MADANAPALLE INSTITUTE OF TECHNOLOGY & SCIENCE
(Deemed to be University)
MADANAPALLE
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DEPARTMENT OF ELECTRONICS AND COMMUNICATION 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 ELECTRONICS AND COMMUNICATION ENGINEERING

MADANAPALLE INSTITUTE OF TECHNOLOGY & SCIENCE

(Deemed to be University)

MADANAPALLE

B. Tech Four Year Curriculum Structure

Branch: ELECTRONICS AND COMMUNICATION 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	25BAPHYTC02	Semiconductor Physics	3	0	0	3	3
5	ESC	25BACSETC01	C Programming for Problem Solving	3	0	0	3	3
6	PCC	25BAECETC01	Sensors and Transducers	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	25BACSELC01	C Programming for Problem Solving Laboratory	0	0	2	2	1
10	ESC	25BACOMLC01	Engineering Skills Laboratory	0	0	2	2	1
Total				**16**	**0**	**8**	**24**	**20**

I Year II Semester

S. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total	
1	BSC	25BAMATTC04	Linear Algebra and Complex Analysis	3	0	0	3	3
2	BSC	25BACHETC02	Chemistry for Electronics	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	25BACDSTC01	Fundamentals of Artificial Intelligence	3	0	0	3	3
6	ESC	25BAMECEC01	Engineering Graphics	2	0	2	4	3
7	BSC	25BACHELC02	Applied 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				**16**	**0**	**8**	**24**	**20**

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

R25 - Curriculum Structure
II Year I Semester

S. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total	
1	BSC	25BAMATTC08	Differential Equations and Transform Techniques	3	0	0	3	3
2	ESC	25BAECETC02	Electromagnetic Field Theory	2	1	0	3	3
3	PCC	25BAECETC03	Electronic Devices and Circuits	3	0	0	3	3
4	PCC	25BAECETC04	Digital Systems	3	0	0	3	3
5	PCC	25BAECETC05	Network Analysis	2	1	0	3	3
6	PCC	25BAECELC01	Electronic Devices and Circuits Laboratory	0	0	2	2	1
7	PCC	25BAECELC02	Digital Systems Laboratory using HDL	0	0	2	2	1
8	PCC	25BAECELC03	Circuits and Simulation Laboratory	0	0	2	2	1
9	SEC		**Skill Enhancement Course – I** *(Refer ANNEXURE - IV)*	1	0	2	3	2
10	EEC		**NSDC - Certification Course – I** *(Refer ANNEXURE - V)*	0	0	2	2	-
Total				**14**	**2**	**10**	**26**	**20**

II Year II Semester

S. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total	
1	BSC	25BAMATTC11	Probability and Stochastic Process	3	0	0	3	3
2	PCC	25BAECETC06	Microprocessors and Microcontrollers	3	0	0	3	3
3	PCC	25BAECETC07	Signals and Systems	2	1	0	3	3
4	PCC	25BAECETC08	Linear Integrated Circuits	3	0	0	3	3
5	OE		**Open Elective – I** *(Refer ANNEXURE - II)*	3	0	0	3	3
6	PCC	25BAECELC04	Microprocessors and Microcontrollers Laboratory	0	0	2	2	1
7	PCC	25BAECELC05	Signals and Simulation Laboratory	0	0	2	2	1
8	PCC	25BAECELC06	Linear Integrated Circuits Laboratory	0	0	2	2	1
9	SEC		**Skill Enhancement Course – II** *(Refer ANNEXURE - IV)*	1	0	2	3	2
10	EEC		**NSDC - Certification Course – II** *(Refer ANNEXURE - V)*	0	0	2	2	-
Total				**15**	**1**	**10**	**26**	**20**

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

R25 – Tentative Curriculum Structure
III Year I Semester

S. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total	
1	PCC	25BAECETC09	Control Systems	2	1	0	3	3
2	PCC	25BAECETC10	Digital Signal Processing	3	0	0	3	3
3	PCC	25BAECETC11	Communication Systems	3	0	0	3	3
4	DE		**Discipline Elective – I** *(Refer ANNEXURE - III)*	3	0	0	3	3
5	OE		**Open Elective – II** *(Refer ANNEXURE - II)*	3	0	0	3	3
6	PCC	25BAECELC07	Digital Signal Processing Laboratory	0	0	2	2	1
7	PCC	25BAECELC08	Communication Systems Laboratory	0	0	2	2	1
8	SEC		**Skill Enhancement Course – III** *(Refer ANNEXURE - IV)*	1	0	2	3	2
9	INT	25BAECEIC01	Summer Internship - I	0	0	2	2	1
10	EEC		**NSDC - Certification Course – III** *(Refer ANNEXURE - V)*	0	0	2	2	-
Total				**15**	**1**	**10**	**26**	**20**

III Year II Semester

S. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total	
1	HSMC		Project Management	3	0	0	3	3
2	PCC	25BAECETC12	VLSI Design	3	0	0	3	3
3	PCC	25BAECETC13	Computer Networks	2	0	0	2	2
4	PCC	25BAECETC14	Embedded Systems	2	0	0	2	2
5	DE		**Discipline Elective – II** *(Refer ANNEXURE - III)*	3	0	0	3	3
6	OE		**Open Elective – III** *(Refer ANNEXURE - II)*	3	0	0	3	3
7	PCC	25BAECELC09	VLSI Design Laboratory	0	0	2	2	1
8	PCC	25BAECELC10	Embedded Systems Laboratory	0	0	2	2	1
9	AEC	25BAENGEC01	Soft Skills (Career Essentials)	1	0	2	3	2
10	EEC		**NSDC - Certification Course – IV** *(Refer ANNEXURE - V)*	0	0	2	2	-
Total				**17**	**0**	**8**	**25**	**20**

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

R25 - Tentative Curriculum Structure
IV Year I Semester

S. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total	
1	HSMC		Financial Discipline, Accounting, Financial Options	3	0	0	3	3
2	PCC	25BAECETC15	Antenna and Microwave Systems	3	0	0	3	3
3	DE		**Discipline Elective – III** *(Refer ANNEXURE - III)*	3	0	0	3	3
4	DE		**Discipline Elective – IV** *(Refer ANNEXURE - III)*	3	0	0	3	3
5	DE		**Discipline Elective – V** *(Refer ANNEXURE - III)*	3	0	0	3	3
6	OE		**Open Elective – IV** *(Refer ANNEXURE - II)*	3	0	0	3	3
7	PCC	25BAECELC11	Antenna and Microwave Systems Laboratory	0	0	2	2	1
8	SEC		**Skill Enhancement Course – IV** *(Refer ANNEXURE – IV)*	1	0	2	3	2
9	INT	25BAECEIC02	Summer Internship - II	0	0	4	4	2
10	EEC		**NSDC - Certification Course – V** *(Refer ANNEXURE - V)*	0	0	2	2	-
Total				**19**	**0**	**10**	**29**	**23**

IV Year II Semester

S. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total	
1	PW	25BAECEPC01	Capstone Project	0	0	28	28	14
2	INT	25BAECEIC03	Full Semester Internship	0	0	6	6	3
Total				**0**	**0**	**34**	**34**	**17**

(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

ANNEXURE - II

OPEN ELECTIVE – I

(To be offered under MOOC's Category from SWAYAM – NPTEL) – **II Year II Semester**

Sl. No.	Course Code	Course Title	Course Offered by Department of
1	25BAHUMOM01	English Language for Competitive Exams	Humanities and Social Sciences
2	25BAHUMOM02	Public Speaking	Humanities and Social Sciences
3	25BAHUMOM03	Indian Business History	Humanities and Social Sciences
4	25BAHUMOM04	Indian Economy: Some Contemporary Perspectives	Humanities and Social Sciences
5	25BAMBAOM01	E – Business	Management
6	25BAMBAOM02	AI in Human Resource Management	Management
7	25BAMBAOM03	AI in Marketing	Management
8	25BAMBAOM04	Artificial Intelligence for Investments	Management
9	25BACIVOM01	Plastic Waste Management	Civil
10	25BAMECOM01	Operations Management	Mechanical
11	25BAEEEOM01	Transducers For Instrumentation	EEE
12	25BACSEOM01	Privacy and Security in Online Social Media	CSE
13	25BACSEOM02	Computer Networks and Internet Protocol	CSE
14	25BACSEOM03	Introduction to Soft Computing	CSE
15	25BACSEOM04	Human Computer Interaction (in Hindi)	CSE
16	25BACOMOM01	Research Methodology	Multidisciplinary
17	25BACOMOM02	Fuzzy Logic and Neural Networks	Multidisciplinary
Any new Interdisciplinary Course offered by SWAYAM NPTEL can be appended in future.			

ANNEXURE – III

LIST OF DISCIPLINE ELECTIVES

Discipline Elective – I (To be offered under MOOC's Category from SWAYAM – NPTEL)		
S. No.	**Course Code**	**Course Title**
1.	25BAECEDM01	System Design Through Verilog
2.	25BAECEDM02	Embedded System Design with ARM
3.	25BAECEDM03	Principles of Digital Communications
4.	25BAECEDM04	Introduction to Machine Learning
Any advanced Course offered by SWAYAM NPTEL can be appended in future.		

Discipline Elective – II		
S. No.	**Course Code**	**Course Title**
1.	25BAECEDC01	Low Power VLSI
2.	25BAECEDC02	Introduction to IoT
3.	25BAECEDC03	Wireless and Mobile Communication
4.	25BAECEDC04	Digital Image Processing
Any advanced courses can be appended in future.		

Discipline Elective – III		
S. No.	**Course Code**	**Course Title**
1.	25BAECEDC05	CAD for VLSI
2.	25BAECEDC06	QNX Real Time Operating Systems
3.	25BAECEDC07	Satellite Communication
4.	25BAECEDC08	Speech Processing
Any advanced courses can be appended in future.		

Discipline Elective – IV		
S. No.	**Course Code**	**Course Title**
1.	25BAECEDC09	Testing of VLSI Circuits
2.	25BAECEDC10	Embedded C
3.	25BAECEDC11	Optical Communication
4.	25BAECEDC12	Computer vision
Any advanced courses can be appended in future.		

Discipline Elective –V		
S. No.	**Course Code**	**Course Title**
1	25BAECEDC13	VLSI Physical Design
2	25BAECEDC14	Wireless Sensor Networks
3	25BAECEDC15	High Speed Switching Networks
4	25BAECEDC16	AI/ML for Signals
Any advanced courses can be appended in future.		

ANNEXURE – IV

List of Skill Enhancement Courses

Skill Enhancement Course – I		
S. No.	**Course Code**	**Course Title**
1.	25BACSESC06	Python Programming
Any Courses can be appended in future.		

Skill Enhancement Course – II		
S. No.	**Course Code**	**Course Title**
1.	25BAECESC01	Embedded C Programming and Interfacing
Any Courses can be appended in future.		

Skill Enhancement course – III		
Sl. No.	**Course Code**	**Course Title**
1.	25BAECESC02	Internet of Things (IoT) using ESP32
Any Courses can be appended in future.		

Skill Enhancement Course – IV		
Sl. No.	**Course Code**	**Course Title**
1.	25BAECESC03	Verilog HDL and FPGA Design
Any Courses can be appended in future.		

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

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 12^{th} 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, 11^{th} Reprint, 2010.
3. R.K. Jain, S.R.K. Iyengar, Advanced Engineering Mathematics, Alpha Science International Ltd. 4^{th} Edition, 2014.
4. Michael D. Greenberg, Advanced Engineering Mathematics, Prentice Hall, 2^{nd} 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

25BAPHYTC02 SEMICONDUCTOR PHYSICS

L	T	P	C
3	0	0	3

Pre-Requisites: Plus two-level physics courses

Course Description:

This course introduces the fundamental physics underlying optical, quantum, and semiconductor phenomena essential to electrical, electronics, and photonics engineering. It covers key topics including wave optics, quantum mechanics, semiconductor theory, electronic devices, and photonics. Emphasizing an application-oriented approach, the course connects these principles to modern technologies in communication, sensing, and optoelectronics.

Course Objectives:

1. Understand the principles of wave optics and their applications in semiconductor photonic systems.
2. Apply quantum mechanics to explain the electronic and optical behaviour of materials.
3. Analyze semiconductor band structures and carrier dynamics for device applications.
4. Describe the operating principles of semiconductor devices and sensors.
5. Explain the fundamentals of lasers and fibre optics in communication and sensing technologies.

UNIT I OPTICS 9 hours

Interference of light: Young's double-slit experiment; Newton's rings experiment.
Fraunhofer diffraction: Single-slit and double-slit diffraction; diffraction grating (N-slit) — qualitative treatment; resolving power and dispersive power.
Polarization: Types of polarization; double refraction; Nicol's prism; quarter-wave and half-wave plates.

UNIT II QUANTUM MECHANICS 9 hours

de Broglie's hypothesis; Uncertainty principle; Postulates of quantum mechanics; Schrödinger wave equation. One-dimensional problems: Free particle; particle in a box; simple harmonic oscillator (qualitative), Tunnelling effect and its application in the scanning tunnelling microscope (STM).

UNIT III FREE ELECTRON THEORY & SEMICONDUCTORS 9 hours

Quantum free electron theory; origin of energy bands; Bloch's theorem, Kronig–Penney model, **E–K** diagrams; material classification; density of states; Fermi level.

Semiconductors: Intrinsic and extrinsic types; direct and indirect band gaps; carrier dynamics; compound semiconductors (e.g., SiC, GaN).

UNIT IV SEMICONDUCTOR DEVICES 9 hours

Drift and diffusion currents; Hall effect; P–N junction diode and its characteristics; Zener diodes; photodiodes; solar cells; LEDs.
LDR and IR sensors; magnetic switches; proximity, linear, and position sensors.

UNIT V PHOTONICS 9 hours

Lasers: Principles, components, and types; Ruby, He–Ne, and semiconductor lasers.

Fibre Optics: Principles, construction, and working of optical fibres; types of fibres; fibre optic communication systems; Fibre Bragg Grating (FBG); photonic crystal fibre (speciality fibre).

Course Outcomes:

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

CO1: Understand the principles of interference, diffraction, and polarization, and apply them in optical and photonic devices.

CO2: Solve fundamental quantum mechanical problems and explain quantum tunneling in semiconductor applications.

CO3: Comprehend electronic band structures and classify semiconductor materials based on quantum models.

CO4: Describe the operating principles and characteristics of semiconductor devices and sensors.

CO5: Explain the principles of laser and fibre optic technologies, and evaluate their applications in communication and sensing systems.

Text Books:

1. A Textbook of Engineering Physics – M. N. Avadhanulu & P. G. Kshirsagar, S. Chand & Company Pvt. Ltd., revised 9th Edition, 2014.
2. Physics of Semiconductor Devices – S. M. Sze, & Kwok K. Ng, Wiley, 3rd Edition, 2008.
3. Semiconductor Physics and Devices - D. A. Neaman, McGraw-Hill Education, 3rd Edition, 2003.
4. Optical Electronics by A. K. Ghatak and K. Thyagarajan, Cambridge University Press, 2012.

Reference Books:

1. Solid State Electronic Devices - B. G. Streetman & Sanjay Banerjee, PHI 6th Ed, 2006.
2. Physics for Engineers - B.S. Rajput, Pragati Prakashan, Vol II, 2009.
3. Optics - A. Ghatak, Tata McGraw-Hill, 4th Edition, 2011.
4. Introduction to Solid State Physics - Charles Kittel, Wiley, 8th Edition, 2012.
5. Introduction to Quantum Mechanics - David J. Griffiths & Darrell F. Schroeter, Cambridge University Press, 3rd Edition, 2018.

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

B. Tech I Year I Semester

25BACSETC01 C PROGRAMMING FOR PROBLEM SOLVING

L	T	P	C
3	0	0	3

Pre-requisite: None

Course Description:
This course introduces algorithmic problem-solving and the fundamentals of C programming. It emphasizes flowcharts, pseudocode, and structured programming constructs, covering functions, arrays, pointers, strings, user-defined data types, and file handling to develop efficient computational solutions.

Course Objectives:

1. Understand the fundamental building blocks of algorithms such as statements, state, control flow, and functions.
2. Apply algorithmic strategies like iteration and recursion for problem solving.
3. Represent and analyze algorithms using flowcharts, pseudocode, and programming constructs.
4. Differentiate control structures and algorithm design techniques through practical problems.
5. Develop comprehensive programming solutions using C syntax and semantics (variables, loops, functions, arrays, pointers, file handling).

UNIT I ALGORITHMIC PROBLEM SOLVING — 9 hours

Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), strategies for developing algorithms. Introduction to scratch & raptor.

UNIT II INTRODUCTION TO C PROGRAMMING — 9 hours

Structure of C Program, C Tokens: Variables, Data types, Constants, Identifiers, key words and Operators, Expressions, Storage classes.
Control Structures: Conditional Statements, Looping Statements.

UNIT III FUNCTIONS AND ARRAYS — 9 hours

Introduction to Functions, Function Definition and Declaration, Function prototype, Function Parameters, Passing arguments and arrays to functions, Recursion.
Introduction to Arrays, Types of arrays and operations.

UNIT IV POINTERS AND STRINGS — 9 hours

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

UNIT V USER DEFINED DATA TYPES & FILE HANDLING — 9 hours

User-defined data types: Structure and Union, Dynamic memory allocation.
Introduction to file concepts, File handling operations.

Course Outcomes:

CO1: Explain fundamental algorithmic concepts and represent problems using pseudocode and flowcharts.

CO2: Implement C programs using control structures such as conditionals and loops.

CO3: Design and use functions and arrays for modular programming.

CO4: Apply pointers, dynamic memory allocation, and string operations to manipulate data effectively.

CO5: Demonstrate file handling techniques and user-defined data types for structured programming solutions.

Text Books:

1. "The C Programming Language", Brian W. Kernighan and Dennis M. Ritchie, Prentice- Hall, 1988

2. C Programming, A Problem Solving Approach, Forouzan, Gilberg,Prasad, CENGAGE, 3rd edition.

Reference Books:

1. Programming in C, Rema Theraja, Oxford, 2016, 2nd edition

2. Schaum’s Outline of Programming with C, Byron S Gottfried, McGraw-Hill Education, 1996

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

B. Tech I Year I Semester

25BAECETC01 SENSORS AND TRANSDUCERS

L	T	P	C
3	0	0	3

Course Description:

This course provides a foundation in the principles, classification, and performance characteristics of sensors and transducers used in measurement systems. It covers mechanical, electrical, thermal, optical, and magnetic sensors along with smart sensors and MEMS devices, highlighting their applications in IoT, automation, and biomedical systems. Students will learn to analyze and select appropriate sensors for engineering and real-world scenarios based on key parameters such as sensitivity, accuracy, and response time.

Course Objectives:

1. To provide fundamental knowledge of the principles of sensors, transducers, and their role in measurement systems.
2. To introduce the classification, characteristics, and performance parameters of sensors.
3. To explain the working principles of mechanical, electrical, thermal, optical, and magnetic sensors.
4. To familiarize students with modern smart sensors, MEMS-based devices, and their applications in emerging technologies.
5. To develop the ability to analyze and select appropriate sensors for engineering and real-world applications.

UNIT I INTRODUCTION TO SENSORS AND TRANSDUCERS 9 hours

Definition, need and role in measurement systems, Basic concepts: sensor, transducer, actuator, signal conditioning, Classification of sensors and transducers, Characteristics: static and dynamic characteristics (sensitivity, accuracy, linearity, resolution, hysteresis, response time, etc.)

UNIT II MECHANICAL AND DISPLACEMENT SENSORS 9 hours

Potentiometric sensors, Strain gauges (resistive type), LVDT (Linear Variable Differential Transformer), Capacitive and inductive displacement sensors, Applications in measurement of force, pressure, and acceleration

UNIT III ELECTRICAL AND THERMAL SENSORS 9 hours

Resistive, capacitive and inductive sensors, Temperature sensors: RTD, Thermistor, Thermocouple, Piezoelectric sensors for pressure and vibration, Applications in industry and daily life

UNIT IV OPTICAL AND MAGNETIC SENSORS 9 hours

Photodiodes, Phototransistors, LDR (Light Dependent Resistor), Fiber optic sensors, Hall effect sensors, Proximity sensors, Magnetic encoders

UNIT V SMART SENSORS AND APPLICATIONS 9 hours

Concept of smart sensors and MEMS-based sensors, Examples: humidity sensor, gas sensor, biosensors, Sensors in IoT and automation, Case studies: automotive sensors, biomedical sensors, consumer electronics

Course Outcomes:

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

- **CO1:** Explain the principles, characteristics, and classification of sensors and transducers.
- **CO2:** Analyze the performance of displacement, force, pressure, and temperature sensors in measurement systems.
- **CO3:** Apply electrical, optical, and magnetic sensors for signal detection in engineering applications.
- **CO4:** Evaluate the performance parameters (sensitivity, accuracy, linearity, resolution, hysteresis) of different sensors.
- **CO5:** Integrate smart sensors and MEMS-based devices in applications related to IoT, automation, and biomedical systems.

Text Books:

1. D. Patranabis, *Sensors and Transducers*, 2nd Edition, PHI Learning, 2010.

2. A. K. Sawhney, *A Course in Electrical and Electronic Measurements and Instrumentation*, 2020 Edition, Dhanpat Rai & Co.

Reference Books:

1. E. A. Doebelin, *Measurement Systems: Application and Design*, 5th Edition, McGraw Hill, 2003.

2. John G. Webster, *Measurement, Instrumentation, and Sensors Handbook*, CRC Press, 2nd Edition, 2014.

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.

Instruments Requirements:

Light sources (Mercury vapor lamp, sodium vapor lamp, Lasers), single slits with mount, diffraction gratings, translation stages with microscopes, spectrometer, P-N junction diode kit, vibration tuning fork, B-H curve apparatus, Meld's apparatus, optical fibers and lens, screen assembly, circular magnetic coil and stewartias and gee arrangement, e/m measurement kit, Planks constant measurement apparatus, Regulated Power supplies, Rheostats, Ammeters, Voltmeter, Active & Passive Electronic Components, LCR kit. Wooden scale, glass slab.

Course Outcomes:

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.

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

25BACSELC01 C PROGRAMMING FOR PROBLEM SOLVING LABORARTORY

L	T	P	C
0	0	2	1

Pre-requisite: NIL

Course Description:

This course introduces the fundamentals of problem-solving and algorithmic thinking, covering flowcharts, pseudocode, and structured programming in C. Students will learn to apply control structures, arrays, functions, pointers, strings, and dynamic memory in developing efficient solutions. Practical exercises include recursion, file handling, and real-world problem-solving through structured programming projects.

Course Objectives:

1. Understand the principles of problem analysis and algorithm design for computational tasks.
2. Represent solutions using flowcharts and pseudocode.
3. Apply control structures, arrays, functions, and recursion in solving problems.
4. Develop programs using pointers, strings, structures, and dynamic memory allocation.
5. Implement file handling and practice real-world problem-solving through C programming.

List of Experiments

1. Develop a flowchart using Raptor for the following tasks

a) Develop a flowchart for the various arithmetic operations on numbers.
b) Develop a flowchart to check whether the number is positive or negative.
c) Develop a flowchart for finding biggest number among three numbers.
d) Develop a flowchart to print factorial of a number using function.
e) Develop a flowchart to check given number is palindrome or not using function.

2. A climate research center stores temperature readings for two different cities in the wrong order.

First, swap the average temperature values of the two cities using:
1.A temporary variable
2.Without a temporary variable (using arithmetic or bitwise operations).
Then, if the swapped temperatures are stored in variables t1 and t2, determine which city is hotter and calculate the absolute difference in their average temperatures.

3. Admission Eligibility & Scientific Calculator
a) A college is developing admission software for a professional course. Based on a student's marks in Maths, Physics, and Chemistry:
If the student has Maths $\geq$ 65, Physics $\geq$ 55, and Chemistry $\geq$ 50 OR the total in all three subjects $\geq$ 180, they're eligible; otherwise, they're not.
Write a program to automate this check.
b)Your friend is tired of using a mobile calculator and wants a simple scientific calculator on their computer that can perform addition, subtraction, multiplication, division, and other advanced mathematical operations.

4. Multiplication Table, Range Sum & Prime Numbers
a)Your cousin just started learning multiplication and asks you to create a program that prints the multiplication table for any number they enter.
b)An online form accepts numbers between 0 and 100. The form keeps storing these numbers until you enter -1. You need to find the sum of all valid numbers entered before -1.
c) Your mathematics professor wants a program that lists all prime numbers between two given limits for research purposes.

5. Matrix Operations
You are working on an image-processing system where images are stored as square matrices (N×N). The system must:
• Add two matrices (combine pixel intensities)
• Multiply two matrices (apply transformation)
Write a program to support both operations.

6. String Operations without Libraries
(a) A company wants a secure text-processing library without using standard string functions (to avoid hidden bugs). Implement:
- String length calculation
- String copying
- String comparison
- String concatenation
- String reverse

all without using <string.h> functions.

(b) You are working as a software developer at a customer support centre. The centre receives numerous customer feedback messages daily, stored as strings. The manager wants a program that can help efficiently analyse these messages.
Task:
Write a C program that takes an array of customer feedback strings and a keyword, then returns the count of feedback entries that contain the given keyword (case-insensitive).
Key points to consider:
- Input: An array of strings representing customer feedback and a keyword string.
- Output: The number of feedback messages that contain the keyword.
- The search should be case-insensitive.
- Efficient string searching or matching techniques should be applied.
- Handle scenarios where the keyword may appear multiple times within the same feedback.

7. Array Sorting with Pointers & Dynamic Memory Allocation
a) A small inventory system stores a list of product prices. The manager wants them sorted using pointer-based operations instead of the usual array index access.
b) You are part of a community sports club that is organizing a local athletics meet. Participants will compete in various running events, and each participant's *name* and *completion time in seconds* will be recorded after the race.
The number of participants is not known beforehand, as registrations happen until the race starts.
Task:
Write a C program that:

1. Dynamically allocates memory to store the race results for N participants (entered at runtime).
2. Stores each participant's name and their completion time.
3. Sorts the participants in ascending order of completion time (fastest first) using pointer-based array manipulation.
4. Displays the sorted results with ranking (1st fastest, 2nd fastest, etc.).

8. Time Difference Calculation
(a) A transport company records the departure and arrival times of buses (in hours, minutes, and seconds). You need to find the travel time between the two times using a structure.
(b) A swimming pool management system keeps track of customers' swimming session times. For each customer, the start time and end time of their swimming session are recorded (in hours, minutes, and seconds). The system needs to calculate the total time spent in the pool for each customer.
Task:
Write a C program that:
1. Uses a structure to store time in hours, minutes, and seconds.
2. Reads the start time and end time of the swimming session.

9. Recursion & Passing Parameters
a) Your mathematics professor assigns you a program to find factorial, greatest common divisor (GCD), and Fibonacci numbers both with recursion.
b) You are working as a developer for a fitness tracking system. The system needs to update a user's daily step count. The update can be done in two ways:
- Using pass-by-value where the function receives a copy of the step count and cannot modify the original value.
- Using pass-by-reference where the function receives a pointer to the step count and can directly update the original value.

10. File Operations
You are working at a library to manage the record of books issued to members. The library maintains a file that stores details of issued books such as book ID, member ID, and the issue date. Write a C program that performs the following operations using file handling:
1. Add new records: Allow the librarian to add multiple book issue records to a file.
2. Display all records: Read and display all the records stored in the file.
3. Search a record: Search for a particular book issue record by book ID and display the details if found.

Course Outcomes:
After completion of the course, Students will be able to

CO1: Implement algorithms and debug simple programs to enhance problem-solving skills.

CO2: Apply conditional statements and loops for controlling program execution.

CO3: Solve real-world tasks using arrays, strings, and related programming constructs.

CO4: Create and use functions, apply pointers, and understand parameter passing techniques.

CO5: Implement structures, dynamic memory allocation, and file handling for practical applications.

Text / Reference Books:

1. Ajay Mittal, Programming in C: A practical approach, Pearson.
2. C Programming, A Problem-Solving Approach, Forouzan, Gilberg, Prasad, CENGAGE
3. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice- Hall of India
4. Byron Gottfried, Schaum's Outline of Programming with C, McGraw Hill

Mode of Evaluation: Continuous Internal Evaluation, Model Test 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

25BAMATTC04 LINEAR ALGEBRA AND COMPLEX ANALYSIS

L	T	P	C
3	0	0	3

Pre Requisites: 25BAMATTC01

Course Description:

The course provides an introduction to Linear Algebra covering the system of linear equations, vector spaces, linear transformations, eigenvalues, eigenvectors and quadratic forms. The course also covers complex functions and their analyticity, complex integration, Taylor and Laurent series expansions and calculus of residues.

Course Objectives:

1. Understand the concept of Rank of a matrix and solving the system of linear equations.
2. Learn the fundamental concepts of vector spaces and linear transformations.
3. Interpret the significance of eigenvalues, eigenvectors and quadratic forms.
4. Analyse the functions of complex variables and their analyticity.
5. Get Acquainted with complex integration, Laurent series and Calculus of residues.

UNIT I MATRICES AND SYSTEM OF LINEAR EQUATIONS 9 hours

Real matrices: Symmetric, Skew-symmetric and Orthogonal matrices. Complex matrices: Hermitian, Skew-Hermitian and Unitary matrices. Rank of a matrix by echelon form, normal form. Inverse of non-singular matrices by Gauss-Jordan method, System of linear equations: Solving system of Homogeneous and Non-Homogeneous equations by Gauss elimination method.

UNIT II VECTOR SPACES 9 hours

Vector spaces, subspaces, linear independence, basis and dimension. Definition and examples, kernel and range of linear transformation. The matrix of a linear transformation, Composite and invertible linear transformations.

UNIT III EIGENVALUES, EIGENVECTORS 9 hours

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

UNIT IV COMPLEX VARIABLE – DIFFERENTIATION 9 hours

Introduction to functions of complex variable, Limit, Continuity and Differentiation, Cauchy-Riemann equations, analytic functions, harmonic functions, finding harmonic conjugate-construction of analytic function by Milne Thomson method

UNIT V COMPLEX VARIABLE – INTEGRATION 9 hours

Cauchy’s theorem, Cauchy Integral formula, Taylor’s series, Laurent series, singularities, Cauchy Residue theorem.

Course Outcomes:

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

CO1: Solve system of equations using rank of the matrices.

CO2: Acquire knowledge on vector spaces and find linear transformations.

CO3: Find the Eigen values, Eigen vectors of a matrix and nature of the real Quadratic form

CO4: Examine the concepts of complex functions using CR-equations.

CO5: Evaluate complex contour integrals and Taylor and Laurent series expansions.

Text Books:

1. Higher Engineering Mathematics, B. S. Grewal, Khanna Publishers, 2017, 44th Edition.
2. Elementary linear Algebra by Stephen Andrilli and David Hecker, 4th Edition, Elsevier, 2010

Reference Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2011.
2. N.P. Bali and M. Goyal, "A text book of Engineering Mathematics", Laxmi Publications, 2008.
3. Complex variables and applications by R. V Churchill and J. W. Brown, 8th edition, 2008, McGraw-Hill.
4. Complex Variables with Applications by A. D. Wunsch, 3rd edition, Pearson Education, Inc.

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

B. Tech I Year II Semester

25BACHETC02 CHEMISTRY FOR ELECTRONICS

L	T	P	C
3	0	0	3

Pre Requisites: Intermediate Level

Course Description:
This course introduces the fundamentals of quantum chemistry, functional and energy-harvesting materials, electrochemistry, and green chemistry concepts. It explores the synthesis, properties, and applications of nanomaterials, conducting polymers, and smart electronic devices, alongside sustainable practices in e-waste management and green electronics. Students will gain a holistic understanding of modern materials and energy technologies with practical and environmental relevance.

Course Objectives:
1. To develop an understanding of the fundamental principles of quantum chemistry, electrochemistry, functional materials, energy harvesting, and green chemistry relevant to modern scientific and technological applications.
2. To enable students to apply theoretical concepts to analyze, interpret, and solve problems related to molecular structures, material properties, energy conversion, and sustainable practices.
3. To cultivate awareness of emerging materials, technologies, and eco-friendly practices in electronics, fostering the ability to propose solutions for energy and environmental challenges.

UNIT I QUANTUM CHEMISTRY 9 hours

Fundamentals of Quantum mechanics, Postulates of Quantum mechanics, Schrodinger Wave equation, significance of Ψ and Ψ^2, particle in one dimensional box, molecular orbital theory – bonding in homonuclear diatomic molecules – energy level diagrams of N_2, and O_2, π-molecular orbitals of butadiene and calculation of bond order. Electronic excitations-Beer-Lambert law

UNIT II FUNCTIONAL MATERIALS 9 hours

Nano materials: Introduction, classification, Synthesis – precipitation method, properties and applications of Fullerenes, carbon nano tubes and Graphene, Quantum Dots.
Super conductors-Introduction, basic concept, applications.
Conducting polymers – polyacetylene, polyaniline, – mechanism of conduction and applications.
Concepts of MEMS, dielectric and ferroelectric materials, OLED

UNIT III ELECTROCHEMISTRY AND APPLICATIONS 9 hours

Electrochemical cell, Nernst equation, numerical problems, potentiometry- potentiometric titrations (redox titrations), concept of conductivity, conductivity cell, conductometric titrations (acid-base titrations).
Primary cells – Zinc-air battery, Secondary cells –lithium-ion batteries- working of the batteries including cell reactions; Fuel cells, hydrogen-oxygen fuel cell– working of the cells.
Supercapacitors: Introduction, Basic Concept-Classification – Applications.
Electrochemical sensors – potentiometric sensors with examples, amperometric sensors with examples, piezoelectric sensors.

UNIT IV ENERGY HARVESTING MATERIALS **9 hours**

Basic principles of photovoltaic (PV) conversion

Atomic structure of silicon; energy bands in semiconductors; n-type and p-type materials; formation of p-n junctions.

Classification based on materials and manufacturing (single crystalline silicon, polycrystalline silicon, amorphous silicon, thin films, organic perovskite),

Advancements in fabrication, efficiency improvement, and Self-healing polymers (SHP)

Smart coating (thin films)

UNIT V GREEN CHEMISTRY & E-WASTE MANAGEMENT **9 hours**

Fundamentals of Green Chemistry : Definition and scope, Importance of sustainability in electronics. Introduction to E-waste, Hazardous substances in E-waste. E-toxic components in computer, Disposal of e-waste (Incineration, Landfilling, Recycling).

Materials in Green Electronics : Lead-free solders and halogen-free flame retardants (SAC alloys, Sn-Cu, Sn-Bi), Nanomaterials for sustainable device fabrication. Application, advantages and challenges of green electronics.

E-waste Management: Introduction (ill effects of e-waste management, global losses, environmental importance), sources, types, effects of e-waste on environment and human health, methods of disposal (Classification), advantages of recycling. Extraction of copper and gold from e-waste (Principle, process, taking PCB as an example)

Course Outcomes:

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

CO1: Explain the fundamental postulates of quantum mechanics and the significance of wave functions

CO2: Explain the synthesis, properties, and applications of nanomaterials, superconductors, conducting polymers, and related functional materials

CO3: Apply the Nernst equation and electrochemical concepts to solve numerical problems and compare and contrast the working principles and cell reactions of different electrochemical energy devices such as batteries, fuel cells, and supercapacitors

CO4: Explain the principles of photovoltaic conversion and semiconductor band structures

CO5: Explain the principles of green chemistry and identify hazardous substances in e-waste

Text Books:

1. Engineering Chemistry Jain and Jain Dhanpat Rai, Publishing company, 17th Edition/2015
2. Engineering Chemistry RV Gadag and A, Nityananda Shetty, Wiley 3rd edition /2019
3. Engineering Chemistry, Wiley Editorial, Wiley 2nd Edition/2013

Reference Books:

1. Textbook of Nanoscience and Nanotechnology, B S Murty;P Shankar;Baldev Raj;B B Rath;James Murday, University Press-IIM
2. *Encyclopedia of Electrochemical Power Sources* — Edited by Garche et al. Elsevier, 2nd Edition 2024
3. Electronic Waste: Recycling and Reprocessing for a Sustainable Future, Maria E. Holuszko, Amit Kumar, Denise C. R. Espinosa, Wiley-VCH, 1st Edition 2022

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

25BACDSTC01 FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE

L	T	P	C
3	0	0	3

Pre-requisite NIL

Course Description:

This course introduces the fundamentals of Artificial Intelligence, including its history, data foundations, and basics of Machine Learning. It explores real-world applications in healthcare, finance, and communication, along with ethical issues, responsible AI, and emerging trends for the future.

Course Objectives:

This course enables students to

1. Understand the fundamentals, history, and evolution of Artificial Intelligence.
2. Recognize the role of data and basic statistics in intelligent systems.
3. Explain the basic concepts, types, and tools of Machine Learning.
4. Explore real-world applications of AI/ML in domains such as healthcare, finance, and communication.
5. Discuss ethical implications and emerging trends of AI in society.

UNIT I INTRODUCTION TO AI 9 hours

History & Evolution of AI, Types of AI-Narrow, General, Super, AI in Everyday Life -chatbots, assistants, recommendation systems, Branches of AI-Problem Solving, Reasoning, Robotics, Language, Ethical & Societal Implications-jobs, bias, privacy, security.

Case Study: Deep Blue vs Kasparov (Chess), Self-Driving Cars

UNIT II FOUNDATIONS OF INTELLIGENT SYSTEMS 9 hours

Role of Data in AI systems, Data vs Information vs Knowledge, Types of Data - Structured, Semi-structured, Unstructured, Basics of Statistics - Mean, Median, Mode, Variance, Importance of Data Quality.

Case Study: Weather Prediction with data.

UNIT III BASICS OF MACHINE LEARNING 9 hours

What is ML? Relation between AI, ML, and Data Science. Types of ML-Supervised, Unsupervised, Reinforcement, Learning Cycle-Training, Testing, Feedback, Introduction to ML Tools (Weka, Teachable Machine, Orange).

Case Study: Email Spam Filtering, Netflix Recommendations.

UNIT IV AI & ML IN THE REAL WORLD 9 hours

Applications of AI/ML- image recognition, NLP (Chatbots, Translation), recommendation systems, Finance (Fraud Detection, Credit Scoring, Stock Market Prediction), Predictive Analytics, Challenges in AI- Bias, Fairness, Privacy, Data Quality, Responsible AI-Trust, Transparency, and Job Automation.

Case Study: Healthcare diagnosis using ML, AI in Banking Fraud Detection.

UNIT V EMERGING TRENDS IN AI 9 hours

Future of AI: General AI, Super AI (conceptual only), AI in Emerging Applications: Smart Homes, Smart Cities, Healthcare, Education, AI for Social Good: agriculture, disaster prediction, accessibility, Limitations of AI today.

Case Study: AI in Climate Change, AI in Education.

Course Outcomes:

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

CO1: Describe the basics, history, and types of Artificial Intelligence.
CO2: Interpret data concepts and apply simple statistical measures.
CO3: Explain the fundamental types of Machine Learning and the ML process.
CO4: Identify and analyse real-world applications of AI/ML.
CO5: Evaluate emerging trends, applications for social good, and limitations of AI.

Text Books

1. Russell, Stuart Jonathan, Norvig, Peter, Davis, Ernest. Artificial Intelligence: A Modern Approach. United Kingdom: Pearson, 2010.
2. Deepak Khemani. A First Course in Artificial Intelligence. McGraw Hill Education (India), 2013.

Reference Books

1. Practical Statistics for Data Scientists, 2nd Edition by Peter Bruce,Andrew Bruce, Peter Gedeck
2. Denis Rothman. Artificial Intelligence by Example, Packt, 2018.

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

25BACHELC02 APPLIED CHEMISTRY LABORATORY

L	T	P	C
0	0	2	1

Pre Requisites: NIL

Course Description:

This laboratory course provides hands-on experience in modern materials, electrochemistry, and green chemistry techniques. Students will synthesize and characterize nanomaterials, conducting and ferroelectric polymers, study electrochemical and photochemical processes, and apply analytical methods to real-world problems including e-waste and energy devices.

Course Objectives:

1. **To develop** practical skills in the synthesis and characterization of nanomaterials, conducting polymers, and ferroelectric/photovoltaic materials.
2. **To familiarize** students with electrochemical and spectrophotometric techniques for quantitative and qualitative analysis.
3. **To promote** sustainable laboratory practices, including green chemistry approaches and recovery of metals from e-waste.

From the following 16 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
2. Determination of Cell constant and Conductance of solutions
3. Potentiometry - determination of redox potentials and emfs
4. Photocatalytic dye-degradation using nanomaterial
5. Synthesis of polyaniline conducting polymer
6. Construction of a Galvanic cell for determination of cell emf and free energy
7. Estimation of ferrous ion by colorimetry
8. Conductometric titration of strong acid vs strong base
9. Conductometric titration of weak acid vs strong base
10. Determination of strength of acid in Pb-acid battery
11. Verification of Beer-Lambert's Law
12. Synthesis of ferroelectric $BiFeO_3$ (BFO) by coprecipitation method
13. Preparation of perovskite material for solar cell application
14. Determination of reaction order and rate constant using MS-excel regression model
15. Colorimetric estimation of cupric ion from e-waste
16. Green synthesis of PVA/starch biopolymer

Course Outcomes:

CO1: Demonstrate the ability to synthesize and characterize nanomaterials, conducting polymers, and ferroelectric/perovskite materials.

CO2: Analyze electrochemical cells, measure conductivity, and determine redox potentials with precision.

CO3: Apply spectrophotometric and colorimetric methods for the quantitative estimation of ions and reaction kinetics.

CO4: Evaluate photocatalytic and electrocatalytic properties of materials for energy and environmental applications.

CO5: Implement green chemistry principles in laboratory experiments, including biopolymer synthesis and metal recovery from e-waste.

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

II Year I Semester

B. Tech II Year I Semester

25BAMATTC08 DIFFERENTIAL EQUATIONS AND TRANSFORMS

L	T	P	C
3	0	0	3

Pre Requisites: 25BAMATTC01**,** 25BAMATTC04

Course Description:

This course reviews and extends the study of differential equations with the objective of introducing classical methods for solving boundary value problems. The course provides a foundation for the applications of differential equations, difference equations, Laplace transforms, Fourier series, Fourier transforms, and Z-transforms in the field of Communication Engineering.

Course Objectives:

1. To apply the concepts of differential equations in obtaining mathematical solutions to various engineering problems.
2. To solve higher-order linear differential equations and systems of first-order differential equations.
3. To apply Laplace and inverse Laplace transforms for solving ordinary differential equations.
4. To apply Fourier series and Fourier transforms in solving sine and cosine transform problems.
5. To introduce the concepts of Z-transforms and the solution of difference equations

UNIT I DIFFERENTIAL EQUATIONS OF FIRST ORDER AND FIRST DEGREE 9 hours

Introduction - General Remarks on Solutions - Families of Curves - Orthogonal Trajectories - Growth, Decay, Chemical Reaction and Mixing - Falling Bodies and other Motion Problems - Homogeneous Equations - Exact Equations - Integrating Factors - Linear Equations - Bernoulli’s Equation.

UNIT II LINEAR DIFFERENTIAL EQUATIONS OF HIGHER ORDER (CONSTANT COEFFICIENTS) AND SYSTEM OF FIRST ORDER EQUATIONS 9 hours

Introduction of Second Order Linear Equations - Homogeneous Equation with constant Coefficients, Euler’s Equi-dimensional equation - The Method of Variation of Parameters - Higher Order Linear Equations - Operator Methods for Finding Particular Solutions. Linear Systems - Homogeneous Linear Systems with Constant Coefficients.

UNIT III LAPLACE TRANSFORMS 9 hours

Introduction - Applications to Differential Equations - Derivatives and Integrals of Laplace transforms, Convolutions-Integral Equation - Unit step and Impulse functions.

UNIT IV FOURIER SERIES AND FOURIER TRANSFORMS 9 hours

The Fourier coefficients - The problem of Convergence - Even and Odd functions - Cosine and Sine Series - Extension to Arbitrary intervals. Introduction – Fourier transforms, Properties, Inverse Fourier sine and cosine transforms, Convolution theorem.

UNIT V Z – TRANSFORMS 9 hours

Introduction to Z-transform, Linearity property - Damping rule - Shifting rule - Initial and final value theorems, Inverse Z- transforms, convolution theorem - Evaluation of Inverse transforms -application to solve difference equations.

Course Outcomes:

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

CO1: Apply the concepts of differential equations to obtain mathematical solutions for various engineering problems.

CO2: Solve higher-order linear differential equations and systems of first-order differential equations.

CO3: Apply Laplace transforms in solving ordinary differential equations relevant to the representation of communication systems.

CO4: Apply Fourier series and Fourier transform for solving boundary value problems in the field of communication engineering.

CO5: Apply Z-transforms and inverse Z-transforms for solving difference equations in communication system analysis.

Text Books:

1. George F. Simmons, "Differential Equations with Applications and Historical Notes", McGraw Hill Education (India) Private Limited, second Edition, 2014.

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

Reference Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2011.

2. N.P. Bali and M. Goyal, "A text book of Engineering Mathematics", Laxmi Publications, 2008.

3. W. E. Boyce and R. C. DiPrima, "Elementary Differential Equations and Boundary ValueProblems", Wiley India, 2009.

4. G.F. Simmons and S.G. Krantz, "Differential Equations", McGraw Hill, 2007.

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

B. Tech II Year I Semester

25BAECETC02 ELECTROMAGNETIC FIELD THEORY

L	T	P	C
2	1	0	3

Pre Requisites: 25BAMATTC01, 25BAPHYTC02

Course Description:

The course will provide strong foundation on vector algebra, Vector Calculus, waves in dielectric and conducting media, wave polarization, wave reflection, refraction, transmission lines which will be useful for creating foundation of communication with wave phenomena. The course covers theory and methods to develop expertise in EM field and transmission line approaches associated with it. Student will understand application EM waves, transmission lines and waveguides.

Course Objectives:

1. To understand and analyze different laws and theorems of electrostatic fields.
2. To study and analyze different laws and theorems of magnetostatic fields.
3. Analyzing Maxwell's equations in different forms.
4. To learn the concepts of wave theory and its propagation through various mediums.
5. To get exposure to the properties of transmission lines and waveguides.

UNIT I ELECTROSTATICS FIELDS 9 hours

Introduction to Vector algebra, Coordinate systems: Cartesian Coordinates, Circular Cylindrical Coordinates, Spherical Coordinates. Coulomb's Law and Field Intensity, Electric Fields due to Continuous Charge Distributions, Electric Flux Density, Gauss's Law-Maxwell's equations and Applications of Gauss' Law, Electric Potential, Relationship between E and V-Maxwell's Equations, Energy Density, Illustrative Problems. Convection and Conduction Currents, Conductors, Dielectric Constant, Poisson's and Laplace's Equations, Illustrative Problems.

UNIT II MAGNETOSTATICS 9 hours

Biot-Savart Law, Ampere's Circuit Law-Maxwell's Equations, Applications of Ampere's Law, Magnetic Flux Density-Maxwell's Equation, Maxwell's Equations for Static EM Fields, Magnetic Scalar and Vector Potentials, Forces due to Magnetic Fields on moving charge and current element, Magnetic Torque and Moment, Magnetic Dipole, Magnetization in Materials, Classification of Magnetic Materials, Magnetic Boundary Conditions, Inductors and Inductances, Magnetic Energy, Illustrative Problems.

UNIT III MAXWELL'S EQUATIONS AND ELECTROMAGNETIC WAVE PROPAGATION 9 hours

Faraday's Law of Induction, Transformer and Motional EMFs, Displacement Current and Displacement Current Density, Maxwell's Equations for Time-Varying field, Maxwell's Equations for Time-Harmonic Fields, EM Waves equation and Solution of EM Wave equation, Wave Propagation in different medium (Lossy Dielectrics, Lossless Dielectrics, Free Space and Good Conductors), Power and Poynting Vector, Reflection of a Plane Wave at Normal Incidence, Illustrative Problems.

UNIT IV TRANSMISSION LINES 9 hours

Introduction, Transmission Line Parameters, Transmission Line Equations, Characteristic Impedance, Lossless Line, Distortionless Line, Input Impedance, Voltage Standing Wave Ratio (VSWR) and

Power, Shorted Line, Open Circuited Line, Matched Line, Smith Chart – Construction and Applications, Quarter wave transformer, Single Stub Matching, Illustrative Problems.

UNIT V WAVEGUIDES 9 hours

Rectangular Waveguide, Transverse magnetic (TM) modes, Transverse Electric (TE) modes, Wave Propagation in the Guide, Power Transmission and Attenuation, Waveguide Current and Mode Excitation, Illustrative Problems.

Course Outcomes:

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

CO1: Understand the fundamentals of vector analysis and vector calculus with introduction to Maxwell's relation.
CO2: Understand the properties of transmission lines and their applications.
CO3: Apply the laws & theorems of electrostatic fields to solve the related problems.
CO4: Gain proficiency in the analysis and application of magnetostatic laws and theorems.
CO5: Analyze the transmission line equation, characteristic quantities, use of smith chart and various waveguides.

Text Books:

1. Matthew N.O. Sadiku, "Elements of Electromagnetics", 4th Edition, Oxford University Press, 2008.
2. William H. Hayt Jr. and John A. Buck, "Engineering Electromagnetics", 7th Edition, Tata McGraw Hill, 2006.

Reference Books:

1. David J. Griffiths, "Introduction to Electrodynamics", 4th Edition, Pearson, 2013.
2. E.C. Jordan and K.G. Balmain, "Electromagnetic Waves and Radiating Systems", 2nd Edition, PHI, 2000.
3. John D. Krauss, "Electromagnetics", 3rd Edition, McGraw Hill, 1988.
4. John D. Ryder, "Networks, Lines, and Fields",2nd Edition, PHI publications, 2012.

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

B. Tech II Year I Semester

25BAECETC03 ELECTRONIC DEVICES AND CIRCUITS

L	T	P	C
3	0	0	3

Pre Requisites: Basic Engineering Physics, Engineering Mathematics, Semiconductor Basics.

Course Description:

This course introduces the fundamental physics, operation, and characteristics of semiconductor devices used in modern electronic systems. It covers semiconductor materials, carrier transport mechanisms, p-n junction diodes, bipolar junction transistors (BJTs), field effect transistors (FETs and MOSFETs), and special purpose semiconductor devices. The course emphasizes device structure, operating principles, electrical characteristics, and applications in analog, digital, communication, and optoelectronic systems.

Course Objectives:

1. Understand the physical principles of semiconductors, carrier transport, and energy band concepts.
2. Analyze the operation and characteristics of p-n junction diodes and related semiconductor devices.
3. Explain the working principles and performance characteristics of BJTs and their configurations.
4. Describe the structure, operation, and characteristics of FETs and MOSFETs, including small-signal models.
5. Identify the operation and applications of special purpose semiconductor devices used in modern electronic and communication systems.

UNIT I PHYSICS OF SEMICONDUCTOR DEVICES — 9 hours

Semiconductor Basics: Energy bands in Solids, Metals, Semiconductors and Insulators, Intrinsic and Extrinsic materials, Energy band diagrams, Fermi-Dirac statistics, Conductivity and Mobility, Drift and Resistance, Effects of temperature and doping on mobility, Hall Effect, Thermal voltage and temperature relations, Carrier mobility, drift velocity, Current density, Einstein relation, Diffusion coefficient and diffusion length, Minority and majority carriers, Carrier concentration equations, Drift and diffusion currents, Drift-diffusion equations, Electron and hole current densities, Carrier lifetime, Mobility and conductivity variation with temperature.

UNIT II P-N JUNCTION DIODE — 9 hours

Unbiased & biased p-n junction, Ideal Diode equation, Voltage-current characteristics, Junction capacitances, Effect of high field on charge carriers in semiconductors, Zener diode and Zener breakdown, Diode effect of temperature on V-I characteristics Impact ionization, Carrier multiplication, avalanche breakdown of junction, LED, Photodiode, Metal-semiconductor schottky barrier diode.

UNIT III BIPOLAR JUNCTION TRANSISTOR (BJT) — 9 hours

Basic principle of operation, CB, CE, and CC configurations, Input and output characteristics, Current gains, Base width modulation, Early effect, Eber-Moll model, hybrid-pi model, Equivalent circuit of BJT, Switching Characteristics, Photo transistor, High frequency transistor.

UNIT IV FIELD EFFECT TRANSISTOR (FET) — 9 hours

Device structure and operation, common source DC characteristics. Metal Oxide Semiconductor (MOS) capacitance: C-V characteristics, threshold voltage, body effect. MOSFET: Device structure and operation, common source DC characteristics. FET small-signal equivalent circuit.

UNIT V SPECIAL PURPOSE DEVICES: — 9 hours

Solar cell, Tunnel diode; Gunn diode; PIN diode, IMPATT diode, Varactor Diode, MESFET, Recent Developments: Heterojunction FET, Heterojunction Bipolar Transistor.

Course Outcomes:

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

CO1: Explain semiconductor physics, carrier transport, and energy band concepts.
CO2: Analyze the characteristics and operation of p-n junction diodes and related devices.
CO3: Evaluate the performance and operation of BJTs in different configurations.
CO4: Interpret the characteristics and applications of FETs and MOSFETs.
CO5: Describe the operation and applications of special purpose semiconductor devices.

Text Books:

1. Solid State Electronic Devices, Ben G. Streetman and Sanjay Kumar Banerjee, Solid State Electronic Devices, 7th Edition, PHI Learning Pvt. Ltd., New Delhi, 2015.
2. Robert L. Boylestad and Louis Nashelsky, "Electronics devices and Circuit theory", Pearson, 10th Edition, 2012, ISBN: 9788131764596.
3. Integrated Electronics Analog Digital Circuits, Jacob Millman and D. Halkias, McGraw Hill.
4. Semiconductor Physics and Devices, Donald A. Neamen, *Semiconductor Physics and Devices: Basic Principles*, 4th Edition, McGraw-Hill Education, New York, 2012.

Reference Books/Materials:

1. Electronic Devices and Circuits, K. Lal Kishore B.S Publications
2. Electronic Devices and Circuits, S. Salivahanan, N. Suresh Kumar, McGraw Hill.
3. Muller & Camins, *Device Electronics for Integrated Circuits*, John Wiley
4. Sze S M, *Physics of Semiconductor Devices*, John Wiley

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

B. Tech II Year I Semester

25BAECETC04 DIGITAL SYSTEMS

L	T	P	C
3	0	0	3

Pre Requisites: NIL

Course Description:

This course provides a modern introduction to logic design and the basic building blocks used in digital systems, in particular digital computers. It starts with a discussion of combinational logic, and also the course deals with sequential circuits with HDL, State machines, Memory and Programmable devices.

Course Objectives:

1. To Understand the properties of Boolean algebra, logic operations, and minimization of Boolean functions.
2. To understand the different levels of modelling in hardware description language
3. To design combination logic circuits using HDL
4. To design sequential logic circuits using HDL
5. To familiarize students with digital system design practices.

UNIT I BOOLEAN ALGEBRA, LOGIC OPERATIONS, AND MINIMIZATION OF BOOLEAN FUNCTIONS **9 hours**

Number Systems and Codes, Representation of unsigned and signed integers, Floating Point representation of real numbers, Laws of Boolean Algebra, Theorems of Boolean Algebra, Realization of functions using logic gates, Canonical forms of Boolean Functions, Minimization of Functions using Karnaugh Maps.

UNIT II HARDWARE DESCRIPTION LANGUAGE **9 hours**

Introduction to Verilog - structural specification of logic circuits, behavioral specification of logic circuits, hierarchical Verilog Code, HDL Modelling Styles - conditional operator, if-else statement, case statement, for loop using storage elements with CAD tools-using Verilog constructs for storage elements, flip-flop with clear capability, using Verilog constructs for registers and counters.

UNIT III Combinational Logic Circuits **9 hours**

Combinational circuits – HDL Codes, Design with basic logic gates, design procedure, adders, subtractors, 4-bitbinary adder/ subtractor circuit, BCD adder, carry look- a-head adder, binary multiplier, magnitude comparator, data selectors, priority encoders, decoders, multiplexers, demultiplexers.

UNIT IV Sequential Logic Circuits **9 hours**

Basic architectural distinction between combinational and sequential circuits, Design procedure, latches, flip-flops, truth tables and excitation tables, timing and triggering consideration, conversion of flip- flops, design of counters, ripple counters, synchronous counters, ring counter, Johnson counter, registers, shift registers, universal shift register. HDL for Sequential Circuits

UNIT V FINITE STATE MACHINES AND PROGRAMMABLE LOGIC DEVICES **9 hours**

Types of FSM, capabilities and limitations of FSM, state assignment, realization of FSM using flipflops, Mealy to Moore conversion and vice-versa, reduction of state tables using partition technique, Design of sequence detector. Types of PLD’s: PROM, PAL, PLA, basic structure of CPLD and FPGA, advantages of FPGAs, Design of sequential circuits using ROMs, PLAs, CPLDs and FPGAs.

Course Outcomes:

At the end of this course students will demonstrate the ability to
CO1: Understand the properties of Boolean algebra, logic operations, concepts of K Map.
CO2: Understand the gate level, behaviour, data flow and switch level modelling of HDL.
CO3: Design combinational circuits using HDL.
CO4: Design sequential circuits using HDL.
CO5: Design of memory devices and programmable logic components.

Text Books:

1. Charles H. Roth, Jr, "Fundamentals of Logic Design", 4th Edition, Jaico Publishers.
2. Stephen Brown and Zvonko Vranesic, "Fundamentals of Digital Logic with Verilog Design", 3rd Edition, McGraw-Hill

Reference Books:

1. Donald D. Givonne, "Digital Principles and Design" TMH, 2003. Digital Logic & State Machine Design, David J. Comer, Oxford University Press, 3rd Reprinted Indian Edition, 2012.
2. M. Morris Mano, "Digital Design", 3rd Edition, PHI.
3. Samir Palnitkar, "Verilog HDL: A Guide to Digital Design and Synthesis", 2nd Edition, Prentice Hall PTR

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

B. Tech II Year I Semester

25BAECETC05 NETWORKS ANALYSIS

L	T	P	C
3	0	0	3

Pre Requisites: Basic Circuit Analysis, Basics of Electrical Engineering

Course Description:

This course covers the fundamentals of electrical circuit theory and network synthesis. Students will study DC/AC network theorems, transient responses in switching circuits, and sinusoidal steady-state analysis. The curriculum also introduces Laplace transforms for network functions, passive network synthesis using Foster and Cauer forms, and the analysis of various two-port network parameters.

Course Objectives:

1. To understand basic circuit elements, source transformations, and fundamental network theorems for DC circuit analysis [BL2]
2. To comprehend the transient and steady-state responses of RL, RC, and RLC circuits under DC excitation [BL2]
3. To understand AC circuit analysis using mesh/nodal methods, complex power concepts, and resonance phenomena [BL3]
4. To apply Laplace transforms for analyzing network functions and synthesizing one-port networks using Foster and Cauer forms [BL3]
5. To apply two-port network parameters (Z, Y, ABCD, h) and their interrelationships to analyze interconnected electrical networks [BL3]

UNIT I BASIC CIRCUIT CONCEPTS AND NETWORK THEOREM 9 hours

Passive and active circuit elements, Independent and dependent sources, Source transformation techniques, Star–Delta (Y–Δ) and Delta–Star (Δ–Y) transformations, Super node and super mesh concepts, Source transformation techniques, Linearity and superposition theorem, Thevenin's theorem and Norton's theorem, Maximum power transfer theorem, Reciprocity theorem, Millman's theorem, Tellegen's theorem

UNIT II TRANSIENT ANALYSIS 9 hours

Introduction to transient and steady-state responses, Initial and final conditions in switching circuits, RL and RC circuits with DC excitation, Natural response and forced response, Time constant and transient behavior, Step response of RL and RC circuits, Series and parallel RLC circuits

UNIT III SINUSOIDAL STEADY-STATE ANALYSIS 9 hours

AC circuit analysis using mesh and nodal methods, Resistance, inductance, and capacitance in AC circuits, Admittance and complex power, Active, reactive, and apparent power, Series and parallel resonance

UNIT IV NETWORK FUNCTIONS AND SYNTHESIS 9 hours

Circuit analysis using Laplace transform, Network functions and transfer functions, poles and zeros of network functions, positive real functions and their properties, driving point and transfer impedance/admittance functions, fundamentals of network synthesis, synthesis of one-port LC, RC, and RL networks, Foster Form–I and Foster Form–II realization, Cauer Form–I and Cauer Form–II realization

UNIT V TWO-PORT NETWORK 9 hours

Relationship of two port variables, Short circuit Admittance parameters, Open circuit Impedance parameters, Transmission Parameters, Hybrid Parameters, Relationship between parameter sets, Parallel connection of two port networks.

Course Outcomes:

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

CO1: Illustrate and interpret the application of various network theorems and circuit reduction techniques [BL2].

CO2: Classify and summarize the time-dependent behavior and switching conditions of reactive circuits [BL2].

CO3: Distinguish and outline AC power components, admittance parameters, and series/parallel resonance profiles [BL2].

CO4: Solve system transfer functions and construct passive LC, RC, and RL networks from driving-point expressions [BL3].

CO5: Determine and manipulate different parameter matrices to evaluate interconnected network configurations [BL3].

Text Books:

1. Hayt Jr, William H., Jack E. Kemmerly, and Steven M. Durbin. *Análise de Circuitos em Engenharia-8*. AMGH Editora, 2014.

2. Van Valkenburg, "Network Analysis", PHI, 3rd Edition, 2011.

3. Sudhakar & Shyam Mohan S. Pillai "Circuits & Network Analysis & Synthesis", TataMcGraw Hill, 2nd Edition, 1994

Reference Books/Materials:

1. Charles K. Alexander and Matthew N. O. Sadiku Fundamentals of Electric Circuits 7th Edition, McGraw Hill Education,2022.

2. Ravish R. Singh, *Network Analysis and Synthesis*, 2nd Edition, McGraw Hill Education, 2019.

3 https://nptel.ac.in/courses/108105159

4. https://nptel.ac.in/courses/117106108

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

B. Tech II Year I Semester

25BAECELC01 ELECTRONIC DEVICES AND CIRCUITS LABORATORY

L	T	P	C
0	0	2	1

Pre-Requisite: Nil

Course Description:

This laboratory course provides hands-on experience in the analysis, design, and characterization of semiconductor devices and basic electronic circuits using both hardware and simulation tools. Students perform experiments on diodes, BJTs, MOSFETs, JFETs, UJTs, rectifiers, voltage regulators, clipping and clamping circuits, amplifiers, and transistor biasing techniques. The course emphasizes the verification of device characteristics, circuit performance, and theoretical concepts through practical experimentation. Students develop skills in circuit design, measurement, analysis, and interpretation of experimental results using characteristic curves and performance parameters.

Course Objectives:

This course enables students to

1. Verify the theoretical concepts practically from all the experiments.
2. Analyse the characteristics of Diodes, BJT, MOSFET, UJT.
3. Design the amplifier circuits from the given specifications.
4. Model the electronic circuits using tools such as PSPICE/Multisim.

List of Experiments:

1. Verify the Volt- Ampere characteristics of a PN junction diode and find static, dynamic and reverse resistance of the diode from the graphs obtained through experiment. (using hardware and software)
2. Design a full wave rectifier for the given specifications with and without filters, and verify the given specifications experimentally. Vary the load and find ripple factor. Draw suitable graphs. (using hardware and software)
3. Verify various clipping and clamper circuits using PN junction diode and draw the suitable graphs. (using hardware and software)
4. Design a Zener diode-based voltage regulator against variations of supply and load. Verify the same from the experiment. (using hardware and software)
5. Draw the output and transfer characteristics of MOSFET (Enhance mode) in Common Source Configuration experimentally. Find Threshold voltage (VT), gm, & K from the graphs. (using hardware)
6. Draw the output and transfer characteristics of MOSFET (Depletion mode) or JFET in Common Source Configuration experimentally. Find IDSS, gm, & VP from the graphs. (using hardware)
7. Verify the input and output characteristics of BJT in Common Emitter configuration experimentally and find required h – parameters from the graphs. (using hardware and software)
8. Draw the input and output characteristics of BJT in Common Base configuration experimentally and determine required h – parameters from the graphs. (using hardware)
9. Draw the Volt Ampere characteristics of UJT and determine η, IP, Iv, VP, &Vv from the experiment (using hardware).
10. Design and analysis of voltage-divider bias/self-bias circuit using BJT. (Using hardware)

11. Design a suitable circuit for switch using BJT. (using hardware)
12. Design a small signal amplifier using BJT (common emitter) for the given specifications. Draw the frequency response and find the bandwidth. (using software)

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

B. Tech II Year I Semester

25BAECELC02 DIGITAL SYSTEMS LABORATORY USING HDL

L	T	P	C
0	0	2	1

Pre-Requisite: Nil

Course Description:

This laboratory course introduces students to digital hardware design using the Verilog Hardware Description Language (HDL). Students learn to model, simulate, and verify combinational and sequential logic circuits, including multiplexers, decoders, adders, comparators, ALUs, registers, counters, multipliers, and ROMs. The course also covers the design and implementation of finite state machines (FSMs), sequence detectors, and traffic light controllers using Verilog. Through hands-on experiments, students gain practical experience in coding, simulation, debugging, and functional verification of digital systems. The course provides a strong foundation for FPGA-based system design and modern VLSI digital design applications.

Course Objectives:

This course enables students to

1. Verify the truth tables of various logic circuits.
2. To design Combinational logic circuits using Hardware Description Language (HDL)
3. To analyze HDL modelling styles in Combinational and sequential logic circuits.
4. To design digital sub systems using HDL.
5. To design memory devices using HDL.

List of Experiments:

1. Design of two level and multi-level circuits using Verilog
2. Design of multiplexer and demultiplexer using Verilog
3. Design of decoder and encoder using Verilog
4. Design of full adder using Verilog
5. Design of comparator using Verilog
6. Design of arithmetic and logic unit using Verilog
7. Design of synchronous counter using Verilog
8. Design of flip flops using Verilog
9. Design of Register using Verilog
10. Design of asynchronous Counter using Verilog
11. Design of Multiplier using Verilog
12. Design of ROM using Verilog
13. Design of FSM using Verilog
14. Design of Sequence detector using Verilog
15. Design of traffic light controller using Verilog

Note: At least 12 experiments shall be performed and any 8 experiments should design in both software and hardware.

Course Outcomes:

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

CO1: Minimize logic design and develop efficient hardware models using Verilog

CO2: Implement and Simulate combinational logic circuits using Verilog

CO3: Implement and Simulate sequential logic circuits using Verilog

CO4: Develop digital sub systems and memory devices using Verilog

CO5: Implement and analyze finite state machine and programmable devices using Verilog.

Text Books:

1. Charles H. Roth, Jr, "Fundamentals of Logic Design", 4th Edition, Jaico Publishers.
2. Stephen Brown and Zvonko Vranesic, "Fundamentals of Digital Logic with Verilog Design", 3^{rd} Edition, McGraw-Hill

Reference Books:

1. Donald D. Givonne, "Digital Principles and Design" TMH, 2003. Digital Logic & State Machine Design, David J. Comer, Oxford University Press, 3rd Reprinted Indian Edition, 2012.
2. M. Morris Mano, "Digital Design", 3rd Edition, PHI.
3. Samir Palnitkar, "Verilog HDL: A Guide to Digital Design and Synthesis", 2nd Edition, Prentice Hall PTR

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

B. Tech II Year I Semester

25BAECELC03 CIRCUITS AND SIMULATION LABORATORY

L	T	P	C
0	0	2	1

Pre-Requisite: Nil

Course Description:

This course is designed to help students verify various network theorems and study the transient analysis of RLC circuits. Also design and analyse resonance circuits, two-port network parameters, and filter circuits.

Course Objectives:

This course enables students to

1. Understand various network theorems.
2. Design circuits to verify various Network theorems: Superposition, Thevenin’s, Norton’s, Millman’s theorem, Miller’s theorem, Reciprocity Theorem and Maximum Power Transfer Theorem.
3. Design and verify series and parallel resonance circuits.
4. Design and analyze the two-port networks.
5. Design filters with cut-off frequencies.

List of Experiments:

1. A) Verification of Kirchhoff’s Law.

   B) Apply Mesh and Node Analysis Techniques for Solving Electrical Circuits.

2. Verification of Superposition and Reciprocity Theorem.

3. A) Verification of Thevenin’s and Norton's Theorem.

   B) Verification of the Maximum Power Transfer Theorem.

4. Verification of Miller's Theorem and Millman’s Theorem.

5. Verification of Tellegen’s Theorem.

6. Design A Series RLC Circuit. Plot the frequency response and find the resonance frequency, Bandwidth, and Q-factor.
7. Design a Parallel RLC Circuit. Plot the frequency response and find the resonance frequency, Bandwidth, and Q-factor.

8. A) Design an RC Time Constant for A Given RC Circuit.
   B) Design an RL Time Constant for A Given RL Circuit.
9. Design and analyse (settling time, overshoot, undershoot, etc.) the step response of a given series RLC circuit for the following cases:
   i) $\zeta = 1$ (critically damped system)
   ii) $\zeta = 1$ (critically damped system)
   iii) $\zeta <$ (Underdamped system)

Choose appropriate values of R, L, and C to obtain each of the above cases one at a time.

10. Design and analyze Z, Y parameters of a two-port network.
11. Design and analyze ABCD & h parameters of a two-port network.
12. Design a Constant-K, T and π section of low-pass and high-pass filters for the following cutoff frequency.
    i)50 Hz
    ii)30 kHz

Course Outcomes:

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

CO1: Apply various theorems to solve the networks.

CO2: Design and verify series and parallel resonance circuits.

CO3: Analyse responses of RL, RC and RLC circuits with different inputs.

CO4: Design and analyse two-port networks using Z, Y, ABCD and h parameters.

CO5: Design filters for various cutoff frequencies

Text Books:

1. Sudhakar, A and Shyammohan S. Palli., "Circuits and Networks, Analysis and Synthesis", McGraw-Hill Education India Pvt. Ltd, 5th Edition, 2010
2. Van Valkenburg, "Network Analysis", Pearson Education, 3rd Edition, 2011.

Reference Books:

1. M.E. Van Valkenburg, "Analog Filter Design", Oxford University Press, 2010.
2. Franklin F. Kuo, "Network Analysis and synthesis", Wiley India Pvt Ltd, 2nd Edition, 2006.
3. Chenna Venkatesh, K and Ganesh Rao, D., "Network Analysis- A Simplified Approach", Elsevier, 2nd Edition, 2010.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

II Year II Semester

B. Tech II Year I Semester

25BAMATTC11 PROBABILITY THEORY AND STOCHASTIC PROCESSES

L	T	P	C
3	0	0	3

Pre Requisites: 25BAMATTC02**,** 25BAMATTC04

Course Description:

Probability, conditional probability, Bayes theorem, random variables, mathematical expectation, discrete and continuous distributions, joint distributions, random sequence, law of large numbers and stochastic processes.

Course Objectives:

1. Introduce the probability concepts through sets, and apply the joint and conditional probability.
2. Study the probability distributions and their importance.
3. Solve the problems related to multivariate probability distributions.
4. Analyze the concept of random sequence and formulate joint distributions by using transformation of random variables.
5. Apply the random processes to evolving in time or space analysis and applications to the signal processing in the communication system.

UNIT I PROBABILITY AND RANDOM VARIABLES **9 hours**

Probability – Classical and introduced through sets, joint and conditional probability, independent events, combined experiments and Bernoulli trials.

UNIT II ONE-DIMENSIONAL RANDOM VARIABLE **9 hours**

Random variable concept, distribution function, density function, Gaussian, binomial, Poisson, uniform, exponential and Rayleigh distributions. Expected value of a random variable, moments, Chebyshev's inequality, characteristic function, moment generating function and Chernoff's bounds.

UNIT III MULTIPLE RANDOM VARIABLES **9 hours**

Vector random variables, joint distribution function, joint density function and its properties, conditional distribution and conditional density functions; Statistical independence, joint moments, joint characteristic function.

UNIT IV TRANSFORMATION OF RANDOM VARIABLES AND RANDOM SEQUENCES **9 hours**

Jointly Gaussian random variables. Transformation of one and multiple random variables; Random sequences and modes of convergence (everywhere, almost everywhere, probability, distribution and mean square); Limit theorems: Strong and weak laws of large numbers, central limit theorem.

UNIT V RANDOM PROCESSES **9 hours**

Random process, Stationarity and independence, correlation functions, measurement of correlation functions, Gaussian random processes. Power spectrum density and its properties. Linear system fundamentals and random signal response of linear systems.

Course Outcomes:

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

CO1: Apply the concepts of probability, sets, joint probability, and conditional probability in solving engineering problems.

CO2: Analyse and apply various probability distributions relevant to engineering and communication systems.

CO3: Solve problems involving multivariate probability distributions and related statistical measures.

CO4: Apply transformations of random variables and analyse random sequences using joint distributions.

CO5: Analyse random processes evolving in time or space and apply them to signal processing in communication systems.

Text Books:

1. Probability, Random Variables & Random Signal Principles - Peyton Z. Peebles, TMH, 4th edition, 2001.

Reference Books:

1. H. Stark and J. Woods, ``Probability and Random Processes with Applications to Signal Processing," 3rd edition, Pearson Education.
2. A. Papoulis and S. Unnikrishnan Pillai, ``Probability, Random Variables and Stochastic Processes," 4th edition, McGraw-Hill.
3. K. L. Chung, Introduction to Probability Theory with Stochastic Processes, Springer International
4. S. Ross, Introduction to Stochastic Models, Harcourt Asia, Academic Press.

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

B. Tech II Year I Semester

25BAECETC06 MICROPROCESSORS AND MICROCONTROLLERS

L	T	P	C
3	0	0	3

Pre Requisites: Nil

Course Description:

This course introduces the fundamentals of microprocessors, microcontrollers, and embedded systems with emphasis on the 8086 and 8051 architectures. It covers assembly language programming, hardware interfacing, and Embedded C programming for real-time applications. Students learn modern embedded system concepts using ARM Cortex processors, communication protocols, and RTOS basics. The course also introduces IoT technologies, sensor interfacing, and ESP32/Arduino-based embedded platforms. It prepares students to design, program, and develop intelligent embedded solutions for industrial and IoT applications.

Course Objectives:

1. Understand architecture and operation of microprocessors and microcontrollers.
2. Develop assembly and Embedded C programs for processor-based systems.
3. Interface memory and peripheral devices with processors.
4. Design embedded applications using modern microcontrollers.
5. Analyze processor architectures including ARM-based systems.
6. Implement real-time hardware-software integrated applications.

UNIT I INTRODUCTION TO MICROPROCESSORS AND 8086 ARCHITECTURE **9 hours**

Evolution of microprocessors, Overview of embedded systems, 8086 architecture, Register organization, Bus structure, Memory segmentation, Pin configuration, Timing diagrams, Interrupt structure, Minimum and maximum mode operation

UNIT II ASSEMBLY LANGUAGE PROGRAMMING AND INTERFACING **9 hours**

Instruction set and addressing modes, Assembly language programming, Stack and subroutines, Macros and assembler directives, Memory interfacing, Interfacing 8255 PPI, Keyboard and display interfacing, ADC and DAC interfacing, Timer/counter applications

UNIT III 8051 MICROCONTROLLER AND EMBEDDED C **9 hours**

8051 architecture, Memory organization, I/O ports, Timers and counters, Serial communication, Interrupts, Embedded C programming basics, GPIO programming, Timer programming in Embedded C, UART communication, overview of instruction set.

UNIT IV ARM CORTEX AND MODERN EMBEDDED SYSTEMS **9 hours**

Introduction to ARM architecture, RISC vs CISC, ARM Cortex-M overview, ARM, programming model, GPIO and interrupt concepts, SPI, I2C and UART protocols, Embedded system design flow, Introduction to RTOS concepts, Power optimization in embedded systems

UNIT V IOT AND REAL-TIME EMBEDDED APPLICATIONS 9 hours
Basics of IoT systems, Embedded system applications, Sensor interfacing, Wireless communication basics, ESP32/Arduino overview, Real-time applications, Smart embedded products

Course Outcomes:
At the end of this course students will demonstrate the ability to
CO1: Explain the architecture and instruction set of microprocessors and microcontrollers.
CO2: Develop assembly and Embedded C programs for processor-based applications.
CO3: Interface peripherals, sensors, ADC/DAC and communication modules.
CO4: Design embedded applications using ARM-based controllers.
CO5: Analyze modern processor architectures and embedded system concepts.

Text Books:

1. Microprocessors and Interfacing Douglas V. Hall, McGraw Hill
2. *The 8051 Microcontroller and Embedded Systems* Muhammad Ali Mazidi, Janice Mazidi Pearson
3. *Embedded Systems: Architecture, Programming and Design* Raj Kamal McGraw Hill
4. *ARM System Developer's Guide* Andrew Sloss, Dominic Symes, Chris Wright Morgan Kaufmann

Reference Books:

1. *Microcomputer Systems: The 8086/8088 Family* Yu-Cheng Liu & Glenn Gibson PHI.
2. *ARM Cortex-M3 Technical Reference* Joseph Yiu Elsevier
3. *Embedded Systems* Shibu K.V. McGraw Hill

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

B. Tech II Year I Semester

25BAECETC07 SIGNALS AND SYSTEMS

L	T	P	C
3	0	0	3

Pre Requisites: Nil

Course Description:

This course introduces continuous-time and discrete-time signals and systems with emphasis on mathematical modelling, transform techniques, computational analysis, DSP simulations, and AI-assisted engineering applications. The course integrates theoretical concepts with practical implementations using modern computational tools and software platforms.

Course Objectives:

1. To understand the fundamentals of continuous-time and discrete-time signals and systems.
2. To analyse Linear Time Invariant (LTI) systems in both time and frequency domains.
3. To apply Fourier, Laplace, and Z-transform techniques for signal and system analysis.
4. To develop computational, programming, and DSP simulation skills using modern engineering tools such as MATLAB and Python.
5. To apply signal processing concepts to real-world applications in communication, biomedical, embedded, IoT, and AI-assisted engineering systems.

UNIT I FUNDAMENTALS OF SIGNALS AND SYSTEMS **9 hours**

Introduction to Signals and Systems, Classification of Signals, Classification of Systems, Elementary Continuous-Time signals, Representation of Discrete-time Signals, Elementary Discrete-Time Signals, Classification of DT signals, Operation on signals, Classification of DT Signals and DT Systems.

UNIT II FOURIER ANALYSIS OF SIGNALS **9 hours**

Orthogonal Signal Representation, Trigonometric Fourier Series, Exponential Fourier Series, Fourier Transform, Properties of Fourier Transform, Parseval's Theorem, Frequency Spectrum Analysis, Bandwidth Concepts

UNIT III ANALYSIS OF LTI SYSTEMS **9 hours**

Linear Time Invariant Systems, Impulse Response, Convolution Integral, Convolution Sum, Properties of Convolution, Correlation, Linear Constant - Coefficient Differential Equation Representation, Linear Constant - Coefficient Difference Equation Representation, Block Diagram Representations of First-Order Systems Described by Differential & Difference Equation's, System Interconnections

UNIT IV LAPLACE TRANSFORM AND SYSTEM MODELING **9 hours**

Laplace Transform, Properties of Laplace Transform, Region of Convergence, Inverse Laplace Transform, Transfer Functions, Pole-Zero Analysis, System Stability, Frequency Response, System Modeling Techniques

UNIT V SAMPLING AND Z-TRANSFORM **9 hours**

Sampling Theorem, Aliasing, Signal Reconstruction, Introduction to Discrete-Time Signal Processing, Z-Transform, Properties of Z-Transform, Inverse Z-Transform, Difference Equations, Digital Signal System Analysis.

Course Outcomes:

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

CO1: Interpret and classify continuous-time and discrete-time signals and systems used in modern engineering applications.

CO2: Analyze Linear Time Invariant (LTI) systems using convolution and time-domain techniques.

CO3: Apply Fourier analysis techniques for frequency-domain representation of engineering signals.

CO4: Evaluate system behaviour and stability using Laplace transform techniques.

CO5: Analyze sampled and discrete-time systems using Z-transform and computational signal processing tools.

Text Books:

1. Oppenheim, Alan V., Alan S. Willsky, and S. Hamid Nawab. Signals and Systems. 2nd ed., Pearson Education, 2015
2. Haykin, Simon, and Barry Van Veen. Signals and Systems. 2nd ed., Wiley India, 2007.
3. Lathi, B. P. Continuous and Discrete Signals and Systems. Oxford University Press, 2009.
4. Lathi, B. P. Signals, Systems and Communications. Oxford University Press, 2009.

Reference Books:

1. Kumar, A. Anand. Signals and Systems. PHI Learning, 2013.
2. Hsu, Hwei P. Signals and Systems. Schaum's Outline Series, McGraw-Hill Education, 2011.
3. Lathi, B. P. Signal Processing and Linear Systems. Oxford University Press, 2005.
4. Proakis, John G., and Dimitris G. Manolakis. Digital Signal Processing: Principles, Algorithms, and Applications. 4th ed., Pearson Education, 2007.
5. Oppenheim, Alan V., and Ronald W. Schafer. Discrete-Time Signal Processing. 3rd ed., Pearson Education, 2010.

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

B. Tech II Year I Semester

25BAECETC08 LINEAR INTEGRATED CIRCUITS

L	T	P	C
3	0	0	3

Pre Requisites: Nil

Course Description:

This course introduces the fundamentals of Linear Integrated Circuits (LICs), operational amplifiers, and their applications in analog circuit design. It covers Op-Amp based circuits, active filters, oscillators, timers, phase-locked loops (PLLs), and data converters (DACs and ADCs). The course develops the ability to analyze and design analog electronic systems for communication, instrumentation, and embedded applications.

Course Objectives:

1. Understand the characteristics and operation of linear integrated circuits and operational amplifiers.
2. Analyze and design Op-Amp based linear and non-linear circuits.
3. Design and study active filters, oscillators, waveform generators, and voltage regulator circuits.
4. Understand the working principles and applications of timers and phase locked loops (PLL).
5. Analyze the operation of DACs, ADCs, and other data conversion circuits used in analog and digital interfacing.

UNIT I INTEGRATED CIRCUITS & OP-AMPS 9 hours

Classification of ICs , Ideal and practical Op-Amp characteristics, Internal circuitry of IC 741,DC and AC characteristics, Modes of operation: Inverting amplifier ,Non-inverting amplifier, Differential amplifier, properties of Op-amp.

UNIT II OP-AMP APPLICATIONS 9 hours

Adder, Subtractor, scaling, Instrumentation amplifier,AC amplifier ,V-I and I-V converters , Integrator and differentiator , Comparators , Schmitt trigger , Multivibrators , Voltage regulators ,IC 723 features

UNIT III ACTIVE FILTERS & OSCILLATORS 9 hours

First-order Low Pass Filter and High Pass Filter, Band-pass and band-reject filters, All-pass filters , RC oscillators , Wien bridge oscillator , Quadrature oscillator , Waveform generators VCO basics

UNIT IV TIMERS & PHASE LOCKED LOOP 9 hours

IC 555 timer, Monostable multivibrator , Astable multivibrator, Schmitt trigger using 555, PLL fundamentals IC 565 PLL,Frequency multiplication and demodulation applications

UNIT V DAC & ADC 9 hours

Weighted resistor DAC, R-2R ladder DAC , IC 1408 DAC, Parallel comparator ADC,Counter type ADC , Successive approximation ADC , Dual slope ADC , DAC/ADC specifications

Course Outcomes:

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

CO1: Analyze the characteristics and performance parameters of operational amplifiers and linear integrated circuits.

CO2: Design and implement Op-Amp based linear and non-linear applications such as amplifiers, filters, oscillators, and waveform generators.

CO3: Apply IC 555 timers and PLL circuits for timing, pulse generation, and communication applications.
CO4: Analyze and design data conversion circuits including DACs and ADCs.
CO5: Design, test, and troubleshoot practical linear IC application circuits in laboratory environments.

Text Books:

1. Linear Integrated Circuits — D. Roy Chowdhury, New Age International Publishers.
2. Op-Amps & Linear ICs — Ramakanth A. Gayakwad, PHI Publications.
3. Operational Amplifiers & Linear Integrated Circuits — R. F. Coughlin and Frederick F. Driscoll, PHI.

Reference Books:

1. Design with Operational Amplifiers & Analog Integrated Circuits — Sergio Franco, McGraw Hill.
2. Operational Amplifiers & Linear ICs — David A. Bell, Oxford University Press.
3. Operational Amplifiers — C. G. Clayton, Elsevier Publications.

Online Learning Resources

1. Oppenheim, Alan V., and Ronald W. Schafer. Discrete-Time Signal Processing. 3rd ed., Pearson Education, 2010.

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

B. Tech II Year I Semester

25BAECELC04 MICROPROCESSORS AND MICROCONTROLLERS LABORATORY

L	T	P	C
0	0	2	1

Pre-Requisite: Nil

Course Description:

This laboratory course provides practical experience in microprocessor, microcontroller, ARM, and IoT system design through hands-on experiments. Students learn 8086 assembly programming, 8051 Embedded C programming, and ARM Cortex-based embedded applications. The course emphasizes hardware interfacing with LEDs, LCDs, sensors, motors, and communication peripherals. It also introduces IoT technologies for real-time monitoring and wireless data transmission using ESP32. The laboratory develops skills in embedded system programming, debugging, and implementation of real-world applications.

Course Objectives:

This course enables students to

1. To develop programming skills in 8086 assembly language and perform arithmetic, logical, and data manipulation operations.
2. To understand the architecture and programming of the 8051 microcontroller using Embedded C for embedded application development.
3. To gain practical knowledge of interfacing peripherals such as LEDs, LCDs, timers, UART, ADCs, sensors, and stepper motors.
4. To implement ARM Cortex-based embedded systems using GPIO, SPI, I2C, and sensor interfacing techniques.
5. To design and develop IoT-based applications using ESP32 for wireless communication, data acquisition, and real-time monitoring.

List of Experiments:

Section A – 8086 and Assembly Programming

1. Addition and subtraction using 8086
2. Multiplication and division programs
3. Sorting and searching algorithms
4. String manipulation programs
5. Delay generation using assembly language
6. Interfacing LED and seven-segment display

Section B – 8051 and Embedded C

7. LED blinking using Embedded C
8. Traffic light controller
9. Timer programming
10. Serial communication using UART
11. LCD interfacing
12. ADC sensor interfacing
13. Temperature monitoring system

14. Stepper motor interfacing

Section C – ARM and IoT Applications

15. GPIO programming using ARM Cortex
16. Sensor interfacing using ARM board
17. SPI and I2C communication
18. Wi-Fi-based data transmission using ESP32
19. IoT-based monitoring system
20. Mini-project implementation

Suggested Software Tools

Category	Tools
8086 Simulation	EMU8086, DOSBox
8051 Development	Keil uVision
Circuit Simulation	Proteus
ARM Development	STM32CubeIDE, Keil
IoT Development	Arduino IDE
Hardware Simulation	Multisim

Course Outcomes:

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

CO1: Develop and execute 8086 assembly language programs for arithmetic, logical, data manipulation, sorting, searching, string processing, and delay generation applications.

CO2: Apply Embedded C programming concepts to develop applications using the 8051 microcontroller, including timers, UART communication, LCDs, ADCs, sensors, and stepper motors.

CO3: Design and implement microcontroller-based interfacing applications involving LEDs, seven-segment displays, traffic light controllers, temperature monitoring systems, and other peripheral devices.

CO4: Develop ARM Cortex-based embedded applications using GPIO, SPI, I²C, and sensor interfacing techniques.

CO5: Design and implement ESP32-based IoT applications for wireless data transmission, real-time data acquisition, and remote monitoring.

Text Books:

1. *Microprocessors and Interfacing* Douglas V. Hall, McGraw Hill
2. *The 8051 Microcontroller and Embedded Systems* Muhammad Ali Mazidi, Janice Mazidi Pearson
3. *Embedded Systems: Architecture, Programming and Design,* Raj Kamal, McGraw Hill
4. *ARM System Developer's Guide,* Andrew Sloss, Dominic Symes, Chris Wright, Morgan Kaufmann

Reference Books:

1. *Microcomputer Systems: The 8086/8088 Family,* Yu-Cheng Liu & Glenn Gibson, PHI
2. *ARM Cortex-M3 Technical Reference,* Joseph Yiu, Elsevier
3. *Embedded Systems,* Shibu K.V., McGraw Hill

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

B. Tech II Year I Semester

25BAECELC05 SIGNALS AND SYSTEMS LABORATORY

L	T	P	C
0	0	2	1

Pre-Requisite: Nil

Course Description:

This laboratory course provides hands-on experience in analyzing and processing continuous-time and discrete-time signals using MATLAB or Python. Students perform signal operations such as convolution, correlation, sampling, and Fourier analysis while studying system properties and stability. The course also covers random processes, Gaussian noise, aliasing, and pole-zero analysis through simulation. It develops programming skills and practical knowledge for real-world signal processing and communication applications.

Course Objectives:

This course enables students to

1. To understand the generation, visualization, and analysis of continuous-time and discrete-time signals and systems.
2. To perform signal processing operations including convolution, correlation, sampling, and Fourier analysis using programming tools.
3. To analyze the time-domain and frequency-domain characteristics of signals through Fourier Transform and Fourier Series techniques.
4. To investigate system properties, sampling theorem, aliasing effects, random processes, and statistical characteristics of signals.
5. To develop programming skills for modeling, simulation, stability analysis, and implementation of signal processing concepts in engineering applications.

List of Experiments:

1. Generate and visualize fundamental continuous-time and discrete-time signals and sequences including periodic and aperiodic signals, unit impulse, unit step, square, sawtooth, triangular, sinusoidal, ramp, and sinc functions.
2. Perform basic operations on signals and sequences such as addition, multiplication, amplitude scaling, time shifting, folding (time reversal), and computation of signal energy and average power.
3. Develop a program to compute the trigonometric and exponential Fourier series coefficients of a rectangular periodic signal, reconstruct the signal using the obtained coefficients, and plot its discrete frequency spectrum.
4. Compute the Fourier Transform of a given signal and plot its amplitude and phase spectra.
5. Develop a program to perform convolution of two discrete-time sequences and plot the input and output sequences.
6. Compute and analyze the autocorrelation and cross-correlation of given sequences.
7. Develop a program to verify the linearity and time-invariance properties of a given continuous-time system.
8. Generate a discrete-time sequence by sampling a continuous-time signal and demonstrate the occurrence of aliasing when the sampling rate is below the Nyquist rate during signal

reconstruction.

9. Develop a program to generate complex Gaussian noise and evaluate its statistical characteristics such as mean, variance, Probability Density Function (PDF), and Power Spectral Density (PSD).
10. Develop a program to generate bipolar random data for a specified data rate (e.g., 10 kbps) and plot the waveform over a duration of 0.2 seconds.
11. Write a program to generate Complex Gaussian noise and find its mean, variance, Probability
12. To plot pole-zero diagram in S-plane of given signal/sequence and verify its stability.

Tools Used:
Google Colab, MATLAB, Python, AI Tools

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

CO1: Generate, visualize, and perform basic operations on continuous-time and discrete-time signals and sequences using programming tools.

CO2: Analyze signals in the time and frequency domains by implementing Fourier Series, Fourier Transform, convolution, correlation, and sampling techniques.

CO3: Evaluate the characteristics of linear time-invariant systems, investigate sampling theorem and aliasing effects, and verify system stability using pole-zero analysis.

CO4: Generate and analyze random signals, Gaussian noise, and bipolar data sequences by evaluating their statistical properties for practical signal processing and communication applications.

CO5: Develop and implement simulation-based solutions for signal processing problems using programming tools, and interpret the results for engineering applications involving signals, systems, and communication.

Text Books:

1. Oppenheim, Alan V., Alan S. Willsky, and S. Hamid Nawab. Signals and Systems. 2nd ed., Pearson Education, 2015.
2. Haykin, Simon, and Barry Van Veen. Signals and Systems. 2nd ed., Wiley India, 2007.
3. Lathi, B. P. Continuous and Discrete Signals and Systems. Oxford University Press, 2009.
4. Lathi, B. P. Signals, Systems and Communications. Oxford University Press, 2009.

Reference Books:

1. Kumar, A. Anand. Signals and Systems. PHI Learning, 2013.
2. Hsu, Hwei P. Signals and Systems. Schaum’s Outline Series, McGraw-Hill Education, 2011.
3. Lathi, B. P. Signal Processing and Linear Systems. Oxford University Press, 2005.
4. Proakis, John G., and Dimitris G. Manolakis. Digital Signal Processing: Principles, Algorithms, and Applications. 4th ed., Pearson Education, 2007.
5. Oppenheim, Alan V., and Ronald W. Schafer. Discrete-Time Signal Processing. 3rd ed., Pearson Education, 2010.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

B. Tech II Year I Semester

25BAECELC06 LINEAR INTEGRATED CIRCUITS LABORATORY

L	T	P	C
0	0	2	1

Pre-Requisite: Nil

Course Description:

Students perform hands-on experiments on amplifiers, comparators, filters, oscillators, waveform generators, ADCs, DACs, voltage regulators, and sample-and-hold circuits. The course emphasizes practical circuit design, simulation, testing, and performance evaluation using standard analog ICs such as IC 741, IC 555, IC 565, IC 723, and LF398. Students develop proficiency in measuring circuit parameters, analyzing responses, and validating theoretical concepts through experimentation.

Course Objectives:

This course enables students to

1. To understand the practical operation and characteristics of operational amplifiers and linear integrated circuits.
2. To design and implement Op-Amp based linear and non-linear circuits.
3. To analyze the performance of active filters, oscillators, waveform generators, and timer circuits.
4. To study the operation of PLL, DAC, ADC, and voltage regulator circuits.
5. To develop practical skills in circuit design, testing, troubleshooting, and measurement using laboratory instruments.

List of Experiments:

1. Design and analysis of inverting and non-inverting amplifier circuits using IC 741.
2. Design and analysis of voltage follower and comparator circuits using Op-Amp.
3. Design and analysis of adder and subtractor circuits using Op-Amp.
4. Design and analysis of integrator and differentiator circuits using IC 741.
5. Design and analysis of comparator and Schmitt trigger circuits using Op-Amp.
6. Design and analysis of active low-pass and high-pass filters using IC 741.
7. Design and analysis of RC phase shift oscillator using Op-Amp.
8. Design and analysis of Wien bridge oscillator using Op-Amp.
9. Design and analysis of square wave and triangular wave generator circuits.
10. Design and analysis of IC 555 timer in monostable mode.
11. Design and analysis of IC 555 timer in astable mode.
12. Design and analysis of PLL applications using IC 565.
13. Design and analysis of DAC using R-2R ladder network.
14. Design and analysis of ADC circuits.
15. Design and analysis of voltage regulator circuits using IC 723 / 78XX series.

16. Design and analysis of sample and hold circuit using LF398.

Note: At least 12 experiments shall be performed and any 8 experiments should design in both software and hardware.

Course Outcomes:

CO1: Design and test Op-Amp based amplifier and waveform generation circuits.

CO2: Implement active filters, oscillators, comparators, and timer circuits using linear ICs.

CO3: Analyze the operation and applications of PLL, DAC, ADC, and voltage regulator ICs.

CO4: Use electronic measuring instruments effectively for testing and verification of circuits.

CO5: Troubleshoot and evaluate the performance of practical linear IC application circuits.

Text Books:

1. Op-Amps and Linear Integrated Circuits — Ramakant A. Gayakwad, Pearson Education.Pearson Edition
2. Linear Integrated Circuits — D. Roy Choudhury & Shail B. Jain, New Age International Publishers.New Age Publishers

Reference Books:

1. Operational Amplifiers and Linear Integrated Circuits — Robert F. Coughlin & Frederick F. Driscoll, PHI. PHI Learning.
2. Design with Operational Amplifiers and Analog Integrated Circuits — Sergio Franco, McGraw Hill. McGraw Hill Edition.
3. Operational Amplifiers and Linear ICs — David A. Bell, Oxford University Press. Oxford University Press

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

SKILL ENHANCEMENT COURSES

Skill Enhancement Course – I

25BACSESC06 PYTHON PROGRAMMING

L	T	P	C
1	0	2	2

Pre-requisite: Nil

Course Description:

This course serves as an introduction to the Python programming language, designed for beginners with little or no prior programming experience. Python is renowned for its simplicity and readability, making it an ideal first language. The course will cover fundamental programming concepts such as variables, data types, control flow (loops and conditionals), functions, and basic file handling. Participants will gain hands-on experience through coding exercises and projects, reinforcing their understanding of Python syntax and best practices.

Course Objectives:

The main objectives of the course are to

1. Introduce core programming concepts of Python programming language.
2. Learn to solve problems using Python conditional and loops.
3. Demonstrate about Python data structures like Lists, Tuples, Sets and dictionaries
4. Implement Functions, Modules and Regular Expressions in Python Programming and to create practical and contemporary applications.
5. Demonstrate to do input/output with files in Python.

UNIT I DATA TYPES, EXPRESSIONS AND CONTROL FLOW STATEMENTS — 6 hours

Introduction: Identifiers, Keywords, Statements and Expressions, Variables, Operators, Precedence and Associativity, Data Types, Indentation, Comments, Reading Input, Print Output, Type Conversions, the type () Function and Is Operator, Dynamic and Strongly Typed Language.

Control Flow Statements: if statement, if-else statement, if...elif…else, Nested if statement, while Loop, for Loop, continue and break Statements, Catching Exceptions Using try and except Statement.

Sample Experiments:

1. Write a program to find the largest element among three Numbers.
2. Write a program to swap two numbers without using a temporary variable.
3. Demonstrate the following Operators in Python with suitable examples.
   i) Arithmetic Operators ii) Relational Operators iii) Assignment Operators iv) Logical Operators v) Bit wise Operators vi) Ternary Operator vii) Membership Operators viii) Identity Operators

UNIT II LISTS & DICTIONARIES — 6 hours

Lists: Creating Lists, Basic List Operations, Indexing and Slicing in Lists, Built-In Functions Used on Lists, List Methods, del Statement.

Dictionaries: Creating Dictionary, Accessing and Modifying key: value Pairs in Dictionaries, Built-In Functions Used on Dictionaries, Dictionary Methods, del Statement.

Sample Experiments:

4. Write a program to perform the given operations on a list:
   i. Addition ii. Insertion iii. slicing
5. Write a program to perform any 5 built-in functions by taking any list.
6. Write a program to sum all the items in a given dictionary.

UNIT III TUPLES AND SETS **6 hours**

Tuples and Sets: Creating Tuples, Basic Tuple Operations, tuple() Function, Indexing and Slicing in Tuples, Built-In Functions Used on Tuples, Relation between Tuples and Lists, Relation between Tuples and Dictionaries, Using zip() Function, Sets, Set Methods, Frozenset.

Sample Experiments:

7. Write a program to create tuples (name, age, address, college) for at least two members and concatenate the tuples and print the concatenated tuples.
8. Write a program to count the number of vowels in a string (No control flow allowed).
9. Write a program to check if a given key exists in a dictionary or not.

UNIT IV FUNCTIONS & STRINGS **6 hours**

Functions: Built-In Functions, Commonly Used Modules, Function Definition and Calling the function, return Statement and void Function, Scope and Lifetime of Variables, Default Parameters, Keyword Arguments, *args and **kwargs, Command Line Arguments.

Strings: Creating and Storing Strings, Basic String Operations, Accessing Characters in String by Index Number, String Slicing and Joining, String Methods, Formatting Strings.

Sample Experiments:

10. Write a program to define a function with multiple return values.
11. Write a program to define a function using default arguments.
12. Write a program to find the length of the string without using any library functions.

UNIT V FILES HANDLING IN PYTHON **6 hours**

Files: Types of Files, Creating and Reading Text Data, File Methods to Read and Write Data, Reading and Writing Binary Files, Pickle Module, Reading and Writing CSV Files, Python os and os.path Modules.

Sample Experiments:

13. Write a program to sort words in a file and put them in another file. The output file should have only lower-case words, so any upper-case words from source must be lowered.
14. Implement a Python program to print each line of a file in reverse order.
15. Write a Python program to compute the number of characters, words and lines in a file.

Course Outcomes:

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

CO1: Understand to adept command of Python syntax, deftly utilizing variables, data types, and control structures.

CO2: Interpret Strings, functions, modules, exception handling to engineer robust and efficient code solutions.

CO3: Apply Python programming concepts like Lists and Dictionary to solve a variety of computational problems.

CO4: Build and manipulate fundamental data structures such as tuples and sets.

CO5: Demonstrate file handling concepts in python.

Text Book(s)

1. Gowri shankar S, Veena A., Introduction to Python Programming, CRC Press.
2. Python Programming, S Sridhar, J Indumathi, V M Hariharan, 2^{nd} Edition, Pearson, 2024.

Reference Books

1. Introduction to Programming Using Python, Y. Daniel Liang, Pearson.
2. Paul Deitel and Harvey Deitel, "Python for Programmers", Pearson Education, 1st Edition, 2021.

Online Material links:

1. https://www.coursera.org/learn/python-for-applied-data-science-ai
2. https://www.coursera.org/learn/python?specialization=python#syllabus

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

Skill Enhancement Course – II

25BAECESC01 EMBEDDED C PROGRAMMING AND INTERFACING

L	T	P	C
1	0	2	2

Pre-requisite: 25BAECESC01

Course Description:

This Skill Enhancement Course provides students with practical knowledge of Embedded C programming and hardware interfacing using microcontrollers. The course focuses on developing firmware, configuring peripherals, and interfacing various sensors and communication modules for real-time embedded applications. The syllabus aligns with industry requirements by emphasizing hands-on experiments and mini-project development. It is also consistent with MITS' emphasis on skill enhancement and embedded systems training.

Course Objectives:

The main objectives of the course are to

1. Understand the fundamentals of embedded systems and Embedded C programming.
2. Develop Embedded C programs for microcontroller-based applications.
3. Interface various input/output devices using GPIO.
4. Configure timers, interrupts, ADC, PWM, and serial communication.
5. Design and implement real-time embedded applications using sensors and actuators

UNIT I INTRODUCTION TO EMBEDDED C PROGRAMMING 6 hours

1. Write an Embedded C program to blink an LED.
2. Write a program to generate different LED blinking patterns using loops.
3. Write Embedded C programs demonstrating:
   i) Arithmetic Operators
   ii) Relational Operators
   iii) Logical Operators
   iv) Bitwise Operators

UNIT II EMBEDDED C FUNCTIONS, POINTERS AND MEMORY 6 hours

Functions in Embedded C, Passing Arguments, Return Values, Inline Functions, Recursive Functions, Pointers, Pointer Arithmetic, Pointer to Functions, Arrays, Strings, Structures, Unions, Enumerations, Dynamic Memory Concepts, Volatile and Const Qualifiers.

Sample Experiments:

4. Write a program using functions to perform arithmetic operations.
5. Write a program demonstrating pointers and pointer arithmetic.
6. Write a program using structures to store sensor information.

UNIT III GPIO INTERFACING AND DISPLAY DEVICES 6 hours

GPIO Configuration, Digital Input and Output, LED Interfacing, Push Button Interfacing, Switch Debouncing, Seven Segment Display, LCD (16×2) Interfacing, Keypad Interfacing, Relay Interfacing, Buzzer Control.

Sample Experiments:

7. Interface LEDs and generate different lighting sequences.
8. Interface push buttons to control LEDs.
9. Interface a 16×2 LCD and display static and dynamic messages.

UNIT IV TIMERS, INTERRUPTS AND SERIAL COMMUNICATION 6 hours

Timers and Counters, Timer Programming, Interrupts, Interrupt Service Routine (ISR), External Interrupts, UART Communication, Serial Data Transmission and Reception, SPI and I²C Communication Basics, PWM Generation.

Sample Experiments:

10. Generate time delays using timers.
11. Interface UART to transmit and receive data.
12. Generate PWM signal for LED brightness control.

UNIT V SENSOR AND ACTUATOR INTERFACING 6 hours

Introduction to Sensors and Actuators, ADC Fundamentals, ADC Programming, Temperature Sensor Interfacing, LDR Sensor, Ultrasonic Sensor, IR Sensor, DC Motor Interfacing, Servo Motor Control, Relay Interfacing, Mini Embedded System Application Development.

Sample Experiments:

13. Interface a temperature sensor and display measured values.
14. Interface an ultrasonic sensor to measure distance.
15. Develop a mini embedded application integrating sensor input and actuator control.

Course Outcomes:

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

CO1: Understand to adept command of Python syntax, deftly utilizing variables, data types, and control structures.

CO2: Interpret Strings, functions, modules, exception handling to engineer robust and efficient code solutions.

CO3: Apply Python programming concepts like Lists and Dictionary to solve a variety of computational problems.

CO4: Build and manipulate fundamental data structures such as tuples and sets.

CO5: Demonstrate file handling concepts in python.

Text Book(s)

1. Gowri shankar S, Veena A., Introduction to Python Programming, CRC Press.
2. Python Programming, S Sridhar, J Indumathi, V M Hariharan, 2nd Edition, Pearson, 2024.

Reference Books

1. Introduction to Programming Using Python, Y. Daniel Liang, Pearson.
2. Paul Deitel and Harvey Deitel, "Python for Programmers", Pearson Education, 1st Edition, 2021.

Online Material links:

1. https://www.coursera.org/learn/python-for-applied-data-science-ai
2. https://www.coursera.org/learn/python?specialization=python#syllabus

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination