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

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
Course Structure
&
Detailed Syllabi

For the students admitted to

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

and

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

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

MADANAPALLE INSTITUTE OF TECHNOLOGY & SCIENCE

(Deemed to be University)

MADANAPALLE

B. Tech Four Year Curriculum Structure

Branch: ELECTRICAL AND ELECTRONICS ENGINEERING

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

I. Induction Program and Holistic Development Activities

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

R25 - Curriculum Structure

I Year I Semester

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

I Year II Semester

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

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

II Year I Semester

S. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total	
1	BSC	25BAMATTC07	Transforms and Numerical Methods	3	0	0	3	3
2	ESC	25BAEEETC04	Electric Circuit Analysis	3	0	0	3	3
3	PCC	25BAEEETC05	DC Machines and Transformers	3	0	0	3	3
4	PCC	25BAEEETC06	Analog Electronic Circuits	3	0	0	3	3
5	PCC	25BAEEETC07	Digital System Design	3	0	0	3	3
6	PCC	25BAEEELC02	DC Machines and Transformers Laboratory	0	0	2	2	1
7	PCC	25BAEEELC03	Analog Electronics Circuits Laboratory	0	0	2	2	1
8	PCC	25BAEEELC04	Digital Systems 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				**16**	**0**	**10**	**26**	**20**

II Year II Semester

S. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total	
1	PCC	25BAEEETC08	Signals and Networks	3	0	0	3	3
2	PCC	25BAEEETC09	AC Rotating Machines	3	0	0	3	3
3	PCC	25BAEEETC10	Control Systems	3	0	0	3	3
4	PCC	25BAEEETC11	Microprocessors and Microcontrollers	3	0	0	3	3
5	OE		**Open Elective – I** *(Refer ANNEXURE - II)*	3	0	0	3	3
6	PCC	25BAEEELC05	AC Rotating Machines Laboratory	0	0	2	2	1
7	PCC	25BAEEELC06	Control Systems Laboratory	0	0	2	2	1
8	PCC	25BAEEELC07	Microprocessors and Microcontrollers 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				**16**	**0**	**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	HSMC		Management Course-1	3	0	0	3	3
2	ESC	25BACSETC07	Data Structures	3	0	0	3	3
3	PCC	25BAEEETC11	Power Electronics	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	ESC	25BACSELC15	Data Structures Laboratory	0	0	2	2	1
7	PCC	25BAEEELC08	Power Electronics Laboratory	0	0	2	2	1
8	SEC		**Skill Enhancement Course – III** *(Refer ANNEXURE - IV)*	1	0	2	3	2
9	INT	25BAEEEIC01	Summer Internship - I	0	0	2	2	1
10	EEC		**NSDC - Certification Course – III** *(Refer ANNEXURE - V)*	0	0	2	2	-
Total				**16**	**0**	**10**	**26**	**20**

III Year II Semester

S. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total	
1	HSMC		Management Course-2	3	0	0	3	3
2	PCC	25BAEEETC12	Transmission and Distribution of Electrical Power	2	0	0	2	2
3	PCC	25BAEEETC13	Power System Analysis	3	0	0	3	3
4	PCC	25BAEEETC14	Electric Vehicle Technology	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	25BAEEELC09	Power System Simulation Laboratory	0	0	2	2	1
8	PCC	25BAEEELC10	Electric Vehicle 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	PCC	25BAEEETC15	Solid State Drives and Control	3	0	0	3	3
2	PCC	25BAEEETC16	Smart Grid	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	25BAEEELC11	Electrical Drives Laboratory	0	0	2	2	1
8	SEC		**Skill Enhancement Course – IV** *(Refer ANNEXURE – IV)*	1	0	2	3	2
9	INT	25BAEEEIC02	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	25BAEEEPC01	Capstone Project	0	0	28	28	14
2	INT	25BAEEEIC03	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)			
S. 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	25BACIVOM02	Safety in Construction	Civil
11	25BAMECOM01	Operations Management	Mechanical
12	25BAECEOM01	Microprocessors and Interfacing	ECE
13	25BAECEOM02	Microprocessors and Microcontrollers	ECE
14	25BACSEOM01	Privacy and Security in Online Social Media	CSE
15	25BACSEOM02	Computer Networks and Internet Protocol	CSE
16	25BACSEOM03	Introduction to Soft Computing	CSE
17	25BACSEOM04	Human Computer Interaction (in Hindi)	CSE
18	25BACOMOM01	Research Methodology	Multidisciplinary
19	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.	25BAEEEDM01	Computer Architecture and Organization
2.	25BAEEEDM02	Computer Architecture
3.	25BAEEEDM03	Microsensors and Nanosensors
4.	25BAEEEDM04	Electronic Systems Design: Hands-on Circuits and PCB Design with CAD Software
5.	25BAEEEDM05	Electronic Modules for Industrial Applications using Op-Amps
6.	25BAEEEDM06	Electronic Systems for Cancer Diagnosis
7.	25BAEEEDM07	Electrical Safety and Risk Management
Any advanced Course offered by SWAYAM NPTEL can be appended in future.		

Discipline Elective – II		
S. No.	**Course Code**	**Course Title**
1.	25BAEEEDC01	Special Electric Machines
2.	25BAEEEDC02	Design of Electrical Machines
3.	25BAEEEDC03	Energy Storage Technology
4.	25BAEEEDC04	Real Time Embedded Systems
5.	25BAEEEDC05	VLSI Design
Any advanced courses can be appended in future.		

Discipline Elective – III		
S. No.	**Course Code**	**Course Title**
1.	25BAEEEDC06	Modeling and Analysis of Electrical Machines
2.	25BAEEEDC07	Power and Energy Management
3.	25BAEEEDC08	Robotics and Control
4.	25BAEEEDC09	FPGA Based System Design
5.	25BAEEEDC10	Data Communication Networks
Any advanced courses can be appended in future.		

Discipline Elective – IV		
S. No.	**Course Code**	**Course Title**
1.	25BAEEEDC11	Digital Control Systems
2.	25BAEEEDC12	System Theory
3.	25BAEEEDC13	Energy Efficient Lighting System
4.	25BAEEEDC14	Power System Design
Any advanced courses can be appended in future.		

Discipline Elective –V		
S. No.	**Course Code**	**Course Title**
1	25BAEEEDC15	Robust Control
2	25BAEEEDC16	Intelligent Systems and Control
3	25BAEEEDC17	High Voltage Transmission Systems
4	25BAEEEDC18	Digital Consumer Technology
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.	25BAEEESC01	Simulation Tools for Electrical Engineers
Any Courses can be appended in future.		

Skill Enhancement Course – II		
S. No.	**Course Code**	**Course Title**
1.	25BACSESC05	C Programming
Any Courses can be appended in future.		

Skill Enhancement course – III		
Sl. No.	**Course Code**	**Course Title**
1.	25BAEEESC02	Internet of Things
Any Courses can be appended in future.		

Skill Enhancement Course – IV		
Sl. No.	**Course Code**	**Course Title**
1.	25BAEEESC03	AI and ML Tools for Electrical Engineering
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 12th Edition, 2014.

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

Reference Books:

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

2. B.V. Ramana, Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.

3. R.K. Jain, S.R.K. Iyengar, Advanced Engineering Mathematics, Alpha Science International Ltd. 4th Edition, 2014.

4. Michael D. Greenberg, Advanced Engineering Mathematics, Prentice Hall, 2nd Edition, 1998.

5. Stanley J. Miklavcic, An Illustrative Guide to Multivariable and Vector Calculus, Springer, 2019.

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

B. Tech I Year I Semester

25BAPHYTC01 ENGINEERING PHYSICS

L	T	P	C
3	0	0	3

Pre Requisites: Plus two level physics courses

Course Description:

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

Course Objectives:

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

UNIT I WAVES AND OSCILLATIONS 9 hours

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

UNIT II OPTICS 9 hours

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

UNIT III QUANTUM MECHANICS & FREE ELECTRON THEORY 9 hours

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

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

UNIT IV SEMICONDUCTORS and LASERS 9 hours

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

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

UNIT V DIELECTRIC AND MAGNETIC MATERIALS 9 hours

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

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

Course Outcomes:

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

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

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

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

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

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

Text Books:

1. Engineering Physics – Dr. M.N. Avadhanulu & Dr. P.G. Kshirsagar, S. Chand and Company, 2014.
2. Engineering Physics – K. Thyagarajan, McGraw-Hill Publishers, 2015.
3. Concepts of Modern Physics by Arthur Beiser, 7th Edition, 2017.

Reference Books:

1. H. J. Pain, The physics of vibrations and waves, Wiley, 2006.
2. Physics Vol I & II, Halliday/Resnick/Krane 5th Edition, John Wiley, 2003.
3. B.G. Streetman, “Solid State Electronic Devices”, Prentice Hall of India, 1995.

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

B. Tech I Year I Semester

25BACAITC02 FOUNDATIONS OF ARTIFICIAL INTELLIGENCE

L	T	P	C
2	0	0	2

Pre-Requisites: NIL

Course Description:

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

Course Objectives:

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

UNIT I INTRODUCTION TO AI **6 hours**

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

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

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

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

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

UNIT IV INTELLIGENT SYSTEMS **6 hours**

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

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

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

Course Outcomes:

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

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

Text Books:

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

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

Reference Books:

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

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

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

B. Tech I Year I Semester

25BAEEETC01 FUNDAMENTALS OF ELECTRICAL ENERGY SYSTEMS

L	T	P	C
3	0	0	3

Pre Requisites: NIL

Course Description:

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

Course Objectives:

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

UNIT I INTRODUCTION TO ELECTRICAL ENERGY SYSTEMS 9 hours

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

UNIT II CONVENTIONAL POWER GENERATION SYSTEMS 9 hours

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

UNIT III RENEWABLE ENERGY TECHNOLOGIES 9 hours

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

UNIT IV INTRODUCTION SMART GRID AND MICROGRID 9 hours

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

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

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

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

Course Outcomes:

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

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

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

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

CO4: Outline emerging technologies in smart and sustainable energy systems

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

Text Books:

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

Reference Books:

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

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

B. Tech I Year I Semester

25BAENGLC01 PROFESSIONAL COMMUNICATION LABORATORY

L	T	P	C
0	0	2	1

Course Description:

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

Course Objectives:

This course aims to:

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

Lab Activities

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

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

Course Outcomes:

Students will be able to:

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

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

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

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

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

Text Books:

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

Reference Books:

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

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

B. Tech I Year I Semester

25BAPHYLC01 PHYSICS LABORATORY

L	T	P	C
0	0	2	1

Pre-requisites: Plus two physics knowledge

Course Description:

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

Course Objectives:

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

List of Experiments:

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

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

Course Outcomes:

Students will be able to

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

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

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

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

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

Text / Reference Books:

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

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

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

B. Tech I Year I Semester

25BACSELC04 PROBLEM SOLVING USING PYTHON LABORATORY

L	T	P	C
0	0	4	2

Pre Requisites:

Course Description:

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

Course Objectives:

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

List of Experiments:

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Course Outcomes:

Students will be able to:

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

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

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

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

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

Text Books:

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

References:

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

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

B. Tech I Year I Semester

25BACOMLC01 ENGINEERING SKILLS LABORATORY

L	T	P	C
0	0	2	1

Pre-Requisites Nil

Course Description:

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

Course Objectives:

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

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

PART – A

Study Experiments:

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

Choose any six from the following list of experiments:

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

Content Beyond the Syllabus (Virtual Laboratory)

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

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

PART – B

List of Experiments:

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

Content beyond Syllabus

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

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

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

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

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

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

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

Text Books:

1. R. S. Sedha, A Textbook of Applied Electronics, S. Chand & Company Ltd.
2. Muhammad Ali Mazidi, The 8051 Microcontroller and Embedded Systems, Pearson Education.
3. V. Ramesh Babu, Engineering Workshop practice for JNTU, VRB Publishers Pvt. Ltd. 2023.
4. A. K. Sarathe, Engineering Workshop Practice, 1st edition, Khanna Book Publishers, 2022
5. Lab manual provided by the departments.

Reference Books:

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

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

I Year II Semester

B. Tech I Year II Semester

25BAMATTC03 LINEAR ALGEBRA AND DIFFERENTIAL EQUATIONS

L	T	P	C
3	0	0	3

Pre Requisites: 25BAMATTC01

Course Description:

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

Course Objectives:

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

UNIT I LINEAR ALGEBRA 9 hours

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

UNIT II FIRST ORDER ORDINARY DIFFERENTIAL EQUATIONS 9 hours

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

UNIT III SECOND ORDER ORDINARY DIFFERENTIAL EQUATIONS 9 hours

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

UNIT IV LAPLACE TRANSFORMS 9 hours

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

UNIT V PARTIAL DIFFERENTIAL EQUATIONS 9 hours

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

Course Outcomes:

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

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

CO2: Solve the first order ordinary differential equations.

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

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

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

Text Books:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 42nd Edition, 2012.
2. Simmons G.F., Differential Equations with Applications and Historical Notes, Tata McGraw Hill Edition 2003, Eighteenth reprint 2010.

Reference Books:

1. George B. Thomas, Maurice D. Weir, Joel R. Hass, Thomas' Calculus, Pearson Education 12th Edition, 2014.
2. Linear Algebra with Applications, Gareth Williams, Jones & Bartlett Learning, 9th Edition, 2018.
3. Jin Ho Kwak and Sungpyo Hong, Linear Algebra, Birkhaüser, Second edition, 2004.
4. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, 9th Edition, 2006.
5. William E. Boyce., Richard C. Diprima., Elementary Differential Equations and Boundary Value Problems, John Wiley & Sons, Inc., 7th Edition, 2001.

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

B. Tech I Year II Semester

25BACHETC01 ENGINEERING CHEMISTRY

L	T	P	C
3	0	0	3

Pre Requisites: Intermediate Level

Course Description:

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

Course Objectives:

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

UNIT I WATER TECHNOLOGY 9 hours

Specifications for drinking water as per BIS and WHO standards

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

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

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

UNIT II ELECTROCHEMISTRY AND CORROSION 9 hours

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

Super capacitors – Classifications & applications

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

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

UNIT III POLYMERS AND FUEL CHEMISTRY 9 hours

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

Biodegradable polymers – PLA & PGA

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

UNIT IV MODERN ENGINEERING MATERIALS 9 hours

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

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

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

UNIT V NANOMATERIALS AND SUPERCONDUCTORS 9 hours

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

Course Outcomes:

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

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

Text Books:

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

Reference Books:

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

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

B.Tech I Year II Semester

25BACIVTC02 INTRODUCTION TO ENVIRONMENT AND SUSTAINABILITY

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

Course Description:

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

Course Objectives:

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

UNIT I ENVIRONMENTAL SYSTEMS 6 hours

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

UNIT II ENVIRONMENTAL CHALLENGES 6 hours

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

UNIT III ENVIRONMENTAL POLICIES 6 hours

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

UNIT IV SUSTAINABILITY GOALS 6 hours

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

UNIT V SUSTAINABLE ENGINEERING APPROACHES 6 hours

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

Course Outcomes:

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

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

Text Books:

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

Reference Books:

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

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

B.Tech I Year II Semester

25BAEEETC02 BASIC ELECTRICAL AND ELECTRONICS ENGINEERING

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

Course Description:

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

Course Objectives:

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

UNIT I INTRODUCTION TO DC AND AC CIRCUITS 9 hours

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

UNIT II MEASURING INSTRUMENTS AND SENSORS 9 hours

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

UNIT III ELECTRICAL MACHINES AND ELECTRICAL SAFETY 9 hours

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

UNIT IV SEMICONDUCTOR DEVICES AND APPLICATIONS 9 hours

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

UNIT V DIGITAL ELECTRONICS 9 hours

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

Course Outcomes:

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

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

Text Books:

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

Reference Books:

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

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

B. Tech I Year II Semester

25BAMECTC02 ENGINEERING MECHANICS

L	T	P	C
2	1	0	3

Pre-requisite: Engineering Physics

Course Description:

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

Course Objectives:

This course is designed to:

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

UNIT I FORCE SYSTEMS 9 hours

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

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

UNIT II ANALYSIS OF PIN JOINTED TRUSSES 9 hours

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

UNIT III CENTROID AND MOMENTS OF INERTIA 9 hours

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

UNIT IV FRICTION AND WORK PRINCIPLES 9 hours

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

UNIT V DYNAMICS OF PARTICLES AND RIGID BODIES 9 hours

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

Course Outcomes:

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

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

Text Books:

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

Reference Books:

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

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

B. Tech I Year II Semester

25BAMECEC01 ENGINEERING GRAPHICS

L	T	P	C
2	0	2	3

Pre-requisite: None

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

Course Objectives:
This course is designed to:

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

UNIT I INTRODUCTION **12 hours**

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

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

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

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

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

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

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

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

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

Course Outcomes:

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

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

Text Books:

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

Reference Books:

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

Online Learning Resources:

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

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

B. Tech I Year II Semester

25BACHELC01 ENGINEERING CHEMISTRY LABORATORY

L	T	P	C
0	0	2	1

Pre Requisites: NIL

Course Description:

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

Course Objectives:

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

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

List of Experiments:

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

Course Outcomes:

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

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

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

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

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

Text / Reference Books:

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

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

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

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

B. Tech I Year II Semester

25BAEEELC01 BASIC ELECTRICAL AND ELECTRONICS ENGINEERING LABORATORY

L	T	P	C
0	0	2	1

Pre requisites Nil

Course Description:

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

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

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

List of Experiments:

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

Virtual Labs and content beyond syllabus

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

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

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

Text Books:

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

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

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

B. Tech I Year II Semester

25BACOMLC02 SCIENTIFIC COMPUTING LABORATORY

L	T	P	C
0	0	2	1

Pre-Requisite: Nil

Course Description:

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

Course Objectives:

This course enables students to

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

List of Experiments:

Module 1 – Spreadsheet for Scientific Computing

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

Module 2 – Presentation Software for Scientific Communication

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

Module 3 – Basics of Computational Software

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

Module 4 – Data Handling & Visualization

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

Module 5 – Applications & Simulation

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

Hardware Requirements:
Computers

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

Course Outcomes:

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

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

Text Books:

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

Reference Books:

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

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

II Year I Semester

B. Tech II Year I Semester

25BAMATTC07 TRANSFORMS AND NUMERICAL METHODS

L	T	P	C
3	0	0	3

Pre Requisites: 25BAMATTC01, 25BAMATTC03

Course Description:

This course introduces numerical techniques for solving algebraic and transcendental equations, interpolation, differentiation, integration, ordinary differential equations, and curve fitting. It also covers Fourier series, Fourier transforms, differential equations, difference equations, and Z-transforms, providing a foundation for Communication Engineering applications in signal analysis and system modelling.

Course Objectives:

1. To introduce numerical methods for solving algebraic and transcendental equations, interpolation, and numerical integration problems.
2. To apply numerical methods for solving ordinary differential equations and empirical techniques for curve fitting.
3. To introduce Fourier series and their applications in solving boundary value problems.
4. To apply Fourier transforms in solving sine and cosine transform problems.
5. To introduce the concepts of Z-transforms and their applications in solving difference equations.

UNIT I ROOTS OF ALGEBRAIC AND TRANSCENDENTAL EQUATIONS, INTERPOLATION AND NUMERICAL INTEGRATION **9 hours**

Introduction - Bisection method - Regula-falsi method - Newton-Raphson method.

Interpolation, Newton's forward and backward interpolation formulae and Lagrange's interpolation formula.

Numerical Integration: Trapezoidal rule - Simpson's 1/3 Rule - Simpson's 3/8 Rule

UNIT II NUMERICAL SOLUTIONS OF ODE AND CURVE FITTING **9 hours**

Taylor's series method - Euler's method - Modified Euler's method - Runge-Kutta method.

Principle of least squares - Method of least squares - Fitting of straight line, parabola and exponential curves.

UNIT III FOURIER SERIES **9 hours**

The Fourier coefficients - The problem of Convergence - Even and Odd functions - Cosine and Sine Series - Extension to Arbitrary intervals.

UNIT IV FOURIER TRANSFORMS **9 hours**

Introduction – Fourier Integral theorem (without proof) -Fourier Sine and Cosine Integrals - complex form of Fourier integrals, 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 the course, the students will be able to:

CO1: Apply numerical methods to solve algebraic and transcendental equations, interpolation, and numerical integration problems.

CO2: Solve ordinary differential equations using numerical techniques and apply empirical methods for curve fitting.

CO3: Apply Fourier series in solving boundary value problems arising in engineering applications.

CO4: Apply Fourier transforms to solve sine and cosine transform problems.

CO5: Apply Z-transforms and inverse Z-transforms for solving difference equations and related engineering problems.

Text Books:

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

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

Reference Books:

1. S.S. Sastry, Introductory methods of numerical analysis, PHI, 4th Edition, 2005

2. Burden and Faires, Numerical Analysis 7th edition, Thomson Learning, 2001.

3. E. Kreyszig, Advanced Engineering Mathematics, 10th edition, Wiley, 2010.

4. M.K. Jain, S.R.K. Iyengar and R.K. Jain, Numerical Methods for Scientific and Engineering, New Age International Ltd., 5th Edition, 2010.

5. Steven C. Chapra, Applied Numerical Methods with MATLAB for Engineers and Scientists 3rd edition, Mc Graw Hill, 2012.

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

B. Tech II Year I Semester

25BAEEETC04 ELECTRIC CIRCUITS ANALYSIS

L	T	P	C
3	0	0	3

Pre Requisites: Basics of Electrical Engineering

Course Description:

This course introduces the fundamental principles and analytical techniques of electrical circuit analysis under steady-state and transient conditions. It covers the analysis of single-phase AC circuits using phasor representation, impedance, complex power, and power factor concepts. The course explores resonance phenomena in series and parallel RLC circuits, emphasizing bandwidth, quality factor, and frequency response. Students learn to apply fundamental network theorems for solving AC circuits and analyze conductively and magnetically coupled circuits. The course also presents transient analysis of RL, RC, and RLC circuits using differential equations and Laplace transform techniques. In addition, it provides a comprehensive understanding of magnetic circuits, magnetic field principles, electromagnetic laws, hysteresis, and the relationship between electrical and magnetic circuits. The course equips students with the analytical foundation required for advanced studies in electrical machines, power systems, power electronics, and control engineering.

Course Objectives:

1. To gain knowledge about Series and parallel AC circuits.
2. To gain knowledge about Series and parallel resonance.
3. To analyse the network theorems and tuned circuits.
4. To apply the laplace transform for transient analysis of networks.
5. To gain knowledge about Electric and Magnetic circuits.

UNIT I AC CIRCUITS **9 hours**

Single phase ac series and parallel circuits – transforming a circuit into a phasor equivalent circuit-electrical power- power factor – impedance and power triangle-concept of complex power.

UNIT II RESONANCE **9 hours**

Series and Parallel Resonance –impedance and phase angle of a resonant circuit – bandwidth and quality factor – voltage and current in a resonant circuit – variation of impedance with frequency.

UNIT III CIRCUIT THEOREMS AND COUPLED CIRCUITS **9 hours**

Mesh and Nodal analysis in AC circuits - Linearity of a circuit and Superposition Theorem - Thevenin's theorem - Norton's theorem - Maximum Power Transfer Theorem - Reciprocity Theorem – Millman's Theorem-Analysis of coupled circuits- conductively coupled circuits- single tuned and double tuned coupled circuit.

UNIT IV CIRCUIT TRANSIENTS **9 hours**

Transient concepts - differential equations and initial conditions in RLC networks - transient response of simple RL, RC, and RLC series circuits to step and sinusoidal inputs using Laplace transform method.

UNIT V MAGNETIC CIRCUITS **9 hours**

Magnetic Field – Magnetic Flux – Magnetic Field Strength – Flux Density – MMF – Reluctance and permeability - Laws of magnetic circuits: Biot-Savart‘s Law, Ampere‘s Circuital Law (derivation of laws only) – Fleming‘s Left hand rule – Hysteresis – Calculation of Ampere-turns for series and series-parallel magnetic circuits – Comparison of Electric and Magnetic circuits.

Course Outcomes:

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

CO1: Apply and analyse the sinusoidal excitation of R, L, C under steady state and associated power relations

CO2: Comprehend frequency response of a resonant circuit and analyse the impact of quality factor, bandwidth on the frequency response.

CO3: Cognize the concept of linearity and apply the circuit theorems to solve complex electric circuits.

CO4: Apply Fourier transforms to solve sine and cosine transform problems.

CO5: Understand the basics of magnetic circuits and the laws related to magnetic circuits.

Text Books:

1. Fundamentals of Electric Circuits, Charles K. Alexander, Mathew N. O. Sadiku, 3rd Edition, Tata McGraw-Hill, 2019
2. Fred Alan Fish, ―Fundamental Principles of Electric and Magnetic Circuits‖, II Edition, Sagwan Press, USA, 2018.
3. Herbert W. Jackson, Dale Temple,etal, ―Introduction to Electric Circuits‖ Oxford University Press Canada, 10th Edition, 2019.

Reference Books:

1. William H. HaytJr, Jack E. Kemmerly, and Steven M.Durbin, "Engineering Circuit Analysis", McGraw Hill Education (India) Private Limited, Ninth Edition, 2020.
2. James W.Nilsson,SusanA.Riedel, ―Electric Circuits‖ Pearson, 11th Edition, 2020
3. Robert.L.Boylestad, ―Introductory Circuit Analysis‖ Pearson Education Limited, 14th Edition, 2024.
4. Joseph A. Edminister and MahmoodNahvi, "Electric Circuits", Schaum's Series, McGraw Hill Education (India) Private Limited, 7th Edition, 2018.
5. John E. Ayers, ―A Practical Introduction to Electrical Circuits‖CRC Press, 1st Edition,2024. 6. https://nptel.ac.in/courses/108104139/

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

B. Tech II Year I Semester

25BAEEETC05 DC MACHINES AND TRANSFORMERS

L	T	P	C
3	0	0	3

Pre Requisites: Basics of Electrical Engineering

Course Description:

This course focuses on DC machines and transformers, including their construction, principles of operation, performance, and testing methods. Key topics include DC generators, DC motors, starting and speed control techniques, single-phase and three-phase transformers, and transformer testing. It covers characteristics, losses, efficiency, and applications of DC machines along with methods of testing such as Swinburne's and Hopkinson's tests. The course also includes single-phase transformers, their equivalent circuits, regulation, and efficiency, as well as auto transformers. Further, it introduces testing of transformers using open circuit and short circuit tests, and analysis of three-phase transformers including different connections, vector groups, harmonics, and parallel operation.

Course Objectives:

1. To familiarize with the constructional details, principle of operation, prediction of performance, the methods of testing of dc generator.
2. To develop the knowledge in starting methods, speed control and testing of DC Machines
3. To acquaint with the constructional details, the principle of operation and performance of single-phase transformers
4. To impart knowledge on various tests conducted on transformers
5. To learn different vector groups of three phase transformers

UNIT I DC GENERATORS **9 hours**

Construction and principle of operation of DC machines – EMF equation for generator – Excitation techniques– characteristics of DC generators –applications of DC Generators, Back-emf and torque equations of DC motor – Armature reaction and commutation, Applications.

UNIT II STARTING, SPEED CONTROL AND TESTING OF DC MACHINES: **9 hours**

Characteristics of DC motors – losses and efficiency – applications of DC motors. Necessity of a starter – starting by 3-point and 4-point starters – speed control by armature voltage and field current control – testing of DC machines – brake test, Swinburne's test –Hopkinson's test–Field Test.

UNIT III SINGLE-PHASE TRANSFORMERS **9 hours**

Introduction to single-phase Transformers (Construction and principle of operation) – emf equation – operation on no-load and on load –lagging, leading and unity power factors loads –phasor diagrams– equivalent circuit – regulation – losses and efficiency – effect of variation of frequency and supply voltage on losses – all day efficiency, Applications. Transformer Design – Area product approach.

UNIT IV TESTING OF TRANSFORMERS **9 hours**

Open Circuit and Short Circuit tests – Sumpner's test – separation of losses— Parallel operation with equal and unequal voltage ratios – auto transformer – equivalent circuit – comparison with two winding transformers.

UNIT V THREE-PHASE TRANSFORMERS 9 hours

Polyphase connections- Y/Y, Y/Δ, Δ/Y, Δ/Δ, open Δ and Vector groups – third harmonics in phase voltages – Parallel operation– three winding transformers- transients in switching – off load and on load tap changers – Scott connection.

Course Outcomes:

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

CO1: Understand the process of voltage build-up in DC generators and characteristics.
CO2: Understand the process of torque production, starting and speed control of DC motors and illustrate their characteristics.
CO3: Obtain the equivalent circuit of single-phase transformer, auto transformer and determine its efficiency & regulation.
CO4: Apply various testing methods for transformers and speed control of DC motors
CO5: Analyze various configurations of three-phase transformers

Text Books:

1. Electric Machinery by Fitzgerald, A.E., Kingsley, Jr.,C.,& Umans, S. D, 7th edition, McGraw-Hill Education, 2014.
2. Performance and analysis of AC machines by M.G. Say, CBS, 2002.

Reference Books:

1. Electrical Machines by D. P.Kothari, I. J .Nagarth, McGraw Hill Publications, 5th edition
2. Electrical Machinery Fundamentals by Stephen J Chapman McGraw Hill education 2011
3. Generalized Theory of Electrical Machines by Dr. P S Bimbhra, 7th Edition, Khanna Publishers, 2021.
4. Theory & Performance of Electrical Machines by J.B.Gupta, S.K.Kataria & Sons,2007.

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

B. Tech II Year I Semester

25BAEEETC06 ANALOG ELECTRONIC CIRCUITS

L	T	P	C
3	0	0	3

Pre Requisites: Basic Circuit Analysis, Basics of Electrical Engineering

Course Description:

This course focuses on transistor biasing, bipolar junction transistor and field effect transistor. Key topics include voltage regulators and power amplifiers using class A, B, AB, C and D amplifiers. Objectives emphasize Analog circuits operations and characteristics knowledge, application, feedback amplifiers, and Oscillators design. Analog electronics is crucial for designing circuits, signal processing and interfacing with real world analog signals.

Course Objectives:

1. To gain knowledge about operation, characteristics and hybrid model of BJT Transistor.
2. To improve the concept of load line, operating point and bias techniques for stabilization.
3. To analyze small signal model of JFET, MODFET and FET amplifiers.
4. To analyze the operation of feedback and oscillator circuits.
5. To learn the design of power amplifiers and voltage regulators.

UNIT I BIPOLAR JUNCTION TRANSISTOR 9 hours

The Junction transistor, Transistor current components, Transistor as an amplifier, Transistor construction, Input and Output characteristics of transistor in Common Base, Common Emitter, and Common collector configurations. α and β Parameters and the relation between them, BJT Specifications. BJT Hybrid Model, h-parameter representation of a transistor, Analysis of single stage transistor amplifier using h-parameters

UNIT II TRANSISTOR BIASING AND STABILISATION 9 hours

Operating point, the D.C and A.C Load lines, Need for biasing, B.J.T biasing, Fixed bias, Collector to base bias, Self bias techniques for stabilization, Stabilization factors, Bias Compensation using diode and transistor, (Compensation against variation in VBE, ICO,) Thermal run away, Condition for Thermal stability.

UNIT III FIELD EFFECT TRANSISTOR AND FET AMPLIFIER 9 hours

JFET (Construction, principal of Operation and Volt –Ampere characteristics). Pinch- off voltage-small signal model of JFET. FET as Voltage variable resistor, Comparison of BJT and FET. MOSFET (Construction, principal of Operation and symbol), MOSFET characteristics in Enhancement and Depletion modes. FET Amplifiers: FET Common source Amplifier, Common Drain Amplifier, Generalized FET Amplifier, FET biasing.

UNIT IV FEEDBACK AND OSCILLATOR CIRCUITS 9 hours

Feedback concepts, Feedback connection types, Practical feedback circuits, Oscillator operation, FET Phase shift oscillator, Wein bridge oscillator, Tuned Oscillator circuit, Crystal oscillator, UJT construction, UJT Oscillator.

UNIT V POWER AMPLIFIERS AND VOLTAGE REGULATORS 9 hours

Amplifier types, Series fed class A amplifier, Transformer coupled class A amplifier, Class B amplifier operation and circuits, Class AB push pull amplifier, Amplifier distortion, Class C and Class D amplifiers. Voltage regulators: Discrete transistor voltage regulation Series and Shunt Voltage regulators.

Course Outcomes:

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

CO1: Remember the concepts and Hybrid model of bipolar junction transistors

CO2: Understand the load line, operating point, biasing techniques.

CO3: Analyze the JFET, Metal Oxide Semiconductor Field Effect Transistor and FET amplifiers.

CO4: Understand the application of feedback circuits and oscillator circuits in amplification.

CO5: Analyse the operation of audio systems using power amplifiers and industrial control using voltage regulators

Text Books:

1. Robert L. Boylestad and Louis Nashelsky, "Electronics devices and Circuit theory", Pearson, 10th Edition, 2012, ISBN: 9788131764596.
2. Adel S. Sedra and Kenneth C. Smith, "Micro Electronic Circuits Theory and Application," 5th Edition ISBN:0198062257
3. Integrated Electronics Analog Digital Circuits, Jacob Millman and D. Halkias, McGraw Hill.

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. https://nptel.ac.in/courses/108102112
4. https://nptel.ac.in/courses/108106105

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

B. Tech II Year I Semester

25BAEEETC07 DIGITAL SYSTEM DESIGN

L	T	P	C
3	0	0	3

Pre Requisites: NIL

Course Description:

This course presents a comprehensive and contemporary introduction to logic design, focusing on the fundamental building blocks employed in digital systems, particularly digital computers. It commences with an in-depth study of combinational logic and subsequently advances to the analysis and design of sequential circuits. Additionally, multiple forms of representation, including truth tables, logic gate implementations, timing diagrams, switch-level models, and state diagrams, are systematically examined to provide a rigorous understanding of digital system design principles.

Course Objectives:

1. To introduce number systems, logic gates, and Boolean algebra.
2. To provide methods for simplifying logical expressions.
3. To designing combinational circuits and their applications.
4. To develop understanding of sequential circuits and their applications.
5. To explain standard programmable logic devices and IC elements.

UNIT I NUMBER SYSTEMS AND LOGIC GATES 9 hours

Number systems and conversions: binary, decimal, octal, hexadecimal. Signed and unsigned numbers. Binary arithmetic: addition, subtraction, multiplication. Logic gates: AND, OR, NOT, NAND, NOR, XOR, XNOR – truth tables and logic symbols. NAND and NOR Implementation.

UNIT II BOOLEAN ALGEBRA AND MINIMIZATION 9 hours

Boolean postulates and laws. DeMorgan's theorems. Standard SOP and POS forms. Boolean Algebra, Minimization of Logic expressions, Quine–McCluskey Method/Tabulation Method, K-Map Simplification (Upto 4-Variable). Realization using logic gates.

UNIT III COMBINATIONAL LOGIC CIRCUITS 9 hours

Binary adder and subtractor - BCD adder - Code converters - Decoders and Encoders - Multiplexers and Demultiplexers - Parity generators and checkers – Magnitude Comparator – Design of combinational logic circuits using logic gates, decoders and multiplexers – Implementation of combinational logic circuits using PROM, PAL and PLA.

UNIT IV SEQUENTIAL LOGIC CIRCUITS 9 hours

Flip Flops - counters - asynchronous and synchronous types - Modulo counters - Shift registers - Ring counter and twisted ring counter - Mealy and Moore Models - State table - excitation table - State diagram - State reduction - State assignment –Analysis and Design of synchronous sequential circuits – Design of sequence detectors, sequence generators and counters using flip-flops – Introduction to asynchronous sequential circuits.

UNIT V DIGITAL IC FAMILIES 9 hours

. Input and output characteristics of logic gates – TTL: Standard TTL – Three state output TTL - Schottky TTL – CMOS Logic: Inverter, NAND, and NOR gates – Interfacing TTL and CMOS families– ECL OR/NOR gate – comparison of TTL, ECL, and CMOS families.

Course Outcomes:

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

CO1: Convert and perform arithmetic operations on different number systems.
CO2: Simplify Boolean expressions and implement logic functions.
CO3: Design combinational circuits using standard building blocks.
CO4: Analyze and implement sequential circuits using flip-flops and counters.
CO5: Explain the working of memory devices and IC families.

Text Books:

1. Digital Design, M. Morris Mano, Micheal D. Ciletti, 5th Edition, 2013, Pearson.

2. Digital Logic Design, Leach, Malvino, Saha,TMH

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. Digital Logic Design, R.D. Sudhakar Samuel, Elsevier

3. Computer System Architecture , M. Morris Mano, 3th Edition, pearson.

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

B. Tech II Year I Semester

25BAEEELC02 DC MACHINES AND TRANSFORMERS LABORATORY

L	T	P	C
0	0	2	1

Pre requisites: Basics of Electrical Engineering

Course Description:

This laboratory course focuses on testing DC machines and transformers, allowing hands-on experience with key experiments related to their operation and performance. Key experiments include testing DC generators and motors, speed control, efficiency determination, open-circuit and short-circuit tests, and parallel operation of transformers. The course provides practical experience in analyzing characteristics of DC machines, efficiency tests, and performance curves. It also includes determining transformer losses and evaluating single-phase transformer performance.

Course Objectives:

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

1. To conduct various tests on transformers.
2. To analyze the Open circuit and load. Characteristics of DC separately excited shunt generator.
3. To conduct and analyze the load test on DC shunt, series and compound motors.
4. To examine the self-excitation in DC generators.
5. To Pre-determine and determine the efficiency of different DC machines

List of Experiments:

1. Speed control of DC shunt motor by Field Current and Armature Voltage Control.
2. Brake test on DC shunt motor- Determination of performance curves.
3. Swinburne’s test - Predetermination of efficiencies as DC Generator and Motor.
4. Hopkinson’s test on DC shunt Machines.
5. Load test on DC compound generator - Determination of characteristics.
6. Load test on DC shunt generator - Determination of characteristics.
7. Fields test on DC series machines - Determination of efficiency.
8. Brake test on DC compound motor - Determination of performance curves.
9. OC & SC tests on single phase transformer.
10. Sumpner’s test on single phase transformer.
11. Scott connection of transformers.
12. Parallel operation of Single-phase Transformers.
13. Separation of core losses of a single-phase transformer

Course Outcomes:

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

CO1: Demonstrate starting and speed control methods of DC Machines.

CO2: Apply theoretical concepts to determine the performance characteristics of DC Machines.

CO3: Analyze the parallel operation of single-phase transformers

CO4: Determine the performance parameters of single-phase transformer.

CO5: Analyze the performance analysis of transformers using various tests.

Text Books:

1. P. S. Bimbhra, “Electrical Machinery”, Khanna Publishers, 2011.
2. E. Fitzgerald and C. Kingsley, "Electric Machinery”, New York, McGraw Hill Education, 2013.
3. E. Clayton and N. N. Hancock, “Performance and design of DC machines”, CBS Publishers, 2004.
4. I. J. Nagrath and D. P. Kothari, “Electric Machines”, McGraw Hill Education, 2010. 5.

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

B. Tech II Year I Semester

25BAEEELC03 ANALOG CIRCUITS LABORATORY

L	T	P	C
0	0	2	1

Pre Requisites:

Course Description:

This laboratory course provides practical exposure to the characteristics and applications of semiconductor devices, transistor amplifiers, waveform shaping circuits, oscillators, multivibrators, data converters, and operational amplifier circuits. Students perform experiments to analyze the performance of BJT configurations, design and test amplifier circuits, generate various waveforms using oscillators and multivibrators, implement clipping and clamping circuits, and study analog-to-digital and digital-to-analog conversion techniques. The course also develops proficiency in using electronic laboratory instruments, simulation tools, and troubleshooting analog electronic circuits.

Course Objectives:

1. To study and experimentally verify the input and output characteristics of BJT transistor configurations.
2. To design, analyze, and evaluate the performance of transistor amplifier circuits and waveform shaping circuits.
3. To construct and test oscillator and multivibrator circuits for generating sinusoidal and non-sinusoidal waveforms.
4. To implement data conversion circuits and operational amplifier applications for analog signal processing.
5. To develop practical skills in electronic circuit implementation, measurement techniques, simulation, and troubleshooting using standard laboratory equipment.

List of Experiments: (Any 6 Experiments are to be conducted)

1. CB Characteristics
2. CE Characteristics
3. CE Amplifier
4. CC Amplifier
5. Clippers
6. Clampers
7. RC Phase shift oscillator
8. Astable multivibrator
9. Monostable multivibrator
10. Triangular wave generator.
11. A to D Converter
12. D to A Converter
13. Op-Amp Applications-Adder, subtractor, comparator

Course Outcomes:

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

CO1: Analyze the characteristics of Common Base (CB) and Common Emitter (CE) transistor configurations and determine their operating parameters.

CO2: Design and evaluate the performance of CE and CC amplifiers, including gain, bandwidth, and frequency response.

CO3: Construct and verify the operation of clipper, clamper, RC phase-shift oscillator, astable multivibrator, monostable multivibrator, and triangular wave generator circuits.

CO4: Implement Analog-to-Digital (ADC) and Digital-to-Analog (DAC) converter circuits and analyze their performance characteristics.

CO5: Design and test operational amplifier-based circuits such as adder, subtractor, and comparator, and interpret the experimental results using appropriate measuring instruments and simulation tools.

Text Books:

1. Sedra, A. S., & Smith, K. C. Microelectronic Circuits, 8th Edition, Oxford University Press, 2020.
2. Boylestad, R. L., & Nashelsky, L. Electronic Devices and Circuit Theory, 12th Edition, Pearson, 2023.

Reference Books:

1. Floyd, T. L. Electronic Devices (Conventional Current Version), 10th Edition, Pearson, 2018.
2. Franco, S. Design with Operational Amplifiers and Analog Integrated Circuits, 4th Edition, McGraw-Hill Education, 2015.
3. Malvino, A. P., & Bates, D. J. Electronic Principles, 8th Edition, McGraw-Hill Education, 2016.
4. Millman, J., & Halkias, C. C.; revised by Parikh, C. D. Integrated Electronics: Analog and Digital Circuits and Systems, 2nd Edition (Reprint), McGraw-Hill Education, 2017.

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

B. Tech II Year I Semester

25BAEEELC04 DIGITAL SYSTEMS LABORATORY

L	T	P	C
0	0	2	1

Pre Requisites:

Course Description:

This laboratory course provides hands-on experience in the design, implementation, and verification of fundamental digital logic circuits. Students learn to realize Boolean expressions using logic gates, implement combinational and sequential circuits, and analyze their functionality through practical experiments. The course covers universal gates, arithmetic circuits, code converters, multiplexers, comparators, encoders, decoders, flip-flops, and counters. It also emphasizes the use of digital ICs, laboratory instruments, simulation tools, and troubleshooting techniques to develop practical skills in digital system design.

Course Objectives:

1. To nderstand and implement basic digital logic circuits using Boolean algebra and logic gates.
2. To design and realize combinational logic circuits using standard and universal logic gates.
3. To construct and analyze sequential logic circuits including flip-flops and counters.
4. To develop digital systems using multiplexers, encoders, decoders, comparators, and arithmetic circuits.
5. To apply simulation tools and laboratory instruments to verify digital circuit operation and troubleshoot hardware implementations.

DIGITAL CIRCUITS List of Experiments: (Any 06 Experiments are to be conducted)

1. Realization of Boolean Expressions using Gates
2. Design and realization of logic gates using universal gates
3. Generation of a clock using NAND / NOR gates
4. Design a 4–bit Adder / Subtractor
5. Design and realization of a 4-bit Gray to Binary and Binary to Gray Converter
6. Design and realization of 8x1 MUX using 2x1 MUX
7. Design and realization of a 4-bit comparator
8. Design and realization of Flip-Flops.
9. Design and realization of Encoders
10. Design and realization of Decoders
11. Design and realization of a 4-bit ripple counter.

Course Outcomes:

CO1: Design and implement Boolean expressions, universal gate realizations, and clock generation circuits using NAND/NOR gates.

CO2: Design, realize, and verify combinational logic circuits including adders/subtractors, code converters, multiplexers, comparators, encoders, and decoders.

CO3: Design and implement sequential logic circuits using flip-flops and analyze their functional characteristics.

CO4: Design and realize synchronous/asynchronous digital circuits such as ripple counters and evaluate their timing behavior.

CO5: Analyze, simulate, and troubleshoot digital circuits using standard laboratory equipment and simulation software while interpreting experimental results.

Text Books:

1. M. Morris Mano & Michael D. Ciletti Digital Design, 6th Edition, Pearson, 2024.
2. R. P. Jain Modern Digital Electronics, 5th Edition, McGraw-Hill Education, 2018 (Reprint 2023).

Reference Books:

1. Donald D. Givone Digital Principles and Design, 2nd Edition, McGraw-Hill Education, 2017 (Reprint).
2. Thomas L. Floyd Digital Fundamentals, 11th Edition, Pearson, 2015 (Reprint 2022).
3. Charles H. Roth Jr. & Larry L. Kinney Fundamentals of Logic Design, 8th Edition, Cengage Learning, 2020.
4. John F. Wakerly Digital Design: Principles and Practices, 5th Edition, Pearson, 2018.
5. A. Anand Kumar Fundamentals of Digital Circuits, 4th Edition, PHI Learning, 2016 (Reprint 2023).

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

II Year II Semester

B. Tech II Year I Semester

25BAEEETC08 SIGNALS AND NETWORKS

L	T	P	C
3	0	0	3

Pre Requisites: NIL

Course Description:

This course introduces the fundamental concepts of continuous-time and discrete-time signals, linear time-invariant (LTI) systems, and network analysis that form the basis of modern electrical, electronics, communication, and control engineering. Students learn various signal representations and system characteristics in both the time and frequency domains using convolution, Fourier series, Fourier transform, Laplace transform, and Z-transform techniques. The course also covers network functions, two-port network parameters, filter analysis, sampling theory, and their practical applications in signal processing, communication systems, and embedded technologies. Emphasis is placed on developing analytical skills to model, analyze, and interpret the behavior of signals and networks encountered in real-world engineering systems.

Course Objectives:

1. Study the mathematical description and representation of discrete and continuous signals and systems.
2. Obtain the response of an LTI system and convert a continuous-time signal to the discrete-time using sampling.
3. Study the frequency domain analysis of continuous time and discreate-time signals and systems using Fourier transform.
4. Analyze the continuous-time systems using Laplace transform.
5. Analyze the discrete-time systems using z-transform.

UNIT I SIGNALS AND SYSTEMS **9 hours**

Representation of continuous and discrete time signals, shifting and scaling properties, linear time invariant and causal systems, Periodic & Aperiodic signals, Deterministic & Random signals, Energy & Power signals. Fourier series representation of continuous and discrete time periodic signals, sampling theorem. Applications of Fourier Transform for continuous and discrete time signals.

UNIT II NETWORK TOPOLOGY **9 hours**

Linear oriented graphs - incidence matrix of a linear oriented graph –Kirchhoff‟s laws in incidence matrix formulation - circuit matrix of a linear oriented graph - tree and its properties - Kirchhoff‟s laws in fundamental circuit matrix formulation – Loop analysis of electric networks - cut sets - - cut set matrix of a linear oriented graph - Kirchhoff‟s laws in fundamental cutest formulation – Node-pair analysis of networks – Analysis using generalized branch model.

UNIT III NETWORK FUNCTIONS AND TWO PORT NETWORKS **9 hours**

Concept of complex frequency - Network functions - Driving point and transfer functions and their properties - Poles and Zeros and their significance - Time domain behavior from pole - zero plot – Impulse response of network functions - Two port networks - Z, Y, ABCD and h parameters - Condition for reciprocity and symmetry - Parameter conversion - Interconnection of two port networks - Analysis of typical two port networks - Input and Output impedances of terminated two port networks - Image impedances.

UNIT IV ELEMENTS OF REALIZABILITY AND SYNTHESIS OF ONE-PORT NETWORKS **9 hours**

Hurwitz polynomials - Positive real functions - Frequency response of reactive one port network - Synthesis of reactive one port networks by Foster method and Cauer method - Synthesis of RL and RC networks by Foster method and Cauer method.

UNIT V FILTERS **9 hours**

The decibel scale - bode plots - passive filters: low pass, high pass, band pass, and band reject filters. Active filters: first order low pass, high pass, band pass, and band reject (or Notch) filter - Scaling: magnitude scaling - frequency scaling - magnitude and frequency scaling - applications.

Course Outcomes:

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

CO1: Classify signals and systems according to their properties.

CO2: Represent signals in the form of network topology.

CO3: Apply the concept of complex frequency in studying network functions and analyze two-port network parameters using various models.

CO4: Identify the given function for positive realness and synthesize LC, RC, and RL one-port networks using Foster and Cauer forms.

CO5: Design active and passive filters.

Text Books:

1. Ravish R. Singh, ―Network Analysis and Synthesis‖, TMH, New Delhi, 3rd Edition, 2018.
2. Roy D.Choudhury, "Networks and Systems", New Age Publications, New Delhi, 2nd Edition, 2014.
3. Alan Oppenheim, Alan Willsky, Hamid, ―Signals and Systems‖, Prentice-hall, 2nd Edition 2015.

Reference Books:

1. Charles K. Alexander and Mathew N.O. Sadiku, ―Fundamentals of Electric Circuits‖ McGraw Hill Education (India) Pvt Ltd, VI Edition, 2019.
2. Franklin F. Kuo, "Network Analysis and Synthesis" Wiley India Pvt. Ltd., New Delhi, 2nd Edition, 2012.
3. Sudhakar A. and Shyammohan S.P., "Circuits and Networks: Analysis and Synthesis", TMH, New Delhi, 2011.
4. Ramesh Babu P. and Anandanatarajan, R., ―Signals and Systems‖, SciTech Publications (India) Pvt Ltd, V Edition, 2011
5. Simon Haykin, Barry Van Veen, ―Signals and Systems‖, 2nd Edition, Wiley 2002.

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

B. Tech II Year II Semester

25BAEEETC09 AC ROTATING MACHINES

	L	T	P	C
Pre Requisites: BEEE, Circuit Analysis, DCMT	**3**	**0**	**0**	**3**

Course Objectives:

1. To learn the construction, operation, and performance characteristics of synchronous generators.
2. To analyze the working principles and applications of synchronous motors.
3. To learn the construction, operation, and equivalent circuit of three-phase induction motors.
4. To evaluate the performance characteristics and control methods of induction motors.
5. To gain the knowledge about operation, theories, and starting methods of single-phase motors.

UNIT I SYNCHRONOUS GENERATOR 9 hours

Constructional features of non-salient and salient pole type alternators- armature windings – distributed and concentrated windings – distribution & pitch factors – E.M.F equation – armature reaction – voltage regulation by synchronous impedance method – MMF method and Potier triangle method – two reaction analysis of salient pole machines - methods of synchronization- Slip test – Parallel operation of alternators.

UNIT II SYNCHRONOUS MOTOR 9 hours

Synchronous motor principle and theory of operation – Effect of excitation on current and power factor– synchronous condenser –expression for power developed –hunting and its suppression – methods of starting, Applications.

UNIT III 3 - PHASE INDUCTION MOTORS 9 hours

Construction of Squirrel cage and Slipring induction motors– production of rotating magnetic field – principle of operation – rotor emf and rotor frequency – rotor current and power factor at standstill and during running conditions– rotor power input, rotor copper loss and mechanical power developed and their inter-relationship –equivalent circuit – phasor diagram, Applications.

UNIT IV PERFORMANCE OF 3-PHASE INDUCTION MOTORS 9 hours

Torque equation – expressions for maximum torque and starting torque – torque-slip characteristics – double cage and deep bar rotors – No load, Brake test and Blocked rotor tests – circle diagram for predetermination of performance- methods of starting –starting current and torque calculations - speed control of induction motor with V/f control method, rotor resistance control and rotor emf injection technique –crawling and cogging – induction generator operation.

UNIT V SINGLE PHASE MOTORS 9 hours

Single phase induction motors – constructional features – double revolving field theory, Cross field theory – equivalent circuit- starting methods: capacitor start capacitor run, capacitor start induction run, split phase & shaded pole, AC series motor, Applications.

Course Outcomes:

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

CO1: Analyze the construction, EMF generation, and performance of synchronous generators.

CO2: Evaluate the performance and applications of synchronous motors under different excitation conditions.

CO3: Explain the operation, equivalent circuit, and characteristics of three-phase induction motors.

CO4: Assess torque characteristics, performance tests, and speed control methods of induction motors.

CO5: Interpret the working principles and starting techniques of single-phase motors and AC series motors.

Text Books:

1. Electrical Machinery, Dr. P.S. Bhimbra, Khanna Publishing, 2021, First Edition.
2. Performance and analysis of AC machines by M.G. Say, CBS, 2002.

Reference Books:

1. Electrical machines, D.P. Kothari and I.J. Nagrath, McGraw Hill Education, 2017, Fifth Edition.
2. Theory & Performance of Electrical Machines by J.B.Gupta, S.K.Kataria & Sons,2007.
3. Electric Machinery, A.E.Fitzgerald, Charles kingsley, Stephen D.Umans, McGraw-Hill, 2020, Seventh edition.

Web Resources:

1. https://nptel.ac.in/courses/108/105/108105131
2. https://nptel.ac.in/courses/108106072

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

B. Tech II Year II Semester

25BAEEETC10 CONTROL SYSTEMS

L	T	P	C
3	0	0	3

Pre Requisites: Nil

Course Description:

This course provides a comprehensive introduction to the analysis and design of control systems. It begins with the fundamentals of open-loop and closed-loop control, feedback concepts, and system representation through block diagrams and signal-flow graphs. Students learn to model physical systems from electrical and mechanical domains and to derive transfer functions using Laplace transform techniques. The course emphasizes time-domain and frequency-domain analysis, enabling students to evaluate transient and steady-state behavior, stability, and performance measures. The course also introduces state-space modeling and modern control techniques, enabling analysis of system dynamics through concepts such as state variables, controllability, observability, and state transition methods.

Course Objectives:

1. To learn the fundamental concepts of open-loop and closed-loop control systems, feedback principles, and system representation using block diagrams and signal-flow graphs.
2. To analyze system performance in the time domain, including transient and steady-state responses, error constants, and behavior of first- and second-order systems.
3. To evaluate system stability and frequency-domain performance using tools such as Routh–Hurwitz criterion, root locus, Bode plots, polar plots, and Nyquist stability analysis.
4. To analyze system performance in the frequency response, including bode plots and polar plots.
5. To analyze the state space model and to apply state-space concepts for modelling, analysis, controllability, and observability of dynamic systems.

UNIT I INTRODUCTION TO CONTROL SYSTEMS 9 hours

Control theory concepts - Open loop and feedback control systems-linear and non-linear control systems- Mathematical model of physical systems – electrical analogies- Analysis of control systems using Laplace transforms – Block diagram algebra – Signal flow graph - Controller components – types.

UNIT II TIME RESPONSE ANALYSIS 9 hours

Test Signals - Analysis of transient and steady state behavior of control systems - Time response of first order and second order systems -Time domain specifications - Steady state errors - Error criterion - Performance indices.

UNIT III STABILITY AND ROOT LOCUS TECHNIQUE 9 hours

Stability concepts – Conditions for stability – Routh, Hurwitz stability criteria – Relative stability analysis - Root locus concepts - Construction of root loci – Effect of pole zero additions on the root loci- Root contours – Systems with transportation lag.

UNIT IV FREQUENCY RESPONSE ANALYSIS AND CONTROLLER DESIGN 9 hours

Correlation between time domain and frequency domain specifications-Bode Plot-Nyquist stability criterion-Relative Stability-Gain margin and phase margin-polar plots.

UNIT V STATE VARIABLE ANALYSIS 9 hours

Introduction - State space representation using physical variables – Phase variables and canonical variables – Derivation of transfer function from state model – Solving the time invariant state equation – State transition Matrix – Its properties and computation. Introduction to controllability and observability.

Course Outcomes:

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

CO1: Recognize various control system types and analog systems.
CO2: Evaluate the system's response and time domain specifications.
CO3: Design and analyze the stability and performances of control systems.
CO4: Implement the frequency domain ideas into practice to assess the system's stability.
CO5: Infer the concept of state variable techniques.

Text Books:

1. Kuo B.C., Automatic Control Systems, Prentice-Hall of India Pvt Ltd., New Delhi, 6th edition, 1991.
2. I.J. Nagrath and M. Gopal, Control System Engineering, 2nd Edn.Wiley Eastern, New Delhi, 1982.

Reference Books:

1. Norman S. Nise, Control Systems Engineering, 4th edition, New York, John Wiley, 2003. (Indian edition)
2. Control Systems Principles & Design by M.Gopal, 4th Edition, Mc Graw Hill Education, 2012.
3. Modern Control Engineering by Katsuhiko Ogata, Prentice Hall of India Pvt. Ltd., 5th edition, 2010.

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

B. Tech II Year II Semester

25BAEEETC11 MICROPROCESSORS AND MICROCONTROLLERS

L	T	P	C
3	0	0	3

Pre Requisites: Basic Electrical and Electronics Engineering, Analog Electronics, Digital Electronics

Course Description:

This course facilitates the students with the fundamentals of Microprocessor-8086, Introduction to 8051 micro controllers, 8051 architecture and programming, peripheral interfacing and applications. Introduction to PIC architecture.

Course Objectives:

1. To understand the fundamentals of microprocessors, embedded systems, and the architecture and operation of the 8086 microprocessor.
2. To analyze the architecture, instruction set, programming techniques, and interfacing methods of the 8051 microcontroller.
3. To develop embedded programs using Assembly language and Embedded C by utilizing timers, interrupts, serial communication, and GPIO interfaces.
4. To understand ARM Cortex-M architecture, memory and I/O interfacing techniques, communication protocols, and embedded system design methodologies.
5. To explore modern embedded applications involving IoT, wireless communication, sensor interfacing, and real-time embedded systems.

UNIT I FUNDAMENTALS OF MICROPROCESSORS 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 THE 8051 ARCHITECTURE 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 INSTRUCTION SET AND PROGRAMMING 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 MEMORY AND I/O INTERFACING 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 EXTERNAL COMMUNICATION INTERFACE AND 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, organization, instruction execution, and operating modes of the 8086 microprocessor and embedded system fundamentals

CO2: Develop and debug Assembly language programs for the 8051-microcontroller using various addressing modes, subroutines, and interfacing peripherals such as ADC, DAC, keyboard, display, and 8255 PPI.

CO3: Design Embedded C programs for the 8051-microcontroller utilizing GPIO, timers, interrupts, and serial communication for embedded applications.

CO4: Analyze ARM Cortex-M architecture and implement memory interfacing, communication protocols (UART, SPI, I²C), and basic RTOS concepts in embedded system design.

CO5: Design and develop basic IoT-enabled embedded applications by interfacing sensors and wireless communication modules using platforms such as ESP32 and Arduino.

Text Books:

1. K M Bhurchandi, A K Ray, Advanced Microprocessors and Peripherals, 3rd edition, McGraw Hill Education, 2017
2. M. A. Mazidi, J. G. Mazidi and R. D. McKinlay, "The 8051 Microcontroller and Embedded Systems: Using Assembly and C", Pearson Education, 2007,
3. K. J. Ayala, "8051 Microcontroller", Delmar Cengage Learning, 2004.

Reference Books:

1. R. Kamal, "Embedded System", McGraw Hill Education,2009.
2. R. S. Gaonkar, ", Microprocessor Architecture: Programming and Applications with the 8085", Penram International Publishing, 1996.
3. D. A. Patterson and J. H. Hennessy, "Computer Organization and Design: The Hardware/Software interface", Morgan Kaufman Publishers, 2013.
4. D. V. Hall, "Microprocessors & Interfacing", McGraw Hill Higher Education, 1991.
5. Ramesh S Gaonkar, Microprocessor Architecture Programming and Applications with the 8085, 6th edition, Penram International Publishing, 2013.

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

B. Tech II Year II Semester

25BAEEELC05 AC ROTATING MACHINES LABORATORY

L	T	P	C
0	0	2	1

Pre Requisite BEEE, Circuit Analysis, AC Rotating Machines

Course Description:

This course provides hands-on lab covering operation, testing, and performance evaluation of AC machines. Includes experiments on transformers, induction motors, and synchronous machines. Students study efficiency, regulation, torque-speed behavior, and speed control methods. Uses standard tests, measuring instruments, and simulation tools for analysis. Prepares students for industrial, power system, and renewable energy applications.

Course Objectives:

1. To determine voltage regulation of a three-phase alternator using synchronous impedance and MMF methods.
2. To evaluate efficiency of three-phase alternators and induction motors using load and brake tests.
3. To analyze parallel operation and performance characteristics of three-phase alternators.
4. To determine machine parameters (Xd, Xq) and study V-curves of synchronous machines.
5. To improve the performance, equivalent circuits, and speed control methods of induction and AC series motors.

List of Experiments:

Any 10 experiments of the following are required to be conducted

1. Regulation of a three -phase alternator by synchronous impedance & MMF methods.
2. Determination of efficiency of three phase alternator by loading with three phase induction motor.
3. Parallel operation of three-phase alternator.
4. Determination of X_d, X_q & Regulation of a salient pole synchronous generator.
5. V and Inverted V curves of a three-phase synchronous motor.
6. Brake test on three phase Induction Motor.
7. Circle diagram of three phase induction motor.
8. Speed control of three phase induction motor by V/f method.
9. Equivalent circuit of single-phase induction motor.
10. Load test on single phase induction motor.
11. Determination of efficiency of a single-phase AC series Motor by conducting Brake test.

Course Outcomes:

CO1: Ability to compute voltage regulation and machine parameters of synchronous machines.
CO2: Ability to evaluate efficiency of alternators and motors under various loading conditions.
CO3: Ability to analyze and interpret performance characteristics and operational behavior of AC machines.
CO4: Ability to apply speed control techniques and assess their impact on motor performance.
CO5: Ability to model and analyze equivalent circuits of single-phase and three-phase machines.

References:

1. A. E. Fitzgerald, C. Kingsley Jr. and S. D. Umans, *"Electric Machinery"*, McGraw Hill Education, 2013.
2. I. J. Nagrath and D. P. Kothari, *"Electric Machines"*, McGraw Hill Education, 2010.
3. P. S. Bimbhra, *"Electrical Machinery"*, Khanna Publishers, 2011.
4. J. B. Gupta, *"Theory & Performance of Electrical Machines"*, S. K. Kataria & Sons, 2007.
5. Stephen J. Chapman, *"Electric Machinery Fundamentals"*, McGraw Hill Education, 2010.

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

B. Tech II Year II Semester

25BAEEELC06 CONTROL SYSTEMS LABORATORY

L	T	P	C
0	0	2	1

Pre requisites: Nil

Course Description:

The Control Systems Laboratory is designed to provide hands-on understanding and practical exposure to the fundamental concepts of control systems through experimental investigation and simulation-based analysis. This course enables students to bridge the gap between theoretical principles and real-world control applications by analysing the dynamic behaviour of electromechanical and linear time-invariant systems. Experiments focus on modelling and determination of transfer functions of DC machines and servo motors, studying the characteristics of synchros, magnetic amplifiers, and AC/DC servo systems, and examining the effect of feedback on system performance.

Course Objectives:

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

1. To experimentally determine the transfer function and dynamic characteristics of DC machines and servo motors using feedback control principles.
2. To design the effect of feedback on system performance and analyze the characteristics of synchros, servo systems, and magnetic amplifiers.
3. To design the influence of P, PI, PD, and PID controllers on first- and second-order systems and evaluate their transient and steady-state responses.
4. To analyze the stability and performance of linear time-invariant systems using time-domain and frequency-domain techniques through MATLAB/SIMULINK.
5. To design and validate compensators and state feedback controllers using software tools for improved control system performance.

List of Experiments:

(Any 10 of the following experiments are to be conducted)

1. Time response analysis of a second-order system.
2. Study of characteristics of synchro's.
3. Programmable Logic Controller (PLC): Study and verification of truth tables of logic gates, simple Boolean expressions, and application to motor speed control.
4. Study of the effect of feedback on a DC servo motor.
5. Determination of the transfer function of a DC machine.
6. Study of the effect of P, PI, PD, and PID controllers on a second-order system.
7. Lag and lead compensation: Analysis using magnitude and phase plots.
8. Design and implementation of a temperature controller using PID control.
9. Study of characteristics of magnetic amplifiers.
10. Study of characteristics of an AC servo motor.
11. Linear system analysis using MATLAB: Time-domain response and error analysis.

12. Stability analysis of linear time-invariant systems using MATLAB (Bode plot, Root Locus, and Nyquist plot).
13. State-space modelling of a classical transfer function and verification using MATLAB.

Course Outcomes:

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

CO1: Apply feedback control concepts to experimentally determine the transfer function of DC servo motors and electrical circuits with R, L, and C components.

CO2: Model control systems and design appropriate controllers and compensators to improve system performance.

CO3: Analyze the effect of pole–zero locations on the transient and steady-state behavior of first- and second-order systems using software tools.

CO4: Evaluate time-domain performance specifications such as rise time, settling time, overshoot, and steady-state error of control systems.

CO5: Analyze the stability of linear time-invariant systems using classical control techniques.

Text Books:

1. M. Gopal, *Control Systems: Principles and Design*, 4th Edition, McGraw Hill Education, 2012.

2. I. J. Nagrath and M. Gopal, *Control Systems Engineering*, New Age International Publishers, 2009.

3. Katsuhiko Ogata, *Modern Control Engineering*, 5th Edition, Prentice Hall of India, 2010.

4. B. C. Kuo and Farid Golnaraghi, *Automatic Control Systems*, 9th Edition, Wiley India, 2014.

5. Norman S. Nise, *Control Systems Engineering*, 7th Edition, Wiley, 2015.

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

B. Tech II Year II Semester

25BAEEELC07 MICROPROCESSORS AND MICROCONTROLLERS LABORATORY

L	T	P	C
0	0	2	1

Pre requisites: Microprocessors and Microcontrollers

Course Description:

This course hands-on lab in programming, interfacing, and embedded application development. Covers assembly programming, timers, interrupts, serial communication, and memory interfacing. Students interface peripherals like LEDs, LCDs, sensors, and ADC/DAC modules. Uses IDEs, simulators, and debugging tools for program verification. Prepares students for roles in automation, IoT, robotics, and embedded systems.

Course Objectives:

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

1. To become skilled in 8086 Assembly Language programming.
2. To develop the detailed software and hardware structure of the microprocessor.
3. Train their practical knowledge through laboratory experiments.
4. To learn about 8051 Microcontroller.
5. To acquire knowledge on microprocessors and microcontrollers, interfacing various peripherals, and configuring.

List of Experiments:

(Any 11 of the following experiments are to be conducted)

1. **8086-Arithmetic Operations**
   a) Write an ALP to Perform Addition and Subtraction of multi-precision numbers.
   b) Write an ALP to Perform Multiplication and division of signed and unsigned Hexadecimal numbers.
   c) Write an ALP to find the square, cube, and factorial of a given number.
2. **8086-Bit Manipulation**
   a) Write an ALP to find the given data is positive or negative.
   b) Write an ALP to find the given data is odd or even.
   c) Write an ALP to find Logical ones and zeros in a given data.
3. **8086 - String Operations**
   a) Write an ALP to find the string length.
   b) Write an ALP for Comparing two Strings.
   c) Write an ALP to reverse a string and check for a palindrome.
4. **8051- Arithmetic Operations:**
   Write an ALP for the 8051 Microcontroller to perform Arithmetic operations like addition, subtraction, multiplication, and Division.
5. **8051-Logical Operations:**
   Write an ALP to an 8051 Microcontroller to perform Logical operations like AND, OR, and XOR, converting packed BCD to unpacked BCD, shift, and rotate.

6. **8051 Interfacing- Stepper Motor**:
   Write an ALP to interface a stepper motor and operate it in clockwise and anti-clockwise directions.

7. **8051 Interfacing ADC/DAC**:
   Write an ALP to interface the ADC to convert the input analog value to digital and the DAC to generate a square wave, triangular wave, and step signal.

8. **8051 Interfacing Traffic Controller**: Write an ALP to interface the traffic light controller using the 8051 microcontrollers to control the sequence of red, yellow, and green lights with appropriate delay timing.

9. **8051-Timer:** Write an ALP to generate a 1kHz square waveform at 50% duty cycle under various modes.

10. **8051-Serial Communication**: Write an ALP to transfer a character serially with a baud rate of 9600 using UART.

11. **8051- LCD Interfacing:** Write an ALP to interface the 16*2 LCD with the 8051 microcontroller and display messages /characters /and numerical data on the screen.

12. **PPI 8255 Interfacing**: Reading and Writing on a Parallel Port

13. **8086 Arrays Operations:**
    a) Write an ALP to find the addition/subtraction of N numbers.
    b) Write an ALP for finding the largest/smallest no.
    c) Write an ALP to sort the given array in ascending/descending order.

Course Outcomes:

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

CO1: Formulate a program and implement algorithms using Assembly language.

CO2: Describe an Assembly language program for the 8086 Microprocessor.

CO3: Develop programs for different applications in the 8086 Microprocessor.

CO4: Interface peripheral devices with 8086 and 8051.

CO5: Use an Assembly/Embedded C programming approach for solving real-world problems.

Text Books:

1. Kenneth. J. Ayala. The 8051 microcontroller, 3rd edition, Cengage learning,2010.
2. Advanced microprocessors and peripherals-A.K ray and K.M.Bhurchandani, TMH, 2nd edition2006.
3. The 8051 Microcontroller and Embedded Systems: Using Assembly and C by Muhammad AliMazidi, Janice Gillispie Mazidi, Second Edition.

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

Skill Enhancement Courses

Skill Enhancement Course – I

25BAEEESC01 SIMULATION TOOLS FOR ELECTRICAL ENGINEERS

L	T	P	C
1	0	2	2

Pre-requisite Nil

Course Description:

This course introduces simulation and modeling techniques for electrical engineering problems. Covers tools like MATLAB/Simulink, LTspice, and PSpice for circuit and system analysis. Includes DC, AC, transient, and frequency-response simulation of analog and digital circuits. Features a design case study applying these tools to a practical system. Builds skills to model, simulate, and validate electrical/electronic designs.

Course Objectives:

This course enables students to

1. Understand the fundamentals of simulation and modeling in electrical engineering.
2. Develop electrical circuit models using industry-standard simulation software.
3. Analyze the simulation for Circuit Analysis.
4. Analyze the simulation for Analog Electronics.
5. Analyze the simulation for Digital Design.

UNIT I INTRODUCTION TO SIMULATION TOOLS 6 hours

Introduction to computer-aided engineering (CAE), Importance of simulation in electrical engineering, Mathematical modeling fundamentals, Numerical methods for simulation, Overview of simulation software, Creating models and interpreting simulation results.

a. Familiarization with Simulation Software (e.g., MATLAB/Simulink, LTspice, PSpice, Scilab Xcos).
b. Introduction to Computer-Aided Engineering (CAE) Tools.
c. Mathematical Modeling of a First-Order Electrical Circuit (RC Circuit).
d. Case Study: Simulation of a Simple Electrical System.

UNIT II MATLAB AND SIMULINK FOR ELECTRICAL SYSTEMS 6 hours

MATLAB programming essentials, Matrix operations, Plotting and visualization, Simulink library blocks, Modeling RLC circuits, Three-phase systems, Transformers, Electrical machines, Harmonic analysis, Parameter estimation.

a. Introduction to MATLAB Environment and Programming.
b. Matrix Operations Using MATLAB.
c. Plotting and Data Visualization in MATLAB.
d. Introduction to Simulink and Library Blocks.

UNIT III INTRODUCTION TO SIMULATION AND CIRCUIT ANALYSIS 6 hours

Introduction to computer-aided simulation, Importance of simulation in electrical engineering, Overview of simulation tools (Ltspice, Pspice, Multisim, MATLAB/Simulink), Circuit modeling techniques, Basic simulation settings, DC analysis, AC analysis, Transient analysis, Frequency response analysis, Parametric sweep.

a. Simulation of Basic DC Resistive Circuits.
b. Simulation of Series and Parallel RLC Circuits.
c. AC Analysis of RC and RL Circuits.
d. Frequency Response Analysis of an RLC Circuit.

UNIT IV ANALOG ELECTRONICS SIMULATION 6 hours

Semiconductor diode characteristics, Rectifier circuits, Zener diode voltage regulator, Bipolar Junction Transistor (BJT) characteristics, MOSFET characteristics, Biasing techniques, Small signal amplifier analysis, Operational amplifier fundamentals, Inverting and non-inverting amplifiers, Integrator and differentiator circuits Active filters Oscillators.

a. Study of PN Junction Diode Characteristics.
b. Study of Zener Diode Characteristics and Voltage Regulator.
c. Operational Amplifier – Inverting and Non-Inverting Amplifiers.
d. Operational Amplifier Applications – Integrator and Differentiator.

UNIT V DIGITAL DESIGN SIMULATION 6 hours

Modeling different types of gates, Half-adder and Full-adder, Half Subtractor and Full Subtractor, 8-Bit Arithmetic Logic Unit, Code converters and Magnitude comparator, Multiplexer and Demultiplexer, Decoder and Encoder, Flip-flops, Shift Registers, Synchronous counters and Asynchronous counters, Sequence detectors and Sequence generators, HDL program for Real time application.

a. Design of an 8-Bit Arithmetic Logic Unit (ALU).
b. Design of Synchronous and Asynchronous Counters.
c. Design of Sequence Detector and Sequence Generator.
d. HDL Programming for Digital System Applications.

Course Outcomes:

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

CO1: Apply simulation tools to analyze electrical circuits under DC, AC, and transient conditions.

CO2: Design and simulate analog electronic circuits using semiconductor devices and operational amplifiers.

CO3: Develop and verify combinational and sequential digital circuits using simulation software.

CO4: Analyze mixed-signal systems and interpret simulation results for engineering applications.

CO5: Design, simulate, and validate practical electrical and electronic systems through project-based learning.

Text Book(s)

1. John O. Attia, PSPICE and MATLAB for Electronics: An Integrated Approach, CRC Press.
2. Adel S. Sedra and Kenneth C. Smith, Microelectronic Circuits, Oxford University Press.

Reference Books

1. M. Morris Mano and Michael D. Ciletti, Digital Design, Pearson.
2. William H. Hayt Jr., Jack E. Kemmerly, and Steven M. Durbin, Engineering Circuit Analysis, McGraw-Hill.

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

Skill Enhancement Course – II

25BACSESC05 C PROGRAMMING

L	T	P	C
1	0	2	2

Pre-requisite: Nil

Course Description:

This course introduces algorithmic thinking and structured programming using C. Covers data types, control structures, functions, arrays, pointers, structures, and file handling. Emphasizes flowcharting, debugging, and code optimization for reliable programs. Uses hands-on exercises to build problem analysis and implementation skills. Establishes a programming foundation for data structures and embedded/software applications.

Course Objectives:

This course enables students to

1. To get the comprehensive knowledge to computer systems, programming languages, and problem-solving techniques.
2. To know now the concept of control structures and their usage in programming.
3. To gain a knowledge from the concept of functions, including declaration, definition, and various aspects of function usage.
4. To acquire the advanced programming concepts, including user-defined data types, pointers, and file handling.
5. To know now and get the knowledge about functions and file handling.

UNIT I INTRODUCTION TO PROGRAMMING AND PROBLEM SOLVING 6 hours

History of Computers, Basic organization of a computer: ALU, input-output units, memory, program counter, Introduction to Programming Languages, Basics of a Computer Program-Algorithms, flowcharts (Using Dia Tool), pseudo code. Introduction to Compilation and Execution, Primitive Data Types, Variables, and Constants, Basic Input and Output, Operations, Type Conversion, and Casting. Problem solving techniques: Algorithmic approach, characteristics of algorithm, Problem solving strategies: Top-down approach, Bottom-up approach, Time and space complexities of algorithms.

a. Programs Using Variables, Constants, and Data Types.
b. Programs Using Arithmetic, Relational, Logical, and Bitwise Operators.
c. Programs on Type Conversion and Type Casting.
d. Simple Mathematical Problem-Solving Using C.

UNIT II CONTROL STRUCTURES 6 hours

Simple sequential programs Conditional Statements (if, if-else, switch), Loops (for, while, do-while) Break and Continue.

a. Sequential Programs Using Input and Output Statements.
b. Programs Using Simple Mathematical Expressions.
c. Programs Using if and if-else Statements.
d. Programs Using while and do-while Loops.

UNIT III ARRAYS AND STRINGS 6 hours

Arrays indexing, memory model, programs with array of integers, two-dimensional arrays, Introduction to Strings, String Operations and String functions.

a. One-Dimensional Array Operations.
b. Matrix Operations Using Two-Dimensional Arrays.
c. String Input and Basic String Operations.
d. String Manipulation Using Standard Library Functions.

UNIT IV POINTERS & USER DEFINED DATA TYPES 6 hours

Pointers, dereferencing and address operators, pointer and address arithmetic, array manipulation using pointers, User-defined data types-Structures and Unions, Dynamic memory allocation.

a. Basic Pointer Operations.
b. Array Manipulation Using Pointers.
c. String Manipulation Using Pointers.
d. Structures and Arrays of Structures.

UNIT V FUNCTIONS & FILE HANDLING 6 hours

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

a. Passing Arrays to Functions.
b. Matrix Operations Using Functions.
c. Recursive Functions.
d. Student Record Management Using Functions and Files.

Course Outcomes:

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

CO1: Illustrate the basic computer concepts and programming principles of C language.
CO2: Develop programs using various control structures in 'C'.
CO3: Design applications using arrays and basic string manipulation.
CO4: Demonstrate the applications of pointers, user-defined types and dynamic memory allocation.
CO5: Design various applications using functions and file concepts.

Text Book(s)

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

Reference Books

1. Computing fundamentals and C Programming, Balagurusamy, E., McGraw-Hill Education, 2008.
2. Programming in C, Rema Theraja, Oxford, 2016, 2nd edition.
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Mode of Evaluation: Continuous Internal Evaluation , Assignments, Mid Term Tests and End Semester Examination.