using PID controller.													
Contribution of Course Outcomes towards achievement of Program Outcomes		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											2
	CO3				3	1										2
	CO4				3	1										2

Course Content

List of Experiments

1. Characteristics of Chromel – Alumel thermocouple 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. Study of pH control system.
10. Study of temperature control in heat exchanger.
11. Characteristics of PID controller in flow process station using LabVIEW.
12. Characteristics of PID controller in level process station using LabVIEW.
13. Auto tuning of PID controller for the given application.
14. Study of Cascade Control System.
15. Design of Fuzzy Controller using Matlab/LabVIEW for the given application.

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
E-resources and other digital material	1. www.freevideolectures.com /Course/3126/Process-Control-and-Instrumentation 2. www.nptel.ac.in/courses/103105064

24EI384 - Virtual Instrumentation Lab

Course Category:	Professional Core Lab	**Credits:**	1.5
Course Type:	Lab	**Lecture - Tutorial - Practice:**	0 - 0- 3
Prerequisites:		**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	40 60 100

Course outcomes	Upon successful completion of the course, the student will be able to:															
	CO1	Develop basic VIs using arithmetic, Boolean, and looping operations.														
	CO2	Implement data structures such as arrays, matrices, and clusters.														
	CO3	Create modular programs using SubVIs, structures, and formula nodes.														
	CO4	Design applications for data plotting, strings, and file I/O.														
	CO5	Develop signal and image processing VIs.														
Contribution of Course Outcomes towards achievement of Program Outcomes		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	3			1	1		2		2		3
	CO2			2	2	3			1	1		2		2		3
	CO3			3	2	3			1	1	1	2		2		3
	CO4			3	2	3			1	1	1	2		2		3
	CO5			3	3	3			1	1	1	2		3		3
Course Content	**List of Experiments** 1. Programs on Arithmetic operations 2. Programs on Boolean operations 3. Programs on repetition and loops 4. Programs on Arrays and Matrices 5. Programs on Clusters 6. Programs on Sub VI's 7. Programs on Data plotting 8. Programs on Structures 9. Programs on Formula nodes and Math script nodes 10. Programs on Strings, File I/O 11. Develop a VI to Simulate Dynamic Signal Analyzer using LabVIEW 12. Develop a VI to detect edges in an image with 2D convolution **Note: Any 10 experiments from the above list**															

Text books and Reference books	**Text Book:** [T1] Jovitha Jerome, "Virtual Instrumentation using LabVIEW", 1st Ed., PHI, 2013. [T2] Jeffrey Travis and Jim Kring, LabVIEW for Everyone: Graphical Programming Made Easy and Fun, 3rd Edition, Pearson Education **Reference Book:** [R1] Virtual Instrumentation Lab Manual
E-resources and other digital material	1. http://www.ni.com

24EI381- EPICS

Course Category:		**Credits:**	2
Course Type:		**Lecture - Tutorial - Practice:**	0 - 0- 4
Prerequisites:		**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	40 60 100

24EI382 – Digital System Design Using Verilog

Course Category:	Professional Core	**Credits:**	2
Course Type:	Skill Course-I (Program specific)	**Lecture - Tutorial - Practice:**	1 - 0- 2
Prerequisites:		**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	40 60 100

Course outcomes	Upon successful completion of the course, the student will be able to:													
	CO1	Apply Verilog modeling techniques to design basic digital circuits.												
	CO2	Design combinational circuits using Verilog HDL.												
	CO3	Develop sequential circuits using Verilog HDL.												
	CO4	Analyze digital circuits using simulation and verification techniques.												
	CO5	Implement Verilog based digital designs for real-time applications.												
Contribution of Course Outcomes towards achievement of Program Outcomes		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
	CO1	3				2							3		
	CO2	3		3											2
	CO3	3		2		2									2
	CO4		3		2	3								3	
	CO5	3				3			2						3
Course Content	**List of Experiments** 1. Modeling Concepts: Design Basic Logic Gates using different Verilog modeling techniques (Gate level, Dataflow and Behavioral modeling). 2. Design, simulate and compare the functionality of Half Adder and Full Adder using Verilog HDL. 3. Design and simulate a multiplexer using Verilog HDL and verify its functionality using a testbench. 4. Design and simulate a 3:8 decoder using Verilog HDL and verify the output for different input combinations. 5. Design and simulate a 8:3 priority encoder using Verilog HDL and analyze its operation through simulation results. 6. Design and simulate a BCD to 7-segment code converter using Verilog HDL and verify the display outputs. 7. Design and simulate a Binary to Gray code converter and verify the code conversion.													

	8. Design and simulation D Flip-Flop using Verilog HDL. 9. Design and simulate an up/down counter using Verilog HDL and verify the counting operation. 10. Designing, implementing, and verifying Memory Creation in Verilog. 11. Design a three-bit shift register using Verilog. 12. Design Traffic Light Controller using Verilog **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	**Text Book:** [T1] M. M. Mano and M. D. Ciletti, "Digital Design", 4th Ed., Pearson Education [T2] S. Palnitkar, "Verilog HDL: A Guide to Digital Design and Synthesis", Pearson, 2nd Ed, 2003 **Reference Books:** [R1] S. Brown and Z. Vranesic, "Fundamentals of Digital Logic with Verilog Design", McGraw-Hill Education, 2nd Ed., 2008 [R2] J. Bhasker, "A Verilog HDL Primer", 3rd Ed., Allentown, PA, USA: Star Galaxy Publishing, 2018.
E-resources and other digital material	1. https://onlinecourses.nptel.ac.in/noc26_cs24/preview 2. https://github.com/topics/verilog

24UC303 – Environmental Science

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

Course outcomes	Upon successful completion of the course, the student will be able to:													
	CO1	Explain various factors causing degradation of natural resources												
	CO2	Explain various ecosystems and need for biodiversity												
	CO3	Analyze problems related to environmental pollution and disaster management and propose solutions												
	CO4	Explore the importance of ethics, sustainable development and acts associated with environment												
	CO5	Demonstrate the use of information and technology to solve social issues and human rights challenges												
Contribution of Course Outcomes towards achievement of Program Outcomes		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
	CO1	3					2								
	CO2		3	2			2	2		2					
	CO3		3	2			3					2			
	CO4						2	3	3		2	2			
	CO5						2	3	3		2	2			

Course Content

UNIT- I

Introduction and Natural Resources:

- Definition, scope, importance, multidisciplinary nature, and need for public awareness about environment.
- Forest resources
- Water resources
- Mineral resources
- Food resources
- Land resources
- Energy resources

UNIT- II

Ecosystems and Biodiversity Structure and Function of Ecosystem

	• Energy flow on the ecosystem • Ecological succession • Food chain food web ecological pyramids • Characteristic features of ecosystems • Biodiversity types, value, threats and conservation • Biodiversity at local, national and global levels • Hot-spots of biodiversity, endangered and endemic species of India. • Bio-geographical Classification of India **UNIT- III** **Environmental Pollution and Disaster Management** • Air Pollution • Water pollution • Noise pollution • Soil pollution • Marine pollution • Thermal pollution • Nuclear pollution • Solid waste management: municipal solid waste, biomedical waste and E-waste. • Disaster management: floods, cyclones, Earthquakes and landslides **UNIT- IV** **Social Issues and the Environment from Unsustainable to Sustainable Development** • Urban problems related to energy • Water conservation, rainwater harvesting and watershed management • Environmental ethics • Climate change • Environmental protection acts • Environment Impact Assessment: E.I.A. **UNIT- V** **Human Population and the Environment** • Population growth variation among nations. • Population explosion family welfare program. • Environment and human health. • Human rights. • Value education. • HIV/AIDS • Women and child welfare. • Role of I.T.in Environment and human health

Text books and Reference books	**Text Book:** [T1] Frank 1. Erach Bharucha, "Environmental Studies for Undergraduate Courses", 2nd Ed., University Grants Commission, New Delhi, Bharati Vidyapeeth Institute of Environment Education and Research. 2005 [T2] Benny Joseph, "Environmental Studies", Tata McGraw- Hill Publishing Company Limited, New Delhi, 2005 [T3] Venu Gopala Rao.P "Principles of Environmental Science & Engineering", Prentice-Hall of India Pvt. Ltd., New Delhi. 2006 **Reference Books:** [R1] De, A.K, "Environmental Chemistry", 9th Ed., New Age India, 2018 [R2] Bharucha Erach, "Biodiversity of India", Mapin Publishing, 2002 [R3] Anjaneyulu. Y, "Introduction to Environmental Sciences", B S Publications, Hyderabad, 2004 [R4] Anjireddy. M. "Environmental Science & Technology", B S Publications, Hyderabad, 2005 [R5] Cunningham Willam, P. & Cunningham Mary Ann, "Environmental Science: A Global Concern", 14th Ed., Mc Graw Hill, 2017. [R6] Kurian Joseph & Nagendran,R, "Essentials of Environmental Studies", Pearson Education, 2005
E-resources and other digital material	1. https://www.ugc.gov.in/oldpdf/modelcurriculum/env.pdf?iframe=true&width=100%25&height=100%25 2. https://www.ugc.gov.in/oldpdf/modelcurriculum/chapter2.pdf 3. https://www.ugc.gov.in/oldpdf/modelcurriculum/chapter4.pdf 4. https://www.britannica.com/science/pollution-environment 5. https://www.supersummary.com/the-snow-leopard/summary/ 6. https://www.gov.nl.ca/ecc/waterres/waste/water-conservation/ 7. https://theberkey.com/pages/a-guide-to-water-conservation 8. https://www.mppcb.mp.gov.in/RWH.aspx 9. https://www.cseindia.org/understanding-eia-383 10. https://www.drishtiias.com/to-the-points/paper3/environmental-impact-assessment-1 11. https://www.drishtiias.com/to-the-points/paper3/wetlands-1 12. https://odphp.health.gov/healthypeople/objectives-and-data/browse-objectives/environmental-health 13. https://www.who.int/health-topics/environmental-health#tab=tab_1 14. https://www.unep.org/