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

DEPARTMENT OF CIVIL 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 CIVIL ENGINEERING

MADANAPALLE INSTITUTE OF TECHNOLOGY & SCIENCE

(Deemed to be University)

MADANAPALLE

B. Tech Four Year Curriculum Structure

Branch: CIVIL 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	25BACIVTC01	Engineering Geology	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

R25 - Curriculum Structure

II Year I Semester

S. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total	
1	BSC	25BAMATTC06	Probability and Statistics for Engineers	3	0	0	3	3
2	ESC	25BACIVTC03	Strength of Materials	2	1	0	3	3
3	PCC	25BACIVTC04	Surveying	3	0	0	3	3
4	PCC	25BACIVTC05	Fluid Mechanics and Hydraulics	3	0	0	3	3
5	PCC	25BACIVTC06	Building Materials in Construction	3	0	0	3	3
6	PCC	25BACIVLC01	Surveying Laboratory	0	0	2	2	1
7	PCC	25BACIVLC02	Strength of Materials Laboratory	0	0	2	2	1
8	PCC	25BACIVLC03	Fluid Mechanics and Hydraulic Engineering 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				**15**	**1**	**10**	**26**	**20**

II Year II Semester

S. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total	
1	BSC	25BAMATTC10	Numerical Methods	3	0	0	3	3
2	PCC	25BACIVTC07	Structural Analysis	2	1	0	3	3
3	PCC	25BACIVTC08	Environmental Engineering	3	0	0	3	3
4	PCC	25BACIVTC09	Engineering Hydrology	3	0	0	3	3
5	OE		**Open Elective – I** *(Refer ANNEXURE - II)*	3	0	0	3	3
6	PCC	25BACIVLC04	Environmental Engineering Laboratory	0	0	2	2	1
7	PCC	25BACIVLC05	Construction Materials Testing Laboratory	0	0	2	2	1
8	PCC	25BACIVLC06	IoT in Civil Engineering Laboratory	0	0	2	2	1
9	SEC		**Skill Enhancement Course – II** *(Refer ANNEXURE - IV)*	1	0	2	3	2
10	EEC		**NSDC - Certification Course – II** *(Refer ANNEXURE - V)*	0	0	2	2	-
Total				**15**	**1**	**10**	**26**	**20**

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

R25 – Tentative Curriculum Structure
III Year I Semester

S. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total	
1	HSMC		Engineering Economics	3	0	0	3	3
2	PCC	25BACIVTC10	Geotechnical Engineering	2	1	0	3	3
3	PCC	25BACIVTC11	Design of Concrete Structures	2	1	0	3	3
4	DE		**Discipline Elective – I** *(Refer ANNEXURE - III)*	3	0	0	3	3
5	OE		**Open Elective – II** *(Refer ANNEXURE - II)*	3	0	0	3	3
6	PCC	25BACIVLC07	NDT and Health Monitoring Laboratory	0	0	2	2	1
7	PCC	25BACIVLC08	Geo-Technical Engineering Laboratory	0	0	2	2	1
8	SEC		**Skill Enhancement Course – III** *(Refer ANNEXURE - IV)*	1	0	2	3	2
9	INT	25BACIVIC01	Summer Internship – I	0	0	2	2	1
10	EEC		**NSDC - Certification Course – III** *(Refer ANNEXURE - V)*	0	0	2	2	-
Total				**14**	**2**	**10**	**26**	**20**

III Year II Semester

S. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total	
1	HSMC		Project Management	3	0	0	3	3
2	PCC	25BACIVTC12	Water Resources and Irrigation Engineering	2	0	0	2	2
3	PCC	25BACIVTC13	Design of Steel Structures	2	1	0	3	3
4	PCC	25BACIVTC14	Highway Engineering	2	0	0	2	2
5	DE		**Discipline Elective – II** *(Refer ANNEXURE - III)*	3	0	0	3	3
6	OE		**Open Elective – II** *(Refer ANNEXURE - II)*	3	0	0	3	3
7	PCC	25BACIVLC09	Highway Materials Laboratory	0	0	2	2	1
8	PCC	25BACIVLC10	Traffic Engineering 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				**16**	**1**	**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	25BACIVTC15	Construction Quality and Safety Management	3	0	0	3	3
2	PCC	25BACIVTC16	Estimation and Costing	2	1	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	25BACIVLC11	Quantity Surveying Laboratory	0	0	2	2	1
8	SEC		**Skill Enhancement Course – IV** *(Refer ANNEXURE - IV)*	1	0	2	3	2
9	INT	25BACIVIC02	Summer Internship - II	0	0	4	4	2
10	EEC		**NSDC - Certification Course – V** *(Refer ANNEXURE - V)*	0	0	2	2	-
Total				**18**	**1**	**10**	**29**	**23**

IV Year II Semester

S. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total	
1	PW	25BACIVPC01	Capstone Project	0	0	28	28	14
2	INT	25BACIVIC03	Full Semester Internship	0	0	6	6	3
Total				**0**	**0**	**34**	**34**	**17**

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

ANNEXURE - I

THREE WEEK MANDATORY INDUCTION PROGRAMME

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

- ***Proficiency modules***

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

HOLISTIC DEVELOPMENT ACTIVITIES

Description of Activities

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

ANNEXURE - II

OPEN ELECTIVE – I

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

Sl. No.	Course Code	Course Title	Course Offered by Department of
1	25BAHUMOM01	English Language for Competitive Exams	Humanities and Social Sciences
2	25BAHUMOM02	Public Speaking	Humanities and Social Sciences
3	25BAHUMOM03	Indian Business History	Humanities and Social Sciences
4	25BAHUMOM04	Indian Economy: Some Contemporary Perspectives	Humanities and Social Sciences
5	25BAMBAOM01	E – Business	Management
6	25BAMBAOM02	AI in Human Resource Management	Management
7	25BAMBAOM03	AI in Marketing	Management
8	25BAMBAOM04	Artificial Intelligence for Investments	Management
9	25BAMECOM01	Operations Management	Mechanical
10	25BAEEEOM01	Transducers For Instrumentation	EEE
11	25BAECEOM01	Microprocessors and Interfacing	ECE
12	25BAECEOM02	Microprocessors and Microcontrollers	ECE
13	25BACSEOM01	Privacy and Security in Online Social Media	CSE
14	25BACSEOM02	Computer Networks and Internet Protocol	CSE
15	25BACSEOM03	Introduction to Soft Computing	CSE
16	25BACSEOM04	Human Computer Interaction (in Hindi)	CSE
17	25BACOMOM01	Research Methodology	Multidisciplinary
18	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.	25BACIVDM01	Advanced Concrete Technology
2.	25BACIVDM02	Integrated Waste Management for a Smart City
3.	25BACIVDM03	Building Materials as a Cornerstone to Sustainability
4.	25BACIVDM04	Sustainable Engineering Concepts and Life Cycle Analysis
5.	25BACIVDM05	Municipal Solid Waste Management
6.	25BACIVDM06	Subsurface Exploration: Importance and Techniques
Any advanced Course offered by SWAYAM NPTEL can be appended in future.		

Discipline Elective – II		
S. No.	**Course Code**	**Course Title**
1.	25BACIVDC01	Prestressed Concrete
2.	25BACIVDC02	Lean Structures
3.	25BACIVDC03	Environmental Management System
4.	25BACIVDC04	Watershed management
5.	25BACIVDC05	Ground Improvement and Geosynthetics
6.	25BACIVDC06	Functional Design of Buildings
Any advanced courses can be appended in future.		

Discipline Elective – III		
S. No.	**Course Code**	**Course Title**
1.	25BACIVDC07	Pavement Analysis and Design
2.	25BACIVDC08	Railway and Airport Engineering
3.	25BACIVDC09	Tunnel and Harbour Engineering
4.	25BACIVDC10	Traffic Engineering and Road Safety
5.	25BACIVDC11	Groundwater Hydrology
6.	25BACIVDC12	Open Channel Hydraulics
Any advanced courses can be appended in future.		

Discipline Elective – IV		
S. No.	**Course Code**	**Course Title**
1.	25BACIVDC13	Finite Element Analysis
2.	25BACIVDC14	Rehabilitation of Structures
3.	25BACIVDC15	Design of Industrial Structures
4.	25BACIVDC16	Design of Concrete and Steel bridges
5.	25BACIVDC17	Foundation Engineering
6.	25BACIVDC18	Contaminant Hydrology and Remediation
Any advanced courses can be appended in future.		

Discipline Elective –V		
S. No.	**Course Code**	**Course Title**
1	25BACIVDC19	Infrastructure Planning and Management
2	25BACIVDC20	Geospatial Applications in Civil Engineering
3	25BACIVDC21	Land Surveying and Real Estate Management
4	25BACIVDC22	Life Cycle Assessment
5	25BACIVDC23	Urban Planning and Management
6	25BACIVDC24	Traffic Flow Modelling and Simulation
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.	25BACIVSC01	Computer Aided Building Planning and Drawing
Any Courses can be appended in future.		

Skill Enhancement Course – II		
S. No.	**Course Code**	**Course Title**
1.	25BACIVSC02	Remote Sensing and Geographical Information Systems
Any Courses can be appended in future.		

Skill Enhancement course – III		
Sl. No.	**Course Code**	**Course Title**
1.	25BACIVSC03	Building Information Modelling
Any Courses can be appended in future.		

Skill Enhancement Course – IV		
Sl. No.	**Course Code**	**Course Title**
1.	25BACIVSC04	Structural Analysis and Design
Any Courses can be appended in future.		

I Year I Semester

B. Tech I Year I Semester

25BAENGTC01 PROFESSIONAL COMMUNICATION

L	T	P	C
2	0	0	2

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

Course Description :

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

Course Objectives:

This course aims to:

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

UNIT I EVERYDAY ENGLISH 6 hours

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

UNIT II NARRATION AND PLANNING 6 hours

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

UNIT III FUNCTIONAL COMMUNICATION IN DAILY LIFE 6 hours

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

UNIT IV READING FOR COMPREHENSION AND PLEASURE 6 hours

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

UNIT V PROFESSIONAL AND BUSINESS COMMUNICATION 6 hours

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

Course Outcomes:

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

Text Books:

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

Reference Books:

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

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

B.Tech I Year I Semester

25BAHUMTC01 HUMAN VALUES AND PROFESSIONAL ETHICS

L	T	P	C
2	0	0	2

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

Course Description :

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

Course Objectives :

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

UNIT I INTRODUCTION TO VALUE EDUCATION 6 hours

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

UNIT II HARMONY IN THE HUMAN BEING 6 hours

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

UNIT III HARMONY IN THE FAMILY AND SOCIETY 6 hours

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

UNIT IV HARMONY IN THE NATURE/EXISTENCE 6 hours

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

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

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

Course Outcomes:

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

Text Book(s)

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

Reference Books

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

Online Resources:

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

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

B. Tech I Year I Semester

25BAMATTC01 ENGINEERING CALCULUS

L	T	P	C
3	0	0	3

Pre Requisites: Mathematics at Intermediate or Equivalent Level

Course Description:

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

Course Objectives:

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

UNIT I DIFFERENTIAL CALCULUS & POLAR GRAPHING 9 hours

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

UNIT II INTEGRAL CALCULUS 9 hours

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

UNIT III MULTIVARIABLE DIFFERENTIAL CALCULUS 9 hours

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

UNIT IV MULTIVARIABLE INTEGRAL CALCULUS 9 hours

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

UNIT V MULTIVARIABLE VECTOR CALCULUS 9 hours

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

Course Outcomes:

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

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

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

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

Text Books:

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

25BACIVTC01 ENGINEERING GEOLOGY

L	T	P	C
3	0	0	3

Course Description:

The course covers the fundamentals of geology and its application in Civil engineering, including the internal structure and composition of the Earth, weathering processes, and geological work of rivers and wind. It introduces the identification and classification of minerals and rocks, their structures, textures, and their engineering significance. The course also covers geological structures such as folds, faults, joints, and unconformities, along with geological hazards.

Course Objectives:

1. To provide fundamental knowledge of geology relevant to Civil engineering applications.
2. To identify and classify minerals and rocks based on physical properties, structures, and textures.
3. To interpret geological structures such as folds, faults, joints, and unconformities for engineering site evaluation.
4. To assess geological hazards, including earthquakes, tsunamis, and landslides, and their impact on Civil engineering projects.

UNIT I BASIC GEOSCIENCE **9 hours**

Definition of engineering geology - main and applied branches of geology - importance of geology and its branches from a civil engineering perspective - brief case studies of failures in Civil engineering constructions due to geological drawbacks - internal structure of the Earth and its composition.

UNIT II PHYSICAL GEOLOGY **9 hours**

Weathering - effect of weathering on the properties of rocks - importance of weathering in civil engineering constructions such as dams, reservoirs, and tunnels - soil formation - geological work of rivers - geological work of wind.

UNIT III MINERALOGY **9 hours**

Definition of mineral - importance of studying minerals - different methods of studying minerals - advantages of studying minerals by physical properties - role of physical properties in mineral identification - study of physical properties of rock-forming and economic minerals.

UNIT IV PETROLOGY **9 hours**

Definition of rock - geological classification of rocks into igneous, sedimentary, and metamorphic - dykes and sills - common structures and textures of igneous, sedimentary, and metamorphic rocks - their distinguishing features - megascopic and microscopic study of granite, dolerite, basalt, pegmatite, laterite, conglomerate, sandstone, shale, limestone, gneiss, schist, quartzite, marble, and slate.

UNIT V STRUCTURAL GEOLOGY **9 hours**

Introduction - stress and strain in rocks - concept of rock deformation and tectonics - outcrop, dip and strike - structural features of rocks - main types of discontinuities according to size - folds: types, nomenclature, and criteria for recognition in field - faults: classification, recognition in field, and effects on outcrops - joints and unconformity: types - geological hazards: earthquake, tsunami, and landslides.

Course Outcomes:

After completing this Unit, students will be able to

CO1: Describe the Earth's internal structure, composition, and major geological processes.
CO2: Explain weathering mechanisms, soil formation, and geomorphic work of rivers and wind.
CO3: Identify and classify minerals and rocks through their physical properties, structures, and textures.
CO4: Recognize and interpret geological structures such as folds, faults, joints, and unconformities.
CO5: Evaluate geological hazards including earthquakes, tsunamis, and landslides in relation to Civil engineering works.

Text Books:

1. P. Singh, *Engineering and General Geology*, New Delhi, India: S. K. Kataria and Sons, 2013.
2 N. Chennakesavulu, *Engineering Geology*, New Delhi, India: McMillan India Ltd., 2005.

Reference Books:

1. S. K. Duggal and H. K. Pandey, *Engineering Geology*, New Delhi, India: McGraw Hill Education Pvt. Ltd., 2014
2. Subinoy Gangopadhyay, *Engineering Geology*, New Delhi, India: Oxford University Press, 2010.
3. D. V. Reddy, *Engineering Geology for Civil Engineering*, New Delhi, India: Oxford and IBH Publishing Co. Pvt. Ltd., 2012.
4. P. K. Mukherjee, *A Text Book of Geology*, Kolkata, India: World Press, 2005.

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:

After completing this Unit, 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:

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:

After completing this Unit, students will be able to

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

25BAMATTC06 PROBABILITY AND STATISTICS FOR ENGINEERS

L	T	P	C
3	0	0	3

Pre Requisites: 25BAMATTC01, 25BAMATTC03

Course Description:

This course provides a foundation in probability and statistics with emphasis on engineering applications. It covers probability theory, random variables, and standard probability distributions for modelling uncertainty. The course further includes joint distributions and regression for multivariate analysis, statistical inference through confidence intervals and hypothesis testing, and analysis of variance (ANOVA) with basic experimental design techniques for engineering applications.

Course Objectives:

1. To strengthen the fundamental concepts of probability and random variables.
2. To apply discrete and continuous probability distributions in engineering problem-solving.
3. To analyse multivariate data using joint distributions, correlation, and regression techniques.
4. To apply statistical inference methods including confidence intervals and hypothesis testing.
5. To understand and analyse engineering experimental designs using ANOVA techniques.

UNIT I PROBABILITY AND RANDOM VARIABLES 9 hours

Introduction to probability, sample space and events, axioms of probability, theorems on probability, conditional probability, multiplication theorem, independence of events, Bayes' theorem.

Random variables: discrete and continuous, probability density functions, cumulative distribution function and its properties. Expectation, properties of expectation, variance, moment generating function.

UNIT II PROBABILITY DISTRIBUTIONS 9 hours

Discrete distributions: Bernoulli trials, Geometric distribution, Binomial distribution, Poisson approximation to Binomial, Poisson distribution— properties and applications.

Continuous distributions: Uniform, Exponential, Gamma, and Normal distributions- properties and applications

UNIT III JOINT DISTRIBUTIONS AND REGRESSION ANALYSIS 9 hours

Joint probability distributions (discrete and continuous), marginal distributions, conditional distributions. Independence of random variables, expectation of joint distributions, covariance and correlation.

Regression analysis: simple linear regression, regression coefficients, lines of regression and their properties.

UNIT IV HYPOTHESIS TESTING AND STATISTICAL INFERENCE 9 hours

Population and sampling, sampling distributions, Central Limit Theorem. Estimation of parameters, confidence intervals. Formulation of null and alternative hypotheses, level of significance, Type I and Type II errors, power of a test. Large sample tests: single mean, single proportion, difference of means, difference of proportions. Small sample tests: t-test (single mean and difference of means), F-test for ratio of variances.

UNIT V ANALYSIS OF VARIANCE AND DESIGN OF EXPERIMENTS 9 hours

Analysis of Variance (ANOVA): one-way and two-way classification. Principles of experimental design: randomization, replication, and local control.Design of Experiments: Randomized Block Design (RBD) and Latin Square Design (LSD).

Course Outcomes:

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

CO1: Apply probability concepts and random variables to model engineering uncertainties.

CO2: Use appropriate probability distributions to solve engineering problems.

CO3: Analyse multivariate data using joint distributions, correlation, and regression techniques.

CO4: Apply statistical inference methods including confidence intervals and hypothesis testing.

CO5: Analyse engineering experiments using ANOVA and design of experiments techniques.

Text Books:

1. J.S. Milton and J.C. Arnold, Introduction to Probability and Statistics, 4th edition, 2003 Tata McGraw-Hill Publications.
2. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 42nd Edition, 2012.

Reference Books:

1. Sheldon M. Ross: Introduction to Probability and Statistics for Engineers and Scientists, 4th Edition, Elsevier, Academic Press, 2010.
2. Walpole, R.E., Myers R.H., Myer S.L., Ye. K: Probability and Statistics for Engineers and Scientists, 8th ed., Pearson Education, 2008.
3. Johnson, R.A. Miller Freund's: Probability and Statistics, 7th Edition, PHI, 2005.
4. Sheldon Ross: A First Course in Probability, 6th Edition, Pearson Education, 2002.

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

B. Tech II Year I Semester

25BACIVTC03 STRENGTH OF MATERIALS

L	T	P	C
2	1	0	3

Pre Requisites: 25BAMECTC02

Course Description:

This course covers the fundamentals of stresses and strains, shear force and bending moment in determinate beams, and bending and shear stresses in structural members. It also includes the study of principal stresses and strains, torsion and combined stresses in circular shafts, buckling analysis of columns, and determination of slopes and deflections of beams.

Course Objectives:

1. To analyze the behavior of materials subjected to axial loading, temperature changes, and impact loading conditions.
2. To evaluate the shear force and bending moment in beams and to evaluate the buckling load of columns.
3. To analyze bending and shear stresses in different beam sections and to design simple beam members subjected to loading conditions.
4. To evaluate slopes and deflections in determinate beams using different analytical methods.
5. To analyze torsion and combined stresses in circular shafts under different loading conditions.

UNIT I SIMPLE STRESS AND STRAIN — 9 hours

Concept of stress and strain- Types of stresses and strains- St. Venant's principle, Elasticity and plasticity - Hooke's law - Stress - Strain diagram for mild steel - Working stress - Factor of safety - Lateral strain, Poisson's ratio and volumetric strain - Elastic moduli and the relationship between them - Bars of varying section - composite bars - Temperature stresses. Strain Energy – Resilience - Gradual, sudden, impact and shock loadings - simple applications.

UNIT II SHEAR FORCE & BENDING MOMENT IN BEAMS, COLUMNS AND STRUTS — 9 hours

SHEAR FORCE AND BENDING MOMENT: Introduction to types of beams, supports and loadings. Definition of bending moment and shear force, Sign conventions, relationship between load intensity, bending moment and shear force. Shear force and bending moment diagrams for statically determinate beams subjected to points load, uniformly distributed loads, uniformly varying loads, couple and their combinations.

COLUMNS AND STRUTS: Axially loaded compression members- Crushing load and Buckling load - Euler's theory for long columns- Rankine's theory- Analyzing the basic problems for Euler's and Rankine's theory.

UNIT III FLEXURAL AND SHEAR STRESSES — 9 hours

BENDING STRESSES: Assumptions - Derivation of bending - Neutral axis - Determination of bending stresses - Section modulus of rectangular and circular sections (Solid and Hollow), I,T, Angle, Channel sections and built-up sections - Design of simple beam sections.

SHEAR STRESSES: Shear Stresses- Derivation of shear stress formula - Shear stress distribution across various beam sections.

UNIT IV DEFLECTIONS OF BEAMS 9 hours

Slope and deflection- Relationship between moment, slope and deflection, Determine slopes and deflections of the determinate beams (Simply supported and Cantilever) using Double integration method, Macaulay's method, Moment area method and Conjugate beam method.

UNIT V TORSION AND COMPOUND STRESSES AND STRAINS 9 hours

TORSION: Derivation of torsion equation and its assumptions. Applications of the equation of the hollow and solid circular shafts, torsional rigidity, Combined torsion and bending of circular shafts, principal stress and maximum shear stresses under combined loading of bending and torsion.
COMPOUND STRESSES AND STRAINS: Two dimensional system, stress at a point on a plane, principal stresses and principal planes, Mohr circle of stress and their applications, Two dimensional stress-strain system, principal strains and principal axis of strain.

Course Outcomes:

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

CO1: Apply the concepts of stress, strain, and elastic properties to analyze materials subjected to axial, thermal, and impact loads.
CO2: Construct and interpret shear force and bending moment diagrams for beams under different loading conditions and evaluate buckling loads of columns.
CO3: Analyze bending and shear stresses in structural members and design simple beam sections
CO4: Determine slopes and deflections of determinate beams using various analytical methods.
CO5: Evaluate torsional and combined stresses in circular shafts and determine principal stresses under combined loading.

Textbooks:

1. S. Ramamrutham and R. Narayanan, Strength of Materials, Dhanpat Rai Publishing Company
2. R K Rajput, Strength of Material, S Chand Publications
3. Gere and Timoshenko , Mechanics Of Materials, 2nd Edition, CBS Publisher.
4. R.C. Hibbeler, Mechanics of Materials, 10th edition, Pearson Education, 2017.

Reference Books:

1. Beer, F. P., Johnston, E. R. and DeWolf, J. T., Mechanics of Materials, Third Edition, McGraw- Hill International Edition, 2002.
2. Lardner, T. J, Archer, R. R., Mechanics of Solids, an introduction, International Edition, McGraw-Hill, 1994.
3. Shames, I. H., Introduction to Solid Mechanics, 2nd Edition, Prentice Hall of India Private Ltd. New Delhi, 1980.
4. Vaidyanathan R., Perumal P. and Lingeswari S., Mechanics of Solids and Structures, Volume I, Laxmi Publications (P) Ltd., New Delhi II, First Ed. 2017.

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

B. Tech II Year I Semester

25BACIVTC04 SURVEYING

L	T	P	C
3	0	0	3

Pre Requisites: Nil

Course Description:

This course covers Principles of Surveying, different measurement techniques, Compass and Plane table surveying, Levelling, Theodolite Surveying and Curves. The course further covers Modern field survey systems like Electronic distance measurement(EDM) using Total station, Global Positioning Systems and Geographical Information System.

Course Objectives:

1. To understand basic surveying principles, measurement techniques, and conventional surveying instruments used in land measurements and mapping.
2. To impart knowledge of compass surveying and plane table surveying methods for determining relative positions of points on the ground.
3. To introduce the principles and procedures of levelling for determining relative elevations of points on the earth's surface.
4. To provide understanding of theodolite surveying techniques and the design/setting out of horizontal curves.
5. To learn modern surveying tools such as EDM, Total Station, GPS, and GIS.

UNIT I INTRODUCTION TO SURVEYING 9 hours

Definition- Classifications - Basic Principles-Equipment and accessories for ranging and chaining – Methods of ranging - well conditioned triangles – Errors in linear measurement and their corrections - Obstacles - Traversing – Plotting.

UNIT II COMPASS AND PLANE TABLE SURVEYING 9 hours

COMPASS SURVEYING: Compass – Basic principles - Types - Bearing- Systems and conversions- Sources of errors - Local attraction - Magnetic Declination -Dip Traversing – Plotting - Adjustment of closing error – applications

PLANE TABLE SURVEYING: Plane table and its accessories - Merits and demerits - Radiation - Intersection - Resection – Traversing- sources of errors – applications.

UNIT III LEVELLING 9 hours

LEVELLING: Level line - Horizontal line - Datum - Bench marks -Levels and staves – temporary and permanent adjustments – Methods of levelling - Fly levelling - Check levelling – Procedure in levelling - Booking -Reduction - Curvature and refraction - Reciprocal levelling – Sources of Errors in levelling- Precise levelling - Types of instruments - Adjustments - Field procedure and it application.

UNIT IV THEODOLITE SURVEYING AND CURVES 9 hours

THEODOLITE SURVEYING: Theodolite - Types - Description - Horizontal and vertical angles - Temporary and permanent adjustments – Heights and distances– Tangential and Stadia Tacheometry – Subtense method - Stadia constants – Anallactic.

CURVES: Elements of simple and compound curves; Method of setting out- Elements of Reverse curve; Transition curve- length of curve- Elements of transition curve; Vertical curves.

UNIT V MODERN FIELD SURVEY SYSTEMS 9 hours

MODERN FIELD SURVEY SYSTEMS: Principle of Electronic Distance Measurement, Modulation, Types of EDM instruments, Total Station - Parts of a Total Station - Accessories -Advantages and Applications; Global Positioning Systems- Segments, GPS measurements, errors and biases, Surveying with GPS, Co-ordinate transformation, accuracy considerations - Introduction to GIS, different GIS software, basic data types and coordinate systems.

Course Outcomes:

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

CO1: Apply the knowledge, techniques, skills, and applicable tools for surveying activities.

CO2: Explain the principles of compass and plane table surveying, and identify sources of errors including local attraction and closing error.

CO3: Determine the methods of levelling and compute reduced levels while accounting for curvature and refraction errors.

CO4: Apply the procedure of theodolite surveying and describe the methods of setting out simple, compound, reverse, and transition curves.

CO5: Apply the basics of modern survey instrument for surveying and mapping purpose.

Text Books:

1. T. P. Kanetkar and S. V. Kulkarni, Surveying and Levelling Parts 1 & 2
2. Arora, K.R., Surveying, Vol-I, II and III, Standard Book House, 2015
3. C Venkatramaiah, Textbook of Surveying, Universities Press

Reference Books:

1. Elements of Geomatics by P.R. Wolf.
2. Bhavikatti, S.S., Surveying and Levelling, Vol. I and II, I.K. International, 2010
3. C Venkatramaiah, Textbook of Surveying, Universities Press
4. Manoj, K. Arora and Badjatia, Geomatics Engineering, Nem Chand & Bros, 2011
5. Madhu, N, Sathikumar, R and Satheesh Gobi, Advanced Surveying: Total Station, GIS and Remote Sensing, Pearson India, 2006.
6. Chandra, A.M., Higher Surveying, Third Edition, New Age International (P) Limited, 2002.
7. Anji Reddy, M., Remote sensing and Geographical information system, B.S. Publications,

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

B. Tech II Year I Semester

25BACIVTC05 FLUID MECHANICS AND HYDRAULICS

L	T	P	C
3	0	0	3

Prerequisites: 25BAMATTC01, 25BAMATTC03, 25BAMECTC02

Course Description:

The objectives of this course are to impart a fundamental understanding of fluid properties and statics, enabling students to analyze fluid motion and energy conservation using kinematics and dynamics principles. It aims to develop skills in computing energy losses in pipe networks and designing hydraulically efficient open channels. Additionally, students will learn to predict varied flow profiles and apply dimensional analysis to design and evaluate scaled engineering models.

Course Objectives:

1. To apply fluid properties, hydrostatic laws, and buoyancy principles in fluid analysis.
2. To use continuity, Euler's, and Bernoulli's equations for fluid flow analysis and measurements.
3. To compute energy losses in series, parallel, and siphon pipe systems.
4. To apply Chezy's and Manning's formulas for open channel design.
5. To analyze varied flow profiles and apply dimensional analysis in hydraulic models.

UNIT I FLUID PROPERTIES AND STATICS **9 hours**

FLUID PROPERTIES: The Concept of a Fluid - Physical Properties of Fluids (Density, Specific Weight, Specific Volume, Specific Gravity, Viscosity: Dynamic and Kinematic Viscosity, Compressibility, Surface tension, Capillary Effect, Vapour Pressure and Cavitation), Newtons law of viscosity, Types of Fluids.

FLUID STATICS: Types of Pressure, Pascal's Law, Hydrostatic Law, Pressure Measurement Devices, Pressure Head, Pressure Diagram, Centre of Pressure, Forces on Plane and Curved Surfaces, Buoyancy and Floatation: Archimedes's Principle, Metacentre, Stability of Submerged and Floating Bodies.

UNIT II FLUID KINEMATICS AND DYNAMICS **9 hours**

KINEMATICS: Types of Flows, Stream lines, Equipotential lines, Stream Function and Velocity Potential Function, Flow Net- (Properties and Uses), Continuity Equation (3-D Cartesian Form).

DYNAMICS: Forces Acting on Fluid in Motion, Euler's Equation along a Streamline, Bernoulli's Theorem, Limitations, Bernoulli's Applications: Venturimeter (Horizontal and Vertical), Orificemeter, Orifices, Time required for Emptying the Tank, Concept of HGL and TEL.

UNIT III FLOW THROUGH PIPES **9 hours**

Reynold's Experiment, Hazen Poisulle's Equation for Viscous Flow through Circular Pipes, Major and Minor Losses, Concept of Equivalent Pipe, Dupit's Equation, Pipes in Series, Parallel and Syphon

UNIT IV OPEN CHANNEL FLOWS **9 hours**

Classification of Flows in Open Channel, Geometric Elements, Chezy's and Manning's Formula, Uniform Flow Computations, Hydraulically Efficient Section (Rectangular, Triangular, Trapezoidal), Depth Energy Relationship in OCF.

UNIT V GRADUALLY VARIED FLOW, RAPIDLY VARIED FLOW AND DIMENSIONAL ANALYSIS **9 hours**

GVF: Classification of Channel Slopes, Dynamic Equation of GVF (Assumption and Derivation), Classification of GVF Profiles- Practical Examples, Direct Step Method of Computation of GVF Profiles
RVF: Hydraulic Jump, Conjugate Depth Relationship, Characteristics, Uses and Types of Hydraulic Jump, Hydraulic Jump as an Energy Dissipater.
DIMENSIONAL ANALYSIS: Buckingham's π theorem - model analysis dimensionless number - scales ratios for distributed models.

Course Outcomes:

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

CO1: Apply fluid properties and hydrostatic principles to determine pressures, hydrostatic forces, and stability of floating bodies.
CO2: Analyze fluid flow using continuity, Euler's, and Bernoulli's equations and evaluate flow measuring devices.
CO3: Compute major and minor losses in pipe flow systems and analyze flow through series, parallel, and siphon pipes.
CO4: Apply Chezy's and Manning's formulas to design hydraulically efficient open channels.
CO5: Analyze gradually and rapidly varied flows and apply dimensional analysis for hydraulic model studies.

Textbooks:

1. R.K. Bansal, "A Textbook of Fluid Mechanics and Hydraulic Machines (SI Units), Laxmi Publication
2. K Subramanya, "Flow in Open Channels," 5th Edition, McGraw Hill Education.

Reference Books:

1. A.K. Jain "Fluid Mechanics" Khanna Publication.
2. Bhavikatti, S.S., Surveying and Levelling, Vol. I and II, I.K. International, 2010
3. Yunus A Cengel and John M Cimbala, "Fluid Mechanics Fundamentals and Applications" (SI Units), Tata McGraw-Hill Education, 3rd Edition, 2017.

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

B. Tech II Year I Semester

25BACIVTC06 BUILDING MATERIALS IN CONSTRUCTION

L	T	P	C
3	0	0	3

Pre-Requisites: 25BACIVTC01

Course Description:

This course covers the application of various building materials across structural elements like foundations, lintels, walls, and roofs. This course focuses on various building materials based on the performing standards and codes, wherein application of each material would be discussed in detail, both in the context of historical and contemporary methodology.

Course Objectives:

1. To understand building components and their relationship with construction materials and planning.
2. To study the source, properties, classification, testing, and applications of traditional and conventional building materials.
3. To analyze the manufacturing, properties, grades, and applications of cement, admixtures, and aggregates.
4. To develop knowledge of concrete preparation, workability, mix design, strength, curing, and special concretes.
5. To evaluate roof systems, roofing materials, fixing methods, and sustainable construction practices.

UNIT I FUNDAMENTAL COMPONENTS OF A BUILDING 9 hours

Introduction to building construction, understanding relation between architectural designs, building components (Foundation, plinth, wall, sill, lintel, roof, doors, windows, ventilators, staircases, sunshades etc.) along with the building materials.

UNIT II VERNACULAR BUILDING MATERIALS 9 hours

Source of the material, classification, tests and various grades available and their uses, physical and chemical properties - Introduction to ferrous and non-ferrous metals - their properties, types and application in building components - Composition of glass, brief study on manufacture, properties, treatment, and uses of glass - Types of glass - Types of timber - Application of timber in building components.

UNIT III CEMENTS & ADMIXTURES AND AGGREGATES 9 hours

CEMENT: Portland cement – manufacturing process, chemical composition, hydration, setting of cement, structure of hydrated cement. Tests on physical properties. Different grades of cement. ADMIXTURES: mineral and chemical admixtures. Types of cement

AGGREGATES: Classification – particle shape & texture, gradation. Bond, strength & other mechanical properties. Specific gravity, bulk density, porosity, adsorption & moisture content. Bulking of sand. Deleterious substances. Soundness of aggregate. Alkali-aggregate reaction. Thermal properties of aggregates.

UNIT IV CONCRETE PREPARATION AND ITS TYPES 9 hours

FRESH CONCRETE: Workability – factors affecting it, measurement by different tests. Setting times of concrete - Effect of time and temperature on workability. Segregation & bleeding. Mixing and vibration of concrete - Steps in manufacture of concrete. Quality of mixing water.

CONCRETE MIX DESIGN: Water/cement ratio – Abram's Law. Gel-space ratio - Nature of strength of concrete. Maturity concept - Strength in tension & compression – factors affecting strength - Relation between compressive & tensile strength - Curing - Special concrete (types)

UNIT V ROOFS AND ROOF COVERINGS 9 hours

Introduction, characteristics of roof, types of roofs (flat- madras terrace roof, RCC slab, classification of roofs by the method of geometry and methods of construction – pitched, lean-to, coupled, couple-closed, collar, scissor, king post and queen post), and by materials (GI sheets, Fibre, Glass, Aluminium, asphaltic, polycarbonate, clay tiles, coir-based corrugated sheets, etc). Roof fixing details along with gutter.

Course Outcomes:

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

CO1: Explain the functions of building components and their relationship with construction materials and architectural planning.

CO2: Identify the properties, classification, testing methods, and applications of vernacular and conventional building materials.

CO3: Analyze the manufacturing process, properties, grades, and applications of cement, admixtures, and aggregates used in construction.

CO4: Apply concepts of concrete preparation, workability, mix design, strength, curing, and special concretes in construction practices.

CO5: Evaluate different roof systems, roofing materials, roof fixing methods, and their applications in building construction.

Text Books:

1. Rangwala, S. C., Building Construction: Materials and types of Construction. 3rd Ed. New York : John Wiley and Sons.
2. Bindra, S.P. and Arora, S.P., Building Construction: Planning Techniques and Methods of Construction, 19th Ed. New Delhi : Dhanpat Rai Publications

Reference Books:

1. Edward, A. and Piano, J.,Fundamentals of Building Construction: Materials and Methods. 5th Ed. Hoboken : John Wiley & Sons, 2009
2. Rangwala, S. Building Construction. 22nd Ed. Anand.: Charotar Pub. House. 11., 2004
3. Sushil-Kumar, T. B., Building Construction, 19th Ed. Delhi : Standard Publishers., 2003
4. Barry, R. Construction of Buildings Vol. 2. 5th Ed. New Delhi : East-West Press.,1999

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

B. Tech II Year I Semester

25BACIVLC01 SURVEYING LABORATORY

L	T	P	C
0	0	2	1

Pre-Requisites: Nil

Course Description:
This course covers practical usage of various surveying instruments for different field measurements like lengths, angles, areas, volumes and elevations.

Course Objectives:

1. To understand the principles and applications of various linear and angular surveying instruments used in civil engineering measurements.
2. To develop practical skills in performing linear, angular, and levelling operations using conventional surveying instruments.
3. To interpret survey data for determining distances, areas, volumes, and contours required for engineering applications.
4. To gain hands-on experience in the operation of modern surveying equipment such as Total Station and Digital Theodolite.
5. To develop the ability to record, draft, and interpret field notes, survey sketches, and engineering layouts accurately.

List of Experiments:

1. Chain survey of road profile with offsets in case of road widening..
2. Plot the site by referring the FMB (field measurement book)
3. Determination of distance between two inaccessible points by using compass.
4. Plane table survey; finding the area of a given boundary by the method of Radiation
5. Fly levelling: Height of the instrument method and rise & fall method (differential levelling) and draw the contours
6. Theodolite survey: determining the horizontal and vertical angles by the method of repetition method
7. Theodolite survey: finding the distance between two in accessible points.
8. Theodolite survey: finding the height of far object.
9. Determination of distance between two inaccessible point by using total station.
10. Determination of area and perimeter using total station.
11. Setting out a curve
12. Surveying camp.

(Minimum of 10 Experiments to be performed)

List of Major Equipment

1. Chains, tapes, Ranging rods (2M and 3M), cross staff, arrows
2. Compasses and Tripods, Optical square.
3. Plane tables, Alidade, Plumbing fork, trough compasses.
4. Levelling instruments, Digital Theodolite and Total Station

Course Outcomes:

The students after completing the course will be able to:

CO1: Identify and use various conventional and modern surveying instruments for linear, angular, and elevation measurements.

CO2: Perform chain, compass, plane table, levelling, theodolite, and total station surveys for engineering applications.

CO3: Compute distances, areas, elevations, and contours from field survey data using appropriate surveying methods.

CO4: Prepare and interpret field notes, survey sketches, contour maps, and plotted survey data accurately.

CO5: Apply surveying techniques for setting out engineering works and solving practical field surveying problems.

Text Books

1. Surveying and Levelling Parts 1 & 2 by T. P. Kanetkar and S. V. Kulkarni.
2. Arora, K.R., Surveying, Vol-I, II and III, Standard Book House, 2015.

URLs

1. Video Lectures, IIT Kanpur
   Online Course http://freevideolectures.com/Course/98/Surveying

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

B. Tech II Year I Semester

25BACIVLC02 STRENGTH OF MATERIALS LABORATORY

L	T	P	C
0	0	2	1

Course Prerequisites 25BACIVTC03

Course Description:

This laboratory course provides hands-on experience in determining the mechanical properties of engineering materials such as steel, wood, concrete, and masonry through standard tests including tension, compression, torsion, shear, hardness, and impact tests. It also covers bending tests on cantilever and simply supported beams to study flexural behaviour, along with durability tests like water absorption and efflorescence on bricks. Additionally, students are introduced to electrical resistance strain gauges for experimental stress analysis. The course bridges theoretical concepts with practical testing skills essential for material evaluation in civil engineering practice.

Course Objectives:

1. To familiarize students with standard testing equipment and procedures used to determine the mechanical properties of engineering materials such as steel, wood, and concrete.
2. To enable students to experimentally determine fundamental material properties including tensile strength, compressive strength, shear strength, hardness, and impact resistance.
3. To develop practical skills in evaluating the flexural (bending) behaviour of beams under different support and loading conditions.
4. To introduce students to the testing of construction materials like bricks and masonry for their suitability in civil engineering applications.
5. To provide exposure to modern experimental stress-analysis techniques, such as electrical resistance strain gauges, used in structural health monitoring.

List of Experiments:

1. Tension test on Steel bar.
2. Bending test on Cantilever beam (Steel)
3. Bending test on a simply supported beam (Wood).
4. Torsion test
5. Hardness test (Rockwell/Brinell).
6. Compression test on wood.
7. Compression test on concrete
8. Double shear test on mild steel
9. Impact test (Izod and Charpy)
10. Compression test on masonry/Brick
11. Water absorption and efflorescence test on brick.
12. Use of electrical resistance strain gauges (for demonstration).

(Minimum of 10 Experiments to be performed)

LIST OF EQUIPMENTS

1. UTM for conducting tension test on rods
2. Steel or Wooden beam for flexure test
3. Torsion testing machine
4. Brinell /Rock well hardness testing machine
5. Spring testing machine
6. Compression testing machine
7. Izod / Charpy Impact machine
8. Beam setup for Maxwell's theorem verification.
9. Electrical Resistance gauges
10. Continuous beam setup.

Course Outcomes:

The students after completing the course will be able to:

CO1: Operate standard testing machines and follow standard procedures to conduct experiments for determining the mechanical properties of steel, wood, and concrete specimens.
CO2: Determine the tensile strength, compressive strength, shear strength, hardness, and impact resistance of various engineering materials through appropriate laboratory tests.
CO3: Evaluate the flexural behaviour of cantilever and simply supported beams and compute bending stresses/deflections under different support and loading conditions.
CO4: Test and assess the suitability of bricks and masonry units for construction by evaluating their compressive strength, water absorption, and efflorescence characteristics.
CO5: Demonstrate the working principle of electrical resistance strain gauges and explain their application in experimental stress analysis.

Textbooks

1. 1. Moondra, H. S., and Gupta R., Laboratory Manual for Civil Engineering, CBS Publication, 2013

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

B. Tech II Year I Semester

25BACIVLC03 FLUID MECHANICS AND HYDRAULIC ENGINEERING LABORATORY

L	T	P	C
0	0	2	1

Course Prerequisites: 25BAMECTC02

Course Description:

This laboratory course provides hands-on experience in verifying fundamental fluid mechanics principles and evaluating hydraulic machinery. Students will calibrate flow-measuring devices like venturimeters and notches, quantify energy losses in pipe systems, and validate Bernoulli's equation. Additionally, the course focuses on analyzing momentum transfer via jet impact and conducting performance tests on operational turbines and pumps to evaluate their efficiency through empirical data and characteristic curves.

Course Objectives:

1. To understand and experimentally verify the fundamental principles of fluid mechanics and hydraulics through laboratory experiments.
2. To develop practical skills in measuring fluid flow parameters and calibrating flow-measuring devices such as venturimeters, orifice meters, and notches.
3. To analyze energy losses, flow behavior, and momentum transfer in fluid flow systems using experimental methods.
4. To gain hands-on experience in conducting performance tests on hydraulic turbines and pumps and evaluating their operating characteristics.
5. To develop the ability to record, analyze, and interpret experimental data for validating hydraulic and fluid flow principles.

List of Experiments:

1. Determination of Coefficient of discharge for Venturimeter
2. Determination of Coefficient of discharge for Orifice meter.
3. Determination of Coefficient of discharge for a small orifice by a constant head method.
4. Determination of Coefficient of discharge for an external mouth piece by variable Head method.
5. Calibration of contracted Rectangular Notch and /or Triangular Notch.
6. Determination of Coefficient of loss of head in a sudden contraction and friction factor.
7. Verification of Bernoulli's equation.
8. Impact of jet on vanes
9. Performance test on Pelton wheel turbine.
10. Performance test on Francis turbine
11. Efficiency test on centrifugal pump
12. Efficiency test on reciprocating pump

(Minimum of 10 Experiments to be performed)

List of Equipments:

1. Venturimeter setup
2. Orifice meter setup.
3. Small orifice setup.
4. External mouthpiece setup.
5. Rectangular and Triangular notch setups.
6. Friction factor test setup.
7. Bernoulli's theorem setup.
8. Impact of jets.
9. Pelton wheel and Francis turbines.
10. Centrifugal and Reciprocating pumps.

Course Outcomes:

The students after completing the course will be able to:

CO1: Calibrate and determine the coefficient of discharge for various flow-measuring devices, orifices, and notches.

CO2: Experimentally validate the conservation of energy principle through the verification of Bernoulli's equation.

CO3: Quantify major frictional losses and minor contraction losses in pipe flow systems to determine flow coefficients.

CO4: Investigate the hydrodynamic impact force of a fluid jet hitting flat or curved stationary vanes.

CO5: Conduct performance tests on hydraulic turbines and pumps to evaluate efficiency and plot characteristic curves.

Textbooks:

1. Majumdar Bireswar, Fluid Mechanics with Laboratory Manual, Second Edition, PHI Learning.
2. Raikar, R. V., Laboratory Manual Hydraulics And Hydraulic Machines, PHI Learning

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

II Year II Semester

B. Tech II Year II Semester

25BAMATTC10 NUMERICAL METHODS

L	T	P	C
3	0	0	3

Pre Requisites: 25BAMATTC01, 25BAMATTC03

Course Description:

This course reviews and continues the study of computational techniques for solving system of algebraic and transcendental equations, interpolating the polynomials, evaluating the derivatives, integrals, ordinary differential equations and curve fitting. The course emphasizes on numerical and mathematical methods of solutions.

Course Objectives:

1. To introduce computation methods of solving algebraic and transcendental equations.
2. To familiarize the knowledge of interpolation.
3. To avail the basics of numerical techniques in calculus
4. To use numerical methods for solving ordinary differential equations.
5. To introduce the empirical techniques for fitting the various curves.

UNIT I SOLUTIONS OF ALGEBRAIC AND TRANSCENDENTAL EQUATIONS 9 hours

Introduction-Bisection method - Regula-falsi method - Iterative method - Newton Raphson method, System of Algebraic equations: Gauss Jacobi method - Gauss Seidal method.

UNIT II FINITE DIFFERENCES AND INTERPOLATION 9 hours

Finite differences, Newton's forward and backward interpolation formulae - Gauss forward and backward formulae, Stirling's formula, Bessel's formula - Lagrange's and Newton's divided difference formulae.

UNIT III NUMERICAL DIFFERENTIATION AND INTEGRATION 9 hours

Formulae for derivatives, Maxima and minima of a tabulated function. Numerical Integration: Trapezoidal rule - Simpson's 1/3 Rule - Simpson's 3/8 Rule

UNIT IV NUMERICAL SOLUTIONS TO ORDINARY DIFFERENTIAL EQUATIONS 9 hours

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

UNIT V CURVE FITTING 9 hours

Introduction - Graphical method - Principle of least squares - Method of least squares - Fitting of straight line and parabola - Fitting of exponential and power curves.

Course Outcomes:

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

CO1: Solve the system of algebraic and transcendental equations.
CO2: Interpolate the equal and unequal spaced arguments of function.
CO3: Apply the numerical techniques to find derivatives and integrals in the field of Engineering
CO4: Find the approximate numerical solutions to ordinary differential equations representing some Engineering problems.
CO5: Estimate the model parameters using the principles of least squares to a curve of best fit for the experimental observations.

Text Books:

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

Reference Books:

1. Curtis F. Gerald, Patrich O. Wheatley, Applied Numerical Analysis, Pearson Education, 7th Edition, 2003.
2. S.S. Sastry, Introductory methods of numerical analysis, PHI, 4th Edition, 2005
3. Burden and Faires, Numerical Analysis 7th edition, Thomson Learning, 2001.
4. E. Kreyszig, Advanced Engineering Mathematics, 10th edition, Wiley, 2010.
5. M.K. Jain, S.R.K. Iyengar and R.K. Jain, Numerical Methods for Scientific and Engineering, New Age International Ltd., 5th Edition, 2010.
6. 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 II Semester

25BACIVTC07 STRUCTURAL ANALYSIS

L	T	P	C
2	1	0	3

Pre-Requisites: 25BAMATTC01, 25BAMECTC02, 25BACIVTC03

Course Description:

This course provides a comprehensive understanding of the behaviour of structural systems through strain energy principles, elastic theorems, and classical methods of analysis. It covers the analysis of indeterminate beams and frames, fixed beams, slope deflection, and moment distribution, along with an introduction to stiffness and flexibility matrix methods used in modern structural engineering.

Course Objectives:

1. To explain the concepts of strain energy and elastic theorems for determining deflections in determinate structures.
2. To determine static and kinematic indeterminacies and analyze simple indeterminate structures using force methods and influence lines
3. To analyze fixed beams under various loading and support conditions using classical methods.
4. To apply the slope deflection method to analyze continuous beams and portal frames with and without support settlements.
5. To apply the moment distribution method to analyze beams and portal frames under various loading conditions with and without settlement of supports.

UNIT I STRAIN ENERGY PRINCIPLES AND ELASTIC THEOREMS 9 hours

Concept of strain energy in a linear elastic system - Strain energy in a prismatic bar under axial load, shear forces, bending moment, and twisting moment - Principle of superposition - Principle of virtual work.

Elastic Theorems: Castigliano's first and second theorems for deflection, Application of strain energy principles and Castigliano's theorems for the determination of deflections of statically determinate beams and pin-jointed trusses.

UNIT II INDETERMINATE STRUCTURAL ANALYSIS 9 hours

Indeterminate structures - Determination of degree of static and kinematic indeterminacies of simple beams, frames and trusses - Introduction to methods of analysis of indeterminate structures (force and displacement methods).

Analysis of simple beams by different Force methods - Introduction to moving loads - concept of influence lines - influence lines for reaction, shear force and bending moment in simply supported beams.

UNIT III ANALYSIS OF FIXED BEAMS 9 hours

Introduction to methods of analysis of Fixed beams - Moment-Area method - Analysis of fixed beams subjected to central point load, eccentric point load, uniformly distributed load, uniformly varying load, couple and combination of loads - Effect of sinking of supports and rotation of supports - Shear force and bending moment diagrams for fixed beams.

UNIT IV SLOPE DEFLECTION METHOD 9 hours

Basic assumptions and introduction to slope deflection equations - Analysis of continuous beams with and without settlement of supports - Analysis of single-bay portal frames without sway.

UNIT V MOMENT DISTRIBUTION METHOD AND MATRIX METHODS OF ANALYSIS **9 hours**

Distribution factor, carry-over factor and distributed moments - Analysis of continuous beams under various loading conditions with and without settlement of supports - Analysis of single-bay portal frames without sway - Shear force and Bending moment diagrams, Elastic curve - Flexibility and Stiffness matrix methods and their applications on continuous beams.

Course Outcomes:

After completing this course, students will be able to:

CO1: Explain strain energy concepts and apply elastic theorems to determine deflections in statically determinate structures.

CO2: Determine degrees of static and kinematic indeterminacy and analyze simple beams using force methods and influence lines.

CO3: Analyze fixed beams under different loading and support conditions using classical methods and construct SFD/BMD.

CO4: Apply the slope deflection method to analyze continuous beams and portal frames with and without support settlements.

CO5: Analyze continuous beams and portal frames using the moment distribution method and apply matrix methods for structural analysis.

Text Books:

1. R.C. Hibbler, Structural Analysis, India: Pearson Education, 10th edition, 2017.
2. S. Ramamrutham and R. Narayan, Theory of Structures, India: Dhanpat Rai Publishing Co. (P) Ltd., 2017.
3. D. Menon, Structural Analysis, New Delhi: Narosa Publishers, 2008.

Reference Books:

1. C.S. Reddy, Basic Structural Analysis, New Delhi: Tata McGraw Hill, 2007.
2. B.C. Punmia, A.K. Jain and A.K. Jain, Theory of Structures, India: Laxmi Publications, 2016.
3. D. Menon, Advanced Structural Analysis, India: Narosa Publishing House, 2008.
4. M.L. Gambhir, Fundamentals of Structural Mechanics and Analysis, India: PHI Learning Pvt. Ltd., 2015.

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

B. Tech II Year II Semester

25BACIVTC08 ENVIRONMENTAL ENGINEERING

L	T	P	C
3	0	0	3

Pre-Requisites: 25BACIVTC02, 25BACIVTC04

Course Description:

The course covers demand, quality treatment and distribution of water along with characterization, collection, low-cost treatment of wastewater and household drainage. Similarly, air pollution, Noise pollution and solid waste management are also included.

Course Objectives:

1. To explain water quality standards, treatment, distribution of water and design of various water treatment units.
2. To analyze the characteristics of wastewater and develop suitable designs for various units of a sewage treatment system.
3. To understand and evaluate low-cost wastewater treatment systems and suggest suitable designs for sludge disposal units.
4. To understand the impacts of air and noise pollution and analyze suitable control measures for minimizing their effects.
5. To describe about solid waste generation, characterization, impacts, and various management techniques.

UNIT I WATER SUPPLY ENGINEERING 9 hours

Sources of water - Source selection - Water demand - Types-Factors affecting water demand-Fluctuations in water demand-Design period -Population forecasting methods and their suitability-Water quality-Characterization- Water quality standards- Conventional water treatment units and their functions-distribution systems, Various valves used in W/S systems.

UNIT II WASTEWATER ENGINEERING 9 hours

Introduction-Sources of wastewater-Sewerage-Systems of sewerage-Sewage and storm water estimation-Hydraulic design of sewers-Different materials used for sewers-Shapes of sewer-Sewer appurtenances-Characteristics of sewage-physical, chemical, biological- Pollution due to improper disposal of sewage-Layout and general outline of wastewater treatment plant-Function of each unit-Principles and design of Aerobic and Anaerobic systems.

UNIT III LOW COST WASTEWATER TREATMENT & SLUDGE MANAGEMENT 9 hours

Working principle of oxidation ponds, oxidation ditches, design of - septic tanks, soak pits and Imhoff tanks, Sludge characterization, sludge thickening, sludge digestion, factors affecting sludge digestion, various methods of sludge conditioning, dewatering- Drying/Incineration and disposal.

UNIT IV AIR AND NOISE POLLUTION 9 hours

Air Pollution: Composition and properties of Air-urban air pollution-Types of pollutants, their sources and impacts, air pollution control, air quality standards, Air quality Index and limits.

Noise Pollution: Basic concept, impacts, measurement and various noise control methods.

UNIT V SOLID WASTE MANAGEMENT 9 hours

Solid waste management- Composition and various chemical and physical parameters of MSW, MSW management: Collection, transport, treatment and disposal of MSW. Effects of solid waste on environment: effects on air, soil, surface and ground water, health hazards. Disposal of solid waste-segregation, reduction at source, recovery and recycle, Disposal methods.

Course Outcomes:

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

CO1: Estimate water demand and design various units of surface water treatment plant

CO2: Estimate sewage generation and perform basic design of the unit operations that are used in Sewage treatment.

CO3: Explain various low-cost wastewater and sludge treatment techniques.

CO4: Describe the impacts of air and noise pollution and review various air and noise pollution control methods.

CO5: Discuss about the impacts of solid waste and various solid waste management techniques.

Text Books:

1. Birdie, G.S, Birdie, J.S., Water supply and sanitary Engineering, Including Environmental Engineering, Water and Air Pollution Laws and Ecology, Dhanpat Rai Publications, 1996.
2. Garg, S.K. Environmental Engineering, Vol.I Khanna Publishers, New Delhi, 2010 and Water Supply Engineering by B.C.Punmia.
3. Peavy, H., Rowe, D.R, Tchobanoglous, G. Environmental Engineering, Mc-Graw - Hill International Editions, New York 1985
4. Integrated Solid Waste Management, Tchobanoglous, Theissen & Vigil. McGraw Hill Publication
5. Metcalf & Eddy, Wastewater Engineering Treatment and Dispose, McGraw Hill Publication

Reference Books:

1. Sincero A P and Sincero G A, Environmental Engineering: A Design Approach, Prentice Hall India, New Delhi (1999).
2. Metcalf and Eddy Inc., Tchobanoglous G, Burton F and Stensel H D, Wastewater Engineering – Treatment and Reuse, 4th Edition, Tata-McGraw Hill, New Delhi (2009).
3. Mackenzie L. Davis, Water and Wastewater Engineering: Design Principles and Practice, McGrawHill Education, 2017,1st Edition

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

B. Tech II Year II Semester

25BACIVTC09 ENGINEERING HYDROLOGY

L	T	P	C
3	0	0	3

Pre-requisites: 25BACIVTC05

Course Description:

This course introduces engineering hydrology, covering the hydrologic cycle, precipitation, and abstraction losses like evaporation and infiltration. Students will learn to analyze streamflow data, develop unit hydrographs, and estimate surface runoff. The curriculum covers quantitative flood forecasting, reservoir and channel routing, and groundwater hydraulics under steady and unsteady conditions. Ultimately, students gain the essential skills needed to design water resource structures and manage watershed risks effectively.

Course Objectives:

1. To understand the components of the hydrologic cycle and apply the watershed water-budget equation.
2. To measure and quantify precipitation, evaporation, and infiltration using standard engineering methods.
3. To estimate surface runoff and analyze streamflow data using various hydrograph techniques.
4. To predict peak flood discharges and perform hydrologic reservoir and channel flood routing.
5. To analyze steady and unsteady groundwater flow into wells based on aquifer properties.

UNIT I HYDROLOGICAL CYCLE 9 hours

Introduction Engineering hydrology and its applications - Hydrological cycle - Precipitation: Types and forms of precipitation, , types of rain gauges, rain gauge network, average rainfall over a basin, consistency of rainfall data, frequency of rainfall, intensity-duration-frequency curves, probable maximum precipitation – Evaporation - Process evaporimeters - evapotranspiration - measurement and equations – potential & actual evapotranspiration over India - interception - depression storage.

UNIT II INFILTRATION AND RUN OFF 9 hours

INFILTRATION – capacity measurement and modelling infiltration capacity – classification - infiltration indices.

RUN OFF: Surface Runoff Models - SCS-CN method of estimating runoff volume - flow-duration curve - flow-mass curve.

UNIT III STREAM FLOW MEASUREMENT AND HYDROGRAPHS 9 hours

STREAM FLOW MEASUREMENT: Measurement of Stage and Velocity - Direct and Indirect methods - Stage-Discharge relationships-Rating curve - Extrapolation of rating curve.

HYDROGRAPHS: hydrograph - factors affecting runoff hydrograph - components of hydrograph - base flow separation - effective rainfall - unit hydrograph - S-Curve - Instantaneous UH Synthetic UH.

UNIT IV FLOOD ESTIMATION & HYDRAULICS 9 hours

FLOOD ESTIMATION: Flood Estimation by Rational method - empirical method -Unit Hydrograph Method - Flood frequency studies: Gumbel's method - Log-Pearson Type III Distribution

FLOOD HYDRAULICS: Basic Equations - Flood Routing-Reservoir routing - Channel routing - Hydrologic Storage Routing - Attenuation - Hydrologic Channel Routing - Muskingum Method - Runge Kutta Method

UNIT V SUB SURFACE HYDRAULICS **9 hours**

Introduction-Forms of Subsurface water - Aquifer Properties – Compressibility - Equation of Motion - Wells - Steady flow into well - Unsteady flow in a confined aquifer – Well Losses - Specific capacity - Ground water recharge

Course Outcomes:

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

CO1: Estimate the areal average precipitation over the basin using the knowledge of hydrological cycle.

CO2: Identify losses and calculate runoff excluding the initial losses.

CO3: Analyze streamflow data and construct unit hydrographs to determine watershed runoff responses.

CO4: Estimate peak flood discharges and evaluate flood routing through reservoirs and channels.

CO5: Solve steady and unsteady well hydraulics equations to estimate groundwater yield and drawdown.

Textbooks:

1. V. T. Chow, D. R. Maidment, and L. W. Mays; Applied Hydrology, McGraw Hill International Editions
2. K Subramanya, Engineering Hydrology, Mc-Graw Hill.

Reference Books:

1. K Subramanya, Water Resources Engineering through Objective Questions, Tata Mc- Graw Hill.
2. G L Asawa, Irrigation Engineering, Wiley Eastern
3. L W Mays, Water Resources Engineering, Wiley.
4. J D Zimmerman, Irrigation, John Wiley & Sons
5. C S P Ojha, R Berndtsson and P Bhunya, Engineering Hydrology

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

B. Tech II Year II Semester

25BACIVLC04 ENVIRONMENTAL ENGINEERING LABORATORY

L	T	P	C
0	0	2	1

Pre Requisites: 25BACIVTC07

Course Description: This laboratory course introduces fundamental techniques for water and wastewater analysis, covering sampling, preservation, and physical-chemical characterization. Students will perform key tests to determine parameters such as solids content, pH, hardness, chlorides, oxygen demand, and coagulant dosage. The course emphasizes hands-on skills and standard methods essential for environmental monitoring and treatment process evaluation.

Course Objectives:

1. To understand the principles and methods of water and wastewater sampling and preservation.
2. To perform standard laboratory tests to determine water quality parameters.
3. To analyze wastewater characteristics and assess pollution levels.
4. To evaluate the effectiveness of treatment processes using chemical and biological tests.
5. To develop hands-on skills in advanced laboratory techniques for environmental monitoring

List of Experiments:

1. Sampling and preservation methods for water and wastewater (Demonstration only)
2. Estimation of Solids (TDS, TSS, TS) in water and wastewater.
3. Determination of pH, Conductivity and Turbidity.
4. Determination of Alkalinity.
5. Determination of Hardness.
6. Determination of Chlorides.
7. Determination of Iron.
8. Determination of Available Chlorine in bleaching powder
9. Conducting Jar test for determining optimum dosage of coagulant
10. Determination of Sludge Volume Index (SVI)
11. Determination of Dissolved Oxygen
12. Estimation of Biochemical Oxygen Demand
13. Estimation of Chemical Oxygen Demand

Note: Minimum 10 out of the above experiments are to be carried out.

Course Outcomes:

Upon successful completion of this course, students will be able to:

CO1: Apply appropriate sampling and preservation techniques for water and wastewater.
CO2: Measure physical and chemical parameters such as turbidity, conductivity, and chlorine content.
CO3: Analyze key water and wastewater quality indicators like BOD, COD, and TKN.
CO4: Assess the efficiency of water treatment processes through laboratory tests.
CO5: Perform microbiological analysis for coli form detection and sludge characterization.

Text Books:

1. Standard methods for the examination of water and wastewater, 21st Edition, Washington: APHA. 2012.
2. Sawyer, C. N., McCarty, P. L., and Perkin, Chemistry for Environmental Engineering and Science, G.F., 5th edition McGraw-Hill Inc., 2002
3. Federation W E and American Public Health Association, Standard Method for the Examination of Water and Wastewater, American Public Health Association (APHA): Washington, DC, USA. (2005).

Reference Books:

1. Industrial Waste Resource Guidelines Sampling and Analysis of Waters, Wastewaters, Soils and Wastes, EPA Victoria, 2009
2. A Guide to the Sampling and Analysis of Waters, Wastewaters, Soils and Wastes, Environment Protection Authority State Government of Victoria March 2000
3. Munson B R, Okiishi T H, Huebsch W W and Rothmayer A P, Fluid Mechanics, Wiley (2013).

Online Learning Resources:

1. https://ee1-nitk.vlabs.ac.in/List%20of%20experiments.html

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

B. Tech II Year II Semester

25BACIVLC05 CONSTRUCTION MATERIALS TESTING LABORATORY

L	T	P	C
0	0	2	1

Pre-requisite: 25BACIVTC06, 25BACIVLC02

Course Description:

This laboratory course provides practical exposure to construction practices and testing methods for commonly used construction materials. It covers masonry construction, material characterisation, concrete mix preparation, strength evaluation and workability assessment of conventional and special concretes.

Course Objectives:

1. To develop practical skills in brick masonry construction and understanding of bond patterns and workmanship.
2. To determine the physical and engineering properties of construction materials such as aggregates, cement and concrete.
3. To perform concrete mix design, preparation and workability assessment using standard laboratory methods.
4. To evaluate the strength properties of cement mortar and concrete specimens through laboratory testing.
5. To understand testing procedures for conventional and special concretes used in construction practice.

List of Experiments:

1. Construction of English Bond Brick Masonry and Study of Bond Pattern and Joint Arrangement.
2. Construction of Flemish Bond Brick Masonry and Study of Bond Pattern and Joint Arrangement.
3. Determination of Physical Properties of Fine and Coarse Aggregates using Sieve Analysis.
4. Determination of Specific Gravity and Water Absorption of Fine Aggregates.
5. Determination of Specific Gravity and Water Absorption of Coarse Aggregates.
6. Determination of Bulk Density of Fine and Coarse Aggregates.
7. Determination of Fineness and Standard Consistency of Cement.
8. Determination of Setting Time and Specific Gravity of Cement.
9. Determination of Compressive Strength of Cement Mortar Cubes.
10. Determination of Workability of Fresh Concrete using Slump Test, Compaction Factor Test and Vee Bee Consistency Test.
11. Mix Design and Preparation of Concrete Mixes as per Standard Guidelines.
12. Determination of Compressive Strength, Split Tensile Strength and Flexural Strength of Concrete Specimens.
13. Determination of Workability of Self-Compacting Concrete using Slump Flow / Flow Table Test (Demonstration).

(Note: Minimum of 10 Experiments to be performed)

List of Major Equipment

1. Pycnometers.
2. Vicat's apparatus
3. Specific gravity bottle.
4. Le-Chatelier's apparatus.
5. Slump cone and compaction factor apparatus
6. Rebound hammer, Pulse velocity equipment.
7. CTM
8. Flow table

Course Outcomes:

The students after completing the course will be able to:

CO1: Demonstrate brick masonry construction practices and identify English and Flemish bond arrangements and workmanship requirements.

CO2: Determine the physical properties of aggregates and cement using standard laboratory testing procedures.

CO3: Perform concrete mix design, preparation and workability assessment for conventional and special concretes.

CO4: Evaluate the strength properties of cement mortar and concrete specimens using laboratory testing methods.

CO5: Analyse the performance characteristics of construction materials based on experimental observations and test results.

Text Books:

1. Shetty, M. S., *Concrete Technology*, New Delhi: S. Chand & Company Ltd., Revised Edition, 2017.
2. Duggal, S. K., *Building Materials*, 4th Edition, New Age International Publishers, New Delhi, 2016.
3. Punmia, B. C., Jain, A. K. and Jain, A. K., *Building Construction*, New Delhi: Laxmi Publications Pvt. Ltd., Latest Edition

Reference Books:

1. Neville, A. M., *Properties of Concrete*, 5th Edition, Pearson Education, New Delhi, 2012.
2. IS 10262:2019, *Concrete Mix Proportioning – Guidelines*, Bureau of Indian Standards, New Delhi, 2019.
3. IS 383:2016, *Coarse and Fine Aggregate for Concrete – Specification*, Bureau of Indian Standards, New Delhi, 2016.
4. IS 456:2000, *Plain and Reinforced Concrete – Code of Practice*, Bureau of Indian Standards, New Delhi, 2000.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

B. Tech II Year II Semester

25BACIVLC06 IoT IN CIVIL ENGINEERING LABORATORY

L	T	P	C
0	0	2	1

Pre-requisite: 25BACSELC04, 25BACOMLC01, 25BACOMLC02

Course Description:

This laboratory course introduces the principles and applications of the Internet of Things (IoT) in civil and environmental engineering. Students learn to design and deploy sensor networks, integrate IoT devices, and analyze real-time infrastructure data using modern communication and cloud platforms. The course emphasizes applications such as structural health monitoring, smart construction, and intelligent urban infrastructure systems.

Course Objectives:

This lab equips civil engineering students with practical IoT skills to monitor infrastructure.

1. This lab equips civil engineering students with practical IoT skills to monitor infrastructure.
2. Students will assemble and interface sensors (strain, vibration, environmental) with microcontrollers on physical models, develop and debug embedded code (Python) to acquire, process, and wirelessly transmit sensor data.
3. They will implement cloud platforms (e.g., AWS, Azure) to ingest, store, and visualize real-time data on dashboards.
4. Students will analyze collected time-series data using basic techniques (statistics, trends) to interpret structural behavior or condition.
5. Crucially, they will diagnose hardware/software issues and rigorously apply lab safety protocols throughout, mastering the full IoT workflow for infrastructure monitoring.

List of Experiments:

1. Determine the Strain in Concrete
2. Determine the Strain in Steel
3. Real-Time Air Quality Monitoring at Construction Site
4. Water Quality Monitoring for Civil Systems
5. Smart Water Level Monitoring in Overhead Tanks
6. Concrete Curing Temperature Monitoring
7. Soil Moisture Monitoring
8. Identify the Coordinates of a location using GPS tracker
9. Water flow sensor
10. IoT-Based People Counter for Smart Building and Transit Corridors
11. Sending Sensor Data via Serial, Multi-Sensor Data Acquisition, Local Data Logging
12. Cloud-Connected SHM System and Cloud Dashboard

Required Hardware, Software, and Accounts

"IoT for Civil Engineers Lab Kit."

1. **Key Hardware Components:**
   Arduino UNO/Nano, Raspberry Pi 4, Breadboards, Jumper Wires, Resistors, LEDs, DHT11 (Temperature/Humidity), Ultrasonic Sensor (HC-SR04), Strain Gauges with Amplifier(HX711), GPS Module, Wi-Fi Module (ESP8266), and LoRa WAN transceivers.
2. **Key Software:**
   Python, Arduino IDE, MIT App Inventor, Fritzing, and IoT MQTT Panel.

Course Outcomes:

Upon successful completion of this course, students will be able to:

CO1: Apply strain measurement techniques and cloud-based structural health monitoring (SHM) for civil infrastructure.

CO2: Implement real-time monitoring of environmental parameters relevant to construction sites and civil systems.

CO3: Utilize IoT sensors for water resource management including level, flow, and quality monitoring.

CO4: Deploy GPS and people-counting IoT solutions for location tracking and occupancy analytics in smart buildings and transit corridors.

CO5: Demonstrate data acquisition, serial communication, local logging, and multi-sensor integration for civil engineering monitoring systems.

Textbook

1. Raj Kamal, "Internet of Things (IoT): Principles and Applications".
2. Vijay Madisetti & Arshdeep Bahga, "Internet of Things: Architecture and Applications".

URLs

1. https://nptel.ac.in/courses/106105166

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

Skill Enhancement Course

Skill Enhancement Course - I

25BACIVSC01 COMPUTER AIDED BUILDING PLANNING AND DRAWING

L	T	P	C
1	0	2	2

Pre-requisite: None

Course Description:

Students will develop practical drafting skills using computer-aided drafting tools such as AutoCAD/Revit/BIM for preparing residential and public building drawings in compliance with National Building Code (NBC) provisions and local building bye-laws.

Course Objectives:

1. To understand standard symbols, sign conventions, building bye-laws, and basic AutoCAD techniques used in civil engineering drawings.
2. To develop drafting skills for masonry bonds, foundations, and building components using conventional and CAD methods.
3. To develop planning and drafting skills for residential buildings using building bye-laws and CAD tools.
4. To prepare detailed drawings of doors, windows, ventilators, roofs, and staircases using standard drafting practices.
5. To prepare architectural drawings for hospital and industrial buildings using modern drafting practices.

UNIT I FUNCTIONAL PLANNING OF BUILDINGS 6 hours

General aspects to consider for planning, bye-laws and regulations, Selection of the site for building construction, Principles of planning, Orientation of building and its relation to the outside environment - Conventional Signs and Symbols as per IS Code for Engineering Drawings and Buildings Drawings - Introduction to AutoCAD interface, basic drawing commands, layers, and plotting.

Sample Experiments:

1. Detailing and drawing of standard sign conventions and symbols used for concrete structures in civil engineering drawings.
2. Detailing and drawing of symbols for steel structures used in civil engineering drawings.

UNIT II BRICK WORK AND FOUNDATION 6 hours

Masonry - stone masonry, brick masonry, different bonds used for brick masonry, permissible stress of brick masonry work - Brick arrangements – Various types of Bonds - Stone Masonry & Stone Joints - Foundation, and its functional requirements, - construction of the foundation.

Sample Experiments:

3. Drafting of English and Flemish Bond and wall details using conventional and CAD methods.
4. Drafting of Foundation details using conventional and CAD methods.

UNIT III RESIDENTIAL BUILDING LINE DIAGRAMS USING BUILDING BYE-LAWS 6 hours

Building Bye Laws - Single Storied Residential House – Plan, Elevation and Section – Line diagrams

Sample Experiments:

5. Drawing of Line Diagram of Residential Buildings by using Building Bye- Laws.
6. Drawing of Plan, Elevation & Section from line diagram for a single Storey Building

UNIT IV DETAILING OF BUILDING COMPONENT AND OPENINGS 6 hours

Doors and its types - Windows & Ventilator - Pitched Roof – Various types - Steel Roof Trusses - Floors and Roofs - Staircases: Functional requirements of a good stair, type of steps, type of stairs, planning a staircase, guidelines for accessible buildings.

Sample Experiments:

7. Detailing & Drawing of building components: Doors and Windows
8. Detailing & Drawing of building components: Ventilators & Roof

UNIT V ARCHITECTURAL DRAWINGS FOR SPECIALIZED BUILDINGS 6 hours

Detailed plans, elevations, and sections for specialized building types, specifically hospital and industrial buildings.

Sample Experiments:

9. Drawing of Plan, Elevation & Section for Hospital Building.
10. Drawing of Plan, Elevation & Section for Industrial Building.

Course Outcomes:

The students after completing the course will be able to:

CO1: Apply standard symbols, sign conventions, building bye-laws, and basic AutoCAD techniques in civil engineering drawings.

CO2: Prepare masonry bond, wall, and foundation drawings using conventional and CAD methods.

CO3: Prepare residential building plans, elevations, and sections using building bye-laws and CAD tools.

CO4: Draft building components such as doors, windows, ventilators, roofs, and staircases using standard drawing practices.

CO5: Develop architectural drawings for hospital and industrial buildings using CAD-based drafting practices.

Textbook(s)

1. Building planning and drawing by M. Chakraborti.
2. Building drawing, M G Shah, C M Kale and S Y Patki, Tata McGraw Hill, New Delhi.
3. Sham Tickoo, *AutoCAD for Engineers and Designers*, CADCIM Technologies, Pune.

Reference Books

1. National Building Code 2016 (Volume- I & II).
2. Principles of Building Drawing, M G Shah and C M Kale, Trinity Publications, New Delhi.
3. Civil Engineering drawing and House planning, B. P. Verma, Khanna publishers, NewDelhi.
4. Civil Engineering Building practice, Suraj Singh: CBS Publications, New Delhi, and Chennai.

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

Skill Enhancement Course - II

25BACIVSC02 REMOTE SENSING AND GEOGRAPHIC INFORMATION SYSTEMS

L	T	P	C
1	0	2	2

Course Description:

This course introduces the fundamentals of Remote Sensing and Geographic Information Systems (GIS) for acquiring, processing, and analyzing geospatial data. It covers satellite imaging, GIS data models, spatial data handling, digital image processing, and raster analysis techniques. The laboratory component provides hands-on training using satellite images, DEMs, vector datasets, and GIS software for mapping and spatial analysis applications.

Course Objectives:

1. To understand the principles of remote sensing, electromagnetic radiation, sensors, and satellite data acquisition.
2. To learn GIS concepts, spatial data types, projections, digitization, and map preparation.
3. To develop skills in vector data analysis, including buffering, interpolation, heatmaps, and network analysis.
4. To apply digital image processing techniques such as FCC/TCC generation, image enhancement, and DEM analysis.
5. To perform raster analysis using raster calculator, overlay analysis, reclassification, and vegetation indices.

UNIT I FUNDAMENTALS OF REMOTE SENSING 6 hours

Principle of remote sensing - Energy sources (Active and Passive) - Electromagnetic radiation laws - Energy matter interactions in atmosphere and at earth surface – Remote sensing platforms and classification of sensors - Types of Resolutions - Potential of satellite remote sensing and Drone aerial - Data acquisition and Interpretation

Sample experiments:

1. Study of aerial Photograph, satellite image and Topographic Maps

UNIT II INTRODUCTION TO GIS 6 hours

Definition, Components and Applications of GIS - Raster and vector data - Database Management – Projection and Transformation for geographical data - Digitization techniques and topology - Raster to vector conversion and vice versa - Fundamental vector Operations (Query, Analysis, Overlay) - Cartography concepts and creation of maps

Sample Experiments:

2. Preparation/Loading of Basemap and Georeferencing a Toposheet or Map
3. Manual Digitization, Attribute table creation and Calculation of Feature geometry

UNIT III VECTOR OPERATIONS 6 hours

Representation of Vector data - Thematic mapping - Heatmap generation - Spatial interpolation techniques - Buffering and Proximity Analysis - Network Analysis

Sample Experiments:

4. Generation of density heatmap from point data and conduct proximity analysis
5. Perform spatial interpolation of point data and create thematic maps
6. Build the topology of an urban road network and perform shortest path/optimal path analysis

UNIT IV DIGITAL IMAGE PROCESSING 6 hours

Concept of Digital Image – True and False colour composite - Image pre-processing, Image enhancement, Image classification - Digital Elevation Model (DEM) – Digital Surface Model – Digital Terrain Model

Sample Experiments:

7. Preparation of FCC/TCC images from multispectral satellite data
8. Generate Contour, Slope and Aspect maps using DEM
9. Prepare a Drainage Network Map using DEM

UNIT V RASTER OPERATIONS 6 hours

Raster data structure & pixel properties - Image Statistics - Raster Calculator & Map Algebra - Raster Reclassification - Raster Overlay Techniques.

Sample Experiments:

11. Extraction of Land use-Landcover data from BHUVAN and Perform Raster Overlay Operations.
12. Derivation of Vegetation Index Maps (NDVI) using Raster Calculator

Course Outcomes:

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

CO1: Understand the remote sensing, sensor types, resolutions, and image interpretation fundamentals.

CO2: Identify raster and vector data models, map projections, and GIS database structures.

CO3: Perform vector data operations such as digitization, buffering, proximity analysis, heatmap generation, and network analysis.

CO4: Apply digital image processing techniques including FCC/TCC generation, image enhancement, image classification, and DEM-based terrain analysis.

CO5: Execute raster operations such as reclassification, raster calculator functions, vegetation index (NDVI) generation, and raster overlay for suitability analysis.

GIS SOFTWARE: QGIS/GRASS GIS/R

Text Books:

1. Bhatta, B. (2011). *Remote sensing and GIS*. Oxford University Press.
2. Reddy, M. A. (2015). *Textbook of remote sensing and geographical information systems* (4th ed.). BS Publications.
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Mode of Evaluation: Continuous Internal Evaluation , Assignments, Mid Term Tests and End Semester Examination.