

CURRICULUM
Scheme (N-2026)
FOR
First Year (1st and 2nd Semester)
THREE YEAR DIPLOMA PROGRAMME
IN

GROUP - A

Computer Engineering	Computer Engineering & IoT
Computer Science & Engineering (AI&ML)	Mechanical Engineering
Automobile Engineering	Instrumentation Engineering
Mechanical Engineering (Tools & Die)	

GROUP - B

Civil Engineering	Electronics & Communication Engineering
Electrical Engineering	Mechatronics
Electrical & Electronics Engineering	Agriculture Engineering
Electrical Engineering & Electrical Vehicle Technology	



FOR THE STATE OF HIMACHAL PRADESH

Prepared by
Composite Curriculum Development Centre
Directorate of Technical Education, Vocational & Industrial Training,
Sundernagar (H.P.)

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SALIENT FEATURES

Programme	Three-Year Engineering Diploma
Duration	Three years (Six Semesters)
Entry Qualification	As prescribed by H.P. Takniki Shiksha Board/ AICTE
Intake	As approved by Govt. of Himachal Pradesh
Pattern	Semester System
Curriculum for	First Year Group-A CO - Computer Engineering IOT - Computer Engineering & IoT AI - Computer Science & Engineering (AI&ML) ME - Mechanical Engineering AE - Automobile Engineering IE - Instrumentation Engineering TD - Mechanical Engineering (Tools & Die) Group-B CI - Civil Engineering EX - Electronics & Communication Engineering EL - Electrical Engineering MX - Mechatronics EE - Electrical & Electronics Engineering, AG - Agriculture Engineering, EV - Electrical Engineering & Electrical Vehicle Technology

COURSE CODES AND DEFINITIONS

Course Code	Definition
L	Lecture
T	Tutorial
P	Practical
HS	Humanities & Social Sciences Courses
BS	Basic Science Courses
ES	Engineering Science Courses
PC	Program Core Courses
PE	Program Elective Courses
OE	Open Elective Courses
AU	Audit Courses
SI	Summer Internship
PR	Project
SE	Seminar
MC	Mandatory Course

OUTCOME BASED EDUCATION

The curriculum is designed following the principles of *Outcome-Based Education* (OBE), ensuring that teaching, learning, and assessment are aligned with clearly defined learning outcomes. Each programme is structured around *Programme Educational Objectives* (PEOs), which describe the career and professional achievements expected of graduates within a few years of completing the programme. These objectives are attained through measurable *Programme Outcomes* (POs) and *Programme Specific Outcomes* (PSOs), which define the knowledge, skills, and competencies expected at the time of completion of programme. Each course has well-defined *Course Outcomes* (COs) that contribute to the attainment of the corresponding POs and PSOs through aligned teaching-learning activities and assessment methods. Each Course Outcome is appropriately mapped to the relevant POs and PSOs to ensure systematic attainment of programme objectives.

The seven common POs prescribed by the National Board of Accreditation (NBA) for diploma engineering programmes are adopted across all programmes. The PEOs and PSOs are defined separately for each discipline and provide the framework for curriculum planning, implementation, assessment, and continuous improvement. The CO–PO mapping matrix shall indicate the extent of correlation between each Course Outcome (CO) and Programme Outcome (PO) using the following scale: 3 - *Strong*, 2 - *Moderate*, 1 - *Low*, and “–” - *No Correlation*.

To ensure progressive development of cognitive abilities, each Course Outcome (CO) is mapped to the appropriate level of Revised Bloom's Taxonomy. The assigned Bloom's level indicates the expected cognitive complexity of the learning outcome and provides a basis for designing teaching-learning activities and assessment methods. The curriculum adopts the six cognitive levels of Bloom's Taxonomy - *Remember* (L1), *Understand* (L2), *Apply* (L3), *Analyze* (L4), *Evaluate* (L5), and *Create* (L6) - to facilitate the systematic development of students' knowledge, technical competence, critical thinking, problem-solving, and innovation. Accordingly, the teaching-learning process and assessment are designed to evaluate students at the intended cognitive level, thereby ensuring constructive alignment among learning outcomes, teaching-learning activities, and assessment.

Programme Outcomes (POs)

The seven Programme Outcomes as defined by NBA for Engineering Diploma Programme as listed below are to be consistently followed all programmes.

1. **Basic and Discipline specific Knowledge:** Apply knowledge of basic mathematics, science and engineering fundamentals and engineering specialization to solve the engineering problems.
2. **Problem Analysis:** Identify and analyse well-defined engineering problems using codified standard methods.
3. **Design/ Development of Solutions:** Design solutions for well-defined technical problems and assist with the design of systems components or processes to meet specified needs.

4. **Engineering Tools, Experimentation and Testing:** Apply modern engineering tools and appropriate technique to conduct standard tests and measurements.
5. **Engineering Practices for Society, Sustainability and Environment:** Apply appropriate technology in context of society, sustainability, environment and ethical practices.
6. **Project Management:** Use engineering management principles individually, as a team member or a leader to manage projects and effectively communicate about well-defined engineering activities.
7. **Life-long learning:** Ability to analyse individual needs and engage in updating in the context of technological changes.

Outcome Attainment

The attainment of Course Outcomes (COs) is to be evaluated through a comprehensive assessment process using multiple direct assessment components conducted throughout the programme.

The assessment includes student performance in internal assessment parameters, assignment questions, class tests, house tests, practical exercises, external practical examination, project work, and internship. Each assessment activity is mapped to the relevant Course Outcomes to determine the level of their attainment.

The external board theory examination is not considered for Course Outcome attainment. Since the examination is conducted by the Board, detailed question-wise mapping and individual student performance data required for CO attainment analysis are not readily available, making its inclusion practically infeasible.

CURRICULUM GUIDELINES

A system of continuous and comprehensive evaluation has been integrated into the curriculum to monitor student progress on a regular basis and to ensure holistic assessment of their knowledge, skills, and competencies throughout the programme.

Academic Session

The academic session shall be organized in accordance with the *Academic Calendar* notified by the H.P. Takniki Shiksha Board. Each semester shall provide a minimum of *15 weeks* of effective instructional duration, excluding examinations and other non-instructional activities, to facilitate the systematic coverage of the curriculum. Prior to the commencement of each semester, a detailed *Lesson Plan* shall be prepared for every course by the concerned teacher. The execution of the lesson plan shall be periodically reviewed and monitored to ensure effective course delivery, timely completion of the syllabus, and attainment of the intended course outcomes.

Internal Assessment

Continuous and comprehensive internal assessment shall form an integral part of the teaching-learning process and shall be carried out for every course throughout the semester. The distribution of internal assessment marks shall be as specified in the *Study and Evaluation Scheme*. A student shall be required to secure at least **40% marks** in the internal assessment of each course to qualify for appearing in the corresponding end-semester Board examination. The marks obtained in the internal assessment shall be combined with the marks secured in the end-semester examination of the respective course for the computation of the final result. Distribution of marks for internal assessment of different types of courses shall be as:

Internal Assessment (Theory)

House Test	: 40%
Class Test	: 20%
Home Assignment	: 20%
Attendance	: 20%

Internal Assessment (Practical – Labs/ Workshops)

Practical Performance	: 60%
Report Writing	: 10%
Viva-voce	: 20%
Attendance	: 10%

Internal Assessment (Drawing)

House Test	: 20%
Class Test	: 20%
Drawing Sheets	: 40%
Attendance	: 20%

Note: The marks awarded for each sheet must be recorded by the evaluator on the student's drawing sheet.

Internal Assessment (Other Courses) – Distribution of marks for internal assessment of project work, seminar, internship and student-centered activities shall be as per the guidelines mentioned in the detail description of the course in the curriculum document.

Guidelines for Internal Assessment

- I. **HOME ASSIGNMENTS** - Each student shall submit a minimum of two home assignments in every theory course during the semester. The assignments shall be evaluated by the concerned subject teacher and awarded marks out of 10 for each assignment. The average of the marks obtained in the best two assignments shall be considered for the computation of the Internal Assessment marks for the course.

II. **CLASS TESTS** - A minimum of two class tests shall be conducted for each theory and drawing subject in accordance with the Board Academic Calendar. Each test shall be of one-hour duration, set by the subject teacher, and carry 30 marks. The first class test shall cover the first 30% of the course syllabus and the second class test should cover the next 30% of the syllabus. Average of two best class tests shall be considered.

Extra class tests can be conducted for the students who wish to improve or could not appear in the first two class tests on the basis of some genuine reason to be judged by the head of the concerned department.

III. **HOUSE TEST** - One house test shall be conducted as per the Board date sheet after 80% syllabus coverage as per the HPTSB datesheet. The house test shall be of two hours duration and carry 60 marks.

In case a student fails to attend the house test due to genuine reasons, re-examination will be conducted with the approval of the concerned Principal on the recommendation of the concerned Head of Department. The schedule of such house tests and setting of question papers shall be done at the institute level.

IV. **ATTENDANCE** – Attendance marks shall be awarded in proportion to the attendance percentage of the student in the respective course.

V. **VIVA-VOCE** – A viva-voce shall be conducted during the evaluation of each practical exercises to assess the student's understanding of the underlying concepts, practical skills, and ability to communicate technical knowledge effectively.

External Assessment

The external examinations shall be conducted by the H.P. Takniki Shiksha Board in accordance with the procedures, regulations, and guidelines notified by the Board from time to time. The duration and maximum marks for each course shall be as prescribed in the Study and Evaluation Scheme of the respective programme.

The minimum qualifying requirements for external assessments, as well as the provisions relating to promotion under the Allowed to Keep Term (ATKT) scheme, shall be governed by the prevailing rules and regulations of the H.P. Takniki Shiksha Board. Any amendments issued by the Board in this regard shall be deemed applicable to the programme from the date of their notification.

The breakup of marks for final practical examination shall be as:

Practical Performance	: 60%
Report Writing	: 20%
Viva-Voce	: 20%

However, the evaluation methodology and distribution of marks for Project, Seminar, and Internship courses may differ from those of regular practical courses. The detailed assessment

criteria, evaluation components, and mark distribution for these courses shall be specified separately in their respective course guidelines.

Bridge Course

The students admitted under lateral entry scheme are required to undergo a mandatory bridge course as per AICTE guideline [*AICTE Approval Process Handbook 2024-25 to 2026-27, Section 8.1*]:

“The Affiliating Body will offer suitable bridge courses such as Mathematics, Physics, Engineering drawing, etc., for the students coming from diverse backgrounds to achieve desired learning outcomes of the programme.”

The bridge course shall be conducted for lateral entry students in 3rd and 4th semesters of the programme during holidays, vacations or other available slots during regular semester classes.

STUDY & EVALUATION SCHEMES

Common to All Branches in GROUP-A
Semester - I

S.N.	Course Code	Course Name	Study Scheme			Credit	Evaluation Scheme				
			Hours per Week	Internal			External				
				Marks			Marks		Exam Time (Hrs)		
				Th	Pr		Th	Pr			
01	HS101	^ English & Communication Skills	3	-	-	3	50	-	100	-	3
02	BS101	* Applied Mathematics - I	3	1	-	4	50	-	100	-	3
03	BS103	* Applied Physics - I	3	-	-	3	50	-	100	-	3
04	ES101	^ Basics of Information Technology and AI	3	-	-	3	50	-	100	-	3
05	HS103	^ English & Communication Skills (Lab)	-	-	2	1	-	50	-	100	3
06	BS105	* Applied Physics -I (Lab)	-	-	2	1	-	50	-	100	3
07	ES103	* Engineering Graphics	-	-	6	3	-	50	-	100	3
08	ES105	^\$Engineering Workshops - I	-	-	6	3	-	50	-	100	3
09	ES107	^ Basics of Information Technology and AI (Lab)	-	-	2	1	-	50	-	100	3
10	AU101	*† Sports & Yoga	-	-	2	-	-	50	-	-	-
11	AU103	*† Students Centered Activities	-	-	3	-	-	50	-	-	-
12	AU105	#† Student Induction Program	-	-	-	-	-	-	-	-	-
			12	1	23	22					

* Common across all branches of engineering diploma in same semester

^ Common across all branches of engineering diploma in alternate semesters

† A grade of Satisfactory (S) or Unsatisfactory (U) to be assigned on the basis of internal assessment only

A mandatory 2 to 3-week induction program is to be conducted for the fresher students as per AICTE guidelines

\$ Three mandatory workshops – Electrical Workshop, Fitting Workshop and Carpentry Workshop

Common to All Branches in GROUP-A
Semester - II

S.N.	Course Code	Course Name	Study Scheme			Credit	Evaluation Scheme				
			Hours per Week	Internal			External				
				Marks			Marks		Exam Time (Hrs)		
				Th	Pr		Th	Pr			
01	BS102	* Applied Mathematics - II	3	1	-	4	50	-	100	-	3
02	BS104	* Applied Physics - II	3	-	-	3	50	-	100	-	3
03	BS106	^ Applied Chemistry	3	-	-	3	50	-	100	-	3
04	ES102/ ES104	^\$Basics of Electrical & Electronics Engineering OR Applied Mechanics	3	-	-	3	50	-	100	-	3
05	XXPC102	Program Core - 1 (Theory)	2	-	-	2	50	-	100	-	3
06	ES106	@ Engineering Workshops - II	-	-	6	3	-	50	-	100	3
07	BS108	* Applied Physics - II (Lab)	-	-	2	1	-	50	-	100	3
08	BS110	^ Applied Chemistry (Lab)	-	-	2	1	-	50	-	100	3
09	ES108/ ES110	^\$Basics of Electrical & Electronics Engineering (Lab) OR Applied Mechanics (Lab)	-	-	2	1	-	50	-	100	3
10	XXPC104	Program Core - 1 (Lab)	-	-	4	2	-	50	-	100	3
11	AU101	*†Sports & Yoga	-	-	2	-	-	50	-	-	-
12	AU103	*†Students Centered Activities	-	-	3	-	-	50	-	-	-
			14	1	21	23					

* Common across all branches of engineering diploma in same semester

^ Common across all branches of engineering diploma in alternate semesters

† A grade of Satisfactory (S) or Unsatisfactory (U) to be assigned on the basis of internal assessment only

\$ Applied Mechanics (AE, CI, AG, ME, TD), Basics of Electrical & Electronics Engineering (CO, IOT, IE, AI, EX, EL, EE, EV, MX)

@ Three Branch-specific Workshops - Electronics Workshop (CO, IoT, AI, EX, EL, IE, AE, MX, EE, EV), Computer Workshop (CO, IoT, AI, EX, EL, IE, EE, EV), Smithy Workshop (ME, TD), Sheet Metal Workshop (CO, IoT, AI, EX, ME, TD, MX, CI, AE, AG), Welding Workshop (ME, IE, EL, MX, AE, TD, CI, AG, EE, EV) and Plumbing Workshop (CI, AG)

Common to All Branches in GROUP-B
Semester - I

S.N.	Course Code	Course Name	Study Scheme			Credit	Evaluation Scheme				
			Hours per Week	Internal			External				
				Marks			Marks		Exam Time (Hrs)		
				Th	Pr		Th	Pr			
01	BS106	^ Applied Chemistry	3	-	-	3	50	-	100	-	3
02	BS101	* Applied Mathematics - I	3	1	-	4	50	-	100	-	3
03	BS103	* Applied Physics - I	3	-	-	3	50	-	100	-	3
04	ES102/ ES104	^\$Basics of Electrical & Electronics Engineering OR Applied Mechanics	3	-	-	3	50	-	100	-	3
05	BS110	^ Applied Chemistry (Lab)	-	-	2	1	-	50	-	100	3
06	BS105	* Applied Physics - I (Lab)	-	-	2	1	-	50	-	100	3
07	ES103	* Engineering Graphics	-	-	6	3	-	50	-	100	3
08	ES106	@ Engineering Workshops - II	-	-	6	3	-	50	-	100	3
09	ES108/ ES110	^\$Basics of Electrical & Electronics Engineering (Lab) OR Applied Mechanics (Lab)	-	-	2	1	-	50	-	100	3
10	AU101	*†Sports & Yoga	-	-	2	-	-	50	-	-	-
11	AU103	*†Students Centered Activities	-	-	3	-	-	50	-	-	-
12	AU105	#† Student Induction Program	-	-	-	-	-	-	-	-	-
			12	1	23	22					

* Common across all branches of engineering diploma in same semester

^ Common across all branches of engineering diploma in alternate semesters

† A grade of Satisfactory (S) or Unsatisfactory (U) to be assigned on the basis of internal assessment only

\$ Applied Mechanics (AE, CI, AG, ME, TD), Basics of Electrical & Electronics Engineering (CO, IOT, IE, AI, EX, EL, EE, EV, MX)

@ Three Branch-specific Workshops - Electronics Workshop (CO, IoT, AI, EX, EL, IE, AE, MX, EE, EV), Computer Workshop (CO, IoT, AI, EX, EL, IE, EE, EV), Smithy Workshop (ME, TD), Sheet Metal Workshop (CO, IoT, AI, EX, ME, TD, MX, CI, AE, AG), Welding Workshop (ME, IE, EL, MX, AE, TD, CI, AG, EE, EV) and Plumbing Workshop (CI, AG)

A mandatory 2 to 3-week induction program is to be conducted for the fresher students as per AICTE guidelines

Common to All Branches in GROUP-B
Semester - II

S.N.	Course Code	Course Name	Study Scheme			Credit	Evaluation Scheme				
			Hours per Week	Internal			External				
				Marks			Marks		Exam Time (Hrs)		
				Th	Pr		Th	Pr			
01	BS102	* Applied Mathematics - II	3	1	-	4	50	-	100	-	3
02	BS104	* Applied Physics - II	3	-	-	3	50	-	100	-	3
03	HS101	^ English & Communication Skills	3	-	-	3	50	-	100	-	3
04	ES101	^ Basics of Information Technology and AI	3	-	-	3	50	-	100	-	3
05	XXPC102	Program Core - 1 (Theory)	2	-	-	2	50	-	100	-	3
06	ES105	^\$ Engineering Workshops - I	-	-	6	3	-	50	-	100	3
07	BS108	* Applied Physics - II (Lab)	-	-	2	1	-	50	-	100	3
08	HS103	^ English & Communication Skills (Lab)	-	-	2	1	-	50	-	100	3
09	ES107	^ Basics of Information Technology and AI (Lab)	-	-	2	1	-	50	-	100	3
10	XXPC104	Program Core - 1 (Lab)	-	-	4	2	-	50	-	100	3
11	AU101	*†Sports & Yoga	-	-	2	-	-	50	-	-	-
12	AU103	*†Students Centered Activities	-	-	3	-	-	50	-	-	-
			14	1	21	23					

* Common across all branches of engineering diploma in same semester

^ Common across all branches of engineering diploma in alternate semesters

† A grade of Satisfactory (S) or Unsatisfactory (U) to be assigned on the basis of internal assessment only

\$ Three mandatory workshops – Electrical Workshop, Fitting Workshop and Carpentry Workshop

DETAILED CONTENT
First Semester (Group – A)

Course Code	:	HS101
Course Title	:	English & Communication Skills
Number of Credits (Teaching Load)	:	3 (L:3, T:0, P:0)
Prerequisites	:	-
Course Category	:	HS
Companion Course	:	HS103

COURSE LEARNING OBJECTIVES

The course aims to develop students' ability to communicate effectively in academic, personal, and professional contexts; enhance their verbal and non-verbal communication skills; improve drafting skills and the use of correct grammar; and build confidence for effective communication through regular practice.

COURSE OUTCOMES

After completing this course along with its companion course, students will be able to:

Course Outcome	Bloom's Level
CO 1. Explain the fundamentals of communication, including its principles, process, barriers, and strategies to overcome these.	L2
CO 2. Comprehend listening and writing forms of communication.	L2
CO 3. Demonstrate proficiency in verbal and non-verbal communication skills in academic, personal and professional contexts.	L3
CO 4. Apply correct grammatical structures in speaking and writing.	L3

OUTCOME MAPPING MATRIX							
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7
CO-1	1	2	2	1	2	3	3
CO-2	1	3	3	1	2	3	3
CO-3	1	2	2	1	2	3	3
CO-4	1	1	2	1	1	2	2

COURSE CONTENTS

Unit 1: Fundamentals of Communication Skills.....30 Marks

Concept, Significance and Process of Communication, Levels and Types of Communication: Verbal and Non-verbal; Formal and Informal, Barriers to Effective Communication and how to Overcome these, 7C's for Effective Communication, Listening Skills : Significance and Essentials of Active Listening Skills, Speaking Skills: Significance and Essentials of Effective Spoken Communication, Concept and Significance of Soft and Life Skills – Role of Communication Skills in Developing Soft and Life Skills.

Unit 2: Reading Skills.....20 Marks

Definition, Meaning and Significance of Reading Skills, Techniques of Reading: SQ3R method of Reading – Survey, Question, Read, Recite, Review, Skimming and Scanning, Extensive and Intensive Reading, Literature and Textual Study for honing Reading Skills: Poetry: Daffodils by William Wordsworth. Prose: Life Sketch of Dr. A.P.J. Abdul Kalam. Short Story: With the Photographer by Stephen Leacock.

Unit 3: Functional Grammar and Vocabulary.....30 Marks

Tenses, Change of Voice, Change of Narration, Article, Parts of Speech: Noun, Pronoun, Adjective, Verb, Adverb, Conjunction, Preposition, Glossary of Administration terms, Pair of Words, Synonyms, Antonyms.

Unit 4: Writing Skills.....20 Marks

Significance and Essential Components of Writing Skills; Drafting Skills: Significance of Notice, Circular, Official letters and Email etiquette, Writing Paragraphs through Outlines, Resume Writing and Forwarding Letter.

SUGGESTED DISTRIBUTION OF MARKS

Unit	Time (Hours)	Marks Allotted
Unit 1: Fundamental of Communication Skills	13	30
Unit 2: Reading Skills	08	20
Unit 3: Functional Grammar and Vocabulary	13	30
Unit 4: Writing Skills	11	20
TOTAL	45	100

REFERENCE BOOKS AND SUGGESTED LEARNING RESOURCES

1. Essentials of Business Communication, Rajendra Pal and J.S. Korlahalli - Sultan Chand and Sons
2. Communication Techniques and Skills, R. K. Chadha - Dhanpat Rai Publications
3. Practical English Usage, Michael Swan - Oxford University Press
4. Text Book of English and Communication Skills Vol - 1, 2, Alwinder Dhillon and Parmod Kumar Singla - Abhishek Publications
5. Course in English Pronunciation, J. Sethi, Kamlesh Sadanand and D.V Jindal - PHI Learning
6. Creative English for Communication, Krishnaswamy N. - Macmillan
7. High School English Grammar and Composition, Wren and Martin- S. Chand
8. Speaking Effectively, Jermy Comfort - Cambridge

ONLINE RESOURCES

9. idoc.pub › documents › life-sketch-of-dr-apj-abdul
10. <https://www.vedantu.com/commerce/barriers-in-communication>

**_*_*_*_

Course Code	:	HS103
Course Title	:	English & Communication Skills (Lab)
Number of Credits (Teaching Load)	:	1 (L:0, T:0, P:2)
Prerequisites	:	-
Course Category	:	HS
Companion Course	:	HS101

COURSE LEARNING OBJECTIVES

The practical component of the subject is designed to help students improve their communication skills through regular practice. By the end of the course, students will be able to listen, speak, read and write with greater confidence. They will be able to develop and use appropriate listening skills, vocabulary, pronunciation and grammar, participate effectively in group discussions and meetings, prepare formal letters, notices, circulars, reports and resumes in the correct format. The students will be able to follow and display proper etiquette, mannerism, positive body language and responsible digital communication in their behaviour, conduct and acts.

COURSE OUTCOMES

After completing this course, students will be able to:

Course Outcome	Bloom's Level
CO 1. Display confidence in speaking and writing in formal and informal situations.	L3
CO 2. Apply correct listening skills, vocabulary, pronunciation, and grammar in all forms of communication.	L3
CO 3. Deliver short speeches and actively participate in group discussions and meetings.	L4
CO 4. Draft formal letters, notices, circulars, reports and resume using standard, custom and correct formats.	L4
CO 5. Demonstrate appropriate and responsible etiquette, positive body language in all communications, including digital communication.	L2

OUTCOME MAPPING MATRIX							
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7
CO-1	2	2	1	1	1	3	2
CO-2	2	2	1	1	1	3	2
CO-3	1	2	1	1	1	3	2
CO-4	-	-	1	2	3	3	2
CO-5	1	-	1	-	2	3	3

LIST OF PRACTICALS

Sr. No.	Practical Objective
1.	a) Demonstration of Listening Skills with suitable and relevant examples of: Difference between Hearing and Listening; Process and Steps in Listening Effectively; Types of Listening; Barriers in Listening; Tips for Effective Listening. b) Exercises of Listening to Monologues and Dialogues through - audio/video, with Appropriate Feedback for Improvement.
2.	a) Demonstration and Practice of Basic Phonetics and Sound Recognition: Structure of Language; Phoneme (Word Sound), Phonetics (Production of speech sounds); Consonant Sounds; Vowel Sounds: Monophthongs (Short, Long sounds) and Diphthongs; Phonic Sounds of English Alphabet. b) Practice on Phonetics: Word stress and Intonation in Effective Speech.
3.	a) Speaking Skills: Recapitulation of Significance and essentials of Effective Spoken Communication. b) Confidently Introduce Yourself and Others, extend Greetings, in Formal and Informal settings.
4.	a) Deliver Short Speeches: Welcome Speech, Farewell Speech, Impromptu Speech, using Essentials Elements of a Good Speech. b) Deliver Effective Academic presentations using audio-visual aids (PPTs/videos).
5.	a) Practice Writing Skills using Correct Formats: i. Formal Letter and Emails ii. Notice and Circular iii. Different Reports iv. Resume and Covering Letter
6.	a) Demonstration and Practice of appropriate Body Language and other important aspects of Non-Verbal Communication. b) Demonstration and Practice of appropriate Etiquette and Manners for various Formal and Informal Situations.
7.	a) Participate effectively in Group Discussion and Meetings, displaying Team Spirit and Collaboration. b) Mock Interviews- Personal and Telephonic Interview.
8.	a) Role Play Activities-Situational Conversations. b) Do's and Don'ts in Digital Communication and Social Media.

GUIDELINES FOR PRACTICAL WORK

1. A Communication Laboratory may be established with appropriate audio-visual equipment and video recording facilities to record the performance of each student. The laboratory should also include a playback facility to help students review their performance and improve their communication skills.
2. A Communication Skills Lab Manual should be made available as a reference for students to guide them in practical activities and writing tasks.
3. Elements of body language, such as posture, gestures, facial expressions, and eye contact, should be incorporated in all practical activities to enhance effective communication.
4. Soft skills, along with ethical and value-based learning, should be emphasized to help students develop confidence, professional behavior, and effective interpersonal communication.

STANDARD LIST OF TOOLS AND EQUIPMENT

Sr. No.	Name of the Tool/ Equipment	Quantity
1.	Computer Systems	20+1
2.	Headphones	20+1
3.	Projector or Interactive Panel	01 No.
4.	Laptop	01 No.
5.	Internet Connectivity	-
6.	Printer	01 No.
7.	Podium with Detachable Microphones	01 No.
8.	Speakers	01 Set
9.	Digital Camera with Video Recording Function	01 No.
10.	Pen Drives – 64 GB	05 Nos.
11.	All necessary furniture (Chair, Stool, Table etc.), Tool Rack, Working Bench, Almirah etc.	As Required

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Course Code	:	BS101
Course Title	:	Applied Mathematics - I
Number of Credits (Teaching Load)	:	4 (L:3, T:1, P:0)
Prerequisites	:	-
Course Category	:	BS

COURSE LEARNING OBJECTIVES

This course is designed to give a comprehensive coverage at an introductory level to the subject of Trigonometry, Differential Calculus and Basic elements of algebra.

COURSE OUTCOMES

After completing this course, the students will be able to:

Course Outcome	Bloom's Level
CO 1. Apply the fundamental concepts of trigonometry to solve mathematical problems.	L3
CO 2. Analyze mathematical functions and evaluate limits using standard limits and methods such as factorization, substitution, and rationalization.	L4
CO 3. Apply differentiation techniques, including first principles and rules of differentiation, to solve problems involving algebraic, trigonometric, and inverse trigonometric functions.	L3
CO 4. Solve algebraic operations on complex numbers; represent them geometrically using the Argand diagram, and use partial fraction decomposition to simplify rational expressions.	L3
CO 5. Apply the concepts of permutations, combinations, and the binomial theorem to solve counting problems.	L3

OUTCOME MAPPING MATRIX							
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7
CO-1	3	2	-	-	-	-	-
CO-2	2	3	-	-	-	-	-
CO-3	3	3	1	-	-	-	-
CO-4	3	2	1	-	-	-	-
CO-5	2	3	2	-	-	-	-

COURSE CONTENTS

Unit 1: Basic Trigonometry.....30 Marks

Concept of angles, measurement of angles in degrees, grades and radians and their conversions, radian measure formula (Arc Length Formula in radians) and simple related problems, Ratios of Allied angles (without proof).

Trigonometric Formulae and Graphs - Sum, difference formulae and their applications (without proof), Product formulae (Transformation of product to sum, difference and vice versa), Graphs of $\sin x$, $\cos x$.

Unit 2: Functions and Limits.....20 Marks

Definition of function, Value of a function, Even and Odd Function, Function of a function.

Limit of a function, Standard limits (with proof) $\lim_{x \rightarrow a} \frac{x^n - a^n}{x - a}$ & $\lim_{x \rightarrow 0} \frac{a^x - 1}{x}$ and related questions.

Problems related to find the limit of an algebraic function by using factorization method, substitution method and rationalization method.

Unit 3: Differentiation15 Marks

Differentiation by first principle (x^n , $\sin x$ & $\cos x$). Rules of differentiation (sum, product, quotient, chain rule (Differentiation of function of a function)). Differentiation of trigonometric and inverse trigonometric functions, Logarithmic differentiation.

Unit 4: Complex Numbers and Partial Fractions.....15 Marks

Complex Numbers: Definition, real and imaginary parts, conjugate of a complex number, algebra of complex numbers (Addition, Subtraction, Multiplication and Division), Additive and multiplicative inverse, solution of a quadratic equation having Discriminant < 0 , Geometrical Representation of a Complex Number - Argand Diagram, modulus & amplitude of a complex number, Polar form of a complex number.

Partial fractions: Definition of polynomial fraction (proper, improper fractions) and definition of partial fractions. Problems related to resolve a fraction (proper & improper fractions) into partial fraction with denominator containing non-repeated linear factors.

Unit 5: Permutations, Combinations and Binomial Theorem20 Marks

Permutations and Combinations: Definition of $n!$, Special case: $0! = 1$, Simplification of factorial expressions, Permutation: Meaning, formula nP_r and simple numerical problems.

Combination: Meaning, formula nC_r and simple numerical problems.

Binomial theorem: Binomial theorem (without proof) for positive integral index (expansion and general form); binomial theorem for any index (expansion without proof) first and second binomial approximation with applications to engineering problems.

SUGGESTED DISTRIBUTION OF MARKS

Unit	Time (Hours)	Marks Allotted
Unit - 1: Basic Trigonometry, Trigonometric Formulae and Graphs	18	30
Unit - 2 : Functions and Limits	11	20
Unit - 3 : Differentiation	09	15
Unit - 4 : Complex Numbers and Partial Fractions	11	15
Unit - 5 : Permutations, Combinations and Binomial Theorem	11	20
TOTAL	60	100

REFERENCE BOOKS AND SUGGESTED LEARNING RESOURCES

1. Applied Mathematics – I & II for Diploma Courses, R. D. Sharma - Dhanpat Rai Publications
2. Mathematics for Class XI & XII - NCERT Publication, New Delhi
3. Higher Engineering Mathematics, B.S. Grewal - Khanna Publishers, New Delhi
4. Engineering Mathematics, Reena Garg - Khanna Publishing House, New Delhi
5. Advanced Engineering Mathematics, Reena Garg & Chandrika Prasad, Khanna Publishing House

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Course Code	:	BS103
Course Title	:	Applied Physics - I
Number of Credits (Teaching Load)	:	3 (L:3, T:0, P:0)
Prerequisites	:	-
Course Category	:	BS
Companion Course	:	BS105

COURSE LEARNING OBJECTIVES

Applied Physics covers a wide range of topics that are closely connected to the phenomena occurring in our surroundings. The subject seeks to develop an understanding of the physical world through observation as well as by predicting the behaviour of objects under different conditions. Emphasis is placed on the practical application of physical laws and analytical methods in various technical and engineering fields, highlighting their relevance in real-world situations.

COURSE OUTCOMES

After completing this course, the students will be able to:

Course Outcome	Bloom's Level
CO 1. Identify different physical quantities, choose appropriate units, and perform accurate measurements.	L1
CO 2. Classify physical quantities as scalars and vectors, distinguish various types of motion.	L2
CO 3. Explain the concepts of work, energy, and power and solve related numerical problems.	L2
CO 4. Interpret the properties of matter and apply the concepts of heat and temperature to explain the behavior of materials and related phenomena.	L2
CO 5. Apply physical principles and analytical methods in various technical and engineering contexts.	L3

OUTCOME MAPPING MATRIX							
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7
CO-1	3	1	-	2	-	-	1
CO-2	3	2	-	1	1	-	1
CO-3	3	3	1	1	-	-	1
CO-4	3	2	1	1	2	-	1
CO-5	3	3	2	2	2	1	2

COURSE CONTENTS

Unit 1: Units and Dimensions.....20 Marks

Physical quantities - fundamental and derived quantities, System of units: CGS, FPS, MKS, SI, Dimensional formulae and SI units of physical quantities - displacement, area, volume, density, velocity, acceleration, linear momentum, force, work, power, energy, pressure, stress & strain, Principle of homogeneity of dimensions, Application of dimensional analysis: checking the correctness of physical equation (three equations of motion), Errors, Types of errors - Instrumental, Systematic, Random and Gross error.

Unit 2: Force and Motion25 Marks

Scalar and vector quantities – definition and examples, representation of vector, types of vectors (equal vectors, negative vectors, unit vectors, co-initial vectors, co-planar vectors), linear momentum, law of conservation of linear momentum with derivation, angular displacement, angular velocity, angular acceleration, relation between linear and angular velocity, torque, angular momentum, law of conservation of angular momentum and its applications, moment of inertia and its physical significance.

Unit 3: Work, Power, and Energy.....20 Marks

Work and types of work (zero work, positive work and negative work) with examples, Energy - definition and its SI unit, examples of transformation of energy, Kinetic energy - definition, examples, formula and its derivation, Potential energy - definition, examples, formula and its derivation, Law of conservation of mechanical energy for freely falling bodies (with derivation), Power and simple numerical problems based on Power.

Unit 4: Properties of Matter15 Marks

Elasticity and plasticity - definition, Definition of stress and strain, Types of stress and strain, Hooke's law, Modulus of elasticity and its types, Pressure - definition, atmospheric pressure, gauge pressure, absolute pressure.

Unit 5: Heat and Temperature.....20 Marks

Definition of heat and temperature (on the basis of kinetic theory), Difference between heat and temperature, Modes of transfer of heat- conduction, convection and radiation with examples, Different scales of temperature and their relationship, Numerical problems based on conversion of temperature into various scales.

SUGGESTED DISTRIBUTION OF MARKS

Unit	Time (Hours)	Marks Allotted
Unit-1 : Units & Dimensions	9	20
Unit-2 : Force and Motion	10	25
Unit-3 : Work, Power & Energy	9	20
Unit-4 : Properties of matter	8	15
Unit-5 : Heat & Temperature	9	20
TOTAL	45	100

REFERENCE BOOKS AND SUGGESTED LEARNING RESOURCES

1. Text Book of Physics for Class XI (Part-I, Part-II) - N. C. E. R. T., Delhi.
2. Fundamentals of Physics, David Halliday et al. - Wiley Publication.
3. Engineering Physics, DK Bhattacharya & Poonam Tandan - Oxford University Press, New Delhi.
4. Concepts in Physics Vol. I & II, HC Verma - Bharti Bhawan Publication, New Delhi
5. Conceptual Physics, Paul G. Hewitt - Pearson Publication.

ONLINE RESOURCES

6. Swayam Portal - <https://swayam.gov.in>
7. <https://phet.colorado.edu/en/simulations/filter?subjects=physics&type=html,prototype>
8. <https://www.physicsclassroom.com/>
9. <http://www.hyperphysics.phy-astr.gsu.edu>
10. <https://phys.org/>

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Course Code	:	BS105
Course Title	:	Applied Physics - I (Lab)
Number of Credits (Teaching Load)	:	1 (L:0, T:0, P:2)
Prerequisites	:	-
Course Category	:	BS
Companion Course	:	BS103

COURSE LEARNING OBJECTIVES

This course aims to develop fundamental experimental skills and scientific aptitude among students by providing hands-on experience with basic measuring instruments and physical laws. The course enables students to understand the construction, working principles, and proper handling of instruments such as Vernier callipers, screw gauge, spherometer, thermometer, and barometer for precise measurement of physical quantities. It emphasizes accuracy, least count determination, error analysis, and systematic data recording. The laboratory training fosters analytical thinking, observational skills, and the ability to correlate theoretical knowledge with practical applications in engineering and science.

COURSE OUTCOMES

After completing this course, students will be able to:

Course Outcome	Bloom's Level
CO 1. Recall the procedure for measuring external diameter, internal diameter, and depth using a Vernier Calliper.	L1
CO 2. Interpret the readings obtained from the Screw Gauge and Spherometer.	L2
CO 3. Explain the concept of Hooke's Law and determine the force constant of a spring.	L2
CO 4. Explain the procedure for measuring room temperature using a thermometer and converting it between different temperature scales.	L2
CO 5. Identify the principles of conservation of mechanical energy and moment of inertia.	L1

OUTCOME MAPPING MATRIX							
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7
CO-1	3	1	-	1	2	-	-
CO-2	3	2	-	2	2	-	-
CO-3	3	2	-	1	1	-	-
CO-4	3	2	-	1	2	-	-
CO-5	3	2	-	1	-	-	-

LIST OF EXPERIMENTS

Sr. No.	Experiment Objective
1.	Laboratory Safety and Familiarization: To acquaint students with laboratory safety rules and the construction, least count, handling, and reading of common measuring instruments such as the Vernier Calliper, Screw Gauge, Spherometer and Thermometer. (Compulsory for all students.)
2.	To find the diameter of a solid cylinder using a Vernier Calliper.
3.	To find the internal diameter and depth of a beaker using a Vernier Calliper and hence find its volume.
4.	To find the diameter of wire & thickness of cardboard by using a screw gauge.
5.	To determine the thickness of the glass strip using a spherometer.
6.	To determine the radius of curvature of a given spherical surface by a spherometer.
7.	To determine the force constant of spring using Hooke's law.
8.	To measure room temperature using a thermometer and convert it into different temperature scales.
9.	To verify the law of conservation of mechanical energy (PE to KE).
10.	To find the moment of inertia of a flywheel.

STANDARD LIST OF TOOLS AND EQUIPMENT

Sr. No.	Name of the Tool/ Equipment	Quantity	Sr. No.	Name of the Tool/ Equipment	Quantity
1.	Vernier Caliper (0-15cm)	10 Nos.	6.	Hooke's Law Apparatus	5 Nos.
2.	Metallic Solid Cylinder	10 Nos.	7.	Stop Watch	2 Nos.
3.	Beaker (Copper)	10 Nos.	8.	Flywheel	2 Nos.
4.	Screw Gauge (0-25mm)	10 Nos.	9.	Mercury Thermometer	10 Nos.
5.	Spherometer (10-0-10mm)	10 Nos.	10.	Hot Plate	2 Nos.

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Course Code	:	ES101
Course Title	:	Basics of Information Technology & AI
Number of Credits (Teaching Load)	:	3 (L:3, T:0, P:0)
Prerequisites	:	-
Course Category	:	ES
Companion Course		ES107

COURSE LEARNING OBJECTIVES

This course provides students with fundamental knowledge of computer systems and modern information technologies. It introduces the basic concepts of computer hardware, software, operating systems, Internet services, office productivity tools, cyber security, and emerging technologies including Artificial Intelligence. The course develops digital literacy and enables students to effectively use digital tools for documentation, data handling, communication, and information management in academic and professional environments.

COURSE OUTCOMES

After completing this course along with its companion course, students will be able to:

Course Outcome	Bloom's Level
CO 1. Identify internal and peripheral components of a computer system.	L1
CO 2. Explain the working principles of a computer system and its major peripheral devices.	L2
CO 3. Explain the functions of system software and application software in a computer system.	L2
CO 4. Use office productivity tools to create documents, spreadsheets, presentations, and digital content.	L3
CO 5. Describe common cyber security threats and suggest appropriate preventive measures for safe digital practices.	L2
CO 6. Explain the role and applications of Artificial Intelligence in everyday life and professional domains.	L2

OUTCOME MAPPING MATRIX							
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7
CO-1	3	-	-	-	-	-	1
CO-2	3	1	-	-	-	-	1
CO-3	3	1	-	-	-	-	1
CO-4	2	-	-	2	-	-	2
CO-5	2	2	-	1	2	-	2
CO-6	2	-	-	-	2	-	3

COURSE CONTENTS

Unit 1: Introduction to Computers and Information Technology20 Marks

- 1.1. Computer Fundamentals: Evolution of computers; characteristics and applications of computers; data and information; hardware and software; block diagram and functional units of a computer system.
- 1.2. Information Technology: Concept and applications of Information Technology (IT); digital transformation; e-Governance, e-Commerce, e-Learning, e-Banking, digital payments; cloud services; impact of IT on society

Unit 2: Computer Hardware.....30 Marks

- 2.1. Computer hardware components – Motherboard, CPU, Memory, Storage Devices, Input Devices and Output Devices.
- 2.2. Central Processing Unit - Functions of CPU, Arithmetic Logic Unit (ALU), Control Unit (CU), Registers (overview), CPU Clock Speed
- 2.3. Input Devices – Keyboard, mouse, scanner, touch screen, microphone, web camera.
- 2.4. Output Devices – Monitor, printer, plotter, speaker, multimedia projector.
- 2.5. Memory and Storage – Units of memory, memory hierarchy, primary memory (RAM, ROM), cache memory (overview only), secondary storage devices - Hard Disk Drive, optical disks (CD/DVD/Blu-ray), flash drives.
- 2.6. Computer ports and connectivity – USB, HDMI, audio ports, Bluetooth (overview), Wi-Fi (overview)

Unit 3: Computer Software.....30 Marks

- 3.1. Operating System – Functions, Types of Operating Systems, GUI and CLI
- 3.2. System Software – Device drivers, Language translators, Utility software
- 3.3. Application Software – General-purpose software, Domain-specific software, Examples of popular application software (Web browsers, Media players, Accounting software, CAD software)
- 3.4. Office Productivity Tools – Word Processing, Spreadsheet, Presentation, PDF tools, Collaboration tools

Unit 4: Cyber Security & Ethics10 Marks

- 4.1. Cyber Security Fundamentals – Cyber threats, Malware, Virus, Worm, Trojan, Ransomware, Spyware, Phishing
- 4.2. Safe Computing Practices – Strong password, Multi-factor authentication, Safe browsing, Secure email, Data backup
- 4.3. Cyber Ethics – Digital citizenship, Copyright, Plagiarism, Privacy, Responsible use of social media

Unit 5: Artificial Intelligence.....10 Marks

- 5.1. Introduction – Concept of AI, History, AI vs ML vs Deep Learning (basic distinction)

5.2. Applications – Education, Healthcare, Agriculture, Manufacturing, Transportation, Finance, Smart Cities

5.3. Generative AI – Concept, Examples, Benefits, Limitations, Examples of Generative AI (ChatGPT, Gemini, Microsoft Copilot).

5.4. Responsible AI – Ethics, Bias, Privacy, Human oversight

SUGGESTED DISTRIBUTION OF MARKS

Unit	Time (Hours)	Marks Allotted
Unit 1: Introduction to Computers and Information Technology	09	20
Unit 2: Computer Hardware	12	30
Unit 3: Computer Software	12	30
Unit 4: Cyber Security & Ethics	06	10
Unit 5: Artificial Intelligence	06	10
TOTAL	45	100

REFERENCE BOOKS AND SUGGESTED LEARNING RESOURCES

1. Introduction to Computers, Peter Norton, McGraw-Hill Education.
2. Fundamentals of Computers, V. Rajaraman, PHI Learning.
3. Fundamentals of Information Technology, Alexis Leon and Mathews Leon, Leon Vikas.
4. Foundations of Computing, Pradeep K. Sinha and Preeti Sinha, BPB Publications.
5. Computer Fundamentals, Anita Goel, Pearson Education.
6. Computer Fundamentals, R. S. Salaria, Khanna Publishing House.
7. Artificial Intelligence, Pradeep K. Sinha and Preeti Sinha, BPB Publications.

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Course Code	:	ES107
Course Title	:	Basics of Information Technology & AI (Lab)
Number of Credits (Teaching Load)	:	1 (L:0, T:0, P:2)
Prerequisites	:	-
Course Category	:	ES
Companion Course	:	ES101

COURSE LEARNING OBJECTIVES

This companion laboratory course provides hands-on experience in using operating systems, Internet services, office productivity tools, cloud-based applications, cyber security practices, and Generative AI tools for academic and professional applications.

COURSE OUTCOMES

After completing this course, students will be able to:

Course Outcome	Bloom's Level
CO 1. Perform basic operating system operations for file management, folder organization, and software management.	L3
CO 2. Use office productivity tools to create professional documents, spreadsheets, presentations, and PDF files.	L3
CO 3. Use Internet services, cloud-based applications, and cyber security practices for secure digital communication and collaboration.	L3
CO 4. Use Generative AI tools responsibly to enhance learning, productivity, and problem solving.	L3

OUTCOME MAPPING MATRIX							
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7
CO-1	3	-	-	3	-	-	1
CO-2	3	1	2	2	-	-	1
CO-3	3	1	2	2	-	-	1
CO-4	2	2	3	2	1	1	2

LIST OF EXPERIMENTS

Sr. No.	Experiment Objective
1.	Identify the basic components, peripheral devices, and ports of a computer system, and connect the computer system to power, peripheral devices, and a network.

2.	Perform basic operating system tasks including booting and shutting down the computer, logging in and logging out, and accessing basic system settings.
3.	Create and manage files and folders using operating system utilities, and perform basic operations on storage devices.
4.	Install and configure commonly used application software, including an office productivity suite and a web browser.
5.	Prepare and format a document using word-processing software by applying appropriate styles, alignment, spacing, numbering, headers, footers, and tables.
6.	Prepare and format a spreadsheet using spreadsheet software by entering different types of data, applying formulae and basic functions, and using cell ranges, formatting, and borders.
7.	Prepare a presentation using presentation software by creating slides, inserting text, images, tables, charts, and shapes, and applying themes, transitions, animations, and presentation tools.
8.	Use Internet and web-based services, including search engines, websites, and cloud applications, by following safe web browsing practices.
9.	Use email services to compose, send, receive, and manage emails, including attachments, CC, BCC, and identification of spam, phishing, spoofed, and fraudulent emails.
10.	Use Generative AI tools to generate, summarize, and refine digital content for academic and professional applications while following responsible AI practices.

STANDARD LIST OF TOOLS AND EQUIPMENT

Sr. No.	Name of the Tool/ Equipment	Quantity
1.	Desktop Computer System ▪ Processor : Intel Core i5 - Core i7/ AMD Ryzen 5 - Ryzen 7 ▪ RAM : 8 - 16 GB, ▪ Storage : HDD 500GB - 2 TB/ SSD 240GB - 500 GB ▪ Display : 19" LED/ FHD ▪ Connectivity : 100/1000 Ethernet, USB Ports ▪ OS : Pre-installed Windows 10/ 11Pro (64 bit)/ Linux	25 Nos.
2.	Online UPS (5 KVA) with 30 Minutes Backup on Full Load	02 Nos.
3.	Printer - All in One Laser Printer (Print, Scan, Copy) - A4	01 No.
4.	Networking Infrastructure ▪ 24-port Gbps Ethernet Switch ▪ 8U Wall Mount Rack ▪ 24-port Patch Panel ▪ UTP Cabling	01 No.

Sr. No.	Name of the Tool/ Equipment	Quantity
5.	Internet Connectivity	-
6.	Steel Almirah - Size: 1980mm (H) x 900mm (W) x 480mm (D)	01 No.
7.	Interactive Panel 65” - 80” ▪ Resolution: 3840 x 2160 ▪ Wireless Keyboard & Mouse	01 No.
8.	Software ▪ Windows 10/ 11 Pro or Linux OS ▪ MS Office/ LibreOffice, ▪ Google Chrome/ Mozilla Firefox/ Microsoft Edge	-

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Course Code	:	ES103
Course Title	:	Engineering Graphics
Number of Credits (Teaching Load)	:	3 (L:0, T:0, P:6)
Prerequisites	:	-
Course Category	:	ES

COURSE LEARNING OBJECTIVES

This course aims to inculcate fundamental drawing skills in students, recognizing engineering drawing as the universal language of engineers and technicians. It enables learners to apply these skills in the preparation, reading, and interpretation of engineering drawings.

The course emphasizes the development of conceptual and visualization skills, adherence to standard drawing practices, and accuracy in graphical communication. All instructions and practices are aligned with BIS SP 46:2003, ensuring conformity with national standards and professional requirements.

COURSE OUTCOMES

After completing this course, students will be able to:

Course Outcome	Bloom's Level
CO 1. Identify and use standard drawing instruments accurately.	L3
CO 2. Draw geometrical figures and apply different types of lines	L3
CO 3. Apply standard dimensioning techniques, drawing codes, conventions, and symbols as per IS SP-46 (2003) in engineering drawings.	L3
CO 4. Draw orthographic projections, sectional and isometric views of simple objects.	L3
CO 5. Interpret and draw the free hand sketches of Civil, Electrical and Mechanical engineering symbols and conventions.	L2

OUTCOME MAPPING MATRIX							
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7
CO-1	3	–	–	2	–	1	–
CO-2	3	–	–	2	–	1	–
CO-3	3	–	–	2	2	1	–
CO-4	3	1	1	2	–	1	1
CO-5	3	–	1	2	–	1	1

Note: I. First angle projection is to be followed unless otherwise specified.

II. Instructions relevant to various drawings may be given along with appropriate demonstrations before assigning drawing practice to the students.

COURSE CONTENTS

Unit 1: Introduction to Engineering Drawing - (2 Sheets)15 Marks

- 1.1. Introduction to engineering drawing instruments and materials; standard drawing sheet layouts and sizes (ISO A-series); standard sizes of drawing boards
- 1.2. Convention of lines and their applications in the Engineering Drawing as per BIS specifications.
- 1.3. Practice of vertical, horizontal and inclined lines; geometrical figures such as triangles, rectangles, circles, ellipses and curves; hexagon and pentagon with the help of drawing instruments.
- 1.4. Freehand and instrumental lettering (alphabets and numerals) – free hand lettering (5, 8 and 12 mm); instrumental lettering of upper-case Gothic, single stroke, vertical with height 25 to 35 mm and in the ratio of 7:4

Unit 2: Dimensioning Techniques - (1 Sheet).....10 Marks

- 2.1. Necessity and principles of dimensioning; dimensioning techniques: elements of dimensioning; dimensioning methods and arrangement of dimensions in accordance with BIS standards.
- 2.2. Dimensioning of: Overall sizes, Circles, Chamfered surfaces, Angles, Tapered surfaces, Holes equally spaced on P.C.D.

Unit 3: Scales - (2 Sheets)10 Marks

- 3.1. Engineering Scales – their need and importance; types of scales; definition of R.F. and length of scale.
- 3.2. Concept, applications, and construction of plain and diagonal scales.

Unit 4: Orthographic Projections - (3 Sheets)20 Marks

- 4.1. Theory of orthographic projections: concept and applications.
- 4.2. Projection of points in different quadrants.
- 4.3. Projection of straight lines (1st and 3rd angle): Line parallel or perpendicular to reference planes. (theoretical concept only and be excluded from assessment)
- 4.4. Three views of orthographic projection of objects (minimum one sheet in 3rd angle).

Unit 5: Sectioning - (2 Sheets)20 Marks

- 5.1. Sectioning: Conventional representation of materials; breaks for shafts, pipes, rectangular, square, angle, channel and rolled sections.
- 5.2. Orthographic sectional views: Full, and Half; Introduction to Partial/Broken-out, Removed sections.

Unit 6: Isometric Views - (1 Sheet).....15 Marks

- 6.1. Fundamentals of isometric projections and isometric scale (theory).
- 6.2. Isometric views of combinations of regular solids: cylinder, cone, cube, prism.

Unit 7: Common Signs, Symbols & Conventions - (1 Sheet).....10 Marks

7.1. Importance of engineering symbols, conventions, and their applications.

7.2. Freehand sketching of standard Civil, Electrical, and Mechanical engineering symbols and conventions.

SUGGESTED DISTRIBUTION OF MARKS

Unit	Nos. of Sheets	Time (Hours)	Marks Allotted
Unit 1: Introduction to Engineering Drawing	2	14	15
Unit 2: Dimensioning Techniques.	1	08	10
Unit 3: Scales.	2	14	10
Unit 4: Orthographic Projections.	3	18	20
Unit 5: Sectioning.	2	16	20
Unit 6: Isometric Views	1	12	15
Unit 7: Common Signs, Symbols & Conventions.	1	08	10
TOTAL	12	90	100

Note : For proper and smooth execution of Engineering Drawing work, there should be sufficient drawing tables - if possible, with attached drafter arrangement - and necessary tools and equipment available in the drawing hall.

The suggested specifications of drawing-related furniture are as follows:

Sr. No.	Name of the Tool/ Equipment	Quantity
1.	Drawing Table with attached Drafter arrangement: L (81 cm) × W (60 cm) × H (100 cm) Table Tilt Angle: 20° to 40°)	As per requirement
2.	Drawing Table: L (245 cm) × W (60 cm) × H (76 cm)	As per requirement
3.	Stool	As per requirement

REFERENCE BOOKS

1. Engineering Drawing, P. S. Gill - S. K. Kataria & Sons, New Delhi.
2. Elementary Engineering Drawing in First Angle Projection, N. D. Bhatt - Charotar Publishing House Pvt. Ltd., Anand.
3. A Text Book of Engineering Drawing, Surjit Singh - Dhanpat Rai & Co., Delhi.
4. Engineering Drawing, R. B. Gupta - Satya Prakashan, New Delhi.
5. Engineering Graphics, Sharad K. Pradhan and K.K Jain - Khanna Book Publishing Co., New Delhi.
6. Engineering Drawing Practice for Schools and Colleges (SP 46:2003 – Bureau of Indian Standards, Government of India, New Delhi

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Course Code	:	ES105
Course Title	:	Engineering Workshops – I
Number of Credits (Teaching Load)	:	3 (L:0, T:0, P:6)†
Prerequisites	:	-
Course Category	:	ES
Common to Programmes	:	All engineering diploma programmes

† Cumulative credits and teaching load for all shops under Engineering Workshops - I.

COURSE LEARNING OBJECTIVES

In order to have a balanced overall development of diploma engineers, it is necessary to integrate theory with practice. Engineering Workshops-I is included in the curriculum in order to provide hands-on experience about use of different tools and basic manufacturing practices. This subject aims at developing general manual and machining skills in the students. In addition, the development of dignity of labour, safety at work place, team working and development of right attitude are the other objectives. Three mandatory shops - *Fitting Workshop*, *Electrical Workshop* and *Carpentry Workshop* - are included in this course.

COURSE OUTCOMES

After completing this course, students will be able to:

Course Outcome	Bloom's Level
CO 1. Identify and explain workshop safety practices, PPE, and the basic tools and materials used in fitting, electrical, and carpentry workshops.	L2
CO 2. Demonstrate the safe and accurate use of measuring, marking, holding, cutting, and hand tools for basic workshop operations.	L2
CO 3. Perform basic fitting operations, including hacksawing, filing, drilling, reaming, tapping, and dieing, to produce simple fitting jobs as per given specifications.	L3
CO 4. Construct and test basic electrical circuits using appropriate measuring instruments, perform domestic wiring practices, and analyse simple electrical faults.	L4
CO 5. Prepare basic carpentry jobs and joints using appropriate tools and techniques, and evaluate the quality, accuracy, and finish of the fabricated workpiece.	L5

OUTCOME MAPPING MATRIX							
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7
CO-1	3	1	-	2	3	1	2
CO-2	3	2	2	3	2	1	2
CO-3	3	3	3	3	2	2	2
CO-4	3	3	2	3	3	2	2
CO-5	3	2	3	3	3	2	3

COURSE CONTENTS

Shop 1. Fitting Workshop

- 1.1. Safety Precautions of fitting shop and use of personal protective equipment (PPE), demonstration of tools, equipment, sample jobs, Best practices in the concerned shop.
- 1.2. Introduction and Function of holding/ clamping devices, hand tools and cutting tools.
- 1.3. Practical applications of fitting.
- 1.4. Introduction, function and types of marking and measuring tools and instruments (surface plate, try square, caliper, steel rule, scribe and Vernier caliper, Micrometer)
- 1.5. Identification of materials. (Iron, Copper, Stainless Steel, Aluminum etc.) and identification of various steel sections (flat, angle, channel, bar etc.).
- 1.6. Introduction to various types of threads (internal and external)
- 1.7. Description and demonstration of various types of tools in tapping & dieing process like drills, taps and dies.
- 1.8. Handling of measuring instruments. Use of dial gauges and feeler gauges, file and make angle, surfaces (Bevel gauge accuracy 1 degree) make simple open and sliding fits, inside square fit, make combined open and sliding fit, straight sides
- 1.9. Introduction to various types of threads (internal and external) - single start, multi-start, left-hand and right-hand threads.
- 1.10. Description and demonstration of various types of drills, taps and dies. Selection of dies for threading, selection of drills, taps and reamers for tapping operations.
- 1.11. Precautions while drilling soft metals, e.g. copper, brass, aluminum etc.

JOBS TO BE PREPARED

- Job I : To fit hacksaw blade in its frame and perform hacksawing operation by using marking tool and straight hacksawing practice on MS workpiece (50 × 50 × 6 mm). (at least three cuts of length 25mm)
- Job II : To perform filing on MS workpiece (50 × 50 × 6 mm) for giving it a perfect square shape within accuracy of ±1mm.
- Job III : To perform drilling, reaming and tapping operation on Mild Steel Flat on Job-II.
- Job IV : Make external thread on MS round and assemble it on Job-III.
- Job V : Radius form filing of different radius on any two corners of Job-II.
- Job VI : To make assembly of V shape fit within Bevel gauge accuracy ±1°.
- Job VII : Making external thread on a pipe by using die and make a GI pipe connection using nipple and socket.

Shop 2. Electrical Workshop

- 2.1. Safety Precautions of concerned shop and use of personal protective equipment (PPE), demonstration of tools, equipment, sample jobs, best practices in the concerned shop.
- 2.2. Demonstration and identification of common electrical materials with standard ratings and specifications such as wires, cables, switches, MCB & ELCB, fuses, cleats, clamps and allied items, tools and accessories.
- 2.3. Identification of phase, Neutral and Earth wires for connection to domestic electrical appliances and their connections to three pin plugs. Difference between series and parallel wiring.
- 2.4. Introduction to single phase and three phase supply and wiring system. Importance of three phase supply (RYB) and its sequence and wiring system. Estimating and costing of power consumption.

JOBS TO BE PREPARED

- Job I : Use of Multimeter, test lamp and line tester to check voltage, continuity, open/short and polarity in simple lamp and socket circuits. Read out current, voltage and electrical power at different loads using various measuring devices of different ranges.
- Job II : Connecting single phase energy meter with supply and load and working out power consumption and cost of energy.
- Job III : Measure total voltage and total capacity/current of batteries by connecting two or three batteries in series and parallel. Test the battery with hydrometer and cell tester.
- Job IV : Assemble and internally wire a single-phase main DB with main switch/ MCB, bus-bars and at least five outgoing lighting/fan circuits with appropriate protection.
- Job V : Carrying out house wiring circuits using fuse, switches, sockets, ceiling rose etc. in batten or P.V.C. casing-capping. Demo of conduit wiring through junctions.
- Job VI : Studying internal wiring diagram, dismantle, diagnose fault, servicing and reassembling of common domestic electrical appliances like ceiling fan, auto electric iron, air cooler etc.
- Job VII : Connection of single phase and three phase motors by using starter. Reversing direction of rotation of single-phase motors.

Shop 3. Carpentry Workshop

- 3.1. Safety Precautions of concerned shop and use of personal protective equipment (PPE), demonstration of tools, equipment, sample jobs, Best practices in the concerned shop.
- 3.2. Introduction and industrial applications of carpentry jobs.
 - 3.2.1. Name and use of raw materials used in carpentry shop: wood & alternative Materials (board, plywood)

- 3.2.2. Introduction to wood, timber and their identification, shapes and specifications, their properties, applications & defects. Study of the joints in roofs, doors, windows and furniture, seasoning of wood
- 3.2.3. Names, uses, and types of hand tools such as Saws, C-Clamp, Chisels, Mallets, Carpenter's vices, Marking gauges, Try-squares, Rulers and other commonly used tools and materials used in carpentry shop by segregating as cutting tools, supporting tools, holding tools, measuring tools etc.
- 3.2.4. Specification of iron jack plane used in carpentry shop.

3.3. Practice

- 3.3.1. Practices for Basic Carpentry Work
- 3.3.2. Sawing practice using different types of saws
- 3.3.3. Assembling jack plane — planning practice including sharpening and blade adjustment of jack plane cutter.
- 3.3.4. Chiseling practice using different types of chisels including sharpening of chisel.
- 3.3.5. Making of different types of wooden pin and fixing methods. Marking, measuring and inspection of jobs.
- 3.3.6. Housekeeping practices and instructions. Introduction to joints, their relative advantages and uses.

JOBS TO BE PREPARED

- Job I : Prepare a rectangular wooden block involving operations like Marking, sawing practice, planning to size, chiseling. (at least two cuts of 70 mm).
- Job II : To prepare a Half Lap Joint (cross, L or T – any one).
- Job III : To prepare a Mortise and Tenon joint (T-Joint).
- Job IV : To prepare a Dove tail Joint (Half lap dovetail joint).
- Job V : To prepare a mitre joint.
- Job VI : To prepare a lengthening joint (scarf, dovetail scarf, tabled scarf - any one).
- Job VII : Painting/ Polishing practice on any one of above job.

IMPLEMENTATION GUIDELINES

- i. *Each workshop is to be assigned equal 30 training hours in the semester.*
- ii. *Students must strictly adhere to the designated workshop dress code during all sessions.*
- iii. *Wearing shoes is compulsory for entry and operations within the workshops.*
- iv. *Instructors must instill, and students must practice, the core principles of occupational safety, workplace cleanliness, and the proper upkeep of tools and equipment.*
- v. *Students must prepare sketches of various tools/ jobs in their practical notebook.*

- vi. *Final marks of the course Engineering Workshops - I are to be calculated as per the evaluation scheme by giving equal weightage to all shops included in the course.*
- vii. *Internal assessment for individual workshop is to be calculated out of 50 marks as per criteria mentioned in the “General Guidelines” section.*
- viii. *The final internal assessment score for the course shall be calculated as the mathematical average of the marks obtained across all individual shops.*
- ix. *Students should preferably perform the jobs individually or in a group of not exceeding three students.*

REFERENCE BOOKS AND WEB RESOURCES

1. Workshop Technology - Vol. I, II & III, S.K. Hajra, Choudhary and A.K. Choudhary - Media Promoters and Publishers Pvt. Ltd.
2. Workshop Technology - Vol. I, II & III, Manchanda - India Publishing House, Jalandhar.
3. Workshop Training Manual - Vol. I & II, S.S. Ubhi - Katson Publishers, Ludhiana.
4. Manual on Workshop Practice, K. Venkata Redd - MacMillan India Ltd., New Delhi.
5. Basic Workshop Practice Manual - Vikas Publishing House (P) Ltd., New Delhi.

STANDARD LIST OF TOOLS AND EQUIPMENT

FITTING WORKSHOP

Sr. No.	Name of the Tool/ Equipment	Quantity	Sr. No.	Name of the Tool/ Equipment	Quantity
1.	Steel Rule, Size : 300mm	12 Nos.	27.	Dot Punch	6 Nos.
2.	Scriber	12 Nos.	28.	Center Punch	3 Nos.
3.	Hacksaw Frame, Size 12 inch	12 Nos.	29.	Number Punch	3 Nos.
4.	Try Square, 6 inch	12 Nos.	30.	Letter Punch	3 Nos.
5.	Heavy Duty Bench Vice, Jaw : 6 inch	12 Nos.	31.	Ball Peen Hammer, 150 g	4 Nos.
6.	Work Bench	3 Nos.	32.	Cross Peen Hammer, 150 g	4 Nos.
7.	Pipe vice, Size: 2 or 3 inch	2 Nos.	33.	Straight Peen Hammer, 150g	4 Nos.
8.	Flat file, Curved cut, 12 inch	2 Nos.	34.	Flat Chisel, 1 inch	2 Nos.
9.	Flat file, Rough, Single cut, 12 inch	2 Nos.	35.	Bench Drill Machine, 1/2 inch	1 No.
10.	Flat file, Bastard, Single cut, 12 inch	2 Nos.	36.	Portable Drill Machine, 1/2 inch	1 No.
11.	Flat file, Rough, Double cut, 12 inch	8 Nos.	37.	Drill Bit 4 to 10mm	2 each
12.	Flat file, Rough, 6 inch	2 Nos.	38.	Tap Set 4 to 12 mm	2 set
13.	Flat file, Smooth, Single cut 12 inch	2 Nos.	39.	Die Set 4 to 12 mm	2 set
14.	Flat file, Smooth, Double Cut 12 inch	8 Nos.	40.	Tap Wrench	4 Nos.
15.	Flat file, Dead Smooth, Double Cut 12 inch	2 Nos.	41.	Pipe Wrench 12,14,18 inch	1 each
16.	Flat file, Smooth, Double Cut 6 inch	2 Nos.	42.	File Brush	12 Nos.
17.	Triangular file, 8 inch	2 Nos.	43.	Bench Grinder, Wheel size : 6 inch	1 No.
18.	Square file, 12 inch	2 Nos.	44.	Anvil, 50 kg with stand	1 No.
19.	Round file, 12 inch	2 Nos.	45.	Open End Spanner Set, 6 to 32 mm	1 No.
20.	Half round file, 12 inch	2 Nos.	46.	Ring End Spanner Set, 6 to 32 mm	1 No.
21.	Surface Plate with Stand	2 Nos.	47.	Allen Key Set	1 No.
22.	Vernier Height Gauge	1 No.	48.	Screw Driver Kit	1 No.
23.	Micrometer, 0-25mm, L.C. 0.01mm	1 No.	49.	Bevel Gauge, Accuracy 1°	8 Nos.
24.	Micrometer, 25-50mm, L.C. 0.01mm	1 No.	50.	Pipe Die Set ½ inch, ¾ inch, 1 inch	2 each
25.	Vernier Calliper, 0-300mm, L.C. 0.02mm	2 Nos.	51.	Steel Almirah, Size: 1980mm(H) x 900mm(W) x 480mm(D)	2 Nos.
26.	Magnetic V-Block	2 Nos.	52.	Job Rack	2 Nos.

STANDARD LIST OF TOOLS AND EQUIPMENT

ELECTRICAL WORKSHOP

Sr. No.	Name of the Tool/ Equipment	Quantity	Sr. No.	Name of the Tool/ Equipment	Quantity
1.	Combination Plier, 8 inch	6 Nos.	26.	Flat File, Smooth, 12 inch	3 Nos.
2.	Long Nose Plier, 8 inch	4 Nos.	27.	Flat File, Rough, 12 inch	3 Nos.
3.	Poker	4 Nos.	28.	Triangular File, 100 mm	3 Nos.
4.	Side Cutting Plier	4 Nos.	29.	Ball Peen Hammer, 150 g	2 Nos.
5.	Wire Cutter or Stripper	12 Nos.	30.	Cross Peen Hammer, 150 g	2 Nos.
6.	Test Pen/ Neon Tester	12 Nos.	31.	Portable Hammer Drill Machine	1 No.
7.	Flat Head Screw Driver 4mm, 6 inch	4 Nos.	32.	Cordless Impact Drill Machine Driver	1 No.
8.	Flat Head Screw Driver 6mm, 6 inch	4 Nos.	33.	Open End Spanner Set 6 to 32 mm	1 No.
9.	Flat Head Screw Driver 8mm, 6 inch	4 Nos.	34.	Ring End Spanner Set 6 to 32 mm	1 No.
10.	Flat Head Screw Driver, 10 inch	3 Nos.	35.	Soldering Iron	2 Nos.
11.	Reversible Screw Driver, 8 inch	2 Nos.	36.	Ammeter, 0-30 A	2 Nos.
12.	Screw Driver Kit, 6 pcs	2 Nos.	37.	Voltmeter, 0-500V	2 Nos.
13.	Precision Screw Driver Set	1 No.	38.	Wattmeter, 0-1000W	2 Nos.
14.	Electrical Toolkit	1 No.	39.	Single-phase Energy meter	1 No.
15.	Philips Head Screw Driver 6mm, 8 inch	2 Nos.	40.	Electric Motor (Single phase, Three phase)	2 Each
16.	Electrician Knife	2 Nos.	41.	Clamp on Meter	1 No.
17.	Steel Spring Wire, 5 mtr	1 No.	42.	Tachometer	1 No.
18.	Wire Gauge	3 Nos.	43.	Hand Gloves	10 Pair
19.	Try square, 150mm	4 Nos.	44.	Allen Key Set	1 No.
20.	Steel Rule, 300 mm	2 Nos.	45.	Battery	3 Nos.
21.	Measuring Tape, 3 mtr	2 Nos.	46.	Hydrometer	2 Nos.
22.	Hacksaw Frame with Blade	6 Nos.	47.	Multimeter	2 Nos.
23.	Work Bench	3 Nos.	48.	Job Rack	2 Nos.
24.	Bench Vice, 150mm	2 Nos.	49.	Steel Almirah, Size: 1980mm(H) x 900mm(W) x 480mm(D)	2 Nos.
25.	Firmer Chiesel	6 Nos.			

STANDARD LIST OF TOOLS AND EQUIPMENT

CARPENTRY WORKSHOP

Sr. No.	Name of the Tool/ Equipment	Quantity	Sr. No.	Name of the Tool/ Equipment	Quantity
1.	Steel Rule, 300mm	12 Nos.	29.	Ball Peen Hammer, 150 g	2 Nos.
2.	Scriber, 150mm	12 Nos.	30.	Cross Peen Hammer, 150 g	2 Nos.
3.	Marking Knife	2 Nos.	31.	Mallet	10 Nos.
4.	Measuring Steel Tape, 3 mtr	3 Nos.	32.	Bench Vice, 200mm	12 Nos.
5.	Measuring Steel Tape, 5 mtr	2 Nos.	33.	T-bar Clamp, 1200 mm	1 No.
6.	Trammel, 450 mm	1 No.	34.	G-Clamp, 100 mm	2 Nos.
7.	Marking Gauge	6 Nos.	35.	Gimlet, 450mm	2 Nos.
8.	Mortise Gauge	6 Nos.	36.	Hand Drill Machine	2 Nos.
9.	Try Square, 150 mm	6 Nos.	37.	Rasp Cut File, 300 mm	10 Nos.
10.	Try Square, 300 mm	6 Nos.	38.	Triangular File, 100 mm	6 Nos.
11.	Bevel Square, 200mm	6 Nos.	39.	Oil Stone, 150 mm	6 Nos.
12.	Rip Saw, 450 mm	6 Nos.	40.	Saw Set Plier	2 Nos.
13.	Panel Saw, 300 mm	6 Nos.	41.	Angle Grinder Machine, Wheel Size 150 mm	1 No.
14.	Tenon Saw, 300 mm	6 Nos.	42.	Spray Painting Machine	1 No.
15.	Jack Plane, 225-250 mm	6 Nos.	43.	Chain Mortise Machine, 2 HP	1 No.
16.	Jack Plane, 350 mm	6 Nos.	44.	Universal Multi Wood Working Machine	1 No.
17.	Trying Plane, 450 mm	2 Nos.	45.	Cordless Drill Machine, 12mm	1 No.
18.	Grooving Plane, 150 mm	2 Nos.	46.	Claw Hammer, 200g	2 Nos.
19.	Firmer Chisel, 6 mm	4 Nos.	47.	Portable Electric Planner	1 No.
20.	Firmer Chisel, 12mm	4 Nos.	48.	Work Bench	3 Nos.
21.	Firmer Chisel, 18mm	4 Nos.	49.	Inside Calliper, 150 mm Spring	2 Nos.
22.	Firmer Chisel, 25mm	6 Nos.	50.	Outside Callper, 150 mm Spring	2 Nos.
23.	Bevel Edge Firmer Chisel, 18 mm	2 Nos.	51.	Open End Spanner Set, 6 to 32 mm	1 No.
24.	Bevel Edge Firmer Chisel, 25 mm	2 Nos.	52.	Ring End Spanner Set, 6 to 32 mm	1 No.
25.	Mortise Chisel, 6 mm	6 Nos.	53.	Allen Key set	1 No.
26.	Mortise Chisel, 12 mm	6 Nos.	54.	Screw Driver kit	1 No.
27.	Mortise Chisel, 18 mm	2 Nos.	55.	Job Rack	2 Nos.
28.	Portable Circular Saw Machine, Blade Size 150mm	1 No.	56.	Steel Almirah, Size: 1980mm(H) x 900mm(W) x 480mm(D)	2 Nos.

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Course Code	:	AU101
Course Title	:	Sports and Yoga
Number of Credits (Teaching Load)	:	0 (L:0, T:0, P:2)
Prerequisites	:	-
Common to Programmes	:	Across all semesters in all programmes
Course Category	:	AU

COURSE LEARNING OBJECTIVES

This course aims to promote physical fitness, mental well-being, teamwork, discipline, and healthy lifestyle practices among students through regular participation in sports and yoga activities. The course develops physical endurance, flexibility, coordination, stress management, and sportsmanship while encouraging lifelong participation in physical activities.

COURSE OUTCOMES

This course will enable the students to:

Course Outcome	Bloom's Level
CO 1. Participate in physical fitness activities to improve strength, flexibility, endurance, coordination, and overall physical fitness.	L3
CO 2. Demonstrate yoga practices, including selected asanas, pranayama, and relaxation techniques, for physical and mental well-being.	L3
CO 3. Participate in individual and team sports by following the rules of the game, discipline, teamwork, and sportsmanship for lifelong healthy living.	L3

COURSE CONTENTS

Module 1: Physical Fitness

This module emphasizes the development of physical fitness through activities such as warm-up, stretching, flexibility, endurance, strength exercises, cool-down.

Module 2: Yoga

The module on yoga may include loosening exercises, Surya Namaskar, Asanas (standing, sitting, prone and supine), Pranayama, Meditation, relaxation techniques.

Module 3: Sports Activities

Students may participate in games such as Volleyball, Basketball, Badminton, Table Tennis, Athletics, Kabaddi, Kho-Kho.

GUIDELINES

- The course shall ordinarily be conducted in two sessions of one hour each per week.
- The Sports and Yoga activities shall be conducted under the supervision of qualified Physical Education Teachers, Yoga Instructors, or other competent trainers to ensure safe and effective participation by students.

- During yoga sessions, trained student volunteers may assist the instructor by demonstrating yoga postures. All activities shall be performed under the supervision of the instructor to ensure correct technique and safe practices.
- Each institution shall organize at least two expert sessions during the semester, preferably by accomplished sportspersons, yoga practitioners, fitness experts, nutritionists, or healthcare professionals, on topics such as advanced yoga practices, nutrition, sports injuries, mental health, stress management, and healthy lifestyle practices.
- To maximize effectiveness, yoga sessions should preferably be scheduled during the first hour of the academic day, while sports and physical activities should preferably be conducted during the last hour of the academic day, subject to institutional timetable and local conditions.
- Students shall participate in one or more individual or team sports based on their interests and the facilities available in the institution. Institutions may select appropriate sports and physical activities according to the available infrastructure and resources.
- The course shall be evaluated through continuous assessment based on attendance, active participation, discipline, teamwork, sportsmanship, and demonstrated improvement in physical fitness and yoga practices. No end-semester theory examination shall be conducted. Participation and achievements in Inter-Polytechnic Sports/Athletic Meets may be given appropriate weightage in the continuous assessment. The final result shall be reported as "Satisfactory (S)" or "Unsatisfactory (U)."

Note: *Students who are medically unfit or temporarily unable to participate in physical activities shall be assigned suitable alternative activities, such as yoga, wellness awareness, officiating, event management, or other activities as decided by the institution.*

SUGGESTED DISTRIBUTION OF MARKS FOR INTERNAL ASSESSMENT

Parameter	Marks Allotted
Attendance and Participation	10
Physical Fitness Practice	10
Yoga Practice	15
Sportsmanship, Discipline and Teamwork	10
Participation in Institutional Sports Activities/ Inter-Polytechnic Competitions	5
TOTAL	50

REFERENCE BOOKS AND SUGGESTED LEARNING RESOURCES

1. Light on Yoga, B.K.S. Iyengar, Harper Collins.
2. The Complete Book of Yoga, Swami Vivekananda Yoga Prakashana.
3. Physical Education and Sports, V.K. Sharma, Friends Publications.
4. Yoga: A Healthy Way of Living, Ministry of AYUSH, Government of India.
5. Fitness and Wellness, Werner W.K. Hoeger and Sharon A. Hoeger, Cengage Learning.

Course Code	:	AU103
Course Title	:	Students Centered Activities
Number of Credits (Teaching Load)	:	0 (L:0, T:0, P:3)
Common to Programmes	:	Across all semesters in all programmes
Course Category	:	AU

COURSE LEARNING OBJECTIVES

The Student-Centric Activities (SCA) course aims to promote the holistic development of students through experiential learning, self-development, creative expression, community engagement, and professional growth. The course seeks to develop leadership, teamwork, communication, ethical values, social responsibility, creativity, innovation, and appreciation for arts and culture by encouraging active participation in different activities.

COURSE OUTCOMES

This course will enable the students to:

Course Outcome	Bloom's Level
CO 1. Participate in professional, academic, cultural, social, and innovation activities for holistic development.	L3
CO 2. Demonstrate leadership, teamwork, communication, creativity, and ethical behaviour while working individually and in teams.	L3
CO 3. Organize and contribute to student-centric activities that promote experiential learning, community engagement, and professional growth.	L3

COURSE CONTENTS

The Student-Centric Activities (SCA) shall focus on the following aspects of the holistic development of students:

1. Professional and Academic Development

The activities include participation in extension lectures, seminars, workshops, technical paper and poster presentations, technical quizzes, educational and industrial visits, technical exhibitions

2. Personality Development and Communication

The activities include participation in group discussions, debates, declamation, public speaking, leadership development programmes, communication skill activities, literary activities, and other personality development programmes

3. Cultural, Creative and Literary Activities

The activities include participation in cultural programmes, music, dance, drama, fine arts, painting, sketching, photography, creative writing, poetry, storytelling, poster making, rangoli, collage, model making, literary festivals, and cultural festivals. Students may also be encouraged to form and participate in hobby clubs such as Photography Club, Music Club, Literary Club, Fine Arts Club, Nature Club, Craft Club, and Model Making Club

4. Social Responsibility, Community Engagement and Innovation

The activities include participation in community service programmes, environmental awareness campaigns, health and social awareness programmes, Swachhata and plantation drives, blood donation awareness campaigns, Institution's Innovation Council (IIC) activities, innovation challenges, and other innovation-related activities.

GUIDELINES

- The Student-Centric Activities shall be coordinated by a designated faculty coordinator.
- Students shall have the freedom to participate in activities of their choice from the different modules of the course, based on their interests, aptitude, and talents. The institution shall provide adequate opportunities for participation in a variety of activities.
- Every student shall be encouraged to participate in SCA throughout the semester. Institutions shall ensure equal opportunities for participation without discrimination.
- Institutions are encouraged to establish Technical Councils, Hobby Clubs, Literary Clubs, Cultural Clubs, Innovation Clubs, and other student bodies to facilitate the effective implementation of Student-Centric Activities. Student-led planning and execution of activities should be encouraged under faculty mentorship.
- Institutions should organize extension lectures, workshops, seminars, interaction sessions, and motivational talks by academicians, industry experts, innovators, alumni, artists, sportspersons, and other distinguished personalities.
- Educational visits, industrial visits, field visits, exhibitions, community outreach programmes, innovation activities, and similar experiential learning opportunities should form an integral part of the course.
- The course shall be evaluated through continuous assessment based on the criteria mentioned below. The final result shall be reported as "Satisfactory (S)" or "Unsatisfactory (U)."

Note: *Students who are unable to participate in specific activities due to medical or other valid reasons shall be assigned suitable alternative activities to achieve the intended learning outcomes.*

SUGGESTED DISTRIBUTION OF MARKS FOR INTERNAL ASSESSMENT

Parameter	Marks Allotted
Attendance & Punctuality	10
Initiative and Enthusiasm	10
Teamwork, Leadership and Discipline	10
Performance in Activities	15
Achievements (Institutional/ Inter-Polytechnic Competitions)	5
TOTAL	50

Course Code	:	AU105
Course Title	:	Student Induction Program
Number of Credits (Teaching Load)	:	0 (02 Weeks)
Common to Programmes	:	Across all in all programmes
Prerequisite	:	Newly admitted students
Course Category	:	AU

COURSE LEARNING OBJECTIVES

By the end of the induction programme, students will understand the institute's structure, rules and academic expectations; demonstrate ethics, discipline, respect and professional behaviour; and improve communication, listening, teamwork and self-presentation. They will also align personal strengths and career goals with industry expectations to support ongoing professional growth.

COURSE OUTCOMES

After successful completion of the SIP, students will be able to:

Course Outcome	Bloom's Level
CO 1. Describe institutional policies, academic structure, and fundamental concepts of core subjects.	L2
CO 2. Explain and demonstrate ethical behaviour, discipline, respect, and professional values.	L2
CO 3. Apply communication, teamwork, and self-presentation skills effectively in academic and professional contexts.	L3
CO 4. Evaluate personal strengths and career goals in alignment with industry expectations.	L5
CO 5. Participate actively in academic and co-curricular activities for holistic professional development.	L3

SCHEDULE OF STUDENTS' INDUCTION PROGRAM

WEEK - 1		
ACTIVITY		RESPONSIBILITY/ FACILITATOR
1.	Inaugural Function	▪ Principal ▪ HODs ▪ Faculty
2.	Institutional Orientation & Campus Tour - Classrooms, Labs, Library Facilities, Main Office and Hostels	▪ Class In-charges ▪ Lab In-charges ▪ Librarian ▪ Hostel Wardens ▪ Hostel Superintendents ▪ Workshop Instructors

3.	Rules & Regulations - System of Sessional Marks, Students' Mentoring System	- Academics In-charge - HODs
4.	UHV Sessions, Drug Abuse, Gender Sensitization	- Faculty Coordinator - Counsellor
5.	Scholarship Schemes, Swayam Registration, Digi-Locker, Online Anti-Ragging Undertaking	Concerned Faculty
6.	Awareness and Importance of Mental Health	Concerned Expert
7.	Yoga and Meditation	Yoga/ Concerned Expert
8.	Entrepreneurship Awareness and Start up	Prominent Entrepreneur
9.	Painting/ Singing/ Dancing/ Poetry Recitation-Competition	Cultural In-charge
10.	Anti-Ragging Provisions	- Concerned Faculty - Police Officials

WEEK - 2

ACTIVITY		RESPONSIBILITY
1.	Fundamentals of Core Branch	Concerned HOD
2.	English Proficiency	English Faculty
3.	Fundamentals of Maths	Lecturer Maths
4.	Fundamentals of Physics	Lecturer Physics
5.	Fundamentals of Chemistry	Lecturer Chemistry
6.	Workshop Fundamentals	Workshop Suptdt.
7.	Alumni interaction	Coordinator Alumni Cell
8.	Visit to Local industry	- Faculty - Workshop Instructors
9.	Sports & Games	Sports Faculty
10.	Feedback & Valedictory Session	- Principal - HODs - All Faculty (1st Year)

Note: - HOD/ a senior faculty shall be the overall coordinator of the students' induction program.

- The final evaluation will be awarded only in two grades, namely **Satisfactory** and **Unsatisfactory**, on the basis of overall performance during the program.

ASSESSMENT RUBRICS

Criteria	Satisfactory	Unsatisfactory
1. Attendance	75% and Above	Less than 75%
2. Participation	Active Participation	Passive Participation
3. Discipline	Follow Rules	Flout Rules
4. Communication	Active Communication	Poor Communication
5. Reflection on Learning	Gives Feedback	No Feedback

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DETAILED CONTENT
Second Semester (Group – A)

Course Code	:	BS102
Course Title	:	Applied Mathematics - II
Number of Credits (Teaching Load)	:	4 (L:3, T:1, P:0)
Prerequisites	:	-
Course Category	:	BS

COURSE LEARNING OBJECTIVES

This course is designed to give a comprehensive coverage at an introductory level to the subject of matrices, integral calculus, coordinate geometry and first order differential equations.

COURSE OUTCOMES

After completing this course, the students will be able to:

Course Outcome	Bloom's Level
CO 1. Apply the concepts of determinants and matrices, perform matrix operations, and solve systems of simultaneous linear equations using determinants and matrix methods.	L3
CO 2. Apply appropriate techniques of integration including substitution, integration by parts, and partial fractions to evaluate standard integrals.	L3
CO 3. Analyze and solve engineering problems involving definite integrals for finding areas bounded by curves and volumes of solids of revolution.	L4
CO 4. Apply principles of coordinate geometry to determine equations of straight lines and circles, and solve related geometrical problems.	L3
CO 5. Apply the basic concepts of differential equations and solve first-order, first-degree differential equations using the variable separable method.	L3

OUTCOME MAPPING MATRIX							
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7
CO-1	3	3	1	-	-	-	-
CO-2	3	2	1	-	-	-	-
CO-3	2	3	2	1	-	-	-
CO-4	3	2	1	-	-	-	-
CO-5	3	3	1	-	-	-	-

COURSE CONTENTS

Unit 1: Determinants and Matrices.....30 Marks

Determinants of order one, two and three, evaluation of determinants up to third order by expansion, concept of minor and cofactor, solution of simultaneous linear equations in two and three variables using determinants (Cramer's Rule for up to three unknowns), definition of

matrix, order and elements of a matrix, equality of matrices, types of matrices including row matrix, column matrix, rectangular matrix, square matrix, zero matrix, diagonal matrix, scalar matrix, identity matrix and triangular matrices, transpose of a matrix and its properties, addition, subtraction and scalar multiplication of matrices up to third order, multiplication of matrices using row by column rule and conditions for multiplication, symmetric and skew-symmetric matrices, singular and non-singular matrices using determinant concept, inverse of a matrix up to third order, solution of simultaneous linear equations using matrix and inverse matrix methods.

Unit 2: Techniques of Integration20 Marks

Integration as inverse operation of differentiation. Simple integration by substitution, Standard Integrals of the type $\int \frac{1}{a^2-x^2} dx$, $\int \frac{1}{a^2+x^2} dx$, $\int \frac{1}{x^2-a^2} dx$, $\int \frac{1}{\sqrt{a^2-x^2}} dx$, $\int \frac{1}{\sqrt{a^2+x^2}} dx$, $\int \frac{1}{\sqrt{x^2-a^2}} dx$, $\int \frac{1}{a+b\sin x} dx$, $\int \frac{1}{a+b\cos x} dx$, and $\int \frac{1}{a\cos x+b\sin x+c} dx$. Integration by parts, Integration of the Integrals of the type $\int (\sqrt{a^2-x^2}) dx$, $\int (\sqrt{a^2+x^2}) dx$, $\int (\sqrt{x^2-a^2}) dx$ Integration by partial fractions (restricted to linear factors only).

Unit 3: Applications of Integration in Engineering20 Marks

Use of formulae $\int_0^{\pi/2} \sin^n x dx$, $\int_0^{\pi/2} \cos^n x dx$, and $\int_0^{\pi/2} \sin^m x \cos^n x dx$ for solving problems where m and n are positive integers.

Applications of integration for

- i.) Simple problem on evaluation of area bounded by a curve and axes.
- ii.) Calculation of Volume of a solid formed by revolution of an area (Circle & Ellipse) about X-axis.

Unit 4: Co-Ordinate Geometry20 Marks

Equation of a straight line in slope-intercept, point-slope, two-point and intercept forms, slope and intercept determination, condition for parallel and perpendicular lines, angle between two lines, perpendicular distance of a point from a line.

General equation of a circle and its characteristics, equation of a circle given center and radius, equation of a circle passing through three points, equation of a circle given coordinates of end points of a diameter, determination of radius and center from equation.

Unit 5: Differential Equations10 Marks

Order and Degree of a differential equation, Linear and Non-Linear Differential Equation, Solution of first order and first-degree differential equation by variable separable method (simple problems).

SUGGESTED DISTRIBUTION OF MARKS

Unit	Time (Hours)	Marks Allotted
Unit 1: Determinants and Matrices	15	30
Unit 2: Techniques of Integration	12	20
Unit 3: Applications of Integration in Engineering	12	20
Unit 4: Co-Ordinate Geometry	12	20
Unit-5: Differential Equations	9	10
TOTAL	60	100

REFERENCE BOOKS AND SUGGESTED LEARNING RESOURCES

1. Applied Mathematics - I & II for Diploma Courses, by R. D. Sharma, Dhanpat Rai Publications.
2. Mathematics for Class XI & XII, NCERT Publication, New Delhi.
3. Higher Engineering Mathematics, by B.S. Grewal, Khanna Publishers, New Delhi, Latest Edition.
4. Advanced Engineering Mathematics, by Reena Garg & Chandrika Prasad, Khanna Publishing House, New Delhi.

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Course Code	:	BS104
Course Title	:	Applied Physics - II
Number of Credits (Teaching Load)	:	3 (L:3, T:0, P:0)
Prerequisites	:	-
Course Category	:	BS
Companion Course	:	BS108

COURSE LEARNING OBJECTIVES

Applied Physics covers a comprehensive range of topics that explain the principles governing natural phenomena. The subject develops students' understanding through systematic observation, logical reasoning, and prediction of physical behavior. The course emphasizes the application of physical laws and analytical approaches in technical and engineering domains, thereby preparing students for practical and industrial applications.

COURSE OUTCOMES

After completing this course, the students will be able to:

Course Outcome	Bloom's Level
CO 1. Classify different types of waves and explain the characteristics of wave motion and simple harmonic motion.	L2
CO 2. Recall the principles of reflection, refraction, total internal reflection, and the basic concepts of lenses and microscopes.	L1
CO 3. Explain the principles of electrostatics, electric field, electric flux, electric potential, Gauss's law, and capacitance.	L2
CO 4. Classify materials based on their electrical and magnetic properties and explain their suitability for technical applications.	L2
CO 5. Apply the fundamental concepts of lasers and optical fibers in technological and engineering contexts.	L3

OUTCOME MAPPING MATRIX							
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7
CO-1	3	2	-	-	-	-	-
CO-2	3	1	-	-	-	-	-
CO-3	3	2	-	1	-	-	-
CO-4	3	2	1	1	-	-	-
CO-5	3	3	2	2	2	-	1

COURSE CONTENTS

Unit 1: Wave Motion and its Applications.....20 Marks

Waves: definition, types (mechanical and electromagnetic waves), Wave motion- transverse and longitudinal with examples, terms used in wave motion like displacement, amplitude, time period, frequency, wavelength, wave velocity; relationship among wave velocity, frequency and wavelength, Simple harmonic motion (SHM): definition, examples, expression for displacement, velocity and acceleration of a particle executing SHM.

Unit 2: Optics.....20 Marks

Reflection and refraction of light, laws of reflection and refraction, refractive index, Lenses: introduction, power of lens and its units (simple numerical problems), Total internal reflection, Critical angle, conditions for total internal reflection and its applications, Introduction to microscope, construction, working and magnifying power of simple microscope and astronomical telescope in normal adjustment.

Unit 3: Electrostatics20 Marks

Introduction to electrostatics, Coulomb's law of electrostatics, Electric field, Electric lines of force, Properties of electric lines of force, Electric flux, Gauss law in electrostatics, Electric Potential and Potential difference (Definition & Units), Capacitor, Capacitance and its units, Series and Parallel combination of capacitors (related numerical).

Unit 4: Electromagnetism & Classification of Materials20 Marks

Definition of energy level, energy bands (conduction band, valence band and forbidden energy gap), Types of materials on the basis of energy band (conductor, semiconductor, and insulator), Types of magnetic materials: diamagnetic, paramagnetic, and ferromagnetic materials with their properties, moving coil galvanometer: principle, construction and working, conversion of a galvanometer into ammeter and voltmeter.

Unit 5: Modern Physics20 Marks

Laser: introduction, absorption, spontaneous emission, stimulated emission, population inversion, He-Ne Laser, Engineering and medical applications of laser, Fiber optics: introduction to optical fibers (definition, principle and diametrical view of optical fiber), Fiber types (Step index, graded index), Applications of optical fiber.

SUGGESTED DISTRIBUTION OF MARKS

Unit	Time (Hours)	Marks Allotted
Unit 1: Wave motion and its applications	9	20
Unit 2: Optics	8	20
Unit 3: Electrostatics	10	20
Unit 4: Electromagnetism & Classification of Materials	8	20
Unit 5: Modern Physics	10	20
TOTAL	45	100

REFERENCE BOOKS AND SUGGESTED LEARNING RESOURCES

1. Text Book of Physics for Class XII (Part-I, Part-II) - N. C. E. R. T., Delhi.
2. Principles of Physics, David Halliday et al. - Wiley Publication.
3. A Text book of Optics, N. Subrahmanyam - S. Chand Publication.
4. Practical Physics, C. L. Arora – S. Chand Publication.

ONLINE RESOURCES

5. Swayam Portal - <https://swayam.gov.in>
6. <https://phet.colorado.edu/en/simulations/filter?subjects=physics&type=html,prototype>
7. <https://www.physicsclassroom.com/>
8. <http://www.hyperphysics.phy-astr.gsu.edu>

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Course Code	:	BS108
Course Title	:	Applied Physics -II (Lab)
Number of Credits (Teaching Load)	:	1 (L:0, T:0, P:2)
Prerequisites	:	-
Course Category	:	BS
Companion Course	:	BS104

COURSE LEARNING OBJECTIVES

The Applied Physics–II Laboratory course is designed to develop students understanding of fundamental principles of oscillations, optics, electrical measurements, optical fiber, and laser technology through hands-on experimentation. The course aims to familiarize students with laboratory practices and the proper handling of scientific instruments. It provides opportunities to perform experiments systematically, record and analyze observations accurately, and interpret experimental results using appropriate scientific methods.

COURSE OUTCOMES

After completing this course, students will be able to:

Course Outcome	Bloom's Level
CO 1. Determine the time period and frequency of a simple pendulum and the time period of a cantilever experimentally.	L3
CO 2. Explain principles of reflection, refraction, and image formation by a convex lens.	L2
CO 3. Interpret the observations obtained during galvanometer conversion and resistance measurement using the half-deflection method.	L2
CO 4. Explain the concept of numerical aperture in an optical fiber.	L2

OUTCOME MAPPING MATRIX							
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7
CO-1	3	2	1	3	-	-	1
CO-2	3	2	-	2	-	-	1
CO-3	2	3	-	3	-	-	1
CO-4	3	2	-	2	1	-	1

LIST OF EXPERIMENTS

Sr. No.	Experiment Objective
1.	Laboratory Safety Precautions: Familiarization with laboratory safety rules, safe handling of laboratory apparatus (such as resistors, rheostat, key, ammeter, voltmeter, galvanometer, convex lens, concave lens, laser, etc.), and their proper use.
2.	To find the time period and frequency of a simple pendulum.
3.	To determine and verify the time period of cantilever.
4.	To verify laws of reflection of light using a mirror.
5.	To verify laws of refraction using a glass slab.
6.	To find the focal length and magnifying power of a convex lens.
7.	To convert a galvanometer into an ammeter.
8.	To convert a galvanometer into a voltmeter of different ranges.
9.	To find the resistance of a galvanometer by half - deflection method.
10.	To measure the numerical aperture (NA) of an optical fiber.

STANDARD LIST OF TOOLS AND EQUIPMENT

Sr. No.	Name of the Tools/ Equipment	Quantity
1.	Cantilever with clamp (100 cm long)	5 Nos.
2.	Optical bench with accessories	5 Nos.
3.	Diode Laser	2 Nos.
4.	Screen with Millimeter Scale	4 Nos.
5.	Optical Fiber Kit	2 Nos.
6.	Simple Pendulum (with Stand, String and Bob)	5 Nos.
7.	Trainer Board to convert Galvanometer into Ammeter	4 Nos.
8.	Trainer Board to convert Galvanometer into Voltmeter	4 Nos.
9.	Apparatus to verify laws of reflection (assembled on a board with laser pointer source)	4 Nos.
10.	Apparatus to verify laws of refraction (assembled on a board with laser pointer source)	4 Nos.

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Course Code	:	BS106
Course Title	:	Applied Chemistry
Number of Credits (Teaching Load)	:	3 (L:3, T:0, P:0)
Prerequisites	:	-
Course Category	:	BS
Companion Course		BS110

COURSE LEARNING OBJECTIVES

This course provides students with the knowledge and skills to apply chemical principles in engineering and industrial processes to solve practical technological problems. It develops an understanding of engineering materials, including metals, alloys, polymers, and composites, focusing on their properties, selection, and industrial applications. Students learn corrosion mechanisms and protection methods to enhance component durability and reduce maintenance costs. The course also covers water quality analysis. Additionally, it introduces fuels, lubricants and energy resources, emphasizing efficient energy utilization, sustainability and environmentally responsible practices in modern engineering and industrial operations.

COURSE OUTCOMES

After completing this course, the students will be able to:

Course Outcome	Bloom's Level
CO 1. Explain the concepts of atomic structure, electronic configuration, chemical bonding and the properties of engineering materials based on chemical principles.	L2
CO 2. Interpret the characteristics of solutions, water quality, hardness and buffer solution for domestic and industrial applications.	L2
CO 3. Apply the principles of electrochemistry and electrolysis to industrial processes, corrosion and metallic prevention methods used in engineering.	L3
CO 4. Analyze metallurgical processes, engineering materials, alloys and polymer to relate their properties with engineering applications.	L4
CO 5. Evaluate the suitability of fuels and lubricants based on their properties and performance for economical and eco-friendly industrial applications.	L5

OUTCOME MAPPING MATRIX							
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7
CO-1	3	2	-	-	-	-	1
CO-2	3	3	-	2	1	-	1
CO-3	3	3	2	2	2	-	1
CO-4	3	3	2	-	2	-	2
CO-5	3	3	2	-	3	2	2

COURSE CONTENTS

Unit 1: Atomic Structure and Chemical Bonding20 Marks

Fundamental Particles of atoms: Electron, Proton, Neutron (definitions only), Bohr's Model of an atom (Postulates, Success and Limitation), atomic number, atomic mass number, isotopes, isobars and isotones, Concept of orbitals, difference between orbit and orbitals, shapes of *s* and *p* orbitals, quantum Numbers (Significance only), Aufbau's principle, Pauli's exclusion principles, Hund's rule of maximum multiplicity, electronic configuration of elements with atomic number (Z) 1 to 30 only, Chemical Bonding - cause of chemical bonding, Types of Bond: Ionic bond (NaCl), covalent bond (O₂, N₂, H₂), difference between sigma and pi (π) bond.

Unit 2: Solutions and Water.....20 Marks

Definition of Solution, Solute and Solvent with examples, Methods to express the concentration of solutions - Molarity, Molality and Normality (Numerical excluded), pH of solution, industrial applications of pH solution, Definition of buffer solution and industrial applications of buffer solution. Definition of Hard and soft water, Types of hardness, Units of hardness (mg/ltr and ppm), and simple numerical based on hardness, Disadvantages caused by use of hard water in domestic and industrial use, removal of hardness - permutit process, Characteristics of drinking water.

Unit 3: Electrochemistry and Corrosion.....20 Marks

Electronic concept of oxidation, reduction and Redox reaction, Definition of Electrolyte and non-electrolyte with suitable examples, Faradays law of Electrolysis and industrial application of electrolysis (Electrometallurgy, Electroplating, Electro-refining), Introduction to corrosion of metals - definition, Internal corrosion preventive measure (purification, alloying and heat treatment) and External corrosion preventive measure: Metal coating (anodic and cathodic).

Unit 4: Engineering Materials and Polymers20 Marks

Natural occurrence of metals- minerals, ores; ores of iron, aluminum and copper, Definition of Gangue, Flux, Metallurgy, Pyrometallurgy, Electrometallurgy & Hydrometallurgy, a brief account of general principles of metallurgy- Crushing, Grinding; Concentration of ore (Froth flotation process); Extraction of metal (Roasting, Calcination & Smelting), Refining (Electrorefining); Extraction of iron from their Haematite ore by using blast furnace in brief along with diagram, Alloys - definition, Ferrous and non-ferrous alloy, purpose of making alloy. Definition of Polymer, Monomer, Degree of Polymerization, name of monomer and simple reaction involved in preparation of Polythene, PVC, PTFE, PS and Nylon-6,6 only.

Unit 5: Chemistry of Fuels and Lubricants.....20 Marks

Definition of fuel, Classification of fuels, Characteristics of a good fuel, Calculation of HCV and LCV by using Dulong's formulas, Fuel rating (octane and cetane numbers), Chemical composition, Calorific value application and diagram of water gas, producer gas and biogas, Definition of Lubricants, Function of good lubricant, Physical properties (Viscosity, viscosity index, flash and fire point) and Chemical properties (TAN, Saponification value) of lubricants.

SUGGESTED DISTRIBUTION OF MARKS

Unit	Time (Hours)	Marks Allotted
Unit 1: Atomic Structure and Chemical Bonding	09	20
Unit 2: Solutions and Water	09	20
Unit 3: Electrochemistry and Corrosion	09	20
Unit 4: Engineering Materials and Polymer	09	20
Unit 5: Chemistry of Fuels and Lubricants	09	20
TOTAL	45	100

REFERENCE BOOKS AND SUGGESTED LEARNING RESOURCES

1. Text books of Chemistry for Class XI & XII (Part -1, Part- II) - NCERT Delhi
2. Engineering Chemistry, Agarwal Shikha - Cambridge Press, New Delhi,
3. Understanding Chemistry, C.N.R. Rao, , University Press(India) Pvt. Ltd.
4. Jain & Jain Engineering Chemistry - Dhanpat Rai and Sons, New Delhi
5. Applied Chemistry Laboratory Practices Vol. 1 & Vol.II, Dr. G.H. Hugar & Prof. A.N. Pathak - NITTTR, Chandigarh.

ONLINE RESOURCES

6. www.chemguide.co.uk/atommenu.html (Atomic Structure and Chemical bonding)
7. www.visionlearning.com (Atomic Structure and Chemical bonding)
8. <https://www.iqsdirectory.com/articles/metal-alloy.html> (Metal, Non-metal, alloy)

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Course Code	:	BS110
Course Title	:	Applied Chemistry (Lab)
Number of Credits (Teaching Load)	:	1 (L:0, T:0, P:2)
Prerequisites	:	-
Course Category	:	BS
Companion Course	:	BS106

COURSE LEARNING OBJECTIVES

The laboratory course develops the ability to prepare and standardize chemical solutions, perform volumetric and gravimetric analysis and determine the concentration of various samples using standard analytical methods. Students gain practical knowledge of electrochemistry by verifying Faraday's First Law of Electrolysis or constructing an electrochemical cell. They acquire hands-on experience with laboratory instruments such as the pH meter. The course also enables students to analyze the moisture and ash content of coal and assess water quality through alkalinity or hardness tests while developing skills in accurate observation, calculations, report writing and safe laboratory practices.

COURSE OUTCOMES

After completing this course, students will be able to:

Course Outcome	Bloom's Level
CO 1. Prepare standard chemical solutions and perform volumetric analysis accurately using appropriate laboratory techniques and safety practices.	L3
CO 2. Determine physicochemical properties of engineering materials and water, such as pH, hardness, alkalinity, moisture, ash content, viscosity and flash point using standard laboratory methods and analyze the result.	L4
CO 3. To construct an electrochemical cell and experimentally verify Faraday's laws of electrolysis by conducting experiment and analyzing the observations.	L4
CO 4. Analyze experimental observations, perform calculations, prepare laboratory records and interpret results for engineering and industrial applications following safe laboratory practices.	L4

OUTCOME MAPPING MATRIX							
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7
CO-1	3	2	-	2	2	-	2
CO-2	3	3	2	3	2	2	2
CO-3	3	3	2	3	2	-	1
CO-4	2	3	-	3	1	2	2

SAFETY RULES AND PRECAUTIONS [DISPLAY CHART]

Chemistry Laboratory involves the use of chemicals, glassware, heating devices and other equipment. Some chemicals are corrosive, toxic and inflammable. Therefore, strict observance of safety rules and precautions must be followed. Some of them are: -

1. Students must wear lab coat, safety shoes and proper protective equipment.
2. Tie long hair, avoid jewellery and keep the laboratory clean and tidy.
3. Handle chemicals carefully, always add acid to water slowly and avoid skin contact.
4. Do not taste chemicals, remove equipment or work without prior permission to teacher.
5. Keep gas/ water taps closed, ensure proper ventilation and know chemical hazards before use.
6. Report any accident immediately and handle glassware, reagents and equipment safely. Wash your hands thoroughly before leaving the lab.

LIST OF EXPERIMENTS

Sr. No.	Experiment Objective
1.	Preparation of standard solution of oxalic acid.
2.	To determine the strength of given sodium hydroxide solution by titrating against standard oxalic acid solution by using phenolphthalein as indicator.
3.	Experimental verification of Faraday's first law of Electrolysis by using copper sulphate solution and copper electrodes.
4.	Determination of pH of given solution by using pH meter.
5.	To estimate the amount of moisture in the given coal sample gravimetrically.
6.	To estimate the amount of ash in the given coal sample gravimetrically.
7.	To compare the viscosity of given lubricating oils by Redwood viscometer.
8.	To estimate the total alkalinity of given water sample by titrating it against standard Sulphuric acid solution.

STANDARD LIST OF TOOLS AND EQUIPMENT

S.N.	Name of the Tool/ Equipment	Quantity	S.N.	Name of the Tool/ Equipment	Quantity
1.	Digital Weighing Balance (Least count Minimum 0.001g)	1 No.	6.	Tongs (12" Stainless Steel)	5 Nos.
2.	D.C. Regulated Power Supply Output Voltage 0-30 V Output Current 0-5A	2 No.	7.	Tongs (6" Stainless Steel)	5 Nos.
3.	Redwood Viscometer	5 Nos.	8.	Tripod Stand	10 Nos.
4.	Hot Air Oven	1 No.	9.	Burette Stand (Propylene Coated)	10 Nos.
5.	Muffle Furnace Higher Temperature Range 800°C	1 No.	10.	Copper Voltammeter	5 Nos.
			11.	Copper Plates/Rods	10 Nos.
			12.	Connecting Wires with Crocodile Clips	20 Nos.

S.N.	Name of the Tool/ Equipment	Quantity
13.	Zinc Rods/ Plates	5 Nos.
14.	Glass Tube (U Shaped)	10 Nos.
15.	Voltmeter (0-5V)	5 Nos.
16.	Burette (50 ml)	25 Nos.
17.	Pipette (10 ml)	25 Nos.
18.	Pipette (20 ml)	20 Nos.
19.	Wire Gauge	10 Nos.
20.	Funnel	25 Nos.
21.	Spatula	25 Nos.
22.	Stop Watch (Mechanical/ Electronic)	5 Nos.
23.	Beaker (50 ml)	20 Nos.
24.	Beaker (250 ml)	20 Nos.
25.	Beaker (500 ml)	10 Nos.
26.	Graduated Flask (250 ml)	10 Nos.
27.	Graduated Flask (500 ml)	10 Nos.
28.	Graduated Flask (1000 ml)	05 Nos.
29.	Measuring Cylinder (10 ml)	10 Nos.
30.	Measuring Cylinder (50 ml)	10 Nos.
31.	Measuring Cylinder (100 ml)	10 Nos.
32.	Measuring Cylinder (250 ml)	10 Nos.
33.	Reagent Bottles (250 ml)	20 Nos.
34.	Kohlrausch Flask	10 Nos.
35.	Silica Crucibles	10 Nos.
36.	Porcelain Crucibles	10 Nos.
37.	China Dish	10 Nos.

S.N.	Name of the Tool/ Equipment	Quantity
38.	Conical Flask (100 ml)	20 Nos.
39.	Conical Flask (250 ml)	20 Nos.
40.	Test Tubes (10ml)	100 Nos.
41.	Pipette Pump (10 ml)	10 Nos.
42.	Pipette Pump (20 ml)	5 Nos.
43.	Wash Bottles	10 Nos.
44.	Dropper	20 Nos.
45.	Desiccator	05 Nos.
46.	Brushes	10 Nos.
47.	Watch Glass	25 Nos.
48.	Rheostat	5 Nos.
49.	Laboratory Thermometer	10 Nos.
50.	Muslin Bag	5 Nos.
51.	Distillator	1 No.
52.	pH Meter	2 Nos.
53.	Filter Paper	100 No.
54.	Porous Pot	5 Nos.
55.	Pipette Stand	5 Nos.
56.	Test Tube Holder	10 Nos.
57.	Mortar and Pestle	2 Nos.
58.	Test Tube Stand	5 Nos.
59.	All necessary furniture - Chair, Stool, Table, Tool Rack, Working Bench, Almirah & Air Conditioners	As per Lab Reqmt.

STANDARD LIST OF CHEMICALS REQUIRED

S.N.	Name of the Chemical	Quantity
1.	Sulfuric Acid	500 ml
2.	Hydrochloric Acid	500 ml
3.	Acetic Acid (Glacial)	500 ml
4.	Sodium Hydroxide	500 g
5.	Potassium Hydroxide	500 g
6.	Oxalic Acid	500 g
7.	Potassium Hydrogen Phthalate	500g
8.	Nitric Acid	500 ml
9.	Phenolphthalein (100 ml)	10 Nos.
10.	Methyl Orange (100 ml)	10 Nos.
11.	Copper Sulphate	500 g

S.N.	Name of the Chemical	Quantity
12.	Cleaning Agent	2.5 L
13.	Ethyl Alcohol	500 ml
14.	Acetone	500 ml
15.	Zinc Sulfate	500 g
16.	Buffer Solution (pH=4)	125ml
17.	Buffer Solution (pH=7)	125ml
18.	Coal Sample	500 g
19.	Oil (Castor/ Olive/ Mustard)	500 ml
20.	Zinc Chloride	500 g
21.	Distilled Water	20 ltr
22.	Buffer Solution (pH range from 7-11)	125 ml

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Course Code	:	ES102
Course Title	:	Basics of Electrical & Electronics Engineering
Number of Credits (Teaching Load)	:	3 (L:3, T:0, P:0)
Prerequisites	:	-
Course Category	:	ES
Companion Course		ES108

COURSE LEARNING OBJECTIVES

This course is designed to provide foundational engineering science knowledge and develop essential technological skills required by engineering disciplines. It aims to introduce students to the fundamental concepts of AC & DC Supply, magnetism, electromagnetism, and the operation of magnetic circuits. Additionally, the course enhances technical understanding through the study of various electrical applications, safety earthing protocols, and energy storage systems. Also, it establishes basic proficiency in electronics by covering semiconductor materials, PN junction diode traits, and the structural behaviour of digital logic gates.

COURSE OUTCOMES

After completing this course, the students will be able to:

Course Outcome	Bloom's Level
CO 1. Apply voltage divider rules, current divider rules, Kirchhoff's Voltage Law (KVL), and Kirchhoff's Current Law (KCL) to solve fundamental electrical circuits.	L3
CO 2. Explain the basic concepts of magnetism and describe the working principles of electromagnetic induction based on Faraday's and Lenz's laws.	L3
CO 3. Contrast the features of AC and DC supply, and outline the installation purpose of equipment earthing along with lead-acid battery maintenance.	L4
CO 4. Illustrate the V-I characteristics of a PN junction diode under forward/reverse bias conditions and state standard LED applications.	L2
CO 5. Construct truth tables and logic symbols to verify the operations of basic, universal, and exclusive logic gates using Boolean algebra laws.	L3

OUTCOME MAPPING MATRIX							
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7
CO-1	3	3	1	-	-	-	1
CO-2	3	2	-	-	-	-	-
CO-3	3	1	-	-	2	-	2
CO-4	3	1	-	-	-	-	1
CO-5	3	2	2	-	-	-	1

COURSE CONTENTS

Unit 1: Electrical Fundamentals25 Marks

Electrical quantities (Definitions & S.I. Units): Charge, Current, Voltage, E.M.F., Power, Energy. Electrical circuit elements: Resistor, inductor, capacitor. Ohms law, combination of resistances in series and parallel, Factors affecting resistance and concept of resistivity. Kirchhoff's Voltage Law (KVL) and Kirchhoff's Current Law (KCL), Voltage and current divider rules.

Unit 2: Electromagnetism and Magnetic Circuits15 Marks

Basic concepts of magnetism (Definitions & S.I. Units): magnetic flux, flux density, magnetic field intensity, permeability, reluctance. Faraday's laws of electromagnetic induction and Lenz's law, Analogy between electric and magnetic circuits.

Unit 3: Electrical Energy: Advantages & Applications.....20 Marks

Difference between AC and DC supply, Various domestic, commercial, and industrial applications of electrical energy. Advantages of electrical energy over other forms of energy. Earthing (Definition), Equipment Earthing, purpose of Earthing. Batteries: Various types of batteries, their comparisons & applications, Grouping of cells in series and parallel.

Unit 4: Introduction to Semiconductors Technology20 Marks

Introduction to semi-conducting materials, Doping, Intrinsic and extrinsic semiconductors. PN junction diode: PN junction formation, depletion region, potential barrier, forward and reverse biasing, knee voltage, reverse breakdown voltage, V-I characteristics & its applications. LEDs and Applications of LEDs.

Unit 5: Basic of Digital Electronics20 Marks

Number systems: Binary, Decimal, Hexadecimal & Octal. Base conversions of number systems (Binary to Decimal and vice versa), Basic Laws & Theorems of Boolean algebra. Introduction to logic gates, their symbols and truth tables: AND, OR, NOT, NAND, NOR, Exclusive OR and Exclusive NOR gates. Universal logic gates.

SUGGESTED DISTRIBUTION OF MARKS

Unit	Time (Hours)	Marks Allotted
Unit 1: Electrical Fundamentals	10	25
Unit 2: Electromagnetism and Magnetic Circuits	8	15
Unit 3: Electrical Energy: Advantages & Applications	9	20
Unit 4: Introduction to Semiconductors Technology	9	20
Unit 5: Basic of Digital Electronics	9	20
TOTAL	45	100

REFERENCE BOOKS AND SUGGESTED LEARNING RESOURCES

1. ABC of Electrical Engineering, B.L.Theraja and A.K.Theraja – S. Chand Publishers, New Delhi.
2. Basic Electrical and Electronics Engineering, S.K.Bhattacharya - Pearson Education.
3. Basic Electric Engineering, DP Kothari and Nagrath - Tata McGraw Hill.
4. Basic Electrical Engineering, VN Mittle and Arvind Mittle - McGraw Hill.
5. Basic Electrical Engineering, V.K.Mehta & Rohit Mehta - S. Chand Publishers.
6. Fundamentals of Electrical Engineering, Tarlok Singh - S.K.Kataria & Sons.

ONLINE RESOURCES

7. Swayam Portal <https://swayam.gov.in>

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Course Code	:	ES108
Course Title	:	Basics of Electrical & Electronics Engineering (Lab)
Number of Credits (Teaching Load)	:	1 (L:0, T:0, P:2)
Prerequisites	:	-
Course Category	:	ES
Companion Course	:	ES102

COURSE LEARNING OBJECTIVES

This practical course aims to familiarize students with the use of essential electrical measuring instruments, including ammeter, voltmeter, wattmeter, and digital storage oscilloscope (DSOs). Through structured experimentation, students will physically verify fundamental electrical circuit principles such as Kirchhoff's voltage and current laws, using divider network methods. Additionally, the lab provides experiential insights into electromagnetism, the behaviour of series-parallel cell groupings, and the operational characteristics of semiconductor PN junction diodes and universal digital logic gates.

COURSE OUTCOMES

After completing this course, students will be able to:

Course Outcome	Bloom's Level
CO 1. Operate basic electrical measuring instruments (ammeter, voltmeter, wattmeter, energy meter, and multimeter) to measure circuit parameters.	L3
CO 2. Test DC electrical circuits to verify Kirchhoff's Current Law (KCL) and Kirchhoff's Voltage Law (KVL) using current and voltage divider rules.	L4
CO 3. Demonstrate the principles of Faraday's law of electromagnetic induction and the effects of series-parallel cell grouping on voltage and current.	L2
CO 4. Examine AC signal characteristics (amplitude, frequency, and time period) using a CRO/DSO and trace the V-I characteristics of a PN junction diode.	L4
CO 5. Construct logic circuits to verify the truth tables of basic (AND, OR, NOT) and universal (NAND, NOR) logic gates.	L3

OUTCOME MAPPING MATRIX							
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7
CO-1	3	1	-	3	-	-	1
CO-2	3	3	-	3	-	-	-
CO-3	3	1	-	2	1	-	-
CO-4	3	2	-	3	-	-	1
CO-5	3	2	1	3	-	-	1

LIST OF EXPERIMENTS

Sr. No.	Experiment Objective
1.	Familiarization to basic equipment like ammeter, voltmeter, watt meter, energy meter, DSO/CRO, multi-meter etc. and their operation, uses.
2.	Determine the value of resistor and capacitor using multimeter/ LCR meter.
3.	Apply the Kirchhoff's Current Law in a dc circuit and verify the result using current divider rule.
4.	Apply the Kirchhoff's Voltage Laws in a dc circuit and verify the result using voltage divider rule.
5.	Demonstration of Faraday's law of electromagnetic induction.
6.	Observe the effect on voltage and current by grouping of cells in series and parallel.
7.	Measure the amplitude, frequency and time period using CRO/DSO
8.	Identify the terminals of PN diode using multimeter and plot the VI characteristics of PN diode
9.	Verify the truth table of basic gates OR, AND and NOT.
10.	Verify the truth table of universal gates NAND and NOR.

STANDARD LIST OF TOOLS AND EQUIPMENT

Sr. No.	Name of the Tool/ Equipment	Quantity	Sr. No.	Name of the Tool/ Equipment	Quantity
1.	Ammeter (Digital/ Analog) Multi-range (0-5A, 0-1A)	08 Nos.	13.	Diode Trainer Kit with Inbuilt Power Supply and Meters	06 Nos.
2.	Voltmeter (Digital/ Analog) Multi-range (0-30V, 0-10V)	08 Nos.	14.	Connecting Wires	L/S
3.	Wattmeter	06 Nos.	15.	Rheostat: Various Values	10 Nos.
4.	Energy Meter	06 Nos.	16.	DC Power Supply - Regulated, Variable Output (0-30V/60V DC, 5A) with Current Limiting Features	04 Nos.
5.	DSO / CRO : Dual-channel, Bandwidth (20MHz - 50MHz)	05 Nos.	17.	Zener Diode	20 Nos.
6.	Digital Multimeter	08 Nos.	18.	IC Trainer Kit	02 Nos.
7.	Bread Board	20 Nos.	19.	Transistor	20 Nos.
8.	Logic Gate Trainer Kit	04 Nos.	20.	Function Generator	02 Nos.
9.	Capacitor Kit with Inbuilt Power Supply (0-30V) and Digital Meters	06 Sets	21.	Universal Gate Trainer Kit	04 Nos.
10.	Inductor/ Copper Coil	08 Nos.	22.	Resistor Kit with Inbuilt Power Supply (0-30V) and Digital Meters	06 Sets
11.	Battery Cells: Standard Values	08 Sets	23.	Soldering Iron	04 Nos.
12.	Wire Stripper / Cutter	04 Nos.	24.	Soldering Wire & Flux	L/S

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Course Code	:	ES104
Course Title	:	Applied Mechanics
Number of Credits (Teaching Load)	:	3 (L:3, T:0, P:0)
Prerequisites	:	-
Course Category	:	ES
Companion Course	:	ES110

COURSE LEARNING OBJECTIVES

This course deals with basic concepts of mechanics like laws of forces, moments, friction, simple machines and centre of gravity, which are required by the students for further understanding of other allied subjects. The subject enhances the analytical ability of the students.

COURSE OUTCOMES

After completing this course, the students will be able to:

Course Outcome	Bloom's Level
CO 1. Determine resultant of coplanar force systems using analytical methods.	L3
CO 2. Analyze moments and equilibrium conditions to determine the resultant and position of force systems.	L4
CO 3. Apply the laws of friction to solve friction problems involving limiting equilibrium on horizontal and inclined plane.	L3
CO 4. Determine Centroid and Centre of Gravity of composite plane figures & bodies.	L3
CO 5. Evaluate the performance of simple lifting machines by applying the laws of machines.	L5

OUTCOME MAPPING MATRIX							
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7
CO-1	3	3	1	2	-	-	-
CO-2	3	3	2	2	-	-	-
CO-3	3	3	2	2	1	-	-
CO-4	3	2	2	2	-	-	-
CO-5	3	3	2	3	1	1	-

COURSE CONTENTS

Unit 1: Basics of Mechanics and Force System25 Marks

Introduction - Mechanics, Applied Mechanics, Statics, Dynamics (Kinetics, Kinematics), utility of mechanics in engineering field, rigid body, flexible body, scalar and vector quantities.

Laws of forces - Definition of force, measurement of force in SI units, its representation, effects of force, characteristics of a force, free body, free body diagram, force systems and its classification, principle of transmissibility, law of superposition, resultant force, parallelogram law of forces (with derivation), triangle law of forces, polygon law of forces – analytically, resolution of forces, resolution of a force into two components only (orthogonal/ non-orthogonal). (*Basic Numerical Problems*)

Unit 2: Moment.....20 Marks

Concept of moment, Moment of a force and units of moment, Varignon's theorem (definition only), equilibrium, equilibrant, general conditions of equilibrium, Lami's theorem, determine resultant and its position in parallel force system (like and unlike parallel forces) under coplanar forces. (*Basic Numerical Problems*)

Unit 3: Friction20 Marks

Friction and its relevance in engineering, types and laws of friction, limiting equilibrium, limiting friction, co-efficient of friction, angle of friction, angle of repose and their relations. Equilibrium of bodies on level surface subjected to force parallel and inclined to plane. Equilibrium of bodies on inclined plane subjected to force parallel to the plane only. (*Basic Numerical Problems*)

Unit 4: Centroid and Centre of Gravity15 Marks

Definition of centroid, centre of gravity, axis of symmetry, reference axis. Centroid of plane figures – square, rectangle, triangle, circle, semi-circle (without derivation), determination of centroid of lamina T, L & I shape, centroid of composite plane figures with/without removed portion (combination of only two plane figures), using the moment method only. Determination of centre of gravity of symmetrical solid bodies – cube, cuboid, cone, cylinder, sphere and hemisphere (without derivation).

Unit 5: Simple Lifting Machine.....20 Marks

Definition of machine, simple machine, load, effort, velocity ratio, mechanical advantage and efficiency of a machine and their relationship. Law of machines. Definition of ideal machine, reversible and self-locking machine. Mechanical advantages, velocity ratio and efficiency of simple wheel & axle, simple screw jack, worm & worm wheel, single winch crab (*Basic Numerical Problems*)

SUGGESTED DISTRIBUTION OF MARKS

Unit	Time (Hours)	Marks Allotted
Unit 1: Basics of Mechanics and Force System	11	25
Unit 2: Moment	8	20
Unit 3: Friction	8	20
Unit 4: Centroid and Centre of Gravity	8	15
Unit 5: Simple Lifting Machine	10	20
TOTAL	45	100

REFERENCE BOOKS AND SUGGESTED LEARNING RESOURCES

1. Text Book of Applied Mechanics, Birinder Singh - Katson Publishing House, New Delhi.
2. Text Book of Applied Mechanics, A.K. Upadhyay - SK Kataria & Sons, New Delhi.
3. A Text Book of Applied Mechanics, S. Ramamurtham - Dhanpat Rai, New Delhi.
4. A Text Book of Engineering Mechanics (Applied Mechanics), R.S. Khurmi - S Chand and Co. Ltd.
5. A Text Book of Applied Mechanics, R. K. Rajput - Laxmi Publications, New Delhi.
6. Engineering Mechanics, D. S. Bedi - Khanna Publishing House, New Delhi.
7. Mechanics of Materials, Dr. Kirpal Singh - Standard Publishers Distribution, New Delhi.

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Course Code	:	ES110
Course Title	:	Applied Mechanics (Lab)
Number of Credits (Teaching Load)	:	1 (L:0, T:0, P:2)
Prerequisites	:	-
Course Category	:	ES
Companion Course	:	ES104

COURSE LEARNING OBJECTIVES

To develop practical skills in applying the fundamental principles of statics and mechanics through laboratory experiments, analysis of observations and interpretation of results.

COURSE OUTCOMES

After completing this course, students will be able to:

Course Outcome	Bloom's Level
CO 1. Perform experiments to verify the polygon law of forces, Lami's theorem using standard laboratory apparatus.	L3
CO 2. Determine the coefficient of friction, angle of friction and angle of repose for different contact surfaces through laboratory experiments.	L3
CO 3. Analyze experimental observations, compare them with theoretical principles and prepare laboratory reports	L4
CO 4. Evaluate the mechanical advantage, velocity ratio and efficiency of different types of simple lifting machines.	L5

OUTCOME MAPPING MATRIX							
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7
CO-1	3	2	-	3	-	-	1
CO-2	3	3	1	3	1	-	1
CO-3	2	3	1	3	-	1	2
CO-4	3	3	2	3	1	1	2

LIST OF EXPERIMENTS

Sr. No.	Experiment Objective
1.	Verification of polygon law of forces graphically using universal force table/ Gravesend's apparatus.
2.	Verification of Lami's theorem.
3.	Study forces in various members of Jib crane.

Sr. No.	Experiment Objective
4.	Determine coefficient of friction and angle of friction on horizontal plane for two or three different contact surfaces.
5.	To verify relation between angle of friction and angle of repose on inclined plane.
6.	To find out center of gravity of a regular & irregular lamina.
7.	To find the M.A., V.R. and efficiency of a Worm and worm wheel.
8.	To find the M.A., V.R. and efficiency of a Simple Screw Jack
9.	To find the M.A., V.R. and efficiency of a Single winch crab.

STANDARD LIST OF TOOLS AND EQUIPMENT

Sr. No.	Name of the Tool/ Equipment	Quantity
1.	Universal Force Table with pulleys and weight hangers	2 Nos.
2.	Gravesend's apparatus with pulleys and weight hangers	2 Nos.
3.	Slotted Weights Set (10 g to 500 g)	4 Sets
4.	String / Thread for force table experiments	4 Rolls
5.	Jib Crane Model Apparatus with load hangers	2 Nos.
6.	Friction Apparatus for Horizontal Plane	2 Nos.
7.	Friction Apparatus with Adjustable Inclined Plane	2 Nos.
8.	Wooden Blocks / Test Blocks for friction experiment	4 Nos.
9.	Set of Weights for friction experiments	4 Nos.
10.	Centre of gravity stand	2 Nos.
11.	Worm and Worm Wheel Apparatus	1 No.
12.	Simple Screw Jack Apparatus	1 No.
13.	Single Winch Crab Apparatus	1 No.
14.	Spring Balance (0–50 N or suitable range)	4 Nos.
15.	Meter Scale / Steel Rule (1 m)	6 Nos.
16.	Spirit Level	2 Nos.
17.	Mirror Strip	20 Nos.

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Course Code	:	ES106
Course Title	:	Engineering Workshops – II
Number of Credits (Teaching Load)	:	3 (L:0, T:0, P:6)†
Prerequisites	:	-
Course Category	:	ES
Common to Programmes	:	As mentioned in the table below.

† Cumulative credits and teaching load for all shops under Engineering Workshops - II.

COURSE LEARNING OBJECTIVES

This course Engineering Workshops-II aims to provide hands-on skill in relevant workshops. The focus of the practical training imparted in this course is to imbibe the dignity of labour, ensure workplace safety, and foster precision in craftsmanship. For each programme, a specific set of three workshops (out of the six available options) has been explicitly identified as mentioned in the table below.

Sr. No.	Engineering Workshops- II	Branch Codes
1.	Electronics Workshop	CO, IoT, AI, EX, EL, IE, AE, MX, EE, EV
2.	Computer Workshop	CO, IoT, AI, EX, EL, IE, EE, EV
3.	Welding Workshop	ME, IE, EL, MX, AE, TD, CI, AG, EE, EV
4.	Sheet Metal Workshop	CO, IoT, AI, EX, ME, TD, MX, CI, AE, AG
5.	Smithy Workshop	ME, TD
6.	Plumbing Workshop	CI, AG

COURSE OUTCOMES

After completing this course, students will be able to:

Course Outcome	Bloom's Level
CO 1. Explain workshop safety protocols, personal protective equipment (PPE) requirements, and the functional features of basic engineering tools and materials.	L2
CO 2. Illustrate the working principles, operational procedures, and industrial applications of primary manufacturing, assembly, installation, and maintenance processes.	L2
CO 3. Execute basic workshop operations using appropriate tools, techniques, and machinery while strictly adhering to standard safety guidelines.	L3
CO 4. Analyze specific workshop processes to identify operational requirements, diagnose defects, and determine corrective methods for optimal output.	L4
CO 5. Evaluate tools, materials, and techniques based on performance, safety, and efficiency criteria to validate the quality of executed engineering solutions.	L5

	OUTCOME MAPPING MATRIX						
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7
CO-1	3	1	-	1	2	3	2
CO-2	3	1	1	1	2	1	1
CO-3	3	2	2	2	3	2	1
CO-4	2	3	2	3	2	1	2
CO-5	2	3	3	3	3	2	3

COURSE CONTENTS

Shop 1. ELECTRONICS WORKSHOP ...(CO, IoT, AI, EX, EL, IE, AE, MX, EE, EV)

1.1. Safety, Tools & Equipment

- 1.1.1. Safety precautions to be observed in the Electronics Shop
- 1.1.2. Identification and use of common workshop hand tools: pliers, wire strippers, cutters, screwdrivers, crimping tools, connectors, heat gun etc.
- 1.1.3. Familiarization with equipment: Multimeter, Function Generator, Power Supply, Oscilloscope and Counters.

1.2. Components Identification and Testing

- 1.2.1. Active and Passive components
- 1.2.2. Analog and Digital ICs
- 1.2.3. Connectors, switches, relays, cables etc.

1.3. Soldering & De-Soldering Practices

- 1.3.1. Soldering/ De-Soldering safety procedure.
- 1.3.2. Use of soldering iron, de-soldering pump, hot air station
- 1.3.3. Practice on PCBs: soldering resistors, ICs, connectors
- 1.3.4. De-soldering and Rework technique

1.4. PCB Basics and Assembly

- 1.4.1. Types of Printed Circuit Board
- 1.4.2. Assembling simple circuits on General Purpose PCB

1.5. Introduction to Artificial Intelligence

- 1.5.1. Role of AI in Electronics Engineering
- 1.5.2. Introduction to basic AI tools like ChatGPT, Canva, Perplexity, Google Gemini and their use by using text prompt (any two).

JOBS TO BE PREPARED

- Job I : Practice on the use of workshop hand tools and instruments. (Brief Write up)
- Job II : Testing & Identification of Resistor, Inductor, Capacitor, Diode & Transistor. (Brief Write up)
- Job III : Practice Soldering and De-soldering. (Brief Write up)

Job IV : Design and testing of a simple electronic circuit on a general-purpose PCB.

Job V : Practice using text prompts to perform basic tasks such as generating explanations, creating simple designs and searching technical information using any AI tool.

Shop 2. COMPUTER WORKSHOP (CO, IoT, AI, EX, EL, IE, EE, EV)

ACTIVITIES TO BE DEMONSTRATED

2.1. Workplace Safety and Safe Equipment Handling

2.1.1. Workplace safety: Importance of workplace safety; basic safety practices in a computer workshop; safe handling of computer hardware and electronic components.

2.1.2. Electrical safety: common electrical hazards, safe use of power cables, extension boards and sockets, proper earthing, precautions while assembling or disassembling computer systems.

2.1.3. Electrostatic discharge (ESD) protection: causes of static electricity, use of anti-static wrist straps and mats, safe handling of sensitive components.

2.1.4. Ergonomic practices while using computers: proper posture, placement of monitor, keyboard and mouse, prevention of eye strain.

2.2. General workshop discipline: maintaining a clean workspace, proper cable management and safe storage of tools and components.

2.3. Identification of Tools, Components and Peripheral Devices

2.3.1. Common tools used in a computer workshop: Phillips and flat-head screwdrivers, needle-nose pliers, tweezers, parts retriever, flashlight, vacuum/blower cleaner, anti-static wrist strap and mat, crimping tool, LAN cable tester, and multimeter.

2.3.2. Common ports and peripheral devices: VGA, DVI, HDMI, USB, Ethernet (RJ-45), audio ports, SD card slot; peripheral devices - keyboard, mouse, monitor, printer, scanner, webcam, speakers, microphone, external storage devices, and network adapters.

2.3.3. Internal components of a computer system: Motherboard, processor (CPU), RAM modules, ROM/BIOS chip, chipset, expansion slots (PCI/PCIe), storage devices (HDD/SSD), optical drive, power supply unit (SMPS), heat sink and cooling fan, CMOS battery, internal cables and connectors (SATA and power connectors).

2.4. Assembling/ Disassembling a Computer System

2.4.1. Opening and closing the system cabinet.

2.4.2. Installation and removal of CPU, RAM, storage devices (HDD/SSD), and expansion cards.

2.4.3. Installation of SMPS and connecting internal power connectors.

- 2.4.4. Connecting internal data cables; reassembling the system and verifying proper connections.
- 2.5. Installing and Configuring OS & Application Software
 - 2.5.1. Installation of OS using bootable media.
 - 2.5.2. Understanding disk partitioning and file system hierarchy.
 - 2.5.3. Basic system configuration (date/time, user accounts, device settings).
 - 2.5.4. Installation of peripheral devices and device drivers.
 - 2.5.5. Installation, updating and uninstalling common application software such as office applications, web browsers, PDF readers, antivirus software and file compression utilities.
- 2.6. Connecting to a Network
 - 2.6.1. Connecting a computer system to a wired LAN and Wi-Fi network.
 - 2.6.2. Identification of networking devices such as modem, router and switch.
 - 2.6.3. Configuration of network settings such as IP address, proxy server and DNS.
 - 2.6.4. Basic troubleshooting of network connectivity.

JOBS TO BE PREPARED

- Job I : Identification of Computer Hardware, Tools and Peripheral Devices.
- Job II : Assembly and Disassembly of a Desktop Compute - Opening cabinet, installation/removal of CPU, RAM, HDD/SSD, SMPS, expansion cards, internal cable connections, reassembly
- Job III : Operating System Installation and Basic Configuration - Creating bootable media (optional), OS installation, partitioning, formatting, user account creation, device configuration.
- Job IV : Installation of Device Drivers and Application Software - Driver installation, software installation/uninstallation, updating applications, configuring printer and other peripherals.
- Job V : LAN Cable Preparation and Network Configuration - RJ-45 connector crimping, cable testing, wired/Wi-Fi connection, IP configuration, network troubleshooting.
- Job VI : Computer System Inspection and Preventive Maintenance - Cleaning computer components, cable management, checking cooling system, BIOS/date-time settings, basic fault diagnosis, safe shutdown procedures.

Shop 3. WELDING WORKSHOP.....(ME, IE, EL, MX, AE, TD, CI, AG, EE, EV)

- 3.1. Safety Precautions of concerned shop and use of personal protective equipment (PPE), demonstration of tools, equipment, sample jobs, Best practices in the concerned shop.
- 3.2. Introduction and importance of welding process as compared to other material joining processes. Specifications and type of Arc welding machines, parts identification, classification, selection and coding of electrodes, welding parameters, welding joints and welding positions. Common weldable materials, safety precautions in welding

shop, use of Personal Protective Equipment, Use of welding screens, Hazards and remedies during welding, Elementary symbolic representations, demo of tools, equipment, sample jobs prepared, set up of Gas welding apparatus, and welding defects.

JOBS TO BE PREPARED

- Job I : Practice of striking arc and depositing uniform and straight beads on flat at different current levels. (Minimum 4 beads on M.S. flat at four setting of current level using shielded metal arc welding and differentiating their characteristics).
- Job II : Cut a job with abrasive cut off / chop saw machine and make a lap joint using shielded metal arc welding (SMAW) process.
- Job III : Edge Preparation and welding butt joint using shielded metal arc / gas welding process.
- Job IV : Edge Preparation and welding T Joint using shielded metal arc welding (50mm x 50mm x 6 mm x 100 mm M.S. Flat).
- Job V : Cut a round pipe with abrasive cut off / chop saw machine & prepare T-pipe joint using gas/arc welding.
- Job VI : Prepare a job on Spot Welding.

Shop 4. SHEET METAL WORKSHOP....(CO, IoT, AI, EX, ME, TD, MX, CI, AE, AG)

- 4.1. Safety Precautions of concerned shop and use of personal protective equipment (PPE), demonstration of tools, equipment, sample jobs, best practices in the concerned shop.
- 4.2. Demonstration of various power tools, apparatus, equipment, hand tools used in sheet metal shop.

JOBS TO BE PREPARED

- Job I : Prepare a rectangular job 100*70mm involving different sheet metal operations like measuring, marking, snipping practice and filing etc. (at least 6 cuts of 70mm).
- Job II : Prepare a seam joint by using hand tools on GI sheet.
- Job III : Prepare double riveted lap joint (zig-zag type) on GI sheet.
- Job IV : Prepare a single cover single riveted butt joint (chain type) on GI sheet.
- Job V : Fabricate a funnel of GI sheet using operations of shearing, flattening, and bending.
- Job VI : Perform any one of sheet metal operation on swaging machine on Job-V like beading/swaging/crimping etc.

Shop 5. SMITHY WORKSHOP (ME, TD)

- 5.1. Safety Precautions of concerned shop and use of personal protective equipment (PPE), demonstration of tools, equipment, sample jobs, Best practices in the concerned shop.
- 5.2. Introduction and industrial applications of smithy jobs.

- 5.2.1. Purpose of Smithy shop.
- 5.2.2. Different types of Hearths used in Smithy shop, Types of fuel used and maximum temperature obtained.
- 5.2.3. Purpose, specifications, uses, care and maintenance of various tools and equipment Used in hand forging by segregating as cutting tools, supporting tools, holding tools, measuring tools, punches etc.
- 5.2.4. Types of raw materials used in Smithy shop.
- 5.2.5. Uses of Fire Bricks and Clays in Forging workshop
- 5.3. Practice
 - 5.3.1. Practice of firing of hearth/Furnace, Cleaning of Clinkers and Temperature Control of Fire.
 - 5.3.2. Practice on different basic Smithy/Forging operations such as Cutting, Upsetting, drawing down, setting down, Necking, Bending, Fullering, Swaging, Punching and Drifting.
 - 5.3.3. Demonstration of Simple Heat treatment processes like Tempering, Annealing, Normalizing and Hardening.
- 5.4. Description of various types of power hammers and their usage (Demonstration only).

JOBS TO BE PREPARED

- Job I : To forge a square/hexagonal shape on both ends of MS round by cold forging.
- Job II : To make a ring of MS round by forge welding.
- Job III : To prepare a job using upsetting operation.
- Job IV : To make a chisel end by hot forging process with hardening and tempering.
- Job V : To make V-notch on other end of Job IV.
- Job VI : To perform Bending process by hot forging on Job V.

Shop 6. PLUMBING WORKSHOP (CI, TD)

- 6.1. Demonstration and Study of Plumbing Tools: Identification and use of tools such as pipe wrench, pipe cutter, die, hacksaw, hammer, spanner etc.
- 6.2. Demonstration and Study of Pipes, Pipe Fittings and valves
 - 6.2.1. Identification of GI, PVC, PPR and HDPE pipes.
 - 6.2.2. Study of fittings such as elbows, tees, reducers, sockets, unions and bends etc.
- 6.3. Pipe Cutting and Threading
 - 6.3.1. Cutting of GI pipes.
 - 6.3.2. Threading of pipes.
- 6.4. Pipe Jointing
 - 6.4.1. Preparation of threaded pipe joints.
 - 6.4.2. Joining pipes using sockets, unions and couplings.
- 6.5. Demonstration of Water Supply Fixtures and Sanitary Fixtures

- 6.5.1. Taps and valves.
- 6.5.2. Wash basin, sink, water closet and flushing system.
- 6.6. Demonstration of Traps: P-trap, S-trap, floor trap, gully trap and intercepting trap.
- 6.7. Layout of cold and hot water supply for a bathroom: Assembling and Disassembling of GI/PVC pipes as per given layout for a bathroom.
- 6.8. Demonstration of house drainage system (by Model)
- 6.9. Demonstration of Septic Tank along with soak pit for 10 users
- 6.10. Repair and Maintenance: Leakage detection, replacement of washers and minor plumbing repairs.

IMPLEMENTATION GUIDELINES

- i. Each workshop is to be assigned equal 30 training hours in the semester.*
- ii. Students must strictly adhere to the designated workshop dress code during all sessions.*
- iii. Wearing shoes is compulsory for entry and operations within the workshops.*
- iv. Instructors must instill, and students must practice, the core principles of occupational safety, workplace cleanliness, and the proper upkeep of tools and equipment.*
- v. Students must prepare sketches of various tools/ jobs in their practical notebook.*
- vi. Final marks of the course Engineering Workshops - II are to be calculated as per the evaluation scheme by giving equal weightage to all shops included in the course.*
- vii. Internal assessment for individual workshop is to be calculated out of 50 marks as per criteria mentioned in the “General Guidelines” section.*
- viii. The final internal assessment score for the course shall be calculated as the mathematical average of the marks obtained across all individual shops.*
- ix. Students should preferably perform the jobs individually or in a group of not exceeding three students.*

REFERENCE BOOKS AND WEB RESOURCES

1. CompTIA A+ Certification Guide (Core 1 Exam 220-1201), CompTIA Press
2. Cisco Certified Support Technician (CCST) IT Support Official Guide, Cisco Press.
3. Upgrading and Repairing PCs by Scott Mueller, Pearson Publication
4. Workshop Technology - Vol. I, II & III, S.K. Hajra, Choudhary and A.K. Choudhary - Media Promoters and Publishers Pvt. Ltd.
5. Tutorial Book: Electronics Workshop and Practice, D.R. Mehta - D.K. Publishing House.
6. Workshop Technology - Vol. I, II & III, Manchanda - India Publishing House, Jalandhar.
7. Electronics Workshop Practice (with Practicals), Kishor P. Akole, Deepak A. Kulkarni - Nirali Prakashan
8. Workshop Training Manual - Vol. I & II, S.S. Ubhi - Katson Publishers, Ludhiana.
9. Manual on Workshop Practice, K. Venkata Redd - MacMillan India Ltd., New Delhi.
10. Basic Workshop Practice Manual - Vikas Publishing House (P) Ltd., New Delhi.

STANDARD LIST OF TOOLS AND EQUIPMENT

1. ELECTRONICS WORKSHOP

Sr. No.	Name of the Tool/ Equipment	Quantity	Sr. No.	Name of the Tool/ Equipment	Quantity
1.	Long Nose Plier	1	8.	Soldering Iron	6 Nos.
2.	Combination Plier	1	9.	De-soldering Pump	3 Nos.
3.	Wire Stripper	1	10.	Breadboard	3 Nos.
4.	Tweezers	1	11.	Digital Multimeter	3 Nos.
5.	Screwdriver Set	1	12.	Regulated DC Power Supply	4 Nos.
6.	Crimping Tool	1	13.	Function Generator	4 Nos.
7.	Temperature Controlled Soldering Station	1	14.	Oscilloscope (CRO/DSO)	4 Nos.

2. COMPUTER WORKSHOP

Sr. No.	Name of the Tool/ Equipment	Quantity
1.	Desktop Computer System - Processor : Intel Core i5 - Core i7/ AMD Ryzen 5 - Ryzen 7 - RAM : 8 - 16 GB, - Storage : HDD 500GB - 2 TB/ SSD 240GB - 500 GB - Display : 19" LED/ FHD - Connectivity : 100/1000 Ethernet, USB Ports - OS : Pre-installed Windows 10/ 11Pro (64 bit)/ Linux	10 Nos.
2.	Online UPS (5 KVA) with 30 Minutes Backup on Full Load	02 Nos.
3.	Printer - All in One Laser Printer (Print, Scan, Copy) - A4	01 No.
4.	Printer - All in One Inkjet Printer (Print, Scan, Copy) - A4	01 No.
5.	Networking Infrastructure 24-port Gbps Ethernet Switch 8U Wall Mount Rack 24-port Patch Panel - UTP Cabling	As Required
6.	Internet Connectivity	-
7.	Steel Almirah Size: 1980mm (H) x 900mm (W) x 480mm (D), 4 Shelves	01 Nos.
8.	Display Almirah Size: 1980mm (H) x 900mm (W) x 480mm (D), 4 Shelves	02 Nos
9.	Interactive Panel 65" - 80" - Resolution: 3840 x 2160	01 No.
10.	Peripheral Devices – Keyboard, Mouse, Scanner, Speaker, Microphone	02 Each
11.	Software - Windows 10/ 11, Linux OS	-
12.	Tools - Phillips and flat-head screwdrivers, needle-nose pliers, tweezers, parts retriever, flashlight, vacuum/ blower cleaner, anti-static wrist strap and mat, crimping tool, LAN cable tester, and multimeter	05 Each
13.	External Storage Devices - hard disk drive (HDD), solid-state drive (SSD), USB flash drive (pen drive), SD cards, microSD cards, and media adapters.	02 Each
14.	Networking Devices (additional to installed devices) - Switch, Patch Panel, Router, WiFi Access Point, WiFi Dongle, Ethernet Card	02 Each

STANDARD LIST OF TOOLS AND EQUIPMENT

3. WELDING WORKSHOP

Sr. No.	Name of the Tool/ Equipment	Quantity	Sr. No.	Name of the Tool/ Equipment	Quantity
1.	Steel Rule, 300mm	10 Nos.	23.	Hand Gloves	6 Pairs
2.	Scriber, 150mm	10 Nos.	24.	Gas Welding Goggle	6 Nos.
3.	Measuring Steel Tape, 3 mtr	3 Nos.	25.	Steel Wire Brush	6 Nos.
4.	Measuring Steel Tape, 5 mtr	2 Nos.	26.	Cylinder Key	2 Nos.
5.	Try Square, 150 mm	6 Nos.	27.	Gas Lighter	2 Nos.
6.	Try Square, 300 mm	4 Nos.	28.	Flat File Rough 12"	10 Nos.
7.	Hacksaw Frame, 12 inch	6 Nos.	29.	Tong	8 Nos.
8.	Bench Grinder	1 No.	30.	Ball Peen Hammer, 250g	2 Nos.
9.	Heavy Duty Bench Vice, Jaw: 6 inch	8 Nos.	31.	Abrasive Cut Off / Chop Saw Machine, Blade: 14 inch	2 Nos.
10.	Work Bench, 1200X2400 mm	2 Nos.	32.	Chisel 6"	2 Nos.
11.	Welding Cabin/ Station	2 Nos.	33.	Anvil with Stand 100kg	2 Nos.
12.	Arc Welding Set (500 Amp, Oil or Air cooled, 2 Phase)	2 Nos.	34.	Welding Screen with Dark & Plain Glass	12 Nos.
13.	Portable Arc Welding Set	1 No.	35.	Number Punch	3 Nos.
14.	Oxygen Gas Cylinder	1 No.	36.	Letter Punch	3 Nos.
15.	Acetylene Gas Cylinder	1 No.	37.	Open End Spanner Set, 6 to 32 mm	1 No.
16.	Oxygen Gas Regulator	1 No.	38.	Ring End Spanner Set, 6 to 32 mm	1 No.
17.	Acetylene Gas Regulator	2 Nos.	39.	Allen Key Set	1 No.
18.	Oxy-Acetylene Gas Welding Hose	10 mtr	40.	Screw Driver Kit	1 No.
19.	Gas Welding Torch	1 Nos.	41.	Spot Welding Machine	1 No.
20.	Arc Welding Lead	10 mtr	42.	Job Rack	2 Nos.
21.	Arc Welding Electrode Holder	2 Nos.	43.	Steel Almirah, Size: 1980mm(H) x 900mm(W) x 480mm(D)	2 Nos.
22.	Chipping Hammer	4 Nos.			

STANDARD LIST OF TOOLS AND EQUIPMENT

4. SHEET METAL WORKSHOP

Sr. No.	Name of the Tool/ Equipment	Quantity	Sr. No.	Name of the Tool/ Equipment	Quantity
1.	Steel Rule, 300mm	12 Nos.	25.	Ballpeen Hammer 900g	2 Nos.
2.	Steel Tape, 3mtr	2 Nos.	26.	Cross Peen Hammer 900g	2 Nos.
3.	Wire Gauge	2 Nos.	27.	Square face Hammer 500g	4 Nos.
4.	Micrometer, 0-25 mm, LC 0.01mm	1 No.	28.	Hand Supporter Big and Small	2 each
5.	Vernier Caliper, 0-150 mm, LC 0.02mm	1 No.	29.	Railway Line: 2100mm Length with Sharp Edge	2 Nos.
6.	Bent Snip	6 Nos.	30.	Swaging Machine	1 No.
7.	Try Square, 6 inch	6 Nos.	31.	Half Moon Stake	2 Nos.
8.	Scriber	12 Nos.	32.	Funnel Stake	2 Nos.
9.	Spring Divider 200 mm	6 Nos.	33.	Anvil with Stand 50 kg	4 Nos.
10.	Trammel: Range 30cm	2 Nos.	34.	MS Square 50x50mm, 4' Long	2 Nos.
11.	Centre Punch	8 Nos.	35.	Hatchet Stake	2 Nos.
12.	Solid Punch Heavy Duty	8 Nos.	36.	Work Bench	2 Nos.
13.	Straight Snip, 300mm	12 Nos.	37.	Hand Lever Shear	1 No.
14.	L-Square (Steel Square) 18" X 24"	4 Nos.	38.	Rivet Sets Snap and Dolly Combined	10 set
15.	Hacksaw Frame	4 Nos.	39.	Bench Drill machine, 1/2 inch	1 No.
16.	Cold Chisel, 1 inch	4 Nos.	40.	Number Punch	2 Nos.
17.	Flat File, 12 inch	2 Nos.	41.	Letter Punch	2 Nos.
18.	Half Round, Smooth, 12 inch	2 Nos.	42.	Open End Spanner Set, 6 to 32 mm	1 No.
19.	Triangular File 150 mm	2 Nos.	43.	Ring End Spanner Set, 6 to 32 mm	1 No.
20.	Round File 200 mm	2 Nos.	44.	Allen Key Set	1 No.
21.	Wooden Mallet	10 Nos.	45.	Screw Driver Kit	1 No.
22.	Rubber Mallet	2 Nos.	46.	Job Rack	2 Nos.
23.	Nylone Mallet	2 Nos.	47.	Steel Almirah, Size: 1980mm(H) x 900mm(W) x 480mm(D)	2 Nos.
24.	Riveting Hammer 500g	10 Nos.			

STANDARD LIST OF TOOLS AND EQUIPMENT

5. SMITHY WORKSHOP

Sr. No.	Name of the Tool/ Equipment	Quantity	Sr. No.	Name of the Tool/ Equipment	Quantity
1.	Smithy Hearth (Smithy Forge) 2'X2' Complete with Chimney, Hood & Blower with 3 HP Motor	1 No.	27.	Flat file, 8", Second Cut Smooth	3 Nos.
2.	Sledge Hammer with Wooden Handle, 3 kg	2 Nos.	28.	Flat file, 12", Second Cut Dead Smooth	3 Nos.
3.	Induction Furnace	1 No.	29.	Half Round File, Second cut Smooth	4 Nos.
4.	Anvil with Stand, 100 kg	5 Nos.	30.	Measuring Steel Tape, 3 mtr	2 Nos.
5.	Anvil with Stand, 50 kg	2 Nos.	31.	Bench Vice, 8 inch jaw	4 Nos.
6.	Swage Block, 16"X16"X5"	2 Nos.	32.	Bench Vice, 5 inch jaw	6 Nos.
7.	Swage Block, 12"X12"X5"	2 Nos.	33.	Work Bench,	3 Nos.
8.	Hacksaw Frame, 12 inch	10 Nos.	34.	Open End Spanner set, 6 to 32 mm	1 No.
9.	Steel Foot Rule, 300 mm	4 Nos.	35.	Ring End Spanner set, 6 to 32 mm	1 No.
10.	Steel Foot Rule, 150 mm	4 Nos.	36.	Allen Key set	1 No.
11.	Brass Foot Rule, 300 mm	4 Nos.	37.	Screw Driver kit	1 No.
12.	Scriber	8 Nos.	38.	Square Hollow Tong, 12 inch	5 Nos.
13.	Cross Peen Hammer, 1 kg	5 Nos.	39.	Square Hollow Tong, 15 inch	6 Nos.
14.	Ball Peen Hammer, 1 kg	2 Nos.	40.	Bevel Gauge	5 Nos.
15.	Double Face Hammer, 1 kg	5 Nos.	41.	Angle Protractor	3 Nos.
16.	Close Flat Tong, 15"	4 Nos.	42.	Try Square, 8 inch	2 Nos.
17.	Close Flat Tong, 12"	3 Nos.	43.	Swage of two different shapes	2 Nos.
18.	Close Flat Tong, 10"	3 Nos.	44.	Fuller of two different sizes	2 Nos.
19.	Round Hollow Tong, 15"	5 Nos.	45.	Flatter	2 Nos.
20.	Round Hollow Tong, 12"	5 Nos.	46.	Set Hammer	2 Nos.
21.	Hot Chisel with MS Handle	8 Nos.	47.	Dot Punch	3 Nos.
22.	Cold Chisel with MS Handle	4 Nos.	48.	Combination Plier	1 No.
23.	Cold Chisel with Wooden Handle	4 Nos.	49.	Punches & Drifts	2 Nos.
24.	High Speed Double Ended Bench Grinder with wheel 6"	1 No.	50.	Face shield	6 Nos.
25.	Flat file, 12", Bastard	7 Nos.	51.	Steel Almirah, Size: 1980mm(H) x 900mm(W) x 480mm(D)	2 Nos.
26.	Flat file, 10", Bastard	2 Nos.	52.	Hand Gloves	6 Pairs
			53.	Job Rack	2 Nos.

STANDARD LIST OF TOOLS AND EQUIPMENT

6. PLUMBING WORKSHOP

Sr. No.	Name of the Tool/ Equipment	Quantity	Sr. No.	Name of the Tool/ Equipment	Quantity
1.	Pipe Wrench Heavy duty, 350 mm (12" and 14")	1 each	16.	Combination Pliers 200 mm Insulated	2
2.	Adjustable Wrench Chrome-plated 250 mm (10" and 12")	1 each	17.	Hammer (Double Face) 1 kg Steel Head	2
3.	Parrot Wrench Forged Steel, 300 mm	1	18.	Electric Drill Machine 13 mm Capacity with Accessories	1
4.	Ratchet Die GI Pipe Threading (½" - 1")	1	19.	Spanner Set Double-ended Metric Set	2
5.	Ball Peen Hammer 200g	2	20.	Plunger Rubber Suction Type	2
6.	Cold Chisel 300 mm (12") Hardened Steel	2	21.	L-Key Set (Allen Keys) Metric Set	2
7.	Electrical Cutter Insulated Handle	1	22.	Tongue & Groove Pliers 250 mm	2
8.	Hand Hacksaw Frame with Blades	4	23.	Plumb Bob Brass/ Steel, 300g	2
9.	PVC Pipe Cutter Suitable for ½" - 2" Pipes	1	24.	Work Table Wooden/ Steel Workbench	2
10.	Measuring Tape Steel Tape, 5m	4	25.	Try Square 300mm Steel	4
11.	Wheel Type Pipe Cutter For GI Pipes	1	26.	KiTEC Type Die 15 to 25mm	1
12.	Pipe Reamer Tool for PVC/GI Pipes	1	27.	Screwdriver Flat & Phillips Heads	2
13.	Spirit Level 300 mm (12") Aluminium Body	2	28.	Masonry Drill Bits 6.5 mm - 12 mm	2
14.	Pipe Vice 12"	2	29.	Steel Almirah, Size: 1980mm(H) x 900mm(W) x 480mm(D)	2
15.	PPR Die Set 15mm to 25mm	1	30.	Job Rack	2

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DETAILED CONTENT
Programme Core Courses
(Second Semester)

Course Code	:	AEPC102
Course Title	:	Basics of Automobile Engineering
Number of Credits (Teaching Load)	:	2 (L:2, T:0, P:0)
Prerequisites	:	-
Course Category	:	PC
Companion Course		AEPC104

COURSE LEARNING OBJECTIVES

This course aims to provide fundamental knowledge of automobiles including their history, major components, classification, chassis layouts, and different types of drive systems. The course enables students to understand the working of engines and knowledge of engine terminology, specifications, functions and application of basic garage equipment and understand the automobile safety systems and traffic regulations.

COURSE OUTCOMES

After completing this course, the students will be able to:

Course Outcome	Bloom's Level
CO 1. Explain automobile history, components and classification.	L2
CO 2. Classify internal combustion engines based on different parameters.	L3
CO 3. Describe construction and working of major engine components.	L2
CO 4. Explain engine terminology, two strokes and four strokes & their difference.	L2
CO 5. Identify service station equipment and understand road safety systems and traffic sign.	L3

OUTCOME MAPPING MATRIX							
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7
CO-1	3	-	-	-	-	-	-
CO-2	3	2	1	-	-	-	-
CO-3	3	2	2	-	-	-	-
CO-4	3	2	1	-	-	-	-
CO-5	2	1	-	3	2	-	-

COURSE CONTENTS

Unit 1: Introduction.....20 Marks

Introduction to Automobile and its history, Components of an automobile, Classification of automobiles, Layout of chassis (4x4 & 4x2), Types of drives-front wheel, rear wheel, four-wheel, left hand and right hand.

Unit 2: Classification of Engines20 Marks

Classification of engines as per stroke, cycle, fuel, ignition, cooling, speed, location, placement, number, arrangement and position of cylinders, governing, cam placement, function material and working of major components (cylinder block, cylinder head, connecting rod, piston, crankshaft, valves, oil sump) in the internal combustion petrol and diesel engine.

Unit 3: Engine Terminology and Working20 Marks

Various terms and specifications of auto engines, concept and working of two stroke and four stroke petrol & diesel engines. Difference between two stroke and four stroke.

Unit 4: Service Station Equipment.....20 Marks

Specification and application of: - Air Compressor (reciprocating type), Hydraulic hoist, car washer, oil sprayers, grease dispensers - manual and bucket type, tire inflation Gauge.

Unit 5: Safety Systems and Road Signs.....20 Marks

Define the term safety, active and passive safety, seat belts and air bags, road signs -mandatory, cautionary, and informatory signals, road markings, penalty for driving vehicle without: driving license, registration certificate, insurance, pollution under control, helmet, seat belt, for drunk and drive.

SUGGESTED DISTRIBUTION OF MARKS

Unit	Time (Hours)	Marks Allotted
Unit 1: Introduction	6	20
Unit 2: Classification of Engines	8	20
Unit 3: Engine terminology and Working	6	20
Unit 4: Service Station Equipment	6	20
Unit 5: Safety Systems and Road Signs	4	20
TOTAL	30	100

REFERENCE BOOKS AND SUGGESTED LEARNING RESOURCES

1. Automobile Engineering Vol I & II, Dr. Kirpal Singh - Standard Publishers, Delhi.
2. Garage Equipment, G.S. Aulakh - Eagle Prakashan, Jalandhar.
3. Motor Vehicle Act 1988 - Asia Law House.
4. Motor Vehicle Act & Transport Management, V.S. Khilery, Satpal Sharma, Shaman Gupta - Ishan Publication.

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Course Code	:	AEPC104
Course Title	:	Basics of Automobile Engineering (Lab)
Number of Credits (Teaching Load)	:	2 (L:0, T:0, P:4)
Prerequisites	:	-
Course Category	:	PC
Companion Course	:	AEPC102

COURSE LEARNING OBJECTIVES

This course is the companion practical course to AEPC102 and is designed to reinforce the concepts covered in the theory course through hands-on experiments, practical exercises, and laboratory activities.

COURSE OUTCOMES

After completing this course, students will be able to:

Course Outcome	Bloom's Level
CO 1. Identify and use automobile workshop tools and gauges.	L3
CO 2. Identify automobile chassis and engine components.	L2
CO 3. Perform basic vehicle inspection and maintenance operations.	L3
CO 4. Demonstrate the use of workshop equipment and servicing tools.	L3
CO 5. Demonstrate road safety and safe workshop practices.	L2

OUTCOME MAPPING MATRIX							
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7
CO-1	3	2	-	3	1	-	1
CO-2	3	2	1	2	-	-	1
CO-3	3	3	2	3	2	1	1
CO-4	2	2	1	3	2	1	1
CO-5	2	1	-	1	3	2	3

LIST OF EXPERIMENTS

Sr. No.	Experiment Objective
1.	Identification and sketching of general tools of automobile workshop and practice to use them.

Sr. No.	Experiment Objective
2.	Identification and sketching of special tools and gauges such as cylinder dial gauge, inside & outside micrometer, telescopic gauge, compression gauge, Vernier caliper, height gauge of automobile workshop and practice to use them.
3.	Identification, function and use of general hand tools used in auto electrical shop.
4.	Identification and sketching of major components in the layout of chassis of a jeep/ car/bus.
5.	Identification and sketching of major components in the internal combustion petrol and diesel engines.
6.	Cleaning, washing, wiping and polishing of jeep/ car and two-wheeler as per maintenance schedule.
7.	Inside and outside inspection/ checking of vehicle, checking of engine oil, horn, starter, cooling water before starting of the vehicle.
8.	Removal and fitting of wheels, tires and repairing of punctures and rotation of tires, use of tire inflation gauges.
9.	Removal and fitting of spark plug and its cleaning, testing.
10.	To study the air compressor.
11.	Demonstration and use of manual grease dispenser on suspension system, steering system and etc.
12.	To know the various road signs and road markings.

STANDARD LIST OF TOOLS AND EQUIPMENT

Sr. No.	Name of the Tool/ Equipment	Quantity
1.	Spanner Set (Open & Ring)	3 No. each
2.	Screw Driver Set (Flat & Phillips)	3 No. each
3.	Pliers (Combination, Nose, Cutting)	3 No. each
4.	Hammer (Ball Peen)	4 No.
5.	Adjustable Wrench	4 No.
6.	Allen Key Set	4 No.
7.	Torque Wrench	2 No.
8.	Bench Vice	2 No.
9.	Cylinder Dial Gauge	2 No.
10.	Inside Micrometer	2 No.

Sr. No.	Name of the Tool/ Equipment	Quantity
11.	Outside Micrometer	2 No.
12.	Telescopic Gauge	2 No.
13.	Compression Gauge	2 No.
14.	Vernier Caliper	2 No.
15.	Height Gauge	2 No.
16.	Multimeter	2 No.
17.	Test Lamp	2 No.
18.	Battery Charger	1 No.
19.	Hydraulic Jack	2 No.
20.	Wheel Spanner	2 No.
21.	Tire Pressure Gauge	2 No.
22.	Air Compressor	1 No.
23.	Spark plug cleaning and testing machine	1 No.
24.	Grease Gun (Manual Grease Dispenser)	1 No.
25.	Road Signs Charts	6 No.
26.	Chassis Model	1 No.
27.	Vehicle Model (Jeep/Car/Two-Wheeler)	1 No.
28.	Engine Model (Petrol & Diesel)	1 No. each
29.	Vacuum Cleaner	1 No.
30.	Car Washer	1 No.

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Course Code	:	AGPC102
Course Title	:	Basics of Agriculture Engineering
Number of Credits (Teaching Load)	:	2 (L:2, T:0, P:0)
Prerequisites	:	-
Course Category	:	PC
Companion Course	:	AGPC104

COURSE LEARNING OBJECTIVES

This subject has been introduced with the objective of making the students conversant with the field of Agriculture & Agricultural Engineering, and to introduce the fundamental concepts, scope, and importance of Agricultural Engineering in modern agriculture. This course provides knowledge of basic farm tools, implements, and agricultural machinery used in different farming operations. This course aims to provide basic knowledge of principles of post-harvest technology, storage, and processing of agricultural products. It also emphasizes learning the basic concepts of engineering which will be required in the subjects to be studied in the subsequent semesters.

COURSE OUTCOMES

After completing this course, the students will be able to:

Course Outcome	Bloom's Level
CO 1. Explain the fundamental concepts, scope, and applications of Agricultural Engineering in modern agriculture.	L2
CO 2. Apply the principles of surveying, levelling, and contouring for basic agricultural land measurements.	L3
CO 3. Explain the principles of refrigeration and air conditioning and their applications in agriculture.	L2
CO 4. Analyse the basic properties of fluids and principles of hydraulics relevant to agricultural engineering applications.	L4
CO 5. Describe post-harvest operations and unit operations involved in agro-processing and storage of agricultural products.	L2

OUTCOME MAPPING MATRIX							
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7
CO-1	3	2	1	–	2	–	2
CO-2	3	3	2	3	2	1	1
CO-3	3	2	2	1	2	–	1
CO-4	3	3	2	2	2	–	1
CO-5	3	2	2	1	3	1	2

COURSE CONTENTS

Unit 1: Agriculture10 Marks

- 1.1. Introduction to Agriculture and its types.
- 1.2. Introduction to allied branches of Agriculture.
- 1.3. Introduction to various types of agro based business.
- 1.4. Resource requirement in Agriculture.

Unit 2: Agriculture Engineering30 Marks

- 2.1. Introduction, need, importance and scope of Agriculture Engineering.
- 2.2. Work areas of Agricultural engineers.
- 2.3. Specialized areas covered under Agriculture Engineering.
 - 2.3.1. Farm Power & Machine
Introduction to various sources of power used at Farm and their adaptability.
Introduction to Machinery/ Implements required for different field operations like Tillage, Sowing, Planting, Weeding, Spraying, Dusting, and Harvesting, Threshing etc. (their names & functions only).
 - 2.3.2. Soil and Water Engineering
Definition of weather, climate, agricultural meteorology, elements of weather (temperature, atmospheric pressure, wind, solar energy, humidity, atmospheric humidity, relative humidity, precipitation, topography) Hydrology, Hydrologic cycle, precipitation, runoff, evaporation, evapotranspiration, condensation etc.
Introduction to Irrigation, sources of irrigation water & irrigation equipment.
Concepts of water management, Rain water harvesting, Soil & water conservation, Water logging, Drainage.
 - 2.3.3. Post-Harvest Technology & Agro Process Engineering
Introduction to Post Harvest Technology and its objectives. Familiarization with various Post Harvest operations and different unit operations in Agro processing (Names & functions only).
 - 2.3.4. Renewable Energy
Introduction and importance of Renewable sources of energy.

Unit 3: Surveying20 Marks

- 3.1. Measuring Survey: Ranging a Line, measuring length with Chain, Measuring length with Tape.
- 3.2. Leveling: Introduction to Leveling & Uses of Leveling, Leveling Staff (Introduction and types), Dumpy level, its uses and settings, Taking Levels of different stations with the help of Dumpy Level.
- 3.3. Contouring: Introduction to contours, Use of contours, Contour Intervals and factors affecting contour intervals, Methods of contouring.

Unit 4: Heat Energy, Refrigeration and Air Conditioning15 Marks

- 4.1. Definition and units of heat energy, Factors affecting heat energy. Thermal Conductivity.
- 4.2. Definitions of Refrigeration and Air conditioning, Principles of refrigeration & air conditioning. Major components of Refrigerators, Major components of Air conditioners, Applications of Refrigerators and Air conditioners in agriculture.

Unit 5: Hydraulics25 Marks

- 5.1. Fluids and Fluid Flow: Fluid, Classification of fluids, Hydraulics, Fluid mechanics- Hydrostatics and Hydro dynamics, Practical applications of hydraulics.
Properties of Fluids: Density or Mass density, Specific Weight, Specific volume, Specific gravity, Viscosity, Kinematic viscosity, Surface tension, Cohesion, Adhesion, Compressibility and bulk modulus, Capillarity, Vapour pressure.
- 5.2. Pressure and its measurement: Concept of pressure, units of pressure and its practical utility, Measurement of pressure or measuring devices (Names only).
- 5.3. Flow of fluids: Kinematics, practical utility, Types of fluid flow- Steady flow, unsteady flow, uniform flow, non- uniform flow, compressible flow, incompressible flow, laminar flow, turbulent flow, rotational flow, Rate of flow or discharge, Hydraulic energy and its types- Potential, pressure or kinetic energy. (No numerical problems & derivations)

SUGGESTED DISTRIBUTION OF MARKS

Unit	Time (Hours)	Marks Allotted
Unit 1: Agriculture	3	10
Unit 2: Agricultural Engg.	9	30
Unit 3: Surveying	6	20
Unit 4: Heat Energy, Refrigeration and Air Conditioning	4	15
Unit 5: Hydraulics	8	25
TOTAL	30	100

REFERENCE BOOKS AND SUGGESTED LEARNING RESOURCES

1. Elements of Agriculture Engineering, Jagdishwar Sahay - Standard Publishers Distributors.
2. Elements of Agricultural Engineering Vol I & II, Dr. O P Singhal - Saroj Prakashan, Allahabad.
3. Principles of Agriculture Engineering Vol I & II, A.M. Michael and T. P. Ojha.
4. Post-Harvest Technology of Cereals, Pulses and Oilseeds, A. Chakraverty.
5. Unit Operations of Agricultural Processing, K. M. Sahay.
6. Hydraulics and Hydraulic Machines, Satinder Rohilla - New India Publishing House, Delhi.
7. Theory of Machines & Mechanism, Raghubir Chand Jindal - Ishan publication, Ambala.
8. Refrigeration & Air Conditioning, Sandeep Bajaj - Ishan Publications, Jalandhar.
9. Surveying and Levelling Vol I & II, KP Kanetkar, SV Kulkarni, - Pune Vidyarthi Gruh Prakashan.

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Course Code	:	AGPC104
Course Title	:	Basics of Agriculture Engineering (Lab)
Number of Credits (Teaching Load)	:	2 (L:0, T:0, P:4)
Prerequisites	:	-
Course Category	:	PC
Companion Course	:	AGPC102

COURSE LEARNING OBJECTIVES

Enable the students to understand and acquire knowledge about basic machine components and different hydraulic equipment's also make them familiarize & acquaintance with farm, soil & water machinery & equipment.

COURSE OUTCOMES

After completing this course, students will be able to:

Course Outcome	Bloom's Level
CO 1. Explain the functioning and activities of agro-based industries, Krishi Vigyan Kendras (KVKs), and renewable energy facilities related to agriculture.	L3
CO 2. Identify and describe basic machine components, farm machinery, and equipment used in agricultural engineering applications.	L2
CO 3. Identify and explain the functions of machinery and equipment used in Soil & Water Engineering, Agro-Processing Engineering, and Post-Harvest Technology.	L2
CO 4. Explain the construction and working principles of various hydraulic equipment used in agricultural engineering laboratories.	L2
CO 5. Perform ranging operations and measure distances using basic surveying techniques and instruments.	L3
CO 6. Determine the elevations of different stations using a dumpy level and related levelling procedures.	L3
CO 7. Prepare contour maps of a given area using indirect contouring methods and interpret the topographical features.	L3

OUTCOME MAPPING MATRIX							
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7
CO-1	3	2	1	–	3	1	2
CO-2	3	2	2	1	1	–	1
CO-3	3	2	2	1	2	–	1
CO-4	3	2	1	3	1	–	1
CO-5	2	3	2	3	1	1	1
CO-6	2	3	2	3	1	1	1
CO-7	2	3	3	3	2	1	2

LIST OF EXPERIMENTS

Sr. No.	Experiment Objective
1.	Visit to nearby Agro Based Industries / Agro Based Business units.
2.	Identification of Basic machine components used in agriculture.
3.	Familiarization & Acquaintance with the Machinery & Equipment's in Farm Machinery. (Identification & Functions).
4.	Familiarization & Acquaintance with the Machinery & Equipment in Soil & Water Engg. (Identification & Functions).
5.	Familiarization & Acquaintance with the Machinery & Equipment in Agro Process Engg./Post Harvest Technology Lab (Identification & Functions).
6.	Familiarization with different hydraulic equipment's of hydraulic lab of the institute.
7.	Visit to Krishi Vigyan Kendra (KVK).
8.	Visit to Renewable Energy Parks/ Solar Power Plants.
9.	Ranging a line and its measurements.
10.	Taking out the levels of different stations with dumpy level.
11.	Drawing contours (Indirect methods).

STANDARD LIST OF TOOLS AND EQUIPMENT

Sr. No.	Name of the Tool/ Equipment	Quantity
1.	Primary Tillage Implements (Ploughs etc.)	1
2.	Secondary Tillage Implements (Harrows etc.)	1
3.	Sowing & Planting Machinery (Seed Drills, Planters & Trans-Planters)	1
4.	Plant Protection Equipment (Sprayers, Dusters etc.)	1
5.	Harvesting Machinery (Mowers, Reapers etc.)	1
6.	Diggers	5
7.	Threshers	1
8.	Power Tiller	1
9.	Horticultural Tools	2 set
10.	Cage Wheel	1

Sr. No.	Name of the Tool/ Equipment	Quantity
11.	Ranging Rods	20
12.	Dumpy Level	2
13.	Measuring Tapes (30m)	5
14.	Planetable with Accessories.	2
15.	Different Types of Pumps (Centrifugal Pump and Reciprocating Pump)	1

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Course Code	:	CIPC102
Course Title	:	Construction Materials
Number of Credits (Teaching Load)	:	2 (L:2, T:0, P:0)
Prerequisites	:	-
Course Category	:	PC
Companion Course	:	CIPC104

COURSE LEARNING OBJECTIVES

This course aims to develop an understanding of the properties, testing, selection, and applications of commonly used construction materials, while emphasizing quality, structural performance, cost-effectiveness, and the use of sustainable and innovative materials in civil engineering construction.

COURSE OUTCOMES

After completing this course, the students will be able to:

Course Outcome	Bloom's Level
CO 1. Explain the sources, manufacturing processes, properties, classifications, specifications, and uses of stones, bricks, tiles, and other masonry materials.	L2
CO 2. Describe the manufacturing process, composition, types, properties, storage, and standard quality tests of cement in accordance with BIS specifications.	L2
CO 3. Explain the properties, seasoning, preservation, defects, and standard specifications of timber used in construction.	L2
CO 4. Identify and compare paints, varnishes, distempers, and other finishing materials based on their properties, applications, and performance requirements.	L3
CO 5. Select suitable construction materials, including engineered wood products, metals, polymers, and eco-friendly materials, for various building applications considering functionality, durability, and sustainability.	L4

OUTCOME MAPPING MATRIX							
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7
CO-1	3	2	2	–	1	–	1
CO-2	3	2	2	1	2	–	1
CO-3	3	2	2	–	2	–	1
CO-4	2	2	2	–	2	–	1
CO-5	3	3	3	1	3	1	2

COURSE CONTENTS

Unit 1: Building Stones & Bricks20 Marks

Introduction to stone: Sources of stones, Quarrying of stones by blasting and its effect on environment, Dressing of stones, Requirements of good building stones, Various uses of stones in construction work, Introduction to bricks: Raw materials for brick manufacturing and properties of good brick making earth, Size and weight of standard brick, Classification and specifications of bricks as per BIS: 1077, Tiles: Brick tiles, Ceramic tiles, Vitrified tiles, PVC Tiles, Paver blocks, interlocking tiles; Brief description and their uses.

Unit 2: Cement.....20 Marks

Introduction to cement: ingredients of cement and their properties, Flow diagram of manufacturing of cement by dry process, Various types of cements, their uses: Ordinary Portland cement, rapid hardening cement, White cement & Portland pozzolana cement, Testing of Cement: Fineness Test, Specific Gravity of Cement, Standard Consistency Test, Initial & Final Setting Times, Soundness of Cement and Compressive Strength of cement, Properties of compounds of cement, Storage of Cement at site.

Unit 3: Timber20 Marks

Timber as a Building Material, Seasoning of timber: Purpose, methods of seasoning as per BIS Code, Properties of timber and specifications of structural timber, Defects in Timber, Preservation of timber and methods of treatment as per BIS.

Unit 4: Paints, Varnishes and Distempers20 Marks

Definition, Purpose and use of paints, Characteristics of an ideal paint, Types of paints and their uses: Oil paints, Water paints, Cement paints and Enamel paint, Definition, Purpose and use of varnishes, Characteristics of an ideal varnish, Definition, Properties and process of distemping.

Unit 5: Miscellaneous Materials.....20 Marks

Introduction and uses of Laminated Board, Block Board, Fiber Board, HDHMR, Board, Sunmica, Plywood, and Veneers, Introduction to Ferrous metals; cast iron, mild steel, HYSD steel, high-tension steel as per BIS, Aluminium, Stainless Steel, PVC wall paneling, Materials used in interior decoration works like POP, Introduction, Properties and uses of UPVC, Eco friendly materials for construction of buildings.

SUGGESTED DISTRIBUTION OF MARKS

Unit	Time (Hours)	Marks Allotted
Unit 1: Building Stones & Bricks	6	20
Unit 2: Cement	6	20
Unit 3: Timber	6	20
Unit 4: Paints, Varnishes and Distempers	6	20
Unit 5: Miscellaneous Materials	6	20
TOTAL	30	100

REFERENCE BOOKS AND SUGGESTED LEARNING RESOURCES

1. Engineering Materials, SK Sharma, GC Mathur - S. Chand and Co. Jalandhar
2. Engineering Materials, Surendra Singh - Vikas Publishing House, New Delhi
3. Engineering Materials, SK Bahl - Rainbow Book Co., New Delhi
4. Civil Engineering Materials, TTTI, Chandigarh - Tata McGraw Hill, New Delhi.
5. Engineering Materials, Gurcharan Singh - Standard Publishers Distributors, Delhi.
6. Construction Materials, SC Rangawala - Charoter Publishers
7. Construction Materials, Alam Singh

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Course Code	:	CIPC104
Course Title	:	Construction Materials (Lab)
Number of Credits (Teaching Load)	:	2 (L:0, T:0, P:4)
Prerequisites	:	-
Course Category	:	PC
Companion Course	:	CIPC102

COURSE LEARNING OBJECTIVES

This course is the companion practical course to CIPC102 and is designed to reinforce the concepts covered in the theory course through hands-on experiments, practical exercises, and laboratory activities.

COURSE OUTCOMES

After completing this course, students will be able to:

Course Outcome	Bloom's Level
CO 1. Identify and classify common construction materials such as stones, bricks, timber, tiles, and other building materials through visual examination and basic laboratory observation.	L3
CO 2. Perform standard laboratory and field tests on bricks and cement to determine properties such as water absorption, efflorescence, dimensional tolerance, fineness, specific gravity, consistency, setting time, soundness, and compressive strength.	L3
CO 3. Interpret experimental results and assess the quality and suitability of construction materials in accordance with relevant specifications and construction practices.	L4
CO 4. Prepare technical laboratory reports and comparative market studies of construction materials based on parameters such as cost, brand, specifications, and sizes available in the local market.	L5

OUTCOME MAPPING MATRIX							
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7
CO-1	3	2	1	2	1	–	–
CO-2	3	3	2	3	2	1	–
CO-3	2	3	2	2	3	1	1
CO-4	1	2	2	2	1	3	2

LIST OF EXPERIMENTS

Sr. No.	Experiment Objective
1.	To identify the stones used in building works by visual examination.

Sr. No.	Experiment Objective
2.	To determine the water absorption & efflorescence of bricks.
3.	To conduct a practical for dimensional tolerances of a brick.
4.	Identify different types of flooring tiles such as: Brick tiles, Ceramic tiles, Vitrified tiles, Glazed tiles, Anti – skid tiles, Interlocking tiles, Paver blocks and prepare a report about specifications.
5.	To determine the crushing strength of bricks.
6.	To determine fineness (by sieve analysis) of cement, normal consistency and initial and final setting times of cement.
7.	To conduct various field test of cement.
8.	To determine the specific gravity of cement.
9.	To determine soundness of cement.
10.	To determine compressive strength of cement.
11.	To identify various types of timber such as: Teak, Sal, Chir, Shisham, Deodar, Kail and Hollock by visual examination only.
12.	* The students should submit a report work on any 02 construction materials out of the 04 mentioned below. They will also show the competitive study based upon the Cost, Brand Name and Sizes available in the local market: a) Plywood, Veneers, Sunmica, HDHMR Board. b) Paints, Varnishes and Distempers. c) Aluminium and Stainless Steels. d) PVC and uPVC Panels.

* Students shall undertake a field visit to any local building materials market for observation and identification and to collect relevant information regarding various construction materials.

STANDARD LIST OF TOOLS AND EQUIPMENT

Sr. No.	Name of the Tool/ Equipment	Quantity
1.	Gauging Trowel, Masonry Trowel	6 Each
2.	Mixing Tray	4 Nos.
3.	Digital Weighing Machine; Capacity – 10kg x0.1g (accuracy)	2 Nos.
4.	Measuring Tape	4 Nos.

Sr. No.	Name of the Tool/ Equipment	Quantity
5.	Standard Test Sieve Size – 90 micron (Spun Brass Framed) conforming to IS: 460	4 Nos.
6.	Le-Chatelier's flask for density test; Capacity – 250ml; conforming to IS: 4031	6 Nos.
7.	Graduated Measuring Cylinders; 100 ml, 500 ml, 1000 ml	4 Each
8.	Vicat Apparatus; conforming to IS:5513	6 Nos.
9.	Le-Chatelier Test Apparatus; conforming to IS:5514	6 Nos.
10.	Water Bath	1 No.
11.	Automatic Compression Testing Machine (ACTM)	1 No.
12.	Cement Mortar Cube Moulds; Size 70.6 mm x 70.6 mm x 70.6 mm; conforming to IS: 10086	10 Nos.

REFERENCE BOOKS AND SUGGESTED LEARNING RESOURCES

1. Lab Manual in Testing of Engineering Materials, Dr. Hemant Sood - New Age International, Delhi
2. Handbook of Civil Engineering by PN Khanna.
3. Civil Engineering Materials, TTTI, Chandigarh - Tata McGraw Hill Publication, New Delhi.
4. Construction Materials, SC Rangawala - Charotar Publishers.

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Course Code	:	COPC102
Course Title	:	Foundations of Web Designing
Number of Credits (Teaching Load)	:	2 (L:2, T:0, P:0)
Prerequisites	:	-
Common to Programmes	:	CO, IoT, AI
Course Category	:	PC
Companion Course	:	COPC104

COURSE LEARNING OBJECTIVES

In today's digital world, the world-wide-web serves as the primary platform for communication, information sharing, business, education, and service delivery. Understanding how web pages are structured, designed, and delivered over the Internet is essential for students pursuing careers in computing and information technology. This course provides the foundational knowledge required to create and manage web content and prepares learners for advanced web development technologies.

COURSE OUTCOMES

After completing this course, the students will be able to:

Course Outcome	Bloom's Level
CO 1. Explain basic Internet and WWW terminology and concepts.	L2
CO 2. Develop structured web pages using appropriate HTML elements and attributes.	L3
CO 3. Apply CSS to control the presentation, layout, and formatting of web pages.	L3
CO 4. Design simple static websites with consistent structure, navigation, and styling.	L6

OUTCOME MAPPING MATRIX							
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7
CO-1	3	-	-	-	-	-	-
CO-2	1	-	3	2	-	-	-
CO-3	-	-	2	3	-	-	-
CO-4	-	1	3	2	-	-	-

COURSE CONTENTS

Unit 1: Internet and World Wide Web15 Marks

Brief History of the Internet and World Wide Web. Basic working of the Internet and client-server model. Familiarization with the key Terms - network protocol, web server, web browser, webpage, website, web application, hypertext, hyperlink, search engine, URL, DNS.

Unit 2: HTML 5 Basic25 Marks

Introduction to HTML: purpose, coding conventions; HTML tags and elements. Structure of an HTML document: `<!DOCTYPE>`, `<html>`, `<head>`, `<body>`, `<title>`, `<meta>`; HTML comments; HTML element attributes; HTML character entities; Basic text elements: headings `<h1>`–`<h6>`; paragraph `<p>`; special text elements `<pre>`, `<code>`, `<q>`, `<var>`; Text formatting elements: `<b>`, `<strong>`, `<em>`, `<i>`, `<mark>`, `<u>`, `<sub>`, `<sup>`; HTML lists: ordered lists `<ol>`; unordered lists `<ul>`; list items `<li>`; list attributes type, start; nested lists; line break `<br>`; horizontal rule `<hr>`; HTML images and frames: `<img>`, `<iframe>` elements; image attributes src, alt, height, width.

Unit 3: HTML Structuring and Layout Elements.....25 Marks

HTML tables: table structure `<table>`, `<thead>`, `<tbody>`, `<tfoot>`, `<tr>`, `<th>`, `<td>`, `<colgroup>`, `<col>`; table attributes cellpadding, cellspacing, border; cell attributes rowspan, colspan.

Hyperlinks: `<a>` element; hyperlink attributes href, target; identifying elements: id, class, and name attributes; block and inline elements; Creating sections: `<div>`, `<span>`; HTML5 semantic elements: `<main>`, `<header>`, `<footer>`, `<article>`, `<section>`, `<nav>`, `<aside>`, `<details>`, `<summary>`, `<time>`, `<figure>`.

Unit 4: Basics of Cascading Style Sheets.....15 Marks

Introduction to CSS, CSS Types - inline, internal, external; `<style>` and `<link>` elements; CSS rule, cascading rules; selector and declaration; CSS comments; CSS length units; CSS Box Model; CSS colors - color names, RGB and HEX formats; opacity, color gradients.

Unit 5: Applying CSS to Elements20 Marks

Setting margins, borders, and padding of elements; setting colors of text, background, and borders. Text styling: font-family, font-size, font-style, font-weight, text-justify, text-transform, text-decoration, text-align. CSS layout: position, float; use of Flexbox and Grid layouts. Styling tables and lists. Basic CSS animation. CSS pseudo-classes: `:hover`, `:link`, `:visited`, `:first-child`, `:last-child`, `:nth-child()`. Responsive web design using viewport meta tag and media queries (introduction only)

SUGGESTED DISTRIBUTION OF MARKS

Unit No.	Time (Hours)	Marks Allotted
Unit 1: Internet and World Wide Web	5	15
Unit-2: HTML 5 Basic	7	25
Unit-3: HTML Structuring and Layout Elements	7	25
Unit-4: Basics of Cascading Style Sheets	5	15
Unit-5: Applying CSS to Elements	6	20
TOTAL	30	100

REFERENCE BOOKS AND SUGGESTED LEARNING RESOURCES

1. HTML & CSS: The Complete Reference, Thomas A. Powell - McGraw Hill
2. Head First HTML and CSS by Elisabeth Robson, Eric Freeman - Oreilly Media
3. HTML & CSS: Design and Build Websites by John Duckett - Wiley Publishing

ONLINE RESOURCES

4. <https://www.w3schools.com> - HTML and CSS
5. Mozilla Developer Network (MDN) Web Docs

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Course Code	:	COPC104
Course Title	:	Foundations of Web Designing (Lab)
Number of Credits (Teaching Load)	:	2 (L:0, T:0, P:4)
Prerequisites	:	Companion course: COPC102
Common to Programmes	:	CO, IoT, AI
Course Category	:	PC
Companion Course		COPC102

COURSE LEARNING OBJECTIVES

This companion laboratory course for COPC102 provides hands-on experience to develop the fundamental skills required for web designing.

COURSE OUTCOMES

After completing this course, students will be able to:

Course Outcome	Bloom's Level
CO 1. Install and configure development environment for creating and testing web pages.	L3
CO 2. Develop structured web pages using appropriate HTML elements and attributes.	L3
CO 3. Apply CSS to control the presentation, layout, and formatting of web pages.	L3
CO 4. Develop a simple multi-page static website integrating HTML and CSS.	L6

OUTCOME MAPPING MATRIX							
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7
CO-1	3	-	-	3	-	-	1
CO-2	3	1	2	2	-	-	1
CO-3	3	1	2	2	-	-	1
CO-4	2	2	3	2	1	1	2

LIST OF EXPERIMENTS

Sr. No.	Experiment Objective
1.	To install and configure Visual Studio Code and Google Chrome for static website development.
2.	Develop an HTML document for self-introduction. The experiment should demonstrate the basic structure of a web page using elements such as <!DOCTYPE>, <html>,

	<head>, <title>, and <body>, different heading levels (<h1>–<h6>) and paragraphs (<p>)
3.	Create a web page to demonstrate different text elements like <pre>, <code>, <q>, <var>, <sub>, <sup> and character entities.
4.	Create a web page to demonstrate the use of HTML lists using , , and use of attributes like start and type.
5.	Develop an HTML table demonstrating row grouping, column grouping, and cell spanning.
6.	To create at least three web pages interlinked with hyperlinks. Hyperlinks should also be created to navigate to different sections within a page. The experiment must demonstrate the use of <a> and <iframe> elements and attributes href and target.
7.	To apply different font properties, background and text colors to text elements in a web page using CSS. The experiment must demonstrate the three CSS types and the cascading effect.
8.	To style tables, images, hyperlinks and lists using CSS. The experiment must demonstrate the use of CSS box model.
9.	To create a web page using semantic elements <main>, <header>, <footer>, <article>, <section>, <nav>, <aside>, <details>, <summary>. The experiment must use the grid and flexbox CSS layouts to properly position the elements as per standard web page layout.
10.	To demonstrate the use of CSS pseudo classes. The experiment must demonstrate the use of :hover, :link, :visited, :first-child, last-child, nth-child(),:focus pseudo classes
11.	To create a web page to demonstrate basic CSS animation. The experiment must demonstrate the @keyframes CSS at-rule and different CSS transformations like translate, rotate and scale.
12.	Create a simple static website by designing a home page and linking it through hyperlinks to all the web pages developed in the experiments of this course.

STANDARD LIST OF TOOLS AND EQUIPMENT

Sr. No.	Name of the Tool/ Equipment	Quantity
1.	Desktop Computer System ▪ Processor : Intel Core i5 - Core i7/ AMD Ryzen 5 - Ryzen 7 ▪ RAM : 8 - 16 GB, ▪ Storage : HDD 500GB - 2 TB/ SSD 240GB - 500 GB ▪ Display : 19" LED/ FHD ▪ Connectivity : 100/1000 Ethernet, USB Ports ▪ OS : Pre-installed Windows 10/ 11 (64 bit)/ Linux	25 Nos.

Sr. No.	Name of the Tool/ Equipment	Quantity
2.	Online UPS (5 KVA) with 30 Minutes Backup on Full Load	02 Nos.
3.	Printer - All in One Laser Printer (Print, Scan, Copy) - A4	01 No.
4.	Networking Infrastructure ▪ 24-port Gbps Ethernet Switch ▪ 8U Wall Mount Rack ▪ 24-port Patch Panel ▪ UTP Cabling	01 No.
5.	Internet Connectivity	-
6.	Steel Almirah ▪ Size: 1980mm (H) x 900mm (W) x 480mm (D)	01 No.
7.	Interactive Panel 65” - 80” ▪ Resolution: 3840 x 2160 ▪ Wireless Keyboard & Mouse	01 No.
8.	Software ▪ Windows 10/ 11 Pro or Linux OS ▪ Visual Studio Code, ▪ Google Chrome/ Mozilla Firefox/ Microsoft Edge	-

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Course Code	:	EEPC102
Course Title	:	Electrical & Electronics Engineering Materials
Number of Credits (Teaching Load)	:	2 (L:2, T:0, P:0)
Prerequisites	:	-
Course Category	:	PC
Common To	:	EE, EV
Companion Course	:	EEPC104

COURSE LEARNING OBJECTIVES

This course aims to develop an understanding of the properties, classification, selection, and applications of electrical and electronic engineering materials, with emphasis on their performance, reliability, safety, and suitability for electrical and electronic systems. It also introduces methods for evaluating material characteristics and familiarizes students with conventional as well as advanced materials used in modern electrical and electronic devices and equipment.

COURSE OUTCOMES

After completing this course, the students will be able to:

Course Outcome	Bloom's Level
CO 1. Classify engineering materials and explain the factors affecting their electrical resistivity.	L2
CO 2. Describe the properties, types and applications of low resistivity and high resistivity conducting materials.	L2
CO 3. Illustrate the characteristics and applications of semiconducting materials and opto-electronic devices.	L3
CO 4. Identify the physical, chemical, thermal & electrical properties of various insulating materials.	L1
CO 5. Differentiate between soft and hard magnetic materials based on their properties and applications.	L4

OUTCOME MAPPING MATRIX							
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7
CO-1	3	1	-	-	-	-	1
CO-2	3	2	1	-	-	-	1
CO-3	3	2	2	1	-	-	2
CO-4	2	1	-	-	2	-	1
CO-5	3	3	2	-	1	-	1

COURSE CONTENTS

Unit 1: Classification and Fundamental Properties20 Marks

Introduction to Classification of materials: Conducting, Semi conducting and Insulating materials, Factors effecting resistivity: Detailed study of the effect of temperature, alloying, mechanical stress and impurity, Concept of superconductor and superconductivity.

Unit 2: Conducting Materials.....20 Marks

Introduction: Conducting material as low resistive and high resistive materials, Low Resistive materials: Copper, Aluminium and steel with their electrical and mechanical properties, High Resistive materials: Carbon, Nichrome, Constantan with their electrical and mechanical properties, Application: Application of high and low resistive material.

Unit 3: Semiconducting Material.....20 Marks

Introduction: Semiconductors and their properties, Types: Different types of semiconducting materials (Silicon, Germanium, Compound Semiconductors), Opto Electronic Materials: Photo Diode, LED, Solar Cell, LDR, Application: Application of Semiconducting material

Unit 4: Insulating Materials20 Marks

Introduction: General properties of insulating materials (Electrical, Mechanical, Thermal, Chemical and Physical), Types: Natural insulating materials (Mica, Ceramic), Plastics (Thermosetting, Thermoplastic), Gaseous (Air, SF₆), Application: Application of Insulating Materials material.

Unit 5: Magnetic Material and Special Materials20 Marks

Introduction: Ferromagnetic materials, permeability, B-H curve, magnetic saturation, hysteresis loop, concept of eddy current and hysteresis loss, curie temperature, magnetostriction effect. Types: Soft Magnetic materials (Nickel-iron alloy and soft ferrites) and Hard magnetic materials (Chrome steel and hard ferrites), Application: Application of Magnetic Materials material.

SUGGESTED DISTRIBUTION OF MARKS

Unit	Time (Hours)	Marks Allotted
Unit 1: Classification and Fundamental Properties	6	20
Unit 2: Conducting Materials	6	20
Unit 3: Semiconducting Material	6	20
Unit 4: Insulating Materials	6	20
Unit 5: Magnetic Material and Special Materials	6	20
TOTAL	30	100

REFERENCE BOOKS AND SUGGESTED LEARNING RESOURCES

1. Electrical and Electronic Engineering Materials, SK Bhattacharya - Khanna Publishers, New Delhi
2. Electrical Engineering Materials, A.J. Dekker - Pearson

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Course Code	:	EEPC104
Course Title	:	Electrical & Electronics Engineering Materials (Lab)
Number of Credits (Teaching Load)	:	2 (L:0, T:0, P:4)
Prerequisites	:	-
Course Category	:	PC
Common To	:	EE, EV
Companion Course	:	EEPC102

COURSE LEARNING OBJECTIVES

This course is the companion practical course to EEPC102 and is designed to reinforce the concepts covered in the theory course through hands-on experiments, practical exercises, and laboratory activities.

COURSE OUTCOMES

After completing this course, students will be able to:

Course Outcome	Bloom's Level
CO 1. List common electrical and electronic materials to categorize them into conducting, insulating, and magnetic types.	L3
CO 2. Describe the standard procedures for measuring material properties such as resistivity, insulation resistance, and dielectric strength.	L2
CO 3. Explain the basic operational principles of opto-electronic components, including LEDs, photodiodes, and solar cells.	L3
CO 4. Identify the physical, chemical, and electrical characteristics of solid and liquid insulating materials through visual inspection and testing.	L1
CO 5. Demonstrate magnetic phenomena, including eddy current losses and B-H curve characteristics, in magnetic materials.	L3

OUTCOME MAPPING MATRIX							
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7
CO-1	2	1	2	1	-	-	1
CO-2	2	2	3	2	-	-	1
CO-3	2	2	2	2	-	-	1
CO-4	2	2	3	1	2	-	1
CO-5	1	1	3	2	3	2	1

LIST OF EXPERIMENTS

Sr. No.	Experiment Objective
1.	Measurement and comparison of the resistivity of different materials like copper, aluminium, steel, constantan and nichrome.
2.	Observation & recording of the change in resistance of copper and aluminium wire when subjected to heating.
3.	Analyze the unidirectional operation of LED & photo diode.
4.	Measurement of the change in output voltage of a solar cell when exposed to varying distance from a light source.
5.	Identification of different types of Solid & liquid insulating materials commonly used in Electrical machines.
6.	Testing the dielectric strength of transformer oil.
7.	Measurement of the insulation resistance of a motor winding, cable using a megger.
8.	Demonstration of the presence of magnetic field and poles in soft & hard magnetic poles using magnetic compass.
9.	Demonstration of eddy current losses in magnetic materials.
10.	To study and plot the B-H curve for ferromagnetic materials.

STANDARD LIST OF TOOLS AND EQUIPMENT

Sr. No.	Name of the Tool/ Equipment	Quantity
1.	Digital Multimeter (DMM)	6 Nos.
2.	Analog Voltmeter and Ammeter	4 Each
3.	Wheatstone Bridge / Meter Bridge	2 Nos.
4.	Micro-ohmmeter	1 No.
5.	Megger (Insulation Resistance Tester)	2 Nos.
6.	LCR Meter	1 No.
7.	Clamp Meter	2 Nos.
8.	Temperature Control Setup (Oven/ Heating Coil with Thermometer)	2 Nos.
9.	Rheostat	4 Nos.
10.	DC Power Supply	4 Nos.
11.	Connecting Wires and Breadboards	10 Sets
12.	Resistance Boxes	4 Nos.
13.	Galvanometer	2 Nos.
14.	B-H Curve Tracer Kit	1 No.

Sr. No.	Name of the Tool/ Equipment	Quantity
15.	Eddy Current Demonstration Kit	1 No.
16.	Silicon and Germanium Samples	4 Each
17.	PN Junction Diodes	10 Nos.
18.	Photodiode	6 Nos.
19.	Light Emitting Diode (LED)	10 Nos.
20.	Solar Cell Panel / Kit	2 Nos.
21.	Magnetic Material Kits (Soft & Hard)	3 Sets
22.	Oscilloscope	1 No.
23.	Copper, Aluminium, Steel, Nichrome, Constantan Samples	5 Sets
24.	Mica, Ceramic, Plastic, Bakelite Samples	5 Sets
25.	Transformer Oil Sample	2 Nos.
26.	LDR (Light Dependent Resistor)	6 Nos.
27.	Hysteresis Loop Setup	1 No.
28.	Magnetostriction Demonstration Kit	1 No.
29.	Soldering Iron Kit	4 Nos.
30.	Safety Gloves and Goggles	6 Sets
31.	Computer System with Simulation Software	2 Nos.
32.	Projector / Smart Board	1 No.

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Course Code	:	ELPC102
Course Title	:	Fundamentals of Electrical Generation Systems
Number of Credits (Teaching Load)	:	2 (L:2, T:0, P:0)
Prerequisites	:	-
Course Category	:	PC
Companion Course	:	ELPC104

COURSE LEARNING OBJECTIVES

This course provides fundamental knowledge of various conventional and renewable energy sources used for power generation. It helps students understand the working principles, components, and applications of different power plants, focusing on their working principles, components, site selection, and environmental impacts.

COURSE OUTCOMES

After completing this course, the students will be able to:

Course Outcome	Bloom's Level
CO 1. Identify the various conventional and renewable energy sources and state their importance in the national energy scenario.	L1
CO 2. Explain the working principles and describe the major components (boiler, turbine, and generator) of coal-based thermal power plants.	L2
CO 3. Demonstrate the operational layout of hydroelectric power plants and calculate the available energy based on discharge and head.	L3
CO 4. Compare the working principles of solar photovoltaic and wind energy systems and examine their respective site selection criteria.	L4
CO 5. Evaluate the environmental impacts and justify the advantages of renewable energy sources.	L5

OUTCOME MAPPING MATRIX							
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7
CO-1	3	-	-	-	3	-	1
CO-2	3	1	-	-	2	-	-
CO-3	3	2	1	-	2	-	-
CO-4	2	2	1	-	3	1	1
CO-5	2	1	-	-	3	-	1

COURSE CONTENTS

Unit 1: Energy Overview & Classification.....15 Marks

Introduction: Conventional and Non-conventional (Renewable) sources of energy, Importance of Non-conventional sources of energy. Role of non-conventional or renewable energy sources in Indian economy, urgent need for a transition to renewable energy sources, Present National energy scenario.

Unit 2: Thermal Generation.....20 Marks

Coal-Based Thermal Plants: Block diagram, working and major components: Boiler, Steam Turbine, Generator, Condenser, and Cooling systems; site selection.

Unit 3: Hydroelectric Power Systems30 Marks

Layout of a hydro power plant, and major elements - Dam, Penstock, Introduction to Impulse and reaction Turbines, Generator and Transformer, Expression for energy available based on discharge (Q), Head(H). Low, Medium and high head hydro power plants, run-of-river, Storage type, and Pumped storage systems. Micro, Mini and Large hydro power plants, environmental advantages of micro and mini over large-scale plants, site selection.

Unit 4: Solar & Wind Energy.....20 Marks

Solar Energy: Introduction to solar radiation, PV technology, Solar Photovoltaic (PV) power plant: layout, construction, working.

Wind Energy: Principles of Wind Energy Conversion Systems (WECS); Horizontal and Vertical axis turbines; Site selection.

Unit 5: Bio-Energy and Environmental Impacts.....15 Marks

Biomass: Introduction to biomass, Anaerobic digestion process, Construction and layout of Biogas power plant, Advantages of Biomass Power Plant, Environmental Impacts of conventional Power Plants.

SUGGESTED DISTRIBUTION OF MARKS

Unit	Time (Hours)	Marks Allotted
Unit 1: Energy Overview & Classification	5	15
Unit 2: Thermal Generation	6	20
Unit 3: Hydroelectric Power Systems	8	30
Unit 4: Solar & Wind Energy	6	20
Unit 5: Bio-Energy and Environmental Impacts	5	15
TOTAL	30	100

REFERENCE BOOKS AND SUGGESTED LEARNING RESOURCES

1. Generation of Electrical Energy, B.R. Gupta - S. Chand Publishing.
2. A Course in Electrical Power, B. Gupta - S.K. Kataria & Sons.
3. Power Plant Engineering, P.K. Nag - McGraw Hill Education.
4. Non-Conventional Energy Sources, G. D. Rai - Khanna Publishers.
5. Energy Technology (Non-conventional, Renewable and Conventional), S. Rao and B.B. Parulekar - Khanna Publishers.
6. Renewable Energy Resources, John Twidell and Tony Weir - Routledge.

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Course Code	:	ELPC104
Course Title	:	Fundamentals of Electrical Generation Systems (Lab)
Number of Credits (Teaching Load)	:	2 (L:0, T:0, P:4)
Prerequisites	:	-
Course Category	:	PC
Companion Course	:	ELPC102

COURSE LEARNING OBJECTIVES

This course is the companion practical course to ELPC102 and is designed to reinforce the concepts covered in the theory course through hands-on experiments, practical exercises, and laboratory activities.

COURSE OUTCOMES

After completing this course, students will be able to:

Course Outcome	Bloom's Level
CO 1. Compile a structured datasheet on India's current conventional and renewable energy mix by gathering authentic data from national statutory portals (MNRE/CEA).	L6
CO 2. Identify and classify the working principles of various prime mover turbines (steam, water and wind) and major components used across different power generation layouts.	L2
CO 3. Explain the critical safety mechanisms of a nuclear reactor and determine the specific operational parts required for routine maintenance of micro-hydro systems.	L3
CO 4. Assemble and test a functional solar home lighting system using discrete solar PV components.	L3
CO 5. Analyze the energy conversion workflow of a biogas power plant and formulate engineering specifications for its key constituent parts.	L6

OUTCOME MAPPING MATRIX							
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7
CO-1	2	2	-	3	2	-	2
CO-2	3	1	-	2	1	-	-
CO-3	3	2	-	2	2	-	1
CO-4	3	1	2	3	3	1	2
CO-5	2	2	1	2	3	-	1

LIST OF EXPERIMENTS

Sr. No.	Experiment Objective
1.	Visit the Ministry of New and Renewable Energy (MNRE) and Central Electricity Authority (CEA) websites to prepare a datasheet on India's current power generation mix (Conventional vs. Renewable).
2.	Identify and study the working of different types of turbines (Steam, Water, and Wind) used as prime movers in various electrical generation plants visiting various technical websites.
3.	Observe and identify the major components of a thermal power plant (Boiler, Turbine, Condenser and Cooling Tower) visiting various technical websites.
4.	Study/ Identify the key safety components of a nuclear reactor (Control rods, Moderators, Shielding) and study their role in controlled fission.
5.	Study the layout of a hydroelectric plant to identify the Dam, Penstock, Surge Tank, and Turbine types.
6.	Identify routine maintenance parts and control requirements for a Micro-Hydro power plant through site visits or technical videos.
7.	Assemble a solar home lighting system.
8.	Study a Biogas power plant to observe the energy conversion process and write component specifications through technical videos or site visit.

STANDARD LIST OF TOOLS AND EQUIPMENT

Sr. No.	Name of the Tool/ Equipment	Quantity
1.	Computing Device: PC/ Laptop with high-speed internet access to navigate MNRE and CEA portals.	2
2.	Hydraulic Layout Board: Large-scale schematic diagram or physical model including Dam, intake gate, Penstock (high-pressure steel pipe model), Surge Tank, and Power house.	1

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Course Code	:	EXPC102
Course Title	:	Fundamentals of Electronics
Number of Credits (Teaching Load)	:	2 (L:2, T:0, P:0)
Prerequisites	:	-
Course Category	:	PC
Companion Course	:	EXPC104

COURSE LEARNING OBJECTIVES

Electronics is playing a key role in all engineering applications. All engineers should have basic knowledge of electronics. Purpose of this subject is to make students familiar with basic electronics concepts. Students will be able to understand the working of Diode, Transistor, FET and overview of Analog and Digital ICs and simulate basic circuits on simulation software.

COURSE OUTCOMES

After completing this course, the students will be able to:

Course Outcome	Bloom's Level
CO 1. Define the historical evolution of electronics, basic properties of semiconductor materials.	L2
CO 2. Illustrate the working mechanisms, characteristics, and applications of Diode, BJTs and FETs.	L2
CO 3. Measure the voltage gain, current gain and signal gain for single-stage amplifiers.	L3
CO 4. Explain and distinguish between the operation of Analog ICs and Digital ICs.	L4

OUTCOME MAPPING MATRIX							
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7
CO-1	3	-	-	-	-	-	2
CO-2	3	1	-	-	-	-	1
CO-3	3	3	1	-	-	-	-
CO-4	3	2	-	-	-	-	-

COURSE CONTENTS

Unit 1: Introduction to Electronics10 Marks

Origin and Historic prospective of electronics, role of semiconductor material in electronics, intrinsic and extrinsic semiconductor, Difference between electronics and electrical engineering.

Unit 2: Diode theory and Application.....20 Marks

PN junction diode, mechanism of current flow in PN junction, depletion layer, forward and reverse biased PN junction, potential barrier, V-I characteristics of Diode, ideal diode, Applications of diode such as rectifier. Types of diodes - Zener diode, LED and Photodiode.

Unit 3: Bipolar Junction Transistors30 Marks

Concept of a bipolar transistor, its structure, PNP and NPN transistors, their symbols and mechanism of current flow, Current relations in a transistor, concept of leakage current; CB, CE, CC configurations of a transistor, Input and output characteristics in CE Configuration, Comparison of CB, CE and CC Configurations, Application of transistors as switch and amplifiers.

Unit 4: Basic Amplifiers15 Marks

Concept of amplification, Voltage gain, current gain and power gain. Single-stage transistor amplifier.

Unit 5: Field effect transistors (FET).....15 Marks

Field effect transistor and its types, Junction field effect transistors (JFET), Comparison of BJT, JFET and MOSFET.

Unit 6: Introduction to Integrated Circuits.....10 Marks

Concept of Analog ICs and Concept of Digital ICs

SUGGESTED DISTRIBUTION OF MARKS

Unit	Time (Hours)	Marks Allotted
Unit 1: Introduction to Electronics	3	10
Unit 2: Diode theory and application	6	20
Unit 3: Bipolar junction transistors	8	30
Unit 4: Basic Amplifiers	5	15
Unit 5: Field effect transistors (FET)	5	15
Unit 6: Introduction to Integrated Circuits	3	10
TOTAL	30	100

REFERENCE BOOKS AND SUGGESTED LEARNING RESOURCES

1. Electronic Devices and Circuits, David A. Bell - Oxford University Press
2. Electronic Principles, Albert Malvino & David, - Tata McGraw-Hill, Seventh edition
3. Electronic Devices and Circuit Theory, R. L. Boylestad & L. Nashelsky - Pearson Education
4. Basic Electronics and Linear Circuit, Kulshreshtha and SC Gupta - Tata McGraw Hill, New Delhi.
5. Principles of Electrical and Electronics Engineering, V K Mehta - S Chand & Co., New Delhi
6. Electronic Principles, S.K. Sahdev - Dhanpat Rai & Co., New Delhi
7. <http://nptel.ac.in/syllabus/117103063/>
8. <https://swayam.gov.in/course/3595-basic-electronics>
9. eSIM available on FOSSEE website: <https://fossee.in/>

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Course Code	:	EXPC104
Course Title	:	Fundamentals of Electronics (Lab)
Number of Credits (Teaching Load)	:	2 (L:0, T:0, P:4)
Prerequisites	:	-
Course Category	:	PC
Companion Course	:	EXPC102

COURSE LEARNING OBJECTIVES

Upon successful completion of this course, students will be able to test and identify the terminals of basic electronic components (diodes, Zener diodes, and transistors) using multimeter and datasheets, analyze and plot their V-I and input/output characteristics, demonstrate their practical applications in rectifier and Common Emitter amplifier circuits, understand the functionalities of common analog and digital ICs, and design as well as simulate these electronic circuits using standard EDA tools like TinkerCAD, KiCAD, or MultiSIM.

COURSE OUTCOMES

After completing this course, students will be able to:

Course Outcome	Bloom's Level
CO 1. Measure and plot the characteristics of Zener diodes and transistors	L2
CO 2. Test and identify basic electronic components using a multimeter.	L3
CO 3. Construct and test basic electronic circuits - rectifiers, CE amplifiers and analog/digital ICs to verify their operation.	L3
CO 4. Analyze the operation of basic electronic circuits using software simulation tools like TinkerCAD, KiCAD or MultiSIM.	L4

OUTCOME MAPPING MATRIX							
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7
CO-1	3	2	-	3	-	-	1
CO-2	3	-	-	3	-	-	1
CO-3	3	2	2	3	1	2	2
CO-4	2	3	1	3	-	-	2

LIST OF EXPERIMENTS

Sr. No.	Experiment Objective
1.	Testing of diode & identify its terminal using multimeter.
2.	To observe the output of half wave and full wave diode rectifier circuit.
3.	Study the VI characteristics of Zener Diode.
4.	Testing of transistor & identify its terminal using multimeter.
5.	Study various parameters of Diode and Transistor using Datasheet.
6.	Plot the input & output characteristics of transistor configuration CE.
7.	Demonstrate transistor as an amplifier using common emitter configuration.
8.	Study of commonly used Analog and Digital ICs.
9.	Simulate simple electronic circuits in Tinker CAD/ eSIM EDA/ KiCAD/ MultiSIM/ Proteous.

STANDARD LIST OF TOOLS AND EQUIPMENT

Sr. No.	Name of the Tool/ Equipment	Quantity
1.	Breadboard/ Trainer board	1
2.	Digital Multimeter	1
3.	Cathode Ray Oscilloscope/ Digital Storage Oscilloscope	1
4.	DC Regulated Power Supply	1
5.	Function Generator	1
6.	Diode (IN4007)	4
7.	BJT Transistor (BC547 or similar)	2
8.	JFET	1
9.	Digital ICs (7408, 7432, 7404, IC741, IC555)	1 each
10.	Resistors (100 ohm -100 kohm) Range	10
11.	Capacitor (Electrolytic & Ceramic Capacitor)	4
12.	Potentiometer/Variable resistor	1
13.	LED, Zener Diode	2
14.	Transformer for Rectifier	1

Sr. No.	Name of the Tool/ Equipment	Quantity
15.	Desktop Computer System: ▪ Processor : Intel Core i5 / AMD Ryzen-5 ▪ 8 - 16 GB RAM, ▪ HDD 500GB - 2 TB/ SSD 240GB - 500 GB ▪ Display - 19" LED/FHD ▪ 100/1000 Ethernet, USB Ports ▪ Pre-installed Windows 10/ 11Pro (64 bit)	1
16.	Circuit Simulation Software Tinker CAD/ eSIM/ EDA/ KiCAD/ Multisim/ Proteus	Any one or more
17.	Connecting Wires/ Patch Cords	15-20
18.	Online UPS (5 KVA) with 30 Minutes Backup on Full Load	01 No.

Note: Quantity will multiply with number of groups (where each group includes 3-4 students).

Dedicated trainer board may be utilized if not to be designed on breadboard.

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Course Code	:	IEPC102
Course Title	:	Fundamentals of Instrumentation Engineering
Number of Credits (Teaching Load)	:	2 (L:2, T:0, P:0)
Prerequisites	:	-
Course Category	:	PC
Companion Course	:	IEPC104

COURSE LEARNING OBJECTIVES

To introduce the basic concepts of measurement and instrumentation with understanding of industrial signal standards and measurement system building blocks. This course will familiarize the students about common process variables, sensors, foundation of automation, basic control concepts, industrial control components and safety practices in industries.

COURSE OUTCOMES

After completing this course, the students will be able to:

Course Outcome	Bloom's Level
CO 1. Explain basic concepts of measurement and instrumentation.	L2
CO 2. Identify functional elements of industrial measurement systems.	L2
CO 3. Explain & apply working principles of common industrial sensors in industrial measurements.	L3
CO 4. Understand basic automation and control concepts.	L2
CO 5. Recognize common industrial control components and safety practices.	L1

OUTCOME MAPPING MATRIX							
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7
CO-1	3	2	-	-	1	-	2
CO-2	3	2	1	2	1	-	2
CO-3	3	2	2	3	1	-	2
CO-4	3	2	2	2	1	1	2
CO-5	3	2	1	2	3	1	2

COURSE CONTENTS

Unit 1: Introduction to Measurement and Instrumentation.....20 Marks

- 1.1. Definition of Measurement.
- 1.2. Role of measurement in safety, quality & control.

- 1.3. Basic definitions of Static characteristics of measurement: Accuracy, Precision, Sensitivity, Resolution, Range, Span, Threshold, Linearity, Repeatability, Hysteresis & Drift.
- 1.4. Definition & Applications of Instrumentation Engineering.
- 1.5. Role of Instrumentation Engineers in industry.
- 1.6. Concept of Calibration.

Unit 2: Industrial Measurement System.....20 Marks

- 2.1. Functional block diagram of generalized measurement system. Need of Signal Conditioning.
- 2.2. Brief idea of: Sensor /Transducer, Controller &Final Control Element/Actuator.
- 2.3. Industrial Signal Standards:
0–10 VDC, 4–20 mA DC current loop, 3–15 psi pneumatic signal.
- 2.4. Advantages of adopting 4–20 mA DC system.
- 2.5. Comparison of Electrical, Pneumatic & Hydraulic System.

Unit 3: Measurement of Process Variables.....20 Marks

- 3.1. Definition & units of process variables: Temperature, Pressure, Level & Flow.
- 3.2. Temperature measurement using RTD (construction & working only).
- 3.3. Pressure measurement using C-type bourdon tube (construction & working only).
- 3.4. Level measurement using resistive technique (construction & working only).
- 3.5. Flow measurement using Rota meter (construction & working only).

Unit 4: Fundamentals of Automation and Control20 Marks

- 4.1. Definition, need, advantages & limitations of Automation.
- 4.2. Definition of Control System.
- 4.3. Comparison of Open loop and closed loop control system.
- 4.4. Concept of Positive & Negative Feedback.
- 4.5. ON/OFF control system.
- 4.6. Introduction to Industry 4.0 standard.
- 4.7. Definition of PLC, DCS, SCADA & PID.

Unit 5: Industrial Control Components and Safety20 Marks

- 5.1. Relay (construction & working only).
- 5.2. Role of annunciator in industries.
- 5.3. Basics of proximity sensor.
- 5.4. Electrical safety practices.
- 5.5. Importance of proper earthing, grounding & shielding in industrial installations

SUGGESTED DISTRIBUTION OF MARKS

Unit	Time (Hours)	Marks Allotted
Unit 1: Introduction to Measurement and Instrumentation	06	20
Unit 2: Industrial Measurement System	06	20
Unit 3: Measurement of Process Variables	06	20
Unit 4: Fundamentals of Automation and Control	06	20
Unit 5: Industrial Control Components and Safety	06	20
TOTAL	30	100

REFERENCE BOOKS AND SUGGESTED LEARNING RESOURCES

1. Instrumentation Measurement and Analysis, B.C. Nakra & K.K. Chaudhry – Tata McGraw Hill
2. Electronic Instrumentation, H.S. Kalsi – Tata McGraw Hill
3. A Course in Electrical and Electronic Measurements and Instrumentation by A.K. Sawhney – Dhanpat Rai & Co.
4. Electrical and Electronic Measurements and Instrumentation by R.K. Rajput – S. Chand Publishing

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Course Code	:	IEPC104
Course Title	:	Fundamentals of Instrumentation Engineering (Lab)
Number of Credits (Teaching Load)	:	2 (L:0, T:0, P:4)
Prerequisites	:	-
Course Category	:	PC
Companion Course	:	IEPC102

COURSE LEARNING OBJECTIVES

This course is the companion practical course to IEPC102 and is designed to reinforce the concepts covered in the theory course through hands-on experiments, practical exercises, and laboratory activities.

COURSE OUTCOMES

After completing this course, students will be able to:

Course Outcome	Bloom's Level
CO 1. Perform measurement of temperature, pressure and flow using basic instruments.	L3
CO 2. Observe and interpret operation of relay and On-Off control systems.	L2
CO 3. Demonstrate PLC-based switching and basic industrial automation.	L3
CO 4. Use laboratory instruments and follow safe engineering practices.	L3

OUTCOME MAPPING MATRIX							
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7
CO-1	3	2	1	3	1	-	2
CO-2	3	2	2	3	1	-	2
CO-3	3	2	2	3	1	1	2
CO-4	2	1	1	3	3	1	2

LIST OF EXPERIMENTS

Sr. No.	Experiment Objective
1.	To observe the range, span & resolution of temperature gauge.
2.	To observe the working of On-Off controller in a pneumatic system.
3.	To measure the temperature using RTD.

Sr. No.	Experiment Objective
4.	To measure the pressure using pressure gauge.
5.	To measure the flow using rotameter.
6.	To observe the working of relay.
7.	To observe the switching (on/off) of light using PLC.

STANDARD LIST OF TOOLS AND EQUIPMENT

Sr. No.	Name of the Tool/ Equipment	Quantity
1.	Temperature Gauge	05 Nos.
2.	Air Compressor (with Auto Cut-Off feature)	01 No.
3.	RTD	05 Nos.
4.	Pressure Gauge	05 Nos.
5.	Flow Trainer with Rotameter	01 Nos
6.	Relay Board	05 Nos.
7.	Digital Multimeter	05 Nos.
8.	Variable DC Power Supply 0-30 VDC	05 Nos.
9.	PLC Trainer with Switching of Light Module.	01 No.
10.	Computer System with UPS	01 No.

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Course Code	:	MEPC102
Course Title	:	Mechanical Engineering Drawing
Number of Credits (Teaching Load)	:	3 (L:0, T:0, P:6)
Prerequisites	:	Engineering Graphics
Course Category	:	PC
Common To	:	ME, TD

Note: The course shall be evaluated with the same weightage and on the same analogy as Engineering Graphics (ES103).

COURSE LEARNING OBJECTIVES

Drawing is the language of engineers and technicians. Reading and interpreting engineering drawing is their day-to-day responsibility. The subject is aimed at developing basic graphic skills in the students so as to enable them to use these skills in preparation of engineering drawings, their reading and interpretation. The emphasis, while imparting instructions, should be to develop conceptual skills in the students following BIS SP 46-2003.

COURSE OUTCOMES

After completing this course, the students will be able to:

Course Outcome	Bloom's Level
CO 1. Apply standard dimensioning techniques on engineering drawings.	L3
CO 2. Draw and read screw threads, nuts and bolts.	L3
CO 3. Draw different sections of various types of keys and cotters.	L3
CO 4. Draw and read the assembly drawings from part details of simple objects.	L3

OUTCOME MAPPING MATRIX							
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7
CO-1	3	–	–	2	2	1	–
CO-2	3	1	1	2	–	1	1
CO-3	3	1	1	2	–	1	1
CO-4	3	2	2	2	–	1	1

COURSE CONTENTS

Unit 1: Advanced Dimensioning Techniques (1 Sheets).....15 Marks

Necessity of dimensioning; methods, types and principles, Dimensioning of: Overall sizes, Circles, Threaded holes, Chamfered surfaces, Angles, Tapered surfaces, Holes on P.C.D.,

Countersunk holes, Counterbore holes, cylindrical Parts, Narrow spaces and gaps, Radii, curves and arches.

Unit 2: Screw Threads (2 Sheets)15 Marks

Thread terms and nomenclature & types: External/Internal, Right-hand/Left-hand, Actual/Conventional, Single/multi-start, Thread forms (Free Hand sketches): V-threads (BSW, BA, American and Metric), Square, Acme, Buttress, Knuckle threads.

Unit 3: Nuts and Bolts (2 Sheets).....25 Marks

Different views of hexagonal and square nuts; square and hexagonal headed bolts, Assembly of hexagonal headed bolt and hexagonal nut with washer, Assembly of square headed bolt with hexagonal nut and washer.

Unit 4: Keys and Cotters (2 Sheets)20 Marks

Various types of keys and cotters – practical applications; drawing of various keys and cotters, Joints: Spigot & Socket, Gib & Cotter, Knuckle.

Unit 5: Drawing, Reading & Interpretation of Assemblies (2 Sheets).....25 Marks

Drawing, reading, interpretation of following mechanical components & assembly with Bill of materials, Couplings: Protected flange, unprotected flange and Flexible, Bearings : Bushed, Foot step.

SUGGESTED DISTRIBUTION OF MARKS

Unit	Time (Hours)	Marks Allotted
Unit 1: Advanced Dimensioning Techniques	10	15
Unit 2: Screw Threads	16	15
Unit 3: Nuts and Bolts	22	25
Unit 4: Keys and Cotters	22	20
Unit 5: Drawing, Reading & Interpretation of Assemblies	20	25
TOTAL	90	100

REFERENCE BOOKS AND SUGGESTED LEARNING RESOURCES

1. Engineering Drawing, P. S. Gill - S. K. Kataria & Sons, New Delhi.
2. Elementary Engineering Drawing in First Angle Projection, N. D. Bhatt - Charotar Publishing.
3. A Text Book of Engineering Drawing, Surjit Singh - Dhanpat Rai & Co.
4. Engineering Drawing, R. B. Gupta - Satya Prakashan.
5. Engineering Graphics, Sharad K. Pradhan and K.K Jain - Kanna Book Publishing Co.
6. Engineering Drawing Practice for Schools and Colleges (SP 46:2003) – Bureau of Indian Standards.

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Course Code	:	MXPC102
Course Title	:	Basics of Mechatronics
Number of Credits (Teaching Load)	:	2 (L:2, T:0, P:0)
Prerequisites	:	-
Course Category	:	PC
Companion Course	:	MXPC104

COURSE LEARNING OBJECTIVES

Mechatronics is a multidisciplinary field that integrates mechanical systems, electrical systems, electronics, sensors and control systems. This subject introduces students to the basic concepts of mechatronics along with fundamentals of electrical machines and electronic devices used in modern automation systems. The course will help students understand how mechanical and electronic components work together in industrial and domestic applications.

COURSE OUTCOMES

After completing this course, the students will be able to:

Course Outcome	Bloom's Level
CO 1. Explain the fundamentals of mechatronics systems, control systems and their multidisciplinary applications.	L2
CO 2. Classify and select appropriate sensors and transducers for basic engineering applications.	L3
CO 3. Explain the construction and operation of pneumatic and hydraulic actuators and associated control components.	L2
CO 4. Analyze the working of mechanical actuation systems and power transmission mechanisms used in mechatronic systems.	L4
CO 5. Differentiate the operation and applications of electrical machines, semiconductor devices and integrated circuits used in automation systems.	L4

OUTCOME MAPPING MATRIX							
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7
CO-1	3	2	-	-	-	-	1
CO-2	2	3	2	3	-	-	1
CO-3	2	3	-	2	3	-	-
CO-4	2	3	3	2	1	-	-
CO-5	3	2	2	3	-	-	2

COURSE CONTENTS

Unit 1: Fundamentals of Mechatronics & Sensors.....15 Marks

- 1.1. Introduction to Mechatronics and its multidisciplinary nature.
- 1.2. Control Systems: Open-loop, Closed-loop, and Sequential (Block Diagrams).
- 1.3. Sensors and Transducers: Displacement, Position, and Motion sensors.
- 1.4. Specialized Applications: Temperature, Liquid flow, and Light sensors

Unit 2: Pneumatic & Hydraulic Systems20 Marks

- 2.1. Basic working and applications of Pneumatic and Hydraulic systems.
- 2.2. Essential components: Control valves and Cylinders.
- 2.3. Introduction to Rotary actuators.

Unit 3: Mechanical Actuation Systems15 Marks

- 3.1. Role of mechanical systems in mechatronics.
- 3.2. Working principles of Cams, Gear trains, and Ratchet and pawl mechanisms.
- 3.3. Power transmission: Belt drives and Chain drives.

Unit 4: Electrical Machines15 Marks

- 4.1. Basic concepts of DC Motors and DC Generators.
- 4.2. Introduction to Transformers.
- 4.3. Real-world applications of electrical motors in daily life.

Unit 5: Transistors & its Applications15 Marks

- 5.1. Working principles of NPN and PNP transistors.
- 5.2. Operational modes: Transistor as a switch and an amplifier.
- 5.3. Applications of transistor in electronic circuit.

Unit 6: Integrated Circuit (ICs) and Modern Mechatronics Concept.....20 Marks

- 6.1. Introduction to ICs and Operational Amplifiers (Op-Amps).
- 6.2. Specific ICs: Digital gates, IC555 (Timer), and Regulator ICs (7805/7812).
- 6.3. Modern Mechatronics: Concepts of Photostat machines and 3-D printing.

SUGGESTED DISTRIBUTION OF MARKS

Unit	Time (Hours)	Marks Allotted
Unit 1: Fundamentals of Mechatronics & Sensors	5	15
Unit 2: Pneumatic & Hydraulic Systems	6	20
Unit 3: Mechanical Actuation Systems	4	15
Unit 4: Electrical Machines	4	15
Unit 5: Transistors & Applications	5	15
Unit 6: Integrated Circuit (ICs) & Modern Mechatronics Concept	6	20
TOTAL	30	100

REFERENCE BOOKS AND SUGGESTED LEARNING RESOURCES

1. Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering, W. Bolton
2. Mechatronics System Design, Devdas Shetty and Richard A. Kolk
3. Introduction to Mechatronics and Measurement Systems, David G. Alciatore, Michael B. Histan
4. Mechatronics: Principles, Concepts and Applications, N. P. Mahalik
5. Mechatronics, HMT Ltd.
6. Industrial Automation and Robotics, A. K. Gupta and S. K. Arora
7. Pneumatics and Hydraulics, Andrew Parr
8. Industrial Electronics and Control, S. K. Bhattacharya and S. Chatterjee
9. Electronic Devices & Circuit Theory, Robert L Boylestad & Louis Nashelsky

ONLINE RESOURCES

10. NPTEL Mechatronics Courses (<https://nptel.ac.in>)
11. SWAYAM Courses on Automation and Mechatronics (<https://swayam.gov.in>)

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Course Code	:	MXPC104
Course Title	:	Basics of Mechatronics (Lab)
Number of Credits (Teaching Load)	:	2 (L:0, T:0, P:4)
Prerequisites	:	-
Course Category	:	PC
Companion Course	:	MXPC102

COURSE LEARNING OBJECTIVES

This course is the companion practical course to MXPC102 and is designed to reinforce the concepts covered in the theory course through hands-on experiments, practical exercises, and laboratory activities.

COURSE OUTCOMES

After completing this course, students will be able to:

Course Outcome	Bloom's Level
CO 1. Perform experiments on sensors and transducers to measure physical parameters and interpret their characteristics for mechatronic applications.	L3
CO 2. Operate and analyze hydraulic, pneumatic and DC motor systems used in mechatronic applications.	L4
CO 3. Construct and test transistor and operational amplifier circuits for basic electronic applications.	L3
CO 4. Assemble and troubleshoot regulated power supply and IC 555 timer circuits for control applications.	L6
CO 5. Analyze the working of a photocopier as an integrated mechatronic system and demonstrate safe laboratory practices with proper documentation.	L4

OUTCOME MAPPING MATRIX							
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7
CO-1	3	2	-	3	1	-	-
CO-2	3	3	2	3	2	-	2
CO-3	3	2	3	3	1	-	1
CO-4	3	3	3	3	2	1	2
CO-5	2	2	-	2	3	2	3

LIST OF EXPERIMENTS

Sr. No.	Experiment Objective
1.	Demonstration and use of temperature transducer to measure temperature on Trainer kit.
2.	Demonstration and use of light transducer to measure presence and absence of light on Trainer kit.
3.	Operation and control of any DC motor using electronics Trainer kit.
4.	Demonstration of Hydraulic and pneumatic system on Trainer kit.
5.	Application of transistor as Switch and Amplifier using Trainer kit.
6.	Application of OPAMP as inverter, comparator and zero crossing detectors on Analog Lab base Trainer.
7.	Generate $\pm 5V$ DC power supply using IC regulators and transformer/rectifier/Filters.
8.	Implement any two 555 based control application on Trainer Kit.
9.	Generate $\pm 12V$ DC power supply using IC regulators and transformer/rectifier/Filters.
10.	Demonstration of Photostat machines as mechatronics based product to explain various parts Input sensors, control, output system, mechanical parts, electrical and electronics system used in photo state machine.

STANDARD LIST OF TOOLS AND EQUIPMENT

Sr. No.	Name of the Tool/ Equipment	Quantity
1.	Temperature Sensor Module (LM35/Thermistor/RTD), Electronics Trainer Kit, Digital Multimeter, Connecting wires	05 Sets
2.	LDR/Photodiode Sensor Module, Electronics Trainer Kit, Digital Multimeter, Breadboard and Patch Cords	05 Sets
3.	DC Motor Trainer Kit, Variable Power Supply, Digital Multimeter, Connecting Wires	05 Sets
4.	Hydraulic Trainer System, Pneumatic Trainer System, Compressor, Valves and Actuators	01 Set each
5.	Analog Electronics Trainer Kit, Transistor Modules, Resistors, Capacitors, Function Generator, CRO/DSO	05 Sets

Sr. No.	Name of the Tool/ Equipment	Quantity
6.	OPAMP Trainer Module, IC 741, Dual Power Supply ($\pm 12V$), Function Generator, Oscilloscope	05 Sets
7.	Transformer, Rectifier Circuit Kit, Filter Capacitors, Voltage Regulator ICs (7805, 7812, 7912), Breadboard, Multimeter	05 Sets
8.	555 Timer IC Trainer Kit, IC NE555, Breadboard, Resistors, Capacitors, LEDs, Push Buttons, Connecting Wires, Regulated DC Power Supply, Digital Multimeter	05 Sets
9.	Step-down Transformer, Bridge Rectifier / Diodes, Filter Capacitors, Voltage Regulator ICs (7805, 7905, 7812, 7912), Breadboard, Connecting Wires, Digital Multimeter, Soldering Kit	05 Sets
10.	Photostat / Photocopy Machine, Computer Interface (if available), Demonstration Charts of Sensors and Control Systems, Screwdriver Set, Multimeter	01 No.

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