MADANAPALLE INSTITUTE OF TECHNOLOGY & SCIENCE
(Deemed to be University)
MADANAPALLE
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Estd 1998

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
Course Structure
&
Detailed Syllabi

For the students admitted to

B. Tech. Regular Four Year Degree Programme during the Academic Year 2025-26

and

B. Tech. Lateral Entry Scheme during the Academic Year 2026-27

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

MADANAPALLE INSTITUTE OF TECHNOLOGY & SCIENCE

(Deemed to be University)

MADANAPALLE

B. Tech Four Year Curriculum Structure

Branch: ELECTRICAL AND ELECTRONICS ENGINEERING

Total Credits	160 Credits for 2025 (Regular) & 120 Credits for 2026 (Lateral Entry) Admitted Batch onwards

I. Induction Program and Holistic Development Activities

Sl.No	Title	Duration
1	Induction Program (Mandatory)	Three weeks' duration at the start of First Year

R25 - Curriculum Structure

I Year I Semester

S. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total	
1	AEC	25BAENGTC01	Professional Communication	2	0	0	2	2
2	HSMC	25BAHUMTC01	Human Values and Professional Ethics	2	0	0	2	2
3	BSC	25BAMATTC01	Engineering Calculus	3	0	0	3	3
4	BSC	25BAPHYTC01	Engineering Physics	3	0	0	3	3
5	ESC	25BACAITC02	Foundations of Artificial Intelligence	2	0	0	2	2
6	PCC	25BAEEETC01	Fundamentals of Electrical Energy Systems	3	0	0	3	3
7	AEC	25BAENGLC01	Professional Communication Laboratory	0	0	2	2	1
8	BSC	25BAPHYLC01	Physics Laboratory	0	0	2	2	1
9	ESC	25BACSELC04	Problem Solving using Python Laboratory	0	0	4	4	2
10	ESC	25BACOMLC01	Engineering Skills Laboratory	0	0	2	2	1
Total				**15**	**0**	**10**	**25**	**20**

I Year II Semester

S. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total	
1	BSC	25BAMATTC03	Linear Algebra and Differential Equations	3	0	0	3	3
2	BSC	25BACHETC01	Engineering Chemistry	3	0	0	3	3
3	ESC	25BACIVTC02	Introduction to Environment and Sustainability	2	0	0	2	2
4	ESC	25BAEEETC02	Basic Electrical and Electronics Engineering	3	0	0	3	3
5	ESC	25BAMECTC02	Engineering Mechanics	2	1	0	3	3
6	ESC	25BAMECEC01	Engineering Graphics	2	0	2	4	3
7	BSC	25BACHELC01	Engineering Chemistry Laboratory	0	0	2	2	1
8	ESC	25BAEEELC01	Basic Electrical and Electronics Engineering Laboratory	0	0	2	2	1
9	ESC	25BACOMLC02	Scientific Computing Laboratory	0	0	2	2	1
Total				**15**	**1**	**8**	**24**	**20**

(L = Lecture, T = Tutorial, P = Practical, C = Credit

ANNEXURE - I

THREE WEEK MANDATORY INDUCTION PROGRAMME

- Yoga and Meditation
- Sports and Games
- NSS
- NCC
- MITS Social Responsibility Club
- Management module
- Design Thinking
- Spoken and Written Communication

- ***Proficiency modules***

  - Basic Computer Proficiency
  - Interpersonal skills
  - Computer Graphics
  - Web programming
  - Mobile Apps
  - Vocabulary enhancement

HOLISTIC DEVELOPMENT ACTIVITIES

Description of Activities

1. Universal Human Values (UHV – I)
2. Physical and Health
3. Culture
4. Literature and Media
5. Social Service
6. Self-Development
7. Nature and Environment
8. Innovation

I Year I Semester

B. Tech I Year I Semester

25BAENGTC01 PROFESSIONAL COMMUNICATION

L	T	P	C
2	0	0	2

Pre Requisites: Universal Human Values (UHV-I) (desirable).

Course Description :

This course aims to develop essential English communication skills required for academic, social, and professional contexts. Students will learn to convey information effectively. The program enhances reading for comprehension, promotes reading for pleasure, and trains students to write various texts including emails, reports, business letters, presentations, and posters, enabling clear and confident communication in diverse settings.

Course Objectives:

This course aims to:

1. Enable students greet, introduce themselves and others, and describe their daily routines, surroundings, and familiar places.
2. Develop the ability to narrate past events or incidents coherently and to express plans and predictions for the future.
3. Foster functional communication skills such as enquiring, requesting, giving directions, instructions, and reporting information accurately.
4. Cultivate reading proficiency by engaging with stories, enhancing comprehension, vocabulary, and critical appreciation.
5. Equip students with skills in professional writing through emails, reports, letters, posters, and visual presentations.

UNIT I EVERYDAY ENGLISH 6 hours

Basics of essential grammar; Functions of communication such as greetings, introductions, leave-taking, polite expressions; describing daily routines and habits using the simple present tense; Describing things related to family, friends, classroom, home, campus, common places, gadgets and other objects.

UNIT II NARRATION AND PLANNING 6 hours

Using past tense forms for narration; sequencing events using connectors; vocabulary related to experiences, festivals, travel, and memorable events; expressing future time; predicting events and making career plans/prospects

UNIT III FUNCTIONAL COMMUNICATION IN DAILY LIFE 6 hours

Making enquiries using wh-questions, polite questions, and indirect requests; requesting and offering help with expressions for permission, obligation, and necessity; giving directions using common roadmap vocabulary; providing and following formal/informal instructions in everyday and academic contexts; reporting information through direct and indirect speech; impersonal passive voice.

UNIT IV READING FOR COMPREHENSION AND PLEASURE 6 hours

Developing extensive reading skills through prescribed short stories: *The Victory* by Rabindranath Tagore and *The Ransom of the Red Chief* by O Henry; applying techniques of reading such as skimming, scanning, and reading for gist and detail; building vocabulary through the texts; engaging in discussions on characters, settings, and themes from the reading; practicing reading comprehension for specific details through formal email samples.

UNIT V PROFESSIONAL AND BUSINESS COMMUNICATION 6 hours

Learning principles of professional communication such as clarity, conciseness, courtesy, correctness, and formats; Email etiquette; Drafting emails/letters critically appreciating the novel/short story read in Unit 4; preparing short reports; drafting business letters such as inquiries, complaints, replies; designing posters with focus on layout, persuasive language, and visuals; delivering short presentations using visual aids.

Course Outcomes:

Students will be able to:
CO1: Greet and introduce themselves and others, describe their routines, places, and things around them.
CO2: Narrate an event or incident, planning and predicting the future
CO3: Enquire, request, give directions/instructions, report and convey information
CO4: Read for pleasure and read for comprehension
CO5: Write formal/informal emails, short reports, presentations, business letters, and make posters.

Text Books:

1. Functional English for Communication by Ujjwala Kakarla, Tanu Gupta, Leena Pundir (SAGE, 2019)
2. Communication Skills by Sanjay Kumar & Pushp Lata (Oxford University Press, 3rd Edition, 2024)
3. Extensive Reading in the Second Language Classroom" by Richard R. Day and Julian Bamford (Cambridge University Press, 2022).

Reference Books:

1. Functional English Grammar (Cambridge University Press, 2024)
2. Essentials of Business Communication by Mary Ellen Guffey & Dana Loewy (Cengage Learning, 10th Edition, 2016)
3. English for Business Communication by Mable Chan (Routledge, 2025)
4. Handbook of Communication Skills edited by Owen Hargie (Routledge)

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination

Dept. of Electrical and Electronics Engineering

B.Tech I Year I Semester

25BAHUMTC01 HUMAN VALUES AND PROFESSIONAL ETHICS

L	T	P	C
2	0	0	2

Pre-requisite None. Universal Human Values (UHV-I) (desirable).

Course Description :

1. This course presents a universal approach to value education by developing the right understanding of reality (i.e., a worldview of the reality "as it is") through the process of self-exploration.
2. The whole course is presented in the form of a dialogue whereby a set of proposals about various aspects of reality are presented, and the students are encouraged to self-explore the proposals by verifying them based on their natural acceptance within oneself and validating experientially in living.
3. The prime focus throughout the course is toward affecting a qualitative transformation in the life of the student rather than just a transfer of information.
4. While introducing the holistic worldview and its implications, a critical appraisal of the prevailing notions is also made to enable the students to discern the difference on their own right.
5. Thus, this course is intended to provide a much-needed orientation input in value education to the young enquiring minds.

Course Objectives :

1. To help the students appreciate the essential complementarity between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity, which are the core aspirations of all human beings.
2. To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a right understanding of the Human reality and the rest of Existence. Such a holistic perspective forms the basis of Universal Human Values (UHV) and movement towards value-based living in a natural way.
3. To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behaviour and mutually enriching interaction with Nature.
4. To aid the students in realising their full human potential and act accordingly.
5. To assist the students to live with a feeling of relationship, harmony and co-existence.

UNIT I INTRODUCTION TO VALUE EDUCATION 6 hours

Lecture 1: Holistic Development and the Role of Education (Right Understanding, Relationship and Physical Facility)
Lecture 2: Understanding Value Education
Lecture 3: Self-Exploration as the Process for Value Education
Lecture 4: Continuous Happiness and Prosperity – the Basic Human Aspirations
Lecture 5: Happiness and Prosperity – Current Scenario

UNIT II HARMONY IN THE HUMAN BEING 6 hours

Lecture 6: Understanding Human being as the Co-existence of the self and the body
Lecture 7: The body as an Instrument of the self
Lecture 8: Understanding Harmony in the self
Lecture 9: Harmony of the self with the body
Lecture 10: Programme to ensure self-regulation and Health

UNIT III HARMONY IN THE FAMILY AND SOCIETY 6 hours

Lecture 11: Harmony in the Family – the Basic Unit of Human Interaction
Lecture 12: 'Trust' – the Foundational Value in Relationship
Lecture 13: 'Respect' – as the Right Evaluation
Lecture 14: Other Feelings, Justice in Human-to-Human Relationship
Lecture 15: Understanding Harmony in the Society

UNIT IV HARMONY IN THE NATURE/EXISTENCE 6 hours

Lecture 16: Understanding Harmony in Nature
Lecture 17: Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature
Lecture 18: Realizing Existence as Co-existence at All Levels
Lecture 19: The Holistic Perception of Harmony in Existence

UNIT V IMPLICATIONS OF THE HOLISTIC UNDERSTANDING – A LOOK AT PROFESSIONAL ETHICS 6 hours

Lecture 20: Natural Acceptance of Human Values
Lecture 21: Definitiveness of (Ethical) Human Conduct
Lecture 22: Competence in Professional Ethics
Lecture 23: Holistic Technologies, Production Systems and Management Models-Typical Case Studies
Lecture 24: Strategies for Transition towards Value-based Life and Profession

Course Outcomes:

After completing this Unit, students will be able to
CO1: Understand the basic human aspiration and Natural Acceptance.
CO2: Aware of themselves and self-regulation.
CO3: Recognize human-human relationship (Justice) and identify human goals in society.
CO4: Appreciate the harmony in nature and existence.
CO5: Develop as socially and ecologically responsible engineers in handling problems with sustainable solutions (user-friendly and eco-friendly).

Text Book(s)

1. R R Gaur, R Asthana, G P Bagaria, *A Foundation Course in Human Values and Professional Ethics*, 3rd Revised Edition, UHV Publications, Sarva Shubha Nyas, Kanpur, 2023. ISBN: 978-81-957703-7-3 (Printed Copy) ISBN: 978-81-957703-6-6 (e-book)
2. R R Gaur, R Asthana, G P Bagaria, *Teachers' Manual for a Foundation Course in Human Values and Professional Ethics*, 3rd Revised Edition, UHV Publications, Sarva Shubha Nyas, Kanpur, 2023.

Reference Books

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book), Annie Leonard, Free Press, 2010.
4. The Story of My Experiments with Truth, Mohandas Karamchand Gandhi, Fingerprint! Publishing
5. Small is Beautiful - E. F Schumacher, Random House, 2011.
6. Slow is Beautiful - Cecile Andrews, New Society Publishers, 2006.
7. Economy of Permanence - J C Kumarappa
8. Vivekananda - Romain Rolland

Online Resources:

1. https://fdp-si.aicte-india.org/index.php
2. https://onlinecourses.swayam2.ac.in/aic22_ge23/preview
3. https://uhv.org.in/
4. https://www.youtube.com/@UniversalHumanValues/playlists
5. https://www.youtube.com/@mitsmadanapalle3058/playlists

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

B. Tech I Year I Semester

25BAMATTC01 ENGINEERING CALCULUS

L	T	P	C
3	0	0	3

Pre Requisites: Mathematics at Intermediate or Equivalent Level

Course Description:

The course introduces the concepts of single variable and multivariable calculus with the view of its applications in various engineering fields. It prepares the students to develop various methods of finding derivatives and integrals; understanding of concepts related to continuous functions and enrich their experience in critical analysis.

Course Objectives:

1. To acquire knowledge on fundamental principles of differential calculus and polar graphing.
2. To develop proficiency in definite integrals, their applications and improper integrals.
3. To familiarize the knowledge of limit, continuity, partial derivatives, extreme values in multivariable functions.
4. To emphasize the role of double and triple integrals in dealing with area and volume of the regions.
5. To illustrate various techniques to compute line, surface and volume integrals in vector calculus.

UNIT I DIFFERENTIAL CALCULUS & POLAR GRAPHING 9 hours

Rolle's Theorem, Mean value theorems, Indeterminate forms of Limits, Taylor and Maclaurin series, Polar coordinates, Polar Graphing.

UNIT II INTEGRAL CALCULUS 9 hours

Definite integrals, Applications of definite integrals to evaluate area and lengths of curves (polar and parametric), volume and surface area of revolutions (polar and parametric), Beta and Gamma functions

UNIT III MULTIVARIABLE DIFFERENTIAL CALCULUS 9 hours

Functions of severable variables, Limits, Continuity, Partial derivatives, Chain rule, Directional derivative and gradient vectors, Extreme values and Saddle points, Constrained maxima and minima, Lagrange multipliers.

UNIT IV MULTIVARIABLE INTEGRAL CALCULUS 9 hours

Multiple Integrals: Double integrals (Cartesian and polar), Reversing the order of integration (Cartesian), Change of integrals (Cartesian to polar), triple integrals, cylindrical and spherical coordinates, Jacobian, Substitutions in Multiple Integrals.

UNIT V MULTIVARIABLE VECTOR CALCULUS 9 hours

Line Integrals-work, circulation, flux; curl and divergence, Green's theorem (without proof), surface Integral, Stokes' and Divergence theorems (without proofs).

Course Outcomes:

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

CO1: Apply the mean value theorems, series expansions and tracing the polar curves in engineering.

CO2: Utilize the definite integrals, Beta and Gamma functions to determine length and underlying area of curves.

CO3: Evaluate the rates of change in time and space variables through the analysis of multivariable functions in engineering.
CO4: Compute multiple integrals in various coordinate systems for engineering applications.
CO5: Employ vector calculus operators and theorems to analyze integrals over curves, surfaces, and volumes**.**

Text Books:

1. George B. Thomas, Maurice D. Weir, Joel R. Hass, Thomas' Calculus, Pearson Education 12th Edition, 2014.
2. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 42th Edition, 2012.

Reference Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, 9th Edition, 2006.
2. B.V. Ramana, Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
3. R.K. Jain, S.R.K. Iyengar, Advanced Engineering Mathematics, Alpha Science International Ltd. 4th Edition, 2014.
4. Michael D. Greenberg, Advanced Engineering Mathematics, Prentice Hall, 2nd Edition, 1998.
5. Stanley J. Miklavcic, An Illustrative Guide to Multivariable and Vector Calculus, Springer, 2019.

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

B. Tech I Year I Semester

25BAPHYTC01 ENGINEERING PHYSICS

L	T	P	C
3	0	0	3

Pre Requisites: Plus two level physics courses

Course Description:

This course provides foundational physics concepts for students in electrical, mechanical, and civil engineering. It covers oscillations and waves, wave optics, quantum mechanics, semiconductors, lasers, and the dielectric and magnetic properties of materials, with an emphasis on applications in modern science and technology.

Course Objectives:

1. Understand oscillations, wave equations, and their applications in engineering systems.
2. Apply principles of interference, diffraction, and polarization in material testing and optical devices.
3. Explain fundamental quantum mechanics concepts and free electron theory for materials.
4. Analyze semiconductor physics and laser operation for scientific and industrial applications.
5. Understand the dielectric and magnetic properties of materials for modern technological use.

UNIT I WAVES AND OSCILLATIONS 9 hours

Simple harmonic motion, damped harmonic oscillations, forced harmonic oscillations, resonance, and quality factor. Transverse waves, one-dimensional wave equation, solution for wave equation, velocity of a transverse wave along a stretched string, modes of vibration of stretched string, standing waves, standing wave ratio, applications (shock absorbers, seismograph, and musical instruments: discussion only).

UNIT II OPTICS 9 hours

Superposition of waves, Young's double slit experiment, Newton's rings experiment. Diffraction, Farunhofer diffraction due to a single slit, double slit and Diffraction grating (N-slit) (Qualitative). Polarization, Types of Polarization, Polarization by reflection, refraction and double refraction, Nicol's prism, Half-wave and Quarter-Waveplates.

UNIT III QUANTUM MECHANICS & FREE ELECTRON THEORY 9 hours

de-Broglie's hypothesis, Uncertainty principle (Qualitative only), Postulates of quantum mechanics, Schrodinger wave equations, particle in a box.

Free electron theory (drift velocity and electrical conductivity), Fermi energy level, density of states, Origin of energy bands, Classification of solids.

UNIT IV SEMICONDUCTORS and LASERS 9 hours

Semiconductors: direct & indirect band gap, intrinsic and extrinsic types, carrier density and Fermi level variation, p-n junction diode, drift & diffusion currents, Hall effect.

Lasers: spontaneous & stimulated emission, Einstein coefficients, Resonator, Ruby and semiconductor lasers.

UNIT V DIELECTRIC AND MAGNETIC MATERIALS 9 hours

Dielectric polarization, Susceptibility, Dielectric constant and Displacement Vector, Relation between the electric vectors, Electronic, Ionic and Orientation polarizations (Qualitative), Lorentz internal field, Clausius-Mossotti equation.

Magnetic dipole moment, Magnetic susceptibility and permeability, atomic origin of magnetism, Classification of magnetic materials, Domain theory, ferromagnetic hysteresis.

Course Outcomes:

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

CO1: Apply wave equations and principles of oscillation to analyze mechanical and electrical systems.

CO2: Use interference, diffraction, and polarization for testing and optical applications.

CO3: Solve simple quantum mechanical problems and explain free electron behavior in solids.

CO4: Analyze semiconductor properties and laser operation for practical applications.

CO5: Explain the dielectric and magnetic properties of materials and their technological relevance.

Text Books:

1. Engineering Physics – Dr. M.N. Avadhanulu & Dr. P.G. Kshirsagar, S. Chand and Company, 2014.

2. Engineering Physics – K. Thyagarajan, McGraw-Hill Publishers, 2015.

3. Concepts of Modern Physics by Arthur Beiser, 7th Edition, 2017.

Reference Books:

1. H. J. Pain, The physics of vibrations and waves, Wiley, 2006.

2. Physics Vol I & II, Halliday/Resnick/Krane 5th Edition, John Wiley, 2003.

3. B.G. Streetman, “Solid State Electronic Devices”, Prentice Hall of India, 1995.

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

B. Tech I Year I Semester

25BACAITC02 FOUNDATIONS OF ARTIFICIAL INTELLIGENCE

L	T	P	C
2	0	0	2

Pre-Requisites: NIL

Course Description:

This course introduces the fundamentals of Artificial Intelligence (AI) with applications in Civil, Mechanical, and Electrical engineering. Topics include intelligent systems, simple decision-making methods, learning from data, and practical problem-solving examples. Students will also explore the ethical, safety, and societal impacts of AI. The course equips learners with a foundational understanding of AI concepts and its potential role in future engineering practice.

Course Objectives:

1. Provide a basic understanding of Artificial Intelligence concepts.
2. Introduce the idea of machines learning from data.
3. Explain simple decision-making and problem-solving methods.
4. Familiarize students with AI applications in Civil, Mechanical, and Electrical engineering.
5. Create awareness about the ethical and societal impacts of AI.

UNIT I INTRODUCTION TO AI **6 hours**

What is AI? – Examples in daily life – Role of AI in engineering – AI in construction, manufacturing, and power systems – Benefits and limitations.

UNIT II BASICS OF LEARNING FROM DATA **6 hours**

Idea of learning – Examples of AI learning from past experience – Basic introduction to classification and prediction (concept only) – Applications in weather prediction, equipment maintenance, and energy usage forecasting.

UNIT III KNOWLEDGE AND DECISION MAKING **6 hours**

Storing and using information – Simple rules for decision-making – Examples: Traffic signal control, fault detection in machines, monitoring building safety.

UNIT IV INTELLIGENT SYSTEMS **6 hours**

Understanding intelligent machines – Examples of intelligent agents (robots, sensors, smart devices) – How AI systems interact with the environment – Simple real-life problem-solving examples.

UNIT V AI IN PRACTICE AND FUTURE TRENDS **6 hours**

Familiarity with simple AI tools (basic overview only) – AI applications in Civil, Mechanical, and Electrical domains – Safety, ethics, and social impact – Future opportunities in engineering with AI.

Course Outcomes:

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

CO1: Explain the basic concepts and scope of Artificial Intelligence.
CO2: Recognize basic machine learning ideas and their uses in engineering
CO3: Describe simple problem-solving approaches used by intelligent systems.
CO4: Identify AI applications relevant to their engineering field.
CO5: Discuss ethical, safety, and societal considerations in AI use.

Text Books:

1. Wolfgang Ertel, Introduction to Artificial Intelligence, Springer, 2021.

2. Stuart Russell and Peter Norvig, Artificial Intelligence – A Modern Approach, Pearson, 2021 (selected simplified readings).

Reference Books:

1. Elaine Rich, Kevin Knight, and Shivashankar B. Nair, *Artificial Intelligence*, McGraw Hill, 2019.

2. Tom M. Mitchell, *Machine Learning*, McGraw Hill, 2017 (conceptual sections only).

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

B. Tech I Year I Semester

25BAEEETC01 FUNDAMENTALS OF ELECTRICAL ENERGY SYSTEMS

L	T	P	C
3	0	0	3

Pre Requisites: NIL

Course Description:

This course introduces the fundamentals of electrical energy systems, including generation, transmission, distribution, and utilization. It covers both conventional and renewable power generation technologies, with emphasis on sustainability and environmental impact. Students will learn about smart grids, microgrids, and modern trends in power systems, along with the role of electrical engineering materials. The course provides a foundation for understanding traditional systems while preparing students for emerging energy technologies.

Course Objectives:

1. To introduce the fundamentals of electrical energy generation, transmission, and distribution.
2. To provide an overview of conventional and renewable energy generation technologies.
3. To explain the basic principles of energy conversion devices and components used in power systems.
4. To create awareness of emerging trends in modern power systems including smart grids, distributed generation, and energy storage
5. To familiarize students with the properties and applications of conducting, insulating, magnetic, semiconducting, and advanced materials used in electrical energy systems.

UNIT I INTRODUCTION TO ELECTRICAL ENERGY SYSTEMS 9 hours

Definition of electrical energy and power, including concepts like real power, reactive power, and power factor. Understanding the interconnectedness of power generation, transmission, and distribution, and utilization, Introduction to Energy Sources (Conventional- coal, hydro, nuclear and Renewable- solar, wind, biomass). Global and Indian energy scenario. Environmental impact of power generation and the need for sustainable energy solutions.

UNIT II CONVENTIONAL POWER GENERATION SYSTEMS 9 hours

Layout and operation of thermal power plants: boilers, turbines, condensers, coal handling and ash handling systems. Hydro-electric power plants: dams, water reservoirs, turbines, and generators. Nuclear power plants: fission process, nuclear reactors, control rods, shielding, and cooling. Advantages, limitations, and environmental impact of conventional power generation systems. Gas Turbine Power Plant (GTPP): Elements, Types of GTPP, Fuels for GTPP.

UNIT III RENEWABLE ENERGY TECHNOLOGIES 9 hours

Solar energy: photovoltaic (PV) principles, panel characteristics, solar PV systems (stand-alone and grid-connected). Wind energy: wind turbines, types of generators, and performance parameters. Overview of biomass, small hydro, geothermal, and ocean energy systems. Comparative study of renewable energy sources. Challenges in integration of renewable energy with the grid aligning with sustainability goals.

UNIT IV INTRODUCTION SMART GRID AND MICROGRID 9 hours

Smart Grid: Conventional power systems and Smart grid, definition of smart grid, need for smart grid, Smart grid architecture, smart grid domains, enablers of smart grid, Communication architecture and protocols for smart grid.

Concept of Microgrids: Introduction to the concept of microgrid, the overview of the structure and architecture of microgrid with brief control, operational aspects. Till date pilot microgrid projects and their outcomes.

UNIT V ELECTRICAL ENGINEERING MATERIALS IN ENERGY SYSTEMS **9 hours**

Conducting materials: copper, aluminium, silver – conductivity, resistivity, temperature coefficient, applications in busbars, cables, windings, kelvin's law for conductor size calculations. **Insulating materials**: paper, mica, ceramics, polymers – dielectric strength, thermal class, applications in transformers, cables, switchgear. **Magnetic materials:** soft magnetic materials (silicon steel, ferrites) for transformers & machines; hard magnetic materials for permanent magnets. **Semiconducting materials**: Silicon and gallium arsenide - their importance in power electronics and renewable energy integration. **Advanced & smart materials**: nanomaterials, composites, superconductors – brief introduction and future applications in energy systems.

Course Outcomes:

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

CO1: Identify various energy sources and their role in electrical energy generation

CO2: Explain the working principles of conventional and renewable power generation systems

CO3: Describe the functioning of electrical machines and transformers used in power systems

CO4: Outline emerging technologies in smart and sustainable energy systems

CO5: Identify, classify, and select appropriate conducting, insulating, magnetic, semiconducting, and advanced materials for use in generation, transmission, and distribution components of electrical energy systems

Text Books:

1. D.P. Kothari and I.J. Nagrath, *Power System Engineering*, Tata McGraw-Hill
2. B.R. Gupta, *Generation of Electrical Energy*, S. Chand & Company.
3. Olle Ingemar Elgerd, *Electric Energy Systems Theory: An Introduction*, Tata McGraw-Hill Publishing Company Limited, 2005.
4. Muhammad Kamran, *Fundamentals of Smart Grid Systems*, Academic Press, 2022.
5. S.P. Seth and P.V. Gupta, Electrical Engineering Materials, Dhanpat Rai & Sons.

Reference Books:

1. Prabha Kundur, *Power System Stability and Control*, McGraw Hill Education, 2006, 1st Edition.
2. M.V. Deshpande, *Elements of Electrical Power Station Design*, PHI
3. J.B. Gupta, *A Course in Power Systems*, S.K. Kataria & Sons
4. Gilbert M. Masters, *Renewable and Efficient Electric Power Systems*, Wiley-IEEE.
5. Amirnaser Yazdani, Reza Iravani, *Voltage-Sourced Converters in Power Systems: Modeling, Control, and Applications*, John Wiley & Sons Inc, 2010.
6. K. M. Gupta and Nishu Gupta, Advanced Electrical and Electronics Materials: Processes and Applications, Wiley.

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

B. Tech I Year I Semester

25BAENGLC01 PROFESSIONAL COMMUNICATION LABORATORY

L	T	P	C
0	0	2	1

Course Description:

This course enhances proficiency in English communication with emphasis on fluency, accurate pronunciation, and confidence. It develops speaking, listening, reading, and writing skills through structured activities. Learners will also develop competence in composing formal correspondence, reports, presentations and designing effective posters.

Course Objectives:

This course aims to:

1. Enable students to confidently greet others, introduce themselves and others in professional and cross-cultural contexts, and describe their everyday routines, roles, environments, and familiar locations with clarity.
2. Build the skill to narrate past experiences, achievements or memorable events clearly and to articulate professional goals, plans and predictions for the future.
3. Enhance practical communication skills such as making enquiries, requesting, giving directions or offering clarifications, and drafting accurate reports in academic and workplace settings.
4. Strengthening reading and listening skills by engaging with stories to improve comprehension, vocabulary, and critical appreciation.
5. Prepare students to compose formal emails, reports, letters, and to make posters, and deliver presentations using effective English expressions, structures, and style.

Lab Activities

Activities shall include listening tasks and a revisit of grammar, vocabulary, pronunciation, and intonation (wherever required)

1. Introduction to sounds of English, stress and intonation for apt pronunciation
2. Greetings; Introducing oneself and others; conversations
3. Describing a person, place, object, etc.
4. Narrating a personal incident/events
5. Planning/predicting a future event/prospects
6. Skit on enquiring and requesting
7. Roleplays on giving formal/informal instructions and reporting what has been done so far in the lab / general scenario
8. Listening to select video/audio and discussing a favorite part of the story/ documentary in groups.
9. Reading comprehension and reading business emails
10. Writing email, letters/reports
11. Presentations and making posters (online and offline)

Course Outcomes:

Students will be able to:

CO1: Speak English fluently with a good pronunciation in an Indian accent, and confidently handle greetings, introductions, and provide descriptions of their routines, locations, and surrounding objects.

CO2: Narrate stories, incidents, or personal experiences, as well as engage in planning and predicting future possibilities using appropriate English structures.

CO3: Demonstrate effective English communication by asking questions, making polite requests, giving instructions, and presenting reports or information clearly.

CO4: Apply listening and reading skills for comprehension, interpretation, and language development in both academic and professional contexts.

CO5: Compose grammatically correct and well-structured formal emails, reports, presentations, and business letters, and design posters with clear English expressions.

Text Books:

1. Communicative English – A Workbook by Shobha K.N. & Rayen J. Lourdes (Cambridge University Press, 2019)

Reference Books:

1. Communication Skills: A Workbook by Sanjay Kumar & Pushp Lata (Oxford University Press, 2019)
2. ELCS Lab Manual: A Workbook for CALL and ICS Lab Activities (Board of Editors, Orient Black Swan Pvt. Ltd., 2016)
3. English Language Skills: A Practical Approach by Veerendra Mishra et al. (Cambridge University Press, 2020)

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

B. Tech I Year I Semester

25BAPHYLC01 PHYSICS LABORATORY

L	T	P	C
0	0	2	1

Pre-requisites: Plus two physics knowledge

Course Description:

This course offers a comprehensive exploration of fundamental physics principles through a series of well-designed experiments, emphasizing both conceptual understanding and hands-on measurement techniques.

Course Objectives:

1. To experimentally analyze and quantify optical phenomena such as interference, diffraction, and polarization, using techniques like Newton's rings, single slit, and diffraction grating.
2. To determine and understand essential material and electronic properties, including energy gap in semiconductors and the mechanical strength of materials using specialized methods.
3. To measure and interpret magnetic and electromagnetic characteristics by studying B-H curves, magnetic fields, and resonance phenomena in electrical circuits.
4. To estimate fundamental physical constants such as Planck's constant and the charge-to-mass ratio of an electron using classical experimental setups.
5. To develop skills in conducting precise experimental investigations, analyzing data, and deriving key physical quantities relevant to modern physics and engineering applications.

List of Experiments:

1. Determination of radius of curvature of a given Plano-convex lens by Newton's rings.
2. Determination of wavelengths of different spectral lines in mercury spectrum using diffraction grating in normal incidence configuration.
3. To determine the slit width (d) using the diffraction pattern produced by a single slit.
4. To determine the Brewster's angle and refractive index of a glass.
5. Determination of Frequency of electrically maintained tuning fork by Melde's experiment.
6. Study the variation of B versus H by magnetizing the magnetic material (B-H curve).
7. Determination of wavelength of Laser light using diffraction grating.
8. Determination of energy gap of a semiconductor using p-n junction diode.
9. Magnetic field along the axis of a current carrying circular coil by Stewart Gee's Method.
10. Determination of young's modulus for the given material of wooden scale by non-uniform bending (or double cantilever) method.
11. Estimation of Planck's constant using photoelectric effect.
12. Determination of numerical aperture and acceptance angle of an optical fiber.
13. To study the frequency response of series LCR circuit-resonance frequency, band width and quality factor.
14. To find the charge to mass ratio of an electron using Thomson's method.

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

Course Outcomes:

Students will be able to

CO1: Know the various phenomena of light practically and gain knowledge about various optical technique methods.

CO2: Verify the theoretical concepts of optics, magnetism, waves and oscillations by hands on experiment.

CO3: Apply the scientific process in the conducting of experiments and report the experimental findings.

CO4: Understand mechanical phenomena by instruments and apply them in real time applications.

CO5: Acquire and interpret experimental data to examine the physical laws.

Text / Reference Books:

1. A Textbook of Practical Physics - S. Balasubramanian, M.N. Srinivasan, S. Chand Publishers, 2017.
2. Engineering Physics Laboratory Manual, Jayaraman, 2013, Pearson Education.
3. A Course of Experiments with He-Ne Lasers, R.S. Sirohi, New Age International (P) limited, Publishers, 1985.

Web Resources: www.vlab.co.in
https://phet.colorado.edu/en/simulations/filter?subjects=physics&type=html,prototype

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

B. Tech I Year I Semester

25BACSELC04 PROBLEM SOLVING USING PYTHON LABORATORY

L	T	P	C
0	0	4	2

Pre Requisites:

Course Description:

This course introduces fundamental concepts of problem-solving using Python, with a specific focus on its application in engineering. It equips students with the skills to use Python's core libraries like NumPy, Pandas, and Matplotlib, to analyze, visualize, and interpret engineering datasets. The curriculum emphasizes computational thinking and hands-on laboratory exercises to process data, identify trends, and develop automated solutions for engineering problems.

Course Objectives:

1. Understand essential concepts of Python programming and its role in engineering
2. Demonstrate proficiency in numerical operations and data analysis using NumPy and Pandas.
3. Apply Python to process, visualize, and interpret engineering datasets.
4. Develop skills in reading, writing, and visualizing tabular data for civil and mechanical engineering contexts
5. Foster computational thinking and logical problem-solving through hands-on labs

List of Experiments:

Experiment 1: Python Fundamentals and Lab Setup: Basics of Python, installation, IDE setup, variables, types, Input/output, arithmetic operations.

Experiment 2: Working with Strings: String creation, indexing, slicing, methods, formatting.

Experiment 3: Control Flow and Conditional Logic: Conditionals, Boolean logic, if/elif/else, comparisons

Experiment 4: Iterative Operations with Loops: For, while, range( )

Experiment 5: Functions for Modular Programming: Defining, calling, parameters, returns

Experiment 6: Storing Data with Lists: Creation, indexing, slicing, methods. Storing measurement data.

Experiment 7: Dictionaries for Data Organization: Key-value pairs, operations.

Experiment 8: Tuples & Sets + Review: Tuples (immutable), sets (unique).

Experiment 9: File Handling: Read/write text, CSV files.

Experiment 10: Error Handling: try/except for robust input and processing.

Experiment 11: Introduction to NumPy: Arrays, indexing, vectorized operations.

Experiment 12: Pandas for Data Analysis: Creating Data Frames, indexing, selection.

Experiment 13: Data Cleaning and Manipulation with Pandas: Handling NaN values, filtering, sorting.

Experiment 14: Data Aggregation with Pandas: groupby, aggregation, statistics

Experiment 15: Matplotlib for Visualization: Customization (colors, markers) & Subplots

Experiment 16: Advanced Visualization with Matplotlib: Advanced visualization technique (Histograms, Scatter, Pie Charts)

Experiment 17: Integrated Data Analysis & Visualization: Combine Pandas & Matplotlib for engineering reports

Course Outcomes:

Students will be able to:

CO1: Recall basic Python syntax, fundamental data types, and common libraries (NumPy, Pandas).

CO2: Demonstrate control flow, functions, and basic file/data operations for solving engineering problems.

CO3: Apply NumPy arrays and Pandas DataFrames for numerical computations and engineering data analysis.

CO4: Analyze engineering data to identify trends and summarize results using visualization.

CO5: Evaluate and compare different approaches (e.g., arrays vs. lists, manual vs. automated analysis) for typical engineering tasks.

Text Books:

1. Python for Everybody: Exploring Data in Python 3 by Charles Severance, 2016.
2. Automate the Boring Stuff with Python: Practical Programming for Total Beginners by Al Sweigart, 3rd Edition 2025.
3. Think Python: How to Think Like a Computer Scientist by Allen B. Downey, 2nd Edition 2016.
4. Python for Science and Engineering (Online PDF)

References:

1. Official Python Documentation – docs.python.org
2. NumPy Documentation – numpy.org
3. Pandas Documentation – pandas.pydata.org
4. Matplotlib Documentation – matplotlib.org

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

B. Tech I Year I Semester

25BACOMLC01 ENGINEERING SKILLS LABORATORY

L	T	P	C
0	0	2	1

Pre-Requisites Nil

Course Description:

This course provides hands-on experience in using basic electrical/electronic instruments and circuit design. and to develop practical skills in microcontroller programming and device interfacing for real-time applications. And provides hands-on training in fundamental manufacturing and fabrication processes used in mechanical engineering. Students will develop practical skills through activities such as sheet metal product development, plastic fabrication, 3D printing, woodwork using carpentry tools, laser engraving, and metal welding. The course also introduces the operation and applications of various mechanical power tools, CNC lathe, and milling machines, enabling learners to gain exposure to modern and traditional manufacturing techniques.

Course Objectives:

By the end of this course, the student will be able to:

1. To provide hands-on experience in using basic electrical/electronic instruments and circuit design.
2. To develop practical skills in microcontroller programming and device interfacing for real-time applications.
3. Provide hands-on experience in basic fabrication processes using sheet metal, plastics, wood, and welding to develop simple utility products.
4. Familiarize students with modern manufacturing technologies such as 3D printing, CNC machining, and laser engraving for product realization.
5. Enable students to understand, identify, and safely operate various mechanical engineering tools and equipment for engineering applications.

PART – A

Study Experiments:

1. Familiarization with Instrumentation and Tools
2. Understanding the microcontroller architecture and Programming

Choose any six from the following list of experiments:

1. Clock Pulse Generation and Signal Analysis using Digital Storage Oscilloscope (DSO).
2. Measurement of Electrical Power, Power Factor, and Energy using Portable Meters.
3. Study, Design and Testing of Full-Wave Bridge Rectifier Circuit.
4. Study, Design and Implementation of a SMPS.
5. Study, Design and Testing of Multiplexer using Logic Gates.
6. Interfacing of 7-Segment Display, Buzzer, Sensor with microcontroller.
7. Speed and Angle Control of Servo Motor using Microcontroller.
8. PCB Soldering Techniques and Testing Using a Multimeter.

Content Beyond the Syllabus (Virtual Laboratory)

9. Familiarisation of ICs.
10. Application of basic logic gates in fire and burglar alarms.
11. Wiring of a simple circuit for controlling

    (1) a lamp/fan point,
    (2) a staircase or corridor winding,
    (3) an electrical appliance (16A socket).

PART – B

List of Experiments:

1. Utility product development using sheet metal.
2. Plastic product fabrication.
3. 3D printing of simple components.
4. Wood product fabrication using carpentry tools.
5. LASER engraving.
6. Metal welding and fabrication.
7. Study of different mechanical engineering power tools.
8. Study of CNC Lathe and Milling machining processes.

Content beyond Syllabus

9. Plumbing
10. Computer Controlled Cutting of wooden object
11. 3D Machining

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

CO1: Demonstrate soldering, measurement, and testing techniques using basic electrical/electronic instruments.

CO2: Design and implement simple circuits and microcontroller-based applications for power and control systems

CO3: Demonstrate the ability to fabricate simple components using sheet metal, wood, and welding processes.

CO4: Analyze and compare traditional and modern manufacturing techniques such as 3D printing, CNC machining, and laser engraving.

CO5: Select and operate appropriate hand tools, power tools, and machine tools for given product development tasks with safety considerations.

Text Books:

1. R. S. Sedha, A Textbook of Applied Electronics, S. Chand & Company Ltd.
2. Muhammad Ali Mazidi, The 8051 Microcontroller and Embedded Systems, Pearson Education.

3. V. Ramesh Babu, Engineering Workshop practice for JNTU, VRB Publishers Pvt. Ltd. 2023.
4. A. K. Sarathe, Engineering Workshop Practice, 1st edition, Khanna Book Publishers, 2022
5. Lab manual provided by the departments.

Reference Books:

1. Boylestad & Nashelsky, Electronic Devices and Circuit Theory, Pearson Education.
2. David A. Bell, Electronic Instrumentation and Measurements, Oxford University Press.
3. The Art of Electronics by Paul Horowitz and Winfield Hill, Cambridge University Press.
4. Sanjay Gupta & Santosh Gupta, SMPS: Switch Mode Power Supply, Technical Publications.
5. Boylestad & Nashelsky, Electronic Devices and Circuit Theory, Pearson Education.
6. P.Kannaiah, K.L.Narayana, Workshop Manual, 2nd Edition, SciTech Publishers, 2009.
7. K.C. John, Mechanical Workshop Practice, 2nd edition, Kindle Edition, 2010.
8. https://fab-coep.vlabs.ac.in/

Mode of Evaluation: Continuous Internal Evaluation, Model Test and End Semester Examination.

I Year II Semester

B. Tech I Year II Semester

25BAMATTC03 LINEAR ALGEBRA AND DIFFERENTIAL EQUATIONS

L	T	P	C
3	0	0	3

Pre Requisites: 25BAMATTC01

Course Description:

This course provides an introduction to Linear Algebra and Differential Equations with applications in science and engineering. Topics include matrices, systems of equations, eigenvalues and eigenvectors, methods for solving first and second order differential equations, Laplace transforms, and partial differential equations with applications to wave and heat equations.

Course Objectives:

1. To solve the system of linear equations, eigenvalues and eigenvectors.
2. To formulate and solve first order ordinary differential equations.
3. To solve second order differential equations of various kinds.
4. To introduce Laplace Transforms methods for solving ordinary differential equations.
5. To obtain the solutions of partial differential equations representing initial and boundary value problems in engineering.

UNIT I LINEAR ALGEBRA 9 hours

Introduction to matrices -Rank and inverse of a matrix - system of linear equations, Eigenvalues and Eigenvectors, diagonalization of matrices, Cayley-Hamilton theorem (without proof).

UNIT II FIRST ORDER ORDINARY DIFFERENTIAL EQUATIONS 9 hours

Introduction - General Remarks on Solutions, Families of Curves, Orthogonal Trajectories, Homogeneous Equations, Exact Equation, Integrating Factors, Linear differential equations and Bernoulli's equation.

UNIT III SECOND ORDER ORDINARY DIFFERENTIAL EQUATIONS 9 hours

Introduction of second order linear differential equations - General solution of the homogeneous equation, Homogeneous equation with constant coefficients, Euler's equi-dimensional equation, Wronskian, Method of variation of parameters, Operator methods for finding particular solutions.

UNIT IV LAPLACE TRANSFORMS 9 hours

Laplace Transform, Inverse Laplace transform, Convolution theorem, applications to solve Integral equations and ordinary differential equations.

UNIT V PARTIAL DIFFERENTIAL EQUATIONS 9 hours

Definition and formulation of partial differential equations, Eigenvalues and Eigenfunctions, method of separation of variables, one dimensional wave equation; One dimensional heat flow, solution of the heat equation.

Course Outcomes:

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

CO1: Solve the system of linear equations and obtain the Eigenvalues and Eigenvectors.

CO2: Solve the first order ordinary differential equations.

CO3: Apply the knowledge of identifying, formulating and solving engineering problems represented by second order differential equations.

CO4: Analyze the Laplace Transforms and apply Laplace Transforms to solve ordinary differential equations in engineering.

CO5: Represent the relevant engineering system into pertinent partial differential equation, solve it and interpret the results.

Text Books:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 42nd Edition, 2012.

2. Simmons G.F., Differential Equations with Applications and Historical Notes, Tata McGraw Hill Edition 2003, Eighteenth reprint 2010.

Reference Books:

1. George B. Thomas, Maurice D. Weir, Joel R. Hass, Thomas' Calculus, Pearson Education 12th Edition, 2014.

2. Linear Algebra with Applications, Gareth Williams, Jones & Bartlett Learning, 9th Edition, 2018.

3. Jin Ho Kwak and Sungpyo Hong, Linear Algebra, Birkhaüser, Second edition, 2004.

4. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, 9th Edition, 2006.

5. William E. Boyce., Richard C. Diprima., Elementary Differential Equations and Boundary Value Problems, John Wiley & Sons, Inc., 7th Edition, 2001.

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

B. Tech I Year II Semester

25BACHETC01 ENGINEERING CHEMISTRY

L	T	P	C
3	0	0	3

Pre Requisites: Intermediate Level

Course Description:

This course introduces essential concepts of chemistry relevant to civil and mechanical engineering, including water treatment, electrochemistry, corrosion, polymers, fuels, modern engineering materials, and nanomaterials. Students will learn the principles, properties, and applications of these materials and processes in engineering practice, emphasizing practical solutions for industrial and environmental challenges.

Course Objectives:

1. To familiarize engineering chemistry and its applications
2. To impart the concept of soft and hard waters, softening methods of hard water
3. To train the students on the principles and applications of electrochemistry, polymers, nanomaterials, and cement

UNIT I WATER TECHNOLOGY 9 hours

Specifications for drinking water as per BIS and WHO standards

Impurities present in water:- Types of hardness, units of hardness, disadvantages of hardness of water, Estimation of hardness of water by EDTA Method, Alkalinity, Estimation of dissolved Oxygen

Boiler troubles –Priming, foaming, scale and sludge, Caustic embrittlement,

Industrial water treatment:– Ion-exchange processes, desalination of brackish water by reverse osmosis (RO), electrodialysis.

UNIT II ELECTROCHEMISTRY AND CORROSION 9 hours

Electrodes –electrochemical cell, Nernst equation, cell potential calculations.

Super capacitors – Classifications & applications

Batteries- classification, Primary cells – Zinc-air battery, Secondary cells – lithium-ion batteries-working principles including cell reactions; Fuel Cells-Basic Concepts, the principle and working of hydrogen-oxygen Fuel cell.

Corrosion: Introduction to corrosion, differential aeration cell corrosion, galvanic corrosion, Factors affecting the corrosion, cathodic and anodic protection, electroplating (Nickel and Copper) and electroless deposition. Surface Coating on thin films.

UNIT III POLYMERS AND FUEL CHEMISTRY 9 hours

Introduction to polymers, types of polymerizations, Thermoplastics and Thermo-setting plastics-: Preparation, properties and applications of Teflon, PVC, Nylon 6,6 and Bakelite. Elastomers – Preparation, properties and applications of Buna S, Buna N.

Biodegradable polymers – PLA & PGA

Fuels: Types of fuels, calorific value of fuels, numerical problems based on calorific value; Analysis of coal (Proximate and Ultimate analysis), Liquid Fuels, refining of petroleum, Octane and Cetane number-alternative fuels- biodiesel.

UNIT IV MODERN ENGINEERING MATERIALS 9 hours

Composites- Definition, Constituents, Classification- Particle, Fibre and Structural reinforced composites, properties and Engineering applications

Lubricants- Classification, Functions of lubricants, Mechanism, Properties of lubricating oils– Viscosity,

Viscosity Index, Flash point, Fire point, Cloud point, saponification number.
Building materials- Portland Cement, constituents, Setting and Hardening of cement (with chemical reactions).

UNIT V NANOMATERIALS AND SUPERCONDUCTORS 9 hours

Nanomaterials: Introduction, classification (Material based), properties (Electrical, catalytic, magnetic, mechanical, super conducting, optical) and applications of Nano materials (nano particles, nano tubes, nano wires, nano composites, dendrimers); synthesis of Nanomaterials – Sol-gel process and precipitation method.
Super Conductors: Introduction, basic concept (BCS Theory), Classification Properties and applications.

Course Outcomes:

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

CO1: Explain the estimation of impurities present in water like hardness, alkalinity and softening of impure water.
CO2: Explain the working principles of batteries & demonstrate the corrosion prevention methods and factors affecting corrosion
CO3: Explain the preparation, properties, and applications of thermoplastics, thermosetting, elastomers, conducting polymers & explain calorific values, octane number, refining of petroleum and cracking of oils.
CO4: Explain the setting and hardening of cement, properties of composites and lubricants.
CO5: Summarize the properties & applications of super conductors and nanomaterials.

Text Books:

1. Jain and Jain, Engineering Chemistry, 16/e, DhanpatRai, 2013.
2. Peter Atkins, Julio de Paula and James Keeler, Atkins' Physical Chemistry, 10/e,Oxford University Press, 2010.
3. G V Subba Reddy, K N Jayaveera, C Ramachandraiah, Engineering Chemistry, McGraw-Hill;First Edition, 2019.

Reference Books:

1. H.F.W. Taylor, Cement Chemistry, 2/e, Thomas Telford Publications, 1997.
2. D.J. Shaw, Introduction to Colloids and Surface Chemistry, Butterworth-Heineman, 1992.
3. Textbook of Polymer Science, Fred W. Billmayer Jr, 3rd Edition

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

B.Tech I Year II Semester

25BACIVTC02 INTRODUCTION TO ENVIRONMENT AND SUSTAINABILITY

		L	T	P	C
Pre-Requisites:	None	**2**	**0**	**0**	**2**

Course Description:

This course provides foundational knowledge of environmental systems, biodiversity, and sustainability. It addresses major environmental challenges like pollution and climate change, and introduces students to key policies, global sustainability frameworks, and sustainable engineering practices.

Course Objectives:

1. Understand the interdependence between environmental system and human well-being.
2. Analyze key environmental issues including pollution, climate change, and resource degradation.
3. Interpret environmental laws, standards, and global sustainability agreements.
4. Evaluate sustainability frameworks and the role of engineering in achieving development goals.
5. Apply sustainable engineering principles to address real-world environmental challenges.

UNIT I ENVIRONMENTAL SYSTEMS 6 hours

Definition, scope, and importance of environment - Components of ecosystem: biotic and abiotic - Energy flow in ecosystems (food chains, food webs) - Biogeochemical cycles: Water, Carbon, Nitrogen - Biodiversity: definition, values, and threats - Overview of natural resources: renewable vs. non-renewable

UNIT II ENVIRONMENTAL CHALLENGES 6 hours

Pollution: definition, types (Air, Water, Soil, Noise) - Causes, effects, and basic control measures - Urbanization – Land degradation - Solid and E-waste management –- Climate change, global warming, greenhouse effect - Ozone depletion and carbon footprint

UNIT III ENVIRONMENTAL POLICIES 6 hours

Overview of ISO 14001:2015 - Roles of CPCB, SPCBs, and NGT - Key environmental acts (Air, Water, Forest, Wildlife) - International agreements: Montreal, Kyoto, Paris Agreement - Basics of Environmental Impact Assessment (EIA) - Introduction to carbon credit and energy auditing

UNIT IV SUSTAINABILITY GOALS 6 hours

Foundations of Sustainability- Definition, Concept, needs and challenges- principles of sustainability - Evolution of Global Sustainability Frameworks - Agenda 21, millennium development goals, and protocols - Sustainable Development Goals - targets, indicators – Role of engineering and technology in achieving SDGs

UNIT V SUSTAINABLE ENGINEERING APPROACHES 6 hours

Introduction to Sustainability in Engineering - Guiding principles and Frameworks for sustainable engineering – Sustainability approaches - Triple bottom Line, Cradle to Cradle concept - Life cycle assessment - Zero waste and R concept - Circular economy - ISO 14000 Series

Course Outcomes:

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

CO1: Recommend ecofriendly solution to protect ecosystem.
CO2: Identify appropriate pollution control methods for specific situations.
CO3: Demonstrate the use of renewable energy for sustainable development.
CO4: Apply techniques to reduce environmental impact from climate change.
CO5: Utilize environmental laws and policies to promote sustainable practices.

Text Books:

1. R. L. Rag and Lekshmi Dinachandran Remesh. Introduction to Sustainable Engineering. 2nd Edition,PHI Learning Pvt. Ltd., 2016.
2. Singh, J.S., Singh, S.P. and Gupta, S.R. 2014. Ecology, Environmental Scienceand Conservation. S. Chand Publishing, New Delhi.
3. **Masters, Gilbert M. & Ela, Wendell P.** – *Introduction to Environmental Engineering and Science*, Pearson Education, 3rd Edition, 2013
4. Bradley. A.S; Adebayo,A.O., Maria, P. Engineering applications in sustainable design and development,Cengage learning
5. Allen, D. T. and Shonnard, D. R., Sustainability Engineering: Concepts, Design and Case Studies,Prentice Hall
6. Richard T. Wright, Dorothy F. Boorse (2017) Environmental Science: Toward A Sustainable Future,Pearson, 13th Edition

Reference Books:

1. R.C. Sohal & S.K. Agrawal – *Environmental Studies*, University Science Press, 2018.
2. Erach Bharucha – *Textbook of Environmental Studies for Undergraduate Courses*, University Grants Commission, 2nd Edition, 2013.
3. Peavy, H.S., Rowe, D.R. & Tchobanoglous, G. – *Environmental Engineering*, McGraw Hill Education, 2017.
4. R.K. Trivedi & P.K. Goel – *An Introduction to Air Pollution*, B.S. Publications, 2015.
5. Harris, Frances (2012) Global Environmental Issues, 2nd Edition. Wiley-Blackwel
6. Rajagopalan, R. (2011). Environmental Studies: From Crisis to Cure. India: Oxford University Press.
7. Leelakrishnan, P. (2022). *Environmental law in India* (Vol. 1). LexisNexis.
8. Ghosh, S. (Ed.). (2019). *Indian environmental law: Key concepts and principles*. Orient BlackSwan.

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

B.Tech I Year II Semester

25BAEEETC02 BASIC ELECTRICAL AND ELECTRONICS ENGINEERING

		L	T	P	C
Pre Requisites:	None	**3**	**0**	**0**	**3**

Course Description:

This course introduces the fundamentals of DC and AC circuits, electrical measurements, and sensors. This course covers the construction, principles, and applications of electrical machines along with essential safety practices. Students can learn about semiconductor devices, their applications in circuits, and basics of digital electronics. The course builds a strong foundation in electrical and electronic engineering concepts for beginners.

Course Objectives:

1. Introduce the basics of DC and AC circuits and power systems.
2. Explain the principles of electrical measurements and sensors.
3. Describe the construction and operation of common electrical machines.
4. Familiarize students with semiconductor devices and their applications.
5. Cover fundamentals of digital electronics and logic circuit design.

UNIT I INTRODUCTION TO DC AND AC CIRCUITS 9 hours

DC Circuits: Basic circuit elements and sources; Ohm's law; Kirchhoff's laws; Series and Parallel connection of circuit elements; Mesh current analysis; Node voltage analysis.
AC Circuits: Alternating voltages and currents, RMS, average, maximum values, Single Phase RL, RC, RLC series circuits, Power in AC circuits, Power Factor, Three-phase balanced systems, Star and delta Connections.

UNIT II MEASURING INSTRUMENTS AND SENSORS 9 hours

Operating Principle – Moving Coil and Moving Iron Instruments, Power Measurement, Energy Meter.Classification and characteristics of Sensors and Transducers; Types: proximity sensors, limit switches, piezoelectric, hall effect, photo sensors, Strain gauge, LVDT, piezo electric crystals, differential pressure transducer, optical and digital transducers, Smart sensors, Thermal Imagers.

UNIT III ELECTRICAL MACHINES AND ELECTRICAL SAFETY 9 hours

Construction, working principle, and applications of DC Machines, Transformers, Three-phase Induction motors, Alternators, Stepper motor, and BLDC motor.
Electrical Safety and Precautions; Fuses and its types; Earthing and its types.

UNIT IV SEMICONDUCTOR DEVICES AND APPLICATIONS 9 hours

Introduction to Semiconductor materials, Characteristics: PN junction diodes, Zener diodes, BJTs; Applications: Rectifiers, Voltage regulator, and Public addressing system.

UNIT V DIGITAL ELECTRONICS 9 hours

Binary arithmetic; Number base conversion; Boolean algebra: simplification of Boolean functions using K-maps; Logic gates; Introduction of basic combinational circuits: Half adder, Full adder; Introduction to sequential circuits; Flip Flops.

Course Outcomes:

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

CO1: Analyse simple DC and AC circuits using fundamental laws.
CO2: Operate measuring instruments and classify sensors used in systems.
CO3: Explain the working and applications of electrical machines and safety devices.
CO4: Apply semiconductor devices in basic power electronic circuits.
CO5: Design simple digital logic circuits using combinational and sequential elements.

Text Books:

1. Kothari DP and Nagrath IJ, "Basic Electrical and Electronics Engineering", McGraw Hill Education, Second Editions, 2020.
2. A.K. Sawhney, Puneet Sawhney 'A Course in Electrical & Electronic Measurements & Instrumentation', Dhanpat Rai and Co, 2015.
3. Bhattacharya SK, "Basic Electrical and Electronics Engineering", Pearson Education, Second Edition,2017
4. R. P. Jain, Modern Digital Electronics, 4th Edition, Tata Mc Graw Hill, 2009

Reference Books:

1. Rajendra Prasad 'Fundamentals of Electrical Engineering', Third Edition, Prentice Hall of India, 2014.
2. Basic Electrical Engineering, D. C. Kulshreshtha, Tata McGraw Hill, 2019, First Edition
3. R. S. Sedha, A Textbook of Electronic Devices and Circuits, S. Chand & Co, 2010.
4. R. L. Boylestad & Louis Nashlesky, Electronic Devices & Circuit Theory, Pearson Education, 2021.

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

B. Tech I Year II Semester

25BAMECTC02 ENGINEERING MECHANICS

L	T	P	C
2	1	0	3

Pre-requisite: Engineering Physics

Course Description:

This course provides a comprehensive introduction to engineering mechanics, covering both statics and dynamics. It begins with the study of force systems, equilibrium of particles and rigid bodies, and progresses to the analysis of pin-jointed trusses. Students will learn concepts of centroid, moments of inertia, and their applications in structural analysis. The course also covers friction, work-energy principles, and the kinematics and kinetics of particles and rigid bodies. Emphasis is placed on problem-solving and applying mechanical principles to real-world engineering situations.

Course Objectives:

This course is designed to:

1. Introduce the principles of mechanics for analyzing forces, moments, and equilibrium in particles and rigid bodies.
2. Develop analytical skills to solve engineering problems involving trusses and supports.
3. Impart knowledge on centroids, center of gravity, and moment of inertia for various geometries.
4. Enable application of friction principles and Work and Energy Principle to practical problems.
5. Apply dynamics principles to solve motion problems using different analytical methods.

UNIT I FORCE SYSTEMS **9 hours**

STATICS OF PARTICLES Introduction to Mechanics - System of Units -Laws of mechanics - Lame's theorem - Parallelogram and triangular Law of forces -Resolution of coplanar forces – Free body diagram - Equilibrium of particles

STATICS OF RIGID BODY: Moment of a force - Varignon's theorem - Moments and Couples - Equivalent system of forces - Requirements of stable equilibrium - Equilibrium of Rigid bodies subjected to two, three and four force system.

UNIT II ANALYSIS OF PIN JOINTED TRUSSES **9 hours**

Classification of trusses -Reactions at supports and connections -Types of loading – Reaction for Simply supported truss, Cantilever truss - Analysis of Trusses using method of joints and methods of sections (Simply supported truss, Cantilever truss).

UNIT III CENTROID AND MOMENTS OF INERTIA **9 hours**

Center of Gravity and Centroid - Area and polar moment of inertia - Radius of Gyration -Parallel and Perpendicular Axis Theorems -Mass Moment of inertia - Problems on centroid and area moment of inertia of plane figures and buildup sections.

UNIT IV FRICTION AND WORK PRINCIPLES **9 hours**

Classification of friction, Laws of friction, Angle of repose, Force required to move a body along horizontal and inclined planes, Analysis of ladder, wedge, and belt friction. Work of a Force, Kinetic Energy of a Particle, Principle of Work and Energy.

UNIT V DYNAMICS OF PARTICLES AND RIGID BODIES **9 hours**

Kinematics - Rectilinear Motion and Curvilinear Motion of Particles. Kinetics- Newton's Second Law of Motion - Equations of Motions, Dynamic Equilibrium, Energy and Momentum Methods – Kinematics of Rigid Bodies and Plane Kinetics.

Course Outcomes:

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

CO1: Understand and apply fundamental principles of statics to particles and rigid bodies (L4).
CO2: Analyze trusses and determine forces in members (L4).
CO3: Calculate centroids, centers of gravity, and moments of inertia for various shapes (L4).
CO4: Apply friction laws to solve practical engineering problems and apply the work-energy principles on a particle. (L4).
CO5: Apply dynamics principles to solve motion problems by various methods (L4).

Text Books:

1. Beer, F. P., Johnston, E. R., Mazurek, D. F., & Eisenberg, E. R. (2021). *Vector Mechanics for Engineers: Statics and Dynamics* (12th ed.). McGraw Hill.
2. Hibbeler, R. C. (2022). *Engineering Mechanics: Statics and Dynamics* (15th ed.). Pearson Education.

Reference Books:

1. Shames, I. H. (2020). *Engineering Mechanics: Statics and Dynamics*. Pearson.
2. Timoshenko, S., & Young, D. H. (2019). *Engineering Mechanics*. McGraw Hill.
3. Meriam, J. L., & Kraige, L. G. (2020). *Engineering Mechanics: Statics and Dynamics* (9th ed.). Wiley.

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

B. Tech I Year II Semester

25BAMECEC01 ENGINEERING GRAPHICS

L	T	P	C
2	0	2	3

Pre-requisite: None

Course Description:
This course introduces the fundamentals of Engineering Graphics and its applications, with hands-on practice using AutoCAD and Autodesk Fusion 360. It covers orthographic projection of points, lines, planes, and solids, including sectional views and surface developments. Students will learn to interpret and convert between isometric and orthographic views, as well as perform simple 2D drawings and 3D modelling. The course emphasizes visualization skills and technical drawing practices essential for engineering design and communication.

Course Objectives:
This course is designed to:

1. Provide fundamental knowledge of engineering graphics and its applications in design and communication.
2. Develop skills in orthographic projections of points, lines, planes, and solids.
3. Enable students to visualize and represent sections and development of engineering solids.
4. Familiarize students with isometric and orthographic views and their interconversion.
5. Introduce computer-aided design (AutoCAD and Autodesk Fusion 360) for 2D drafting and simple 3D modelling.

UNIT I INTRODUCTION **12 hours**

Introduction to Engineering Graphics and its Applications. Introduction to AutoCAD commands. Types of Lines, Dimensioning and Geometrical Constructions, Simple 2D drawings using AutoCAD.

UNIT II PROJECTIONS OF POINTS & LINES **12 hours**

Projection of points: Orthographic projections, notation system, positions and projection of points in four quadrants.
Projection of lines: Positions and projection of lines (inclined to one plane, HP/VP).

UNIT III PROJECTIONS OF PLANES & SOLIDS **12 hours**

Projection of planes: Positions and projection of planes (inclined to two planes, HP and VP).
Projection of solids: Projections of regular solids. (resting on HP and axis inclined to HP only).

UNIT IV SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES **12 hours**

Section of solids: Sectional view of regular solids (cutting plane inclined to HP) and its true shapes.
Development of Surfaces: Development of surfaces of regular solids (Prism and Pyramid only).

UNIT V ISOMETRIC, ORTHOGRAPHIC VIEWS AND SIMPLE 3D MODELLING **12 hours**

Conversion of isometric views into orthographic views and vice-versa.
3D Modelling: Introduction to 3D modelling. Simple 3D modelling using Autodesk Fusion 360. (Software practice only. Not for examination)

Course Outcomes:

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

CO1: Interpret and apply AutoCAD commands to create simple 2D engineering drawings.
CO2: Construct orthographic projections of points, lines, and planes in different quadrants.
CO3: Generate projections of solids, sectional views, and true shapes.
CO4: Develop surface diagrams of prisms and pyramids and apply them to practical applications.
CO5: Convert between isometric and orthographic views and create simple 3D CAD models using Fusion 360.

Text Books:

1. K.L. Narayana & P. Kannaiah, *Engineering Graphics*, 4th Edition, Scitech Publications, 2021.
2. K. Venugopal & V. Prabhu Raja, *Engineering Drawing + AutoCAD*, 7th Edition, New Age International, 2022.
3. Dhananjay A. Jolhe, *Engineering Drawing with an Introduction to AutoCAD*, 5th Edition, McGraw Hill Education, 2023.

Reference Books:

1. N.D. Bhatt & V.M. Panchal, *Engineering Drawing: Plane and Solid Geometry*, 56th Edition, Charotar Publishing House, 2023.
2. Shah, P.J., *Engineering Drawing*, 3rd Edition, Pearson Education, 2021.
3. Agrawal B. & Agrawal C.M., *Engineering Graphics*, 2nd Edition, Tata McGraw Hill, 2020.

Online Learning Resources:

1. National Programme on Technology Enhanced Learning (NPTEL), Engineering Graphics – IIT Kharagpur. Available at: https://nptel.ac.in/courses/11210560
2. Autodesk Education, AutoCAD & Fusion 360 Learning Resources. Available at: https://www.autodesk.com/education/edu-software/overview
3. Coursera, Engineering Drawing and Visualization – Georgia Tech. Available at: https://www.coursera.org/learn/engineering-drawing

Mode of Evaluation: Continuous Assessment, Mid Term Tests and End Semester Examination.

B. Tech I Year II Semester

25BACHELC01 ENGINEERING CHEMISTRY LABORATORY

L	T	P	C
0	0	2	1

Pre Requisites: NIL

Course Description:

This laboratory course provides practical exposure to essential techniques in modern materials, water chemistry, electrochemistry, polymers, and green chemistry. Students will gain hands-on experience in synthesizing nanomaterials and biopolymers, analyzing water and industrial samples, performing electrochemical measurements, and applying analytical methods for real-world engineering applications.

Course Objectives:

1. **To develop** experimental skills in the synthesis and characterization of nanomaterials, conducting polymers, and biopolymers.
2. **To train** students in analytical techniques for water quality assessment, industrial material analysis, and electrochemical measurements.
3. **To promote** environmentally sustainable laboratory practices, including green synthesis and safe handling of chemical materials.

From the following 18 experiments, students are required to perform any 10 using volumetric and/or instrumental methods of analysis. Wherever applicable, modeling software may also be used.

List of Experiments:

1. Preparation of a nanomaterial by precipitation method
2. Determination of Hardness of a groundwater sample
3. Synthesis of polyaniline conducting polymer
4. Estimation of alkalinity of water sample
5. Construction of a Galvanic cell and determination of cell emf & free energy
6. Conductometric titration of strong acid vs strong base
7. Conductometric titration of weak acid vs strong base
8. Electroless deposition of copper from copper sulphate solution
9. Estimation of Dissolved Oxygen by Winkler's method
10. Determination of strength of an acid in Pb-Acid battery
11. Estimation of Calcium in Portland Cement
12. Determination of molecular weight of a polymer by using Ostwald's viscometer
13. Determination of percentage moisture content in a coal sample
14. Estimation of iron in cement by colorimetry
15. Green synthesis of PVA/Starch biopolymer
16. Synthesis of PVA biopolymer
17. Potentiometry - determination of redox potentials and emfs
18. Determination of Saponification value of an oil sample

Course Outcomes:

CO1: Demonstrate the ability to synthesize and characterize nanomaterials, conducting polymers, and biopolymers.

CO2: Accurately determine water quality parameters, including hardness, alkalinity, and dissolved oxygen, using standard laboratory methods.

CO3: Construct and analyze electrochemical cells, perform potentiometric and conductometric titrations, and evaluate redox potentials.

CO4: Apply analytical techniques for the quantitative estimation of industrially relevant materials such as cement, coal, and oils.

CO5: Implement green chemistry principles in laboratory experiments, including biopolymer synthesis and environmentally friendly deposition techniques.

Text / Reference Books:

1. Vogel's Textbook of Quantitative Chemical Analysis – J. Mendham, R.C. Denney, J.D. Barnes & M.J.K. Thomas, 6th Ed., Pearson Education, 2000.

2. Instrumental Methods of Chemical Analysis – B.K. Sharma, 23rd Ed., Goel Publishing House, 2007.

3. S. Choudhury, *Experiments in Nanomaterials, Electrochemistry and Green Chemistry*, Wiley, 2nd Edition, 2013.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

B. Tech I Year II Semester

25BAEEELC01 BASIC ELECTRICAL AND ELECTRONICS ENGINEERING LABORATORY

L	T	P	C
0	0	2	1

Pre requisites Nil

Course Description:

This laboratory course provides practical exposure to fundamental concepts of electrical and electronics engineering. Students perform experiments to verify basic circuit laws, measure power in three-phase systems, test electrical machines, and study transducers. The lab also includes the design and implementation of basic digital circuits, enabling learners to connect theoretical knowledge with real-world applications.

Course Objectives: By the end of this course, the student will be able to:

1. To understand and verify fundamental electrical circuit laws and theorems using basic circuit components.
2. To measure and analyze power consumption in different load configurations (Star and Delta).
3. To study the performance characteristics of electrical machines like transformers, DC motors, and induction motors through practical testing.
4. To explore the working principles and applications of key transducers such as LVDTs and strain gauges.
5. To design and implement basic digital logic circuits including gates, flip-flops, and adders.

List of Experiments:

1. Verification of Kirchhoff's Current Law (KCL) and Voltage Law (KVL)
2. Measurement of Active Power in Balanced Star and Delta Connected Loads
3. Speed Control of a DC Motor
4. Load Test on a Single-Phase Transformer
5. Load Test on a Three-Phase Induction Motor
6. Study and Operation of a Linear Variable Differential Transformer (LVDT)
7. Measurement of Strain Using a Resistance Strain Gauge
8. Implementation and Verification of Basic Logic Gates
9. Design and Testing of Flip-Flops
10. Design and Implementation of Binary Adders

Virtual Labs and content beyond syllabus

1. Generation of clock using NAND and NOR gate
2. To study the torque speed characteristics of three phase induction motor.

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

CO1: Apply and verify Kirchhoff's laws to analyze electrical circuits.
CO2: Measure active power in three-phase balanced loads using appropriate instruments.
CO3: Evaluate the performance of electrical machines and understand their practical applications.
CO4: Demonstrate the working and application of transducers such as LVDT and resistance strain gauges.
CO5: Design and implement fundamental digital circuits using logic gates, flip-flops, and adders.

Text Books:

1. Theraja, B.L. & Theraja, A.K. A Textbook of Electrical Technology Vol. I & II,S. Chand Publications
2. Hughes, Edward, Ian McKenzie Smith, John Hiley, Keith Brown, Electrical and Electronic Technology Pearson Education.

3. Boylestad, Robert L. & Nashelsky, Louis, Electronic Devices and Circuit Theory, Pearson Education
4. Morris Mano, M. & Ciletti, Michael D.,Digital DesignPearson Education.
5. Sawhney, A.K.,A Course in Electrical and Electronic Measurements and Instrumentation, Dhanpat Rai & Co.

Mode of Evaluation: Continuous Internal Evaluation, Model Test and End Semester Examination.

B. Tech I Year II Semester

25BACOMLC02 SCIENTIFIC COMPUTING LABORATORY

L	T	P	C
0	0	2	1

Pre-Requisite: Nil

Course Description:

This course trains students in Excel for data analysis and visualization, PowerPoint for scientific presentations, and simulation software for computational problem solving. The course covers numerical methods, simulations, and data visualization techniques. Students can develop proficiency in integrating multiple tools for technical reporting. This course enhances analytical, computational, and communication skills.

Course Objectives:

This course enables students to

1. Acquire proficiency in using spreadsheet tools for scientific data organization, analysis, and visualization.
2. Develop skills to design and deliver professional technical presentations using presentation software.
3. Apply computational software for basic programming, problem solving, and data processing.
4. Perform data handling, plotting, and visualization using computational tools.
5. Model and simulate simple scientific and engineering applications using computational techniques.

List of Experiments:

Module 1 – Spreadsheet for Scientific Computing

1. Introduction to spreadsheet interface, formulas, and functions.
2. Data organization, filtering, and conditional formatting.
3. Charts & graphs (line, bar, scatter, pie) and trendline analysis.
4. Basic statistical functions (mean, median, standard deviation, regression).

Module 2 – Presentation Software for Scientific Communication

5. Introduction to presentation software, slide master, and themes.
6. Adding and formatting charts, tables, and images from spreadsheet/computational tools.
7. Creating animations, transitions, and embedding media.
8. Preparing a professional project presentation integrating scientific results.

Module 3 – Basics of Computational Software

9. Introduction to computational environment, commands, and script/program files.
10. Array/matrix creation, manipulation, and operations.
11. Use of control statements (`if`, `for`, `while`) and vectorized operations.

Module 4 – Data Handling & Visualization

12. Importing/exporting data between spreadsheet and computational software.
13. Plotting 2D graphs (line, scatter, bar, stem) and customizing plots.
14. Creating 3D plots (mesh, surface, contour).

Module 5 – Applications & Simulation

15. Modeling simple physical phenomena (e.g., projectile motion).
16. Simulation of basic electrical/electronic systems (e.g., RC charging/discharging).
17. Population growth or decay models.
18. Mini-project: Integrating spreadsheet, computational, and presentation tools for scientific reporting.

Hardware Requirements:
Computers

Software requirements:
Spreadsheet software, Presentation software, and Computational/Programming software (e.g., MATLAB / Python / Octave / Scilab)

Course Outcomes:

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

CO1: Use spreadsheet tools for organizing, analyzing, and visualizing scientific/engineering data.
CO2: Create professional scientific presentations using presentation software with integrated charts and media.
CO3: Develop programs and scripts to solve computational problems using appropriate software tools.
CO4: Perform data analysis and visualization using 2D/3D plotting features in computational software.
CO5: Simulate simple engineering and scientific applications and present results using integrated tools.

Text Books:

1. **Holly Moore**, *MATLAB for Engineers*, Pearson Education, 6th Edition, 2022.
2. **Amos Gilat** – MATLAB: An Introduction with Applications, 6th Edition, Wiley, **2017**.
3. **Faithe Wempen** – Microsoft Office 365: In Practice, 2019 Edition, McGraw-Hill Education, **2019**.
4. **Rudra Pratap -** Getting started with Simulation Software: A quick introduction for scientist & engineers by, Oxford, **2010**.
5. **Wayne L. Winston**, *Microsoft Excel Data Analysis and Business Modeling*, Microsoft Press, 5th Edition.

Reference Books:

1. **Brian Hahn & Daniel T. Valentine** – *Essential MATLAB for Engineers and Scientists*, 7th Edition, Academic Press, **2022**.
2. **Michael Alexander & Dick Kusleika** – *Excel 2021 Bible*, Wiley, **2021**.
3. **Jaan Kiusalaas** – *Numerical Methods in Engineering with MATLAB*, 4th Edition, Cambridge University Press, **2019**.
4. **Faithe Wempen**, *PowerPoint Bible*, Wiley, 3rd Edition.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination