SAHRDAYA AUTONOMOUS
COLLEGE OF ENGINEERING & TECHNOLOGY
A CENTRE OF EXCELLENCE IN SCIENCE & TECHNOLOGY | MANAGED BY IRINJALAKUDA DIOCESAN EDUCATION TRUST
Approved by AICTE & Affiliated to APJ Abdul Kalam Technological University | Accredited by:
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B. Tech

Curriculum and Syllabus (2024) - Semester I & II

Civil Engineering

Branch Code: CE

(SHR/AC/Auto/ Acad. Council /B.Tech/3/Syll./CE)

Recommended by BoS on 29/08/2024

Approved by Academic Council on 31/08/2024

Preface to the Curriculum

The B.Tech. Civil Engineering (CE) curriculum is meticulously drafted to cultivate industry-ready professionals endowed with creativity and innovative thinking. This comprehensive curriculum includes induction programs, core and elective courses, practical courses, projects, internships, skill enhancement courses, and extracurricular activities. Designed to total 170 credits, the curriculum ensures a holistic education that prepares students for the dynamic field of Civil Engineering. Below is a detailed overview of the curriculum's salient features:

1. **Project-Based Learning Courses:** From the first semester to the fifth semester, one course integrated with Project-Based Learning **(PBL)** empowers students with creativity, engaging them in meaningful projects to learn, explore, and investigate. PBL promotes teamwork and collaboration, essential skills for any professional, by having students work together in teams, each contributing unique skills and perspectives to achieve a common goal.
2. **Skill Enhancement Courses**: These courses are designed to provide students with industry-relevant certifications from reputed organizations, enhancing their employability by certifying their skill sets. They are integral to the academic curriculum and offered from Semester 1 to Semester 5, each carrying one credit.
3. **Foreign Language Courses**: To prepare students for global careers, the curriculum includes options to learn foreign languages, promoting cross-cultural communication skills and international collaboration. These courses are available in the seventh semester.
4. **Program Electives and Micro Specializations**: Students can pursue micro-specializations by completing thematic courses, which allow them to gain in-depth knowledge in specific sub-areas of their discipline. Starting in the fourth semester, this provides an opportunity for focused learning and expertise in emerging fields in alignment with program elective courses.
5. **Industry Elective Courses**: Offered jointly with industry partners, these courses ensure relevance and practical applicability. The academic department and industry partners develop and assess them collaboratively, without end-semester examinations, providing continuous and practical learning experiences.
6. **Startups and Entrepreneurial Skills**: The curriculum encourages students to pursue startups, offering options to engage in product-based or service-based startups during their seventh and eighth semesters. This fosters innovation, creativity, and entrepreneurial skills, preparing students for the dynamic business environment.

7. **Courses Embedded with Practicals**: The curriculum includes theory courses embedded with practicals and projects, ensuring students apply theoretical knowledge to real-world problems. This hands-on approach enhances learning outcomes and practical skills.
8. **Internships**: The program includes mandatory internships, allowing students to gain industry exposure and practical experience. Students can undertake at least four to six months of internship in a recognized industry, research organization, or prestigious institution relevant to their field. This bridges the gap between academic learning and industry requirements, enhancing employability.
9. **Community Work, Social Responsibility, and Universal Human Value Courses**: The curriculum integrates opportunities for community work and socially relevant projects, promoting civic responsibility and leadership skills. Universal Human Value courses also aim to cultivate a holistic understanding of life, enhancing physical and mental well-being and social and life skills. These courses address various dimensions of life, including individual, family, society, and the environment, promoting a healthy and harmonious lifestyle.
10. **Activity Points**: In addition to academic credits, students must earn activity points through participation in extracurricular activities such as sports, cultural events, community service, and entrepreneurship. This holistic approach ensures the development of leadership, teamwork, and communication skills, preparing students for global challenges.
11. **MOOC Courses:** Students selected for internships can fulfil their credit requirements in the seventh and eighth semesters through MOOC courses, providing flexibility and additional learning opportunities.
12. **Higher Credit Elective:** These courses carry more than the standard credit weight of elective courses. They allow students pursuing honors to reduce the number of required courses by earning additional credits through higher-credit electives. Additional credits earned from higher credit electives can be credited towards the total credit requirement of the honors program, with a maximum of 12 additional credits being applied towards the honors credit requirement.

This curriculum is designed to seamlessly blend theoretical knowledge with practical experience, foster interdisciplinary learning, and enhance employability through hands-on projects and internships, preparing students for successful careers in civil engineering.

General Course Structure

1. Credit and Courses:

Credits are a unit of measurement for coursework based on the number of hours of instruction required per week. One hour of classroom lecture (L), 60 minutes long per week and carried out during all weeks of the semester, is considered one instructional

unit or one credit. The same goes for a tutorial (T) or a project (R) that is 60 minutes long per week and carried out during all weeks of the semester. In addition, a minimum of 120 minutes per week of laboratory session, practical or fieldwork, training (P) or a combination of these, carried out during all weeks of the semester, is also considered one Instructional Unit or one Credit.

Classification	Credit assigned
1 Hour Lecture [L] per week	1 Credit
1 Hour Tutorial [T] per week	1 Credit
1 Hour Project [R] per week	1 Credit
1-2 Hours Practical [P] per week	1 Credit
3-4 Hours Practical [P] per week	2 Credit

- *For internship/Start-Up/Main project/Mini project, the credit weightage for equivalent hours is 50% of that for lectures/tutorials*

2. Course Category and Credits

The B.Tech. Program curriculum has 168 academic credits and 2 additional pass/fail credits that can be gained through 100 activity points. The program is expected to accommodate courses from other disciplines so that students have multi-disciplinary exposure. Additionally, the program should provide sufficient opportunities for students to enhance their communication, soft, managerial, and technical skills. Depending on the program, the courses should fall under the engineering, basic science, humanities science, and management categories. The structure of the UG program should essentially have the following categories of courses with the breakup of credits as given:

Sl. No	Category	Code	Credits
1	Humanities and Social Sciences including Management Courses	HMC	9
2	Basic Science Courses	BSC	20
3	Engineering Science Courses	ESC	26
4	Programme (Professional) Core Courses	PCC	52
5	Programme (Professional) Core Courses-Project Based Learning	PBL	16
6	Program Elective Courses	PEC	18
7	Open Elective Courses/Industry Linked Elective	OEC/ILE	9
8	Project Work and Seminar	PS	12
9	UHV and Community Work	PW	1
10	Skill Enhancement Courses	SEC	5
11	Mandatory Student Activities.	MSA	2
	Total Mandatory Credits	**170**	

A 10% to 15 % deviation in credits is permitted under each discipline. While developing the curriculum, the department offering the program should ensure that the students attain the above distribution upon completing their program. Either Minor or Honors can be opted from the optional specialization.

The courses are organized into 1/2/3/4 credit courses based on the content delivery mechanism and desired depth. The delivery methods include Theory-only, Theory with tutorial, Theory with practice, Theory with project, etc. The L-T-P-R-C for each course indicates the number of credits delivered as Lecture (L), Tutorial (T), Practical (P), Project (R) and the total instructional delivery indicated as Credits (C).

$$C = L + T + [P/2] + R$$

Apart from lectures, tutorials, practical/practice and project hours, the curriculum offers Self-learning hours (S) that indicate the number of hours students are expected to spend for activities that should be completed outside the class defined by the faculty handling courses. The activities aim to support learning and should be initiated by the students themselves without guidance or direction from tutors. For each course, the self-learning hour per week is calculated as:

$$S= (L*1+P*1+[R/2])$$

Categories of courses included in the curriculum and their L-T-P-R-C componentsare given in the table below:

Sl. No.	Lecture- Tutorial- Practical- Project [L-T-P-R]	Credit [C]	Description
1.	1-0-2-0	2	Theory course without End Semester Examination [ESE]
2.	1-0-0-0	1	
3.	2-0-2-1	4	Theory course embedded with practical and project
4.	3-1-0-0	4	Theory course embedded with tutorial
5.	3-0-0-0	3	Theory course
6.	2-0-0-0	2	
7.	3-0-2-0	4	Theory course embedded with practical
8.	3-0-0-1	4	Theory course embedded with project
9.	0-0-2-0	1	Practical course without ESE
10.	0-0-3-0	2	Practical course
11.	0-0-3-0	2	Mini Project
12.	0-0-3-0	2	Seminar
13.	0-0-0-8	4	Major Project/Internship/Start-Up
14.	0-0-0-0	1	MOOC Course
Mandatory Courses			
15.	0-0-2-0	1	Skill Enhancement Courses
Minor/ Honors Course			
16.	4-0-0-0	4	Theory course
17.	0-0-0-4	4	Project only course

3. Course Code

Every course of B. Tech. The program shall take a code from the table given below.

Course category	Description
PCC	Program (Professional) Core Courses
PBL	Project Based Learning
CLT	Combined Lab Theory
PEC	Professional Elective Course
OEC	Open Elective Course
BSC	Basic Science Course
ESC	Engineering Science Course
HMC	Humanities, Social Sciences and Management course
MOOC	MOOC Course
IEL	Industry Elective Course
PW	Socially Relevant course
PS	Project Work and Seminar
SEC	Skill Enhancement Courses
HR	Honours
MR	Minor

Structure of Course Code: Each course will be identified by a unique Course Code consisting of eight alphanumeric characters, formatted as **24XXYABC**. The code can be interpreted as follows: "24" represents the regulation year, "XX" is the course category code, "Y" indicates the course delivery mode, "A" is the semester number (ranging from 1 to 8, with 0 indicating the course is offered in both odd and even semesters), "B" denotes the version of the course under each category, and "C" signifies the course sequence number.

For example, 24CET303 is a theory course offered by the civil engineering department in the third semester of the 2024 scheme.
24BML408 - laboratory course offered by the biomedical engineering department in the fourth semester of the 2024 scheme
The detailed expansion of the abbreviation of the course code structure is listed in the table below:

XX	Y	A	B	C
Course category	Course delivery mode	Semester No	Version of the course	Serial No: of course
BM-Biomedical Engineering	T-Theory L-Laboratory			

BT-Biotechnology CE – Civil Engineering CS-Computer Science Engineering EC-Electronics and Communication Engineering EE-Electrical and Electronics Engineering MA-Mathematics CY – Chemistry PH-Physics ES-Engineering Science course HU-Humanities and Management Courses SE-Skill Enhancement Courses PW-Social Science and Community work	R-Theory Embedded with Project K-Certification Course E-Elective Course G- Minor H-Honour M-MOOC O-Open Elective I-Industry Elective S-Seminar P-Project N-Internship U-Start Up C – Theory Embedded with practical	0 1 2 3 etc	1 2 3 etc.	1 2 3 4 5 6 etc

4. Allotted and Cumulative Credits

The allotted and cumulative credits are given in the table below:

Semester	Allotted Credits	Cumulative Credits
First	21	-
Second	22	43
Third	26	69
Fourth	24	93
Fifth	24	117
Sixth	23	140
Seventh	17	157
Eighth	11	168

FIRST SEMESTER (July-December)												
10 Days Compulsory Induction Program and UHV												
Sl. No:	**Slot**	**Course Code**	**Course Type**	**Course Title (Course Name)**	**Credit Structure**				**Total Marks**		**Credits**	**Hrs/ Week**
					L	**T**	**P**	**R**	**CIA**	**ESE**		
1	A	24MAT131	BSC	Linear Algebra & Differential Equations	3	0	0	0	40	60	3	3
2	B	24CYC122	BSC-CLT	Chemistry for Civil Engineering	3	0	2	0	50	50	4	5
3	C	24EST113	ESC	Engineering Mechanics	3	0	0	0	40	60	3	3
4	D	24EST124	ESC	Introduction to Civil Engineering	4	0	0	0	40	60	4	4
5	F	24ESR105	ESC-PBL	Algorithmic Thinking with Python	2	0	2	1	50	50	4	5
6	L	24ESL106	ESC	Civil Engineering Workshop	0	0	2	0	50	---	1	2
7	I*	24HUT007	HMC	Communicative English	0	0	2	0	100	---	1	2
8	J*	24SEK10N	SEC	Skill Enhancement Course1							1	
Total											**21**	**24**

SECOND SEMESTER (January-June)												
Sl. No:	**Slot**	**Course Code**	**Course Type**	**Course Title (Course Name)**	**Credit Structure**				**Total Marks**		**Credits**	**Hrs./ Week**
					L	**T**	**P**	**R**	**CIA**	**ESE**		
1	A	24MAT231	BSC	Infinite Series, Vector Calculus & Statistics	3	0	0	0	40	60	3	3
2	B	24PHC232	BSC-CLT	Engineering Physics	3	0	2	0	50	50	4	5
3	C	24EST003	ESC	Engineering Graphics	3	0	0	0	40	60	3	3
4	D	24CER204	PCC-PBL	Surveying and Geomatics	3	0	0	1	50	50	4	4
5	E	24EST205	ESC	Mechanics of Solids	3	1	0	0	40	60	4	4
6	I*	24HUT006	HMC	Professional Ethics & Sustainable Development	1	0	2	0	100	--	2	3
7	L	24ESL007	ESC	Computer Aided Drawing (CAD) & Manufacturing workshop	0	0	2	0	50	--	1	2
8	J*	24SEK10N	SEC	Skill Enhancement Course2							1	
Total											**22**	**24**

No Grade Points will be awarded for the MOOC, I and J slot courses.
***The self-learning (S) hours for each course is calculated based on the formulae,* S= (L*1+P*1+[R/2])**

SEMESTER-I
SYLLABUS

24MAT131	LINEAR ALGEBRA AND DIFFERENTIAL EQUATIONS	L	T	P	R	C	Year of Introduction
		3	0	0	0	3	2024

Preamble:
The course enables civil engineering students to understand basic concepts and tools of differential equations and Linear Algebra. Topics like linear algebra, differential equations and partial derivatives are included. This course helps the learners in modelling and analysing physical phenomena by applying modern tools and technologies in mathematics.

Prerequisite: Matrix theory and basic concepts of calculus.

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

CO 1	Apply Gauss elimination method to solve given systems of linear equations and to determine whether a matrix is diagonalizable. **[Apply]**
CO 2	Solve various forms of first order differential equations.**[Apply]**
CO 3	Apply initial conditions or boundary conditions to determine specific solutions to differential equations. **[Apply]**
CO 4	Apply the concept of partial derivatives to evaluate the extrema of two variable functions. **[Apply]**

CO - PO MAPPING

CO	PO1	PO 2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	3	3	2	3	2							
CO 2	3	3	2	2	2							
CO 3	3	3	2	3								
CO 4	3	3	2	3	2							

Assessment Pattern

Bloom's Category	Continuous Assessment Tools			End Semester Examination
	Test1	Test 2	Other tools	
Remember	√	√	√	√
Understand	√	√	√	√
Apply	√	√	√	√
Analyse				
Evaluate				
Create				

Mark Distribution of CIA

Course Structure [L-T-P-R]	Attendance	Theory [L]			Total Marks
		Assignment	Test-1	Test-2	
3-0-0-0	5	10	12.5	12.5	40

Total Mark distribution

Total Marks	**CIA (Marks)**	**ESE (Marks)**	**ESE Duration**
100	40	60	2.5 hours

End Semester Examination [ESE]			
PATTERN	**PART A**	**PART B**	**ESE Marks**
PATTERN 1	8 Questions(2 Questions from each module), each question carries 3 marks Marks: (3x8 =24 marks)	2 questions will be given from each module, out of which 1 question should be answered. Each question can have a maximum of two sub divisions. Each question carries 9 marks. Marks: (9x4 = 36 marks)	60

SYLLABUS

MODULE I: LINEAR ALGEBRA

(Text 2: Relevant topics from sections 7.3, 7.4, 7.5, 8.1, 8.4)

Linear systems of equations, Solution by Gauss elimination, Row echelon form and rank of a matrix, Fundamental theorem for linear systems, homogeneous and nonhomogeneous (without proof), Eigen values and Eigen vectors, Diagonalization of matrices.

MODULE II: FIRST ORDER DIFFERENTIAL EQUATIONS

(Text 3: Relevant topics from sections 11.1,11.2,11.3,11.4,11.5,11.6,11.8,11.9,11.11,11.12,11.13)

Differential equation, First order ordinary differential equations of the form dy/dx = f(x), First order ordinary differential equations of the form dy/dx = f(y), First order ordinary differential equations of the form dy/dx = f(x).f(y), First order ordinary differential equations of the form (dy/dx)+Py = Q

MODULE III: SECOND ORDER DIFFERENTIAL EQUATIONS

(Text 2: Relevant topics from sections 2.1, 2.2, 2.5, 2.6, 2.7, 2.10)

Homogeneous linear ODEs of second order, Superposition principle, General solution, Homogeneous linear ODEs of second order with constant coefficients (Method to find general solution, solution of linear Initial and Boundary Value Problem), Euler Cauchy Equation.

MODULE IV: MULTIVARIABLE CALCULUS AND APPLICATIONS

(Text 1: Relevant topics from sections 13.2, 13.3, 13.4, 13.5,13.8)

Limits and continuity, Partial derivatives, Partial derivatives viewed as rate of change and slopes, Second order and higher order partial derivatives, Chain rule, total derivative, Implicit differentiation, relative maxima and minima.

Text books

1. H. Anton, I. Biven,S.Davis, Calculus, Wiley, 10th edition, 2015.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 10thEdition, John Wiley & Sons, 2016.

3. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 44th Edition, 2010.

Reference books

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9 th Edition, Pearson, Reprint, 2002.
2. Peter V. O'Neil, Advanced Engineering Mathematics, Cengage, 7th Edition, 2012
3. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
4. J. Stewart, Essential Calculus, Cengage, 2nd edition, 2017
5. N.P.Bali, Dr. Manish Goyal, A textbook of Engineering Mathematics, 8th Edition, Lakshmi Publications India Ltd.,2019
6. Babu Ram,Engineering Mathematics Volume 2,pearson India Education Services Pvt Ltd,2012

NPTEL/SWAYAM Courses for reference:

1. Differential Equations for Engineers By Prof. Srinivas Rao Manam https://onlinecourses.nptel.ac.in/noc24_ma85/preview (Relevant sections)
2. Prof. Gilbert Strang, Linear Algebra [MIT OPENCOURSEWARE] https://ocw.mit.edu/courses/18-06-linear-algebra-spring-2010/(Relevant sections)

No.	COURSE CONTENTS AND LECTURE SCHEDULE	No. of Hours [36hours]
	MODULE I [10 hours]	
1.1	Linear systems of equations	1
1.2	Solution by Gauss elimination	2
1.3	Row echelon form and rank of a matrix	2
1.4	Fundamental theorem for linear systems homogeneous and non-homogeneous (without proof)	1
1.5	Eigen values and Eigen vectors	2
1.6	Diagonalisation of matrices	2
	MODULE II [8 hours]	
2.1	Differential equation	1
2.2	First-order ordinary differential equations of the form dy/dx = f(x)	1
2.3	First-order ordinary differential equations of the form dy/dx = f(y)	2
2.4	First-order ordinary differential equations of the form dy/dx = f(x).f(y)	2
2.5	First-order ordinary differential equations of the form dy/dx+Py = Q	2
	MODULE III [9 hours]	
3.1	Homogeneous linear ODEs of second order	2
3.2	Superposition principle, General solution.	1
3.3	Homogeneous linear ODEs of second order with constant coefficients (Method to find general solution)	1
3.4	Euler Cauchy Equations (second order)	2
3.5	Solution of linear Initial Value Problem	2

3.6	solution of linear Boundary Value Problem	1
MODULE IV [9 hours]		
4.1	Limits and continuity	1
4.2	Partial derivatives, Partial derivatives viewed as rate of change and slopes	1
4.3	Second order and higher order partial derivatives	1
4.4	Chain rule	2
4.5	Total derivative	1
4.6	Implicit differentiation	2
4.7	Relative maxima and minima	1

CO Assessment Questions

CO 1

1. Show that if A is not square, either the row vectors or the column vectors of A are linearly dependent.
2. After performing Gauss elimination on a system, you get an inconsistent system (e.g., a row corresponding to an equation like 0=5). What does this tell you about the system of equations?
3. Convert the following system of equations into its augmented matrix form and then solve it using Gauss elimination:
   x+2y−3z=9, 2x−y+4z=8, −x+3y−z=4
4. Determine if the following matrix C is diagonalisable. If it is, find the matrix P and the diagonal matrix D such that $A=PDP^{-1}$
   Given, $C = \begin{bmatrix} 1 & 2 \\ 0 & 1 \end{bmatrix}$

Team Work:

1. Write a program or script in a programming language (e.g., Python, MATLAB) to solve systems of linear equations using Gauss elimination.
2. Create several systems of linear equations with different characteristics (e.g., unique solution, no solution, infinitely many solutions) and use your program to solve them. Include explanations and interpretations of the results.

CO 2

1. Verify that $y=e^{-x}+x^2$ is a solution to the differential equation $\frac{dy}{dx} = -y+2x$
2. Use separation of variables to solve the differential equation $\frac{dy}{dx}=y^2e^x$
3. A tank initially contains 100 liters of water. Water is added at a rate of 5 liters per minute, and the tank leaks at a rate proportional to the amount of water in the tank with a proportionality constant of 0.02. Write and solve a first-order differential equation to find the amount of water in the tank after t minutes.
4. A population of bacteria grows according to the differential equation $\frac{dP}{dt}=0.1P$, where P is the population at time t. If the initial population is 500, determine the population after 10 hours.

Team Work:

Solve the first-order differential equations analytically using MATLAB's symbolic toolbox.

(a) $\frac{dy}{dx}+3y=6x$ (b) $\frac{dy}{dx}=ye^x$ (c) $(2x+y)dx+(x-2y)dy=0$

	(c) $(2x+y)dx+(x-2y)dy=0$
CO 3	1. Solve the initial value problem $y^{II}+4y=\sin 2x$ with $y(0)=0$ and $y'(0)=1$ 2. What is an initial value problem (IVP) for a second-order differential equation? How does it differ from a boundary value problem? 3. Determine the stability of the solutions to the differential equation $y''+4y=0$. What can you say about the behavior of solutions as $t\to\infty$? 4. Solve the boundary value problem(BVP) $y''+y=0$, $y(0)=0, y'(\pi)=0$ **Team Work:** Model a real-world scenario where a second-order differential equation is applicable (e.g., a mass-spring-damper system). Solve the differential equation for the given scenario and interpret the results.
CO 4	1. Given the function $f(x,y) = x^2 + y^2 - 4x - 6y + 9$, find the extreme values by calculating the partial derivatives . 2. For the function $f(x,y)=3x^2-2xy+y^2+4x-5y$ determine the nature of the critical points (i.e., whether they are local maxima, local minima, or saddle points) using the second derivative test. 3. For the function $f(x,y)=\ln(x^2+y^2+1)$, compute the partial derivatives, find the critical points, and classify them. 4. Let $z=f(u,v)$, $u=x^2+y^2$ and $v=e^x\sin y$ Find $\partial z/\partial x$ and $\partial z/\partial y$ **Team Work:** Develop a mathematical model for the load-bearing capacity of the structural element. This model should include the influence of design parameters such as cross-sectional area, material properties, and dimensions.

Prepared by
Anu Jose
Asst. Prof., ASH

24CYC122	CHEMISTRY FOR CIVIL ENGINEERING	L	T	P	R	C	Year of Introduction
		3	0	2	0	4	2024

Preamble:
This course provides students with a comprehensive exploration of electrochemistry, corrosion mechanisms in engineering materials, molecular spectroscopy, analytical techniques, and environmental chemistry. Students will gain insights into the fundamental concepts, advanced methodologies, and practical applications for addressing contemporary materials science and environmental sustainability challenges. This course equips learners with the knowledge and skills necessary to analyze, innovate, and implement solutions in civil engineering fields, ensuring a robust foundation for tackling complex real-world problems.

Prerequisite: Basic knowledge in Chemistry and Physics

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

CO 1	Employ the fundamental principles of electrochemistry and corrosion, to explore their potential applications across civil engineering sectors. **(Apply)**
CO 2	Apply knowledge of different engineering materials to select and integrate appropriate materials in various electronic sectors through practical experimentation in the laboratory. **(Apply)**
CO 3	Interpret various analytical techniques effectively across civil engineering domains. **(Apply)**
CO 4	Understand and apply the principles of environmental chemistry and waste management. **(Apply)**

CO - PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2					2			
CO2	3	3	3	2					2			
CO3	3	3		2					2			
CO4	3	3	3	2		2	3		2			

Assessment Pattern

Bloom's Category	Continuous Assessment Tools			End Semester Examination
	Test1	Test 2	Other tools	
Remember	√	√	√	√
Understand	√	√	√	√

Apply	√	√	√	√
Analyses				
Evaluate				
Create				

Assessment Pattern for the Lab component

Bloom's Category	**Continuous Assessment Tools**	
	Class work	**Test1**
Remember	√	√
Understand	√	√
Apply	√	√
Analyse		
Evaluate		
Create		

Mark Distribution of CIA

Course Structure [L-T-P-R]	**Attendance**	**Theory [L]**			**Practical [P]**		**Total Marks**
		Assignment	**Test-1**	**Test-2**	**Continuous Assessment**	**Lab Exam**	
3-0-2-0	5	5	7.5	7.5	15	10	50

Total Mark distribution

Total Marks	**CIA (Marks)**	**ESE (Marks)**	**ESE Duration**
100	50	50	2 hours

End Semester Examination [ESE]: Pattern

PATTERN	**PART A**	**PART B**	**ESE Mark**
PATTERN 2	2 Questions from each module. Total of 8 Questions, Answer any 6 questions. Each carrying 3 marks	2 questions will be given from each module, out of which 1 question should be answered. Each question can have a maximum of 3 subdivisions.	50

	(6x3 =18 marks)	Each question carries 8 marks. (4x8 = 32 marks)	

SYLLABUS

MODULE I: Electrochemistry and Corrosion Science (9 Hours)

Electrochemical Cell- Electrode potential- Nernst equation for single electrode and cell (numerical problems), Reference electrodes – SHE & Calomel electrode – construction and working, Glass electrode & pH measurement. Li-ion battery: construction and working.

Corrosion –Electrochemical corrosion mechanism (acidic & alkaline medium), Galvanic series, corrosion control methods, Cathodic Protection - sacrificial anodic protection and impressed current cathodic protection. Electroplating of copper, Electroless plating of copper.

MODULE II: Engineering Materials (9 Hours)

Fuels: Calorific value – HCV and LCV, experimental determination of calorific value of solid fuels. Octane & Cetane number. Biofuels- biodiesel, green hydrogen

Lubricants: Classification - solid, semisolid and liquid lubricants. Properties of lubricants – viscosity index, flash point, fire point, cloud point, pour point & aniline point.

Cement: Manufacture of portland cement – theory of setting and hardening of cement.

Nanomaterials: Classification based on dimension & materials, Synthesis – sol gel & chemical reduction, applications of nanomaterials.

Polymers: ABS & Kevlar -synthesis, properties and applications. Conducting polymers- classification, application.

MODULE III: Molecular Spectroscopy and Analytical Techniques (9Hours)

Spectroscopy-Types of spectra- molecular energy levels, beer lambert's law, numerical problems, Electronic spectroscopy – principle, types of electronic transitions, Vibrational spectroscopy – principle, vibrational modes of CO_2 and H_2O, applications.

Thermal analysis: TGA- principle, instrumentation (block diagram) and applications, TGA of $CaC_2O4.H_2O$ and polymers. DTA-principle, instrumentation (block diagram) and applications, DTA of $CaC_2O_4.H_2O$.

Electron Microscopic Techniques: SEM - principle, instrumentation and applications.

MODULE IV: Environmental Chemistry (9 Hours)

Water characteristics - Hardness - types of hardness, temporary and permanent, disadvantages of hard water, degree of hardness (numericals). Water softening methods-ion exchange process-principle, procedure and advantages. Water disinfection methods – chlorination, break point chlorination, ozone and UV irradiation. dissolved oxygen (DO), BOD and COD- definition & significance.

Waste Management: Air Pollution- sources & effects, greenhouse gases, ozone depletion, control methods. Sewage water treatment- primary, secondary and tertiary,

flow diagram, trickling filter and UASB process. Solid waste disposal methods- composting, landfill & incineration

Text books

1. Dr. Muhammad Arif M, Smt. Kavitha P Nair, Dr. Annette Fernandez "Engineering Chemistry", Owl Books, 2021
2. Engineering Chemistry- B. L. Tembe, Kamaluddin, M. S. Krishnan-2018
3. Instrumental Methods of Analysis- H. H. Willard, L. L. Merritt, CBS Publishers,7th Edition,2005

Reference books

1. Fundamentals of Molecular Spectroscopy C. N. Banwell McGraw-Hill, 4th dn., 2017
2. Principles of Physical Chemistry B. R. Puri, L. R. Sharma, M. S. Pathania Vishal Publishing Co 47th Edition, 2017
3. Engineering Chemistry- Jain & Jain, Dhanpath Rai Publishing Company, 17th Edition, 2015
4. Introduction to Spectroscopy Donald L. Pavia Cengage Learning India Pvt. Ltd 2015
5. Polymer Chemistry: An Introduction Raymond B. Seymour, Charles E. Carraher Marcel Dekker Inc 4th Revised Edition, 1996
6. The Chemistry of Nanomaterials: Synthesis, Properties and Applications Prof. Dr. C. N. R. Rao, Prof. Dr. h.c. mult. Achim Müller, Prof. Dr. A. K. Cheetham Wiley-VCH Verlag GmbH & Co. KGaA 2014
7. Organic Electronics Materials and Devices Shuichiro Ogawa Springer Tokyo 2024
8. Instrumental Methods of Analysis- H. H. Willard, L. L. Merritt, CBS Publishers,7th Edition,2005

NPTEL/SWAYAM Courses for reference:

Module - I

1. https://archive.nptel.ac.in/courses/104/106/104106137/ Elementary Electrochemistry
2. https://archive.nptel.ac.in/courses/113/105/113105102/ Electrochemical Energy storage
3. https://archive.nptel.ac.in/courses/113/104/113104082/ Corrosion

Module - II

1. https://archive.nptel.ac.in/courses/113/104/113104102/ Nanomaterials and their properties
2. https://archive.nptel.ac.in/courses/104/105/104105124/ Introduction to Polymer Science
3. https://archive.nptel.ac.in/courses/103/105/103105110/Fuel and combustion technology

Module III

1. https://nptel.ac.in/courses/104106122/ Fundamentals of spectroscopy

Module IV

1. https://archive.nptel.ac.in/courses/122/106/122106030/Environmental chemistry and analysis

No.	COURSE CONTENTS AND LECTURE SCHEDULE	No. of Hours [36]
MODULE 1: Electrochemistry and Corrosion Science (9 Hours)		
1.1	Electrochemical Cell- Electrode potential- Nernst equation for single electrode and cell (numerical problems)	1
1.2	Reference electrodes – SHE & Calomel electrode –construction and working, Glass electrode & pH measurement	2
1.3	Li-ion battery: construction and working.	1
1.4	Corrosion –Electrochemical corrosion mechanism (acidic & alkaline medium), Galvanic series.	2
1.5	Corrosion control methods, Cathodic Protection - sacrificial anodic protection and impressed current cathodic protection. Electroplating of copper, Electroless plating of copper.	3
MODULE II: Engineering Materials (9 Hours)		
2.1	Fuels: Calorific value – HCV and LCV, experimental determination of calorific value of solid fuels. Octane & Cetane number. Biofuels-biodiesel, green hydrogen	2
2.2	Lubricants: Classification - solid, semisolid and liquid lubricants. Properties of lubricants – viscosity index, flash point, fire point, cloud point, pour point & aniline point.	2
2.3	Cement: Manufacture of portland cement –theory of setting and hardening of cement.	1
2.4	Nanomaterials: Classification based on dimension & materials, Synthesis – sol gel & chemical reduction, applications of nanomaterials.	2
2.5	Polymers: ABS & Kevlar -synthesis, properties and applications. Conducting polymers- classification, application.	2
MODULE III: Molecular Spectroscopy and Analytical Techniques (9 Hours)		
3.1	Molecular spectroscopy-Types of spectra- molecular energy levels, beer lambert's law, numerical problems	1
3.2	Electronic spectroscopy – principle, types of electronic transitions, Vibrational spectroscopy – principle, vibrational modes of CO_2 and H_2O, applications	3

3.3	Thermal analysis: TGA- principle, instrumentation (block diagram) and applications, TGA of $CaC_2O_4.H_2O$ and polymers.	2
3.4	DTA-principle, instrumentation (block diagram) and applications, DTA of $CaC_2O_4.H_2O$.	2
3.5	Electron Microscopic Techniques: SEM - principle, instrumentation and applications.	1
MODULE IV: Environmental Chemistry (9 Hours)		
4.1	Water characteristics - Hardness - types of hardness, temporary and permanent, disadvantages of hard water, degree of hardness (numerical).	1
4.2	Water softening methods-ion exchange process-principle, procedure and advantages. Reverse osmosis – principle, process and advantages.	2
4.3	Water disinfection methods – chlorination, break point chlorination, ozone and UV irradiation. dissolved oxygen (DO), BOD and COD-definition & significance	2
4.4	Waste Management: Air Pollution- sources & effects, greenhouse gases, ozone depletion, control methods.	2
4.5	Sewage water treatment- primary, secondary and tertiary, flow diagram, trickling filter and UASB process. Solid waste disposal methods- composting, landfill & incineration	2

LESSON PLAN FOR LAB COMPONENT

No.	Topic	No. of Hours	Experiment (24 hrs)
1	Electrochemistry Corrosion Science	4	1. Calibration of pH meter and determination of pH of a solution
			2. Determination of cell constant and conductance of solutions
2	Engineering Materials	6	1. Synthesis of polymers a) Urea-formaldehyde resin b) Phenol-formaldehyde resin
			2. Determination of flash point of oils and fats by using Pensky-Martens apparatus
			3. Estimation of copper in brass.
3	Molecular Spectroscopy and Analytical	6	1. Determination of wavelength of absorption maximum and colorimetric estimation of Fe^{3+} in solution

	Techniques		2. Determination of molar absorptivity of a compound ($KMnO_4$ or any water-soluble food colorant)
4	Environmental Chemistry	8	1. Estimation of dissolved oxygen by Winkler's method
			2. Estimation of total hardness of water-EDTA method
			3. Estimation of chloride content in water
(Any 2 experiments from each topic is to be completed)			
CO Assessment Questions			
CO1	1. A zinc electrode is placed in a 1 M $ZnSO_4$ solution at 25°C. Calculate the electrode potential given that $[Zn^{2+}]$ = 1 M and $E°(Zn^{2+}\|Zn)$ = -0.76 V. Discuss how this potential changes with temperature and concentration variations. 2. Utilizing the electrochemical series, predict the feasibility of a reaction between iron metal and a copper(II) sulphate solution. Provide the relevant half-reactions and explain your reasoning. 3. Give the construction of Li-ion cell. Give the reactions that take place at the electrodes during charging and discharging. What happens to anodic material when the cell is 100% charged. 4. Calibrate the pH meter and determine the pH of a given solution.		
CO2	1. Outline the manufacturing process of Portland cement. Discuss the chemical reactions involved during setting and hardening. 2. Differentiate between solid, semisolid, and liquid lubricants. Provide examples of each and discuss their typical applications. 3. Explain the difference between a Higher Calorific Value (HCV) and a Lower Calorific Value (LCV). How are these values experimentally determined for solid fuels? 4. Compare and contrast the methods used to determine octane number and cetane number and evaluate their significance in fuel quality assessment. 5. Synthesize Urea-formaldehyde resin and find its yield.		
CO3	1. A dye solution of concentration 0.08M shows absorbance of 0.012 at 600 nm; while a test solution of same dye shows absorbance of 0.084 under same conditions. Calculate the concentration of the test solution. 2. Outline the principle of DTA. Analyse a DTA graph of $CaC_2O_4.H_2O$ and interpret the observed endothermic and exothermic peaks 3. You are given an IR spectrum of an unknown compound. Describe the steps you would take to identify functional groups present in the compound. 4. Determine the wavelength of absorption maximum and colorimetric estimation of Fe^{3+} in solution.		

CO4	1. Explain the ion exchange resins and the process for removal of hardness of water? How exhausted resins are regenerated? 2. Discuss the advantages and challenges associated with landfill as a solid waste disposal method 3. Sketch the flow diagram of the different steps in sewage treatment. Explain the Each step. 4. Calculate the temporary and permanent hardness of a water sample which contains $[Ca^{2+}]$ = 160 mg/L, $[Mg^{2+}]$ = 192 mg/L and $[HCO_3^-]$ = 122 mg/L. 5. Estimate the amount of dissolved oxygen present in the given water sample.

Prepared by

Dr. Sukhila Krishnan
Asst. Prof., ASH

24EST113	ENGINEERING MECHANICS	L	T	P	R	C	Year of Introduction
		3	0	0	0	3	2024

Preamble:
The objective of this course is to expose the students to the fundamental concepts of mechanics and enhance their problem-solving skills. It introduces students to the influence of applied force systems and the geometrical properties of rigid bodies. After this course students will be able to recognize similar problems in real-world situations and respond accordingly.

Prerequisite: Nil

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

CO 1	Use the applicable principles or theorems to solve problems of mechanics **[Apply]**
CO 2	Apply the conditions of equilibrium to various practical problems involving different force systems. **[Apply]**
CO 3	Determine the properties of distributed areas and masses **[Apply]**
CO 4	Develop the understanding of fundamental principles of rigid body dynamics **[Apply]**

CO - PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	3	2	2									
CO 2	3	3	2									
CO 3	3	3	2									
CO 4	3	3	2									

Assessment Pattern

Bloom's Category	Continuous Assessment Tools			End Semester Examination
	Test1	Test 2	Other tools	
Remember	✓	✓	✓	✓
Understand	✓	✓	✓	✓
Apply	✓	✓	✓	✓
Analyse			✓	
Evaluate				
Create				

Mark Distribution of CIA

Course Structure [L-T-P-R]	Attendance	Theory [L-T]			Total Marks
		Assignment	Test-1	Test-2	
3-0-0-0	5	10	12.5	12.5	**40**

Total Mark distribution

Total Marks	CIA (Marks)	ESE(Marks)	ESE Duration

100	40	60	2 Hrs 30 Mins

End Semester Examination [ESE]: Pattern

PATTERN	PART A	PART B	ESE Marks
PATTERN 1	8 Questions (2 questions from each module), each question carries 3 marks Marks: (3x8 =24 marks)	2 questions will be given from each module, out of which 1 question should be answered. Each question can have a maximum of 2 subdivisions. Each question carries 9marks. Marks: (9x 4 = 36 marks)	60

SYLLABUS

Module I:Resultant of Force Systems, Equilibrium of Rigid Bodies

Introduction to statics: introduction to branches of mechanics, concept of rigid body, scalars and vectors, vector operations, forces in space.

Force systems: rectangular components in 2D and 3D, moment and couple, resultants Support reactions of beams

Equilibrium: system isolation and the free-body diagram, equilibrium conditions 2D

Module II: Friction, Centroid and Moment of Inertia

Friction: -laws of friction – analysis of blocks and ladder

Centroid of composite areas- – moment of inertia- parallel axis and perpendicular axis theorems. Polar moment of inertia, radius of gyration, mass moment of inertia- ring and disc

Module III: Dynamics of Rigid Bodies

Dynamics – rectilinear translation - equations of motion in kinematics and kinetics – D'Alembert's principle. – motion on horizontal and inclined surfaces, motion of connected bodies

Module IV:Curvilinear translation, Rotation

Curvilinear translation - equations of kinematics –projectile motion

Rotation – kinematics of rotation- equation of motion for a rigid body rotating about a fixed axis –rotation under a constant moment

Text Books:

1. Timoshenko and Young, Engineering Mechanics, McGraw Hill Publishers.
2. Shames, I. H., Engineering Mechanics - Statics and Dynamics, Prentice Hall of India.
3. R. C. Hibbeler and Ashok Gupta, Engineering Mechanics, Vol. I statics, Vol II Dynamics, Pearson Education.

Reference Books:

1. Merriam J. L and Kraige L. G., Engineering Mechanics - Vols. 1 and 2, John Wiley.
2. Tayal A K, Engineering Mechanics – Statics and Dynamics, Umesh Publications.
3. Bhavikkatti, S.S., Engineering Mechanics, New Age International Publishers
4. F.P.Beer abd E.R.Johnston (2011), Vector Mechanics for Engineers, Vol.I- Statics, Vol.II-Dynamics, 9th Ed, Tata McGraw Hill
5. Rajasekaran S and Sankarasubramanian G, Engineering Mechanics – Statics and Dynamics, Vikas Publishing House Pvt Ltd.

NPTEL/SWAYAM Courses for reference:

1. PROF. K. RAMESH, ENGINEERING MECHANICS, IIT Madras, https://archive.nptel.ac.in/courses/112/106/112106286/#
2. PROF. ANUBHAB ROY, ENGINEERING MECHANICS - STATICS AND DYNAMICS, IIT Madras https://archive.nptel.ac.in/courses/112/106/112106180/

No.	COURSE CONTENTS AND LECTURE SCHEDULE	No. of Hours (36)
	Module 1 (10 Hours)	
1.1	Introduction to Mechanics–Mechanics of Rigid Bodies (EMS), Mechanics of deformable Bodies (MoS) and Mechanics of fluids (FM). Relevance of Engineering Mechanics, introduction to studies of bodies at rest (Statics) and studies of bodies in motion (Dynamics). Rigid bodies, Principle of transmissibility of forces, scalars and vectors, vector operations,	1
1.2	Vector operations, forces in space– vectorial representation of forces, simple problems to illustrate vector representations of forces,	1
1.3	Support reactions of beams - Simple beam subject to concentrated vertical loads and UDL.	1
1.4	Force systems: rectangular components in 2D and 3D - composition and resolution of forces, resultant of forces	1
1.5	moment and couple - methods of moment-Varignon's Theorem of Moments -resultant of parallel forces	1
1.6	System isolation and Free body diagrams	1
1.7	analysis of concurrent forces - resultant and equilibrium equations - – extended problem solving	1
1.8	General coplanar force system -resultant and equilibrium equations - – extended problem solving	1
1.9	Solution to practice problems - resultant for concurrent forces in space– extended problem solving	1
1.10	resultant and equilibrium equations - – extended problem solving	1

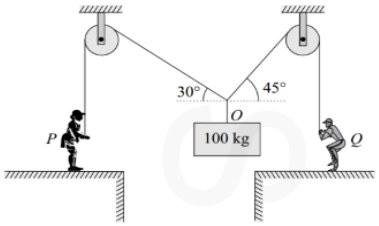
Module II (10 Hours)		
2.1	Friction – sliding friction - Coulomb's laws of friction – analysis of single bodies	1
2.2	Analysis of ladder -–illustrative examples ladder friction	1
2.3	Problems on friction-extended problem solving.	1
2.4	Centroid – Concept, Centroid of simple and regular geometrical shapes – Rectangle, right-angled triangle, circle, semi-circle.	1
2.5	Location of centroids using the principle of moments. Centroid of composite areas- examples for illustration – problems	1
2.6	Moment of inertia- parallel axis theorem –examples for illustration	1
2.7	Moment of inertia - perpendicular axis theorem - example for illustration	1
2.8	Solutions to practice problems – problems related to centroid	1
2.9	Solutions to practice problems – problems related to moment of inertia	1
2.10	Polar moment of inertia, Radius of gyration. Mass moment of inertia of ring, and disc.	1
Module III (8 Hours)		
3.1	Introduction to dynamics –kinematics and kinetics.	1
3.2	Dynamics – review of rectilinear translation	1
3.3	Equations of kinematics – problems to review the concepts	1
3.4	D'Alembert's principle- illustration of the concepts using numerical exercise	1
3.5	Motion on horizontal surfaces – Problems	1
3.6	Motion on inclined surfaces - Problems	1
3.7	Motion of connected bodies – problems.	1
3.8	Motion of connected bodies-extended problem solving.	1
Module IV (Hours)		
4.1	Curvilinear translation - Review of kinematics	1
4.2	projectile motion – simple problems to review the concepts – introduction to kinetics – equation of motion	1
4.3	Extended problem solving – rectilinear and curvilinear translation.	1
4.4	Rotation – kinematics of rotation	1
4.5	Equation of motion for a rigid body rotating about a fixed axis – simple problems for illustration.	1
4.6	Equation of motion for a rigid body rotating about a fixed axis – simple problems for illustration.	1
4.7	Rotation under a constant moment – teacher assisted problem	1

	solving.	
4.8	Rotation under a constant moment - extended problem solving.	1

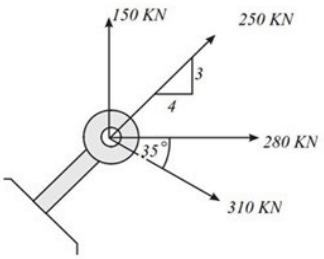
CO Assessment Questions

CO1

1. Two persons lift a mass of 100 kg by cables passing over two pulleys as shown in figure. Determine the forces P and Q that must be applied by the two persons if the body is in equilibrium at the position shown.

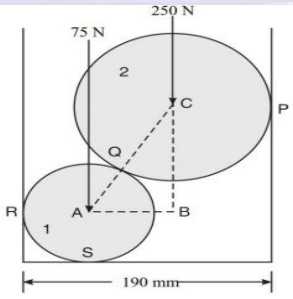


2. Four forces are acting on a bolt as shown in Figure. Determine the magnitude and direction of the resultant force.

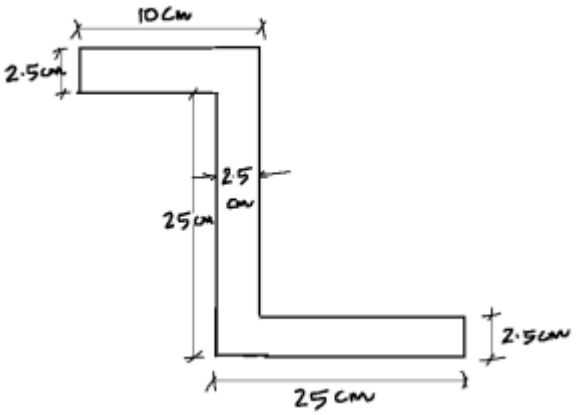
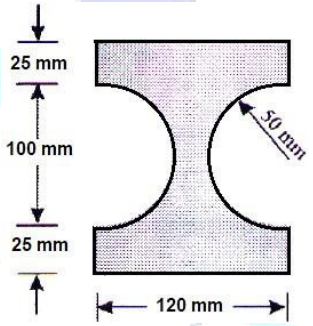
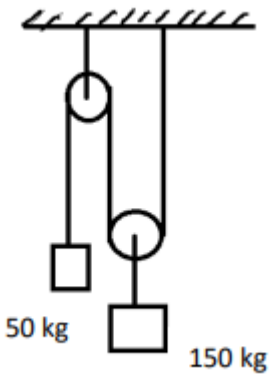


CO2

1. Determine the reactions at contact points P, Q, R, and S for the system shown in Figure. The radii of spheres 1 and 2 are, respectively, 40 mm and 60 mm.



2. A uniform ladder of 4 m length rests against a vertical wall with which it makes an angle of 45°. The coefficient of friction between the ladder and the wall is 0.4 and that between ladder and the floor is 0.5. At what position along the ladder from the bottom end does the ladder slips, if a man, whose weight is one-half of that of the ladder, ascends it.

CO3	1. Find the centroid of the cross-sectional area of the section shown in figure.  2. The cross section of a beam is shown in figure. Determine the moments of inertia of the section about its horizontal and vertical axes passing through the centroid. 
CO4	1. Determine the tension in the strings and accelerations of two blocks of mass 150 kg and 50kg connected by a string and a frictionless and weightless pulley as shown in figure.  2. A wheel accelerates from rest to a speed of 180 rpm uniformly in 0.4 seconds. It then rotates at that speed for 2s and then decelerates and comes to rest in 0.3s. Determine the total revolutions made by the wheel.

Prepared by
Mr.Anoop Lonappan
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24EST124	INTRODUCTION TO CIVIL ENGINEERING	L	T	P	R	C	Year of Introduction
		4	0	0	0	4	2024

Preamble:
Objective of this course is to provide an insight and inculcate the essentials of Civil Engineering materials and practices to the students and to impart an awareness on the principles of surveying.

Prerequisite: Nil

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

CO 1	Understand the role of civil engineer in society and to relate the various disciplines of Civil Engineering. **[Understand]**
CO 2	Identify different types of buildings, building components, building materials and building construction. **[Understand]**
CO 3	Apply the principles of surveying to determine the distance and angles. **[Apply]**
CO 4	Apply principles of levelling for the preparation of contour. **[Apply]**

CO - PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	3					3	2	2				2
CO 2	3						2	3				2
CO 3	3	3	2	2				2				
CO 4	3	3	2	2				2				

Assessment Pattern

Bloom's Category	Continuous Assessment Tools			End Semester Examination
	Test1	Test 2	Other tools	
Remember	√	√		√
Understand	√	√		√
Apply	√	√		√
Analyze				
Evaluate				
Create				

Mark Distribution of CIA

Course Structure [L-T-P-R]	Attendance	Assignment	Theory [L-T]		Total Marks
			Test-1	Test-2	
4-0-0-0	5	10	12.5	12.5	40

Total Marks distribution

Total Marks	CIA (Marks)	ESE (Marks)	ESE Duration
100	40	60	2.5 hrs

End Semester Examination [ESE]: Pattern

PATTERN	PART A	PART B	ESE Marks

PATTERN 1	2 questions from each module. 8 Questions, each question carries 3marks Marks: (3x8 =24 marks)	2 questions will be given from each module, out of which 1 question should be answered. Each question can have a maximum of 3 subdivisions. Each question carries 9 marks. Marks: (4x9 = 36 marks)	60

SYLLABUS

MODULE I : Introduction (10 hours)

General Introduction to Civil Engineering: Relevance of Civil Engineering in the overall infrastructural development of the country. Brief introduction to major disciplines of Civil Engineering like Transportation Engineering, Structural Engineering, Geo-technical Engineering, Water Resources Engineering and Environmental Engineering. Introduction to buildings: Types of buildings, selection of site for buildings, components of a residential building and their functions. Building rules and regulations: Relevance of NBC, KBR & CRZ norms Building area: Plinth area, built up area, floor area, carpet area and floor area ratio for a building as per KBR. (Numerical Problems)

MODULE II : Construction materials (10 hours)

Construction materials, Conventional construction materials: types, properties and uses of building materials: bricks, stones, cement, Aggregates and timber. Cement concrete: - Constituent materials, properties. Steel: - Steel sections and steel reinforcements, types and uses. Roofs and floors: - Functions, types; flooring materials. Modern construction materials: - Architectural glass, ceramics, Plastics, composite materials, thermal and acoustic insulating materials, decorative panels, waterproofing materials.

MODULE III : Surveying (14 hours)

Building Construction: Foundations: Bearing capacity of soil (definition only), functions of foundations, types – shallow and deep. Masonry - Brick masonry and Stone masonry Introduction to Surveying- Principles, uses and classification, linear and angular methods. - (Numerical problems)

MODULE IV : Levelling (14 hours)

Levelling - Definitions - Level line, Horizontal line, Datum, Bench mark, Reduced Level– Curvature and refraction –Methods of Levelling (Height of collimation, Rise and fall) - Differential levelling – Reciprocal levelling -– Applications of levelling (profile levelling and contouring). (Numerical problems)

Textbooks

1. Dalal, K R, Essentials of Civil Engineering, Charotar Publishing house.
2. Mckay, W.B. and Mckay, J. K., Building Construction, Volumes 1 to 4, Pearson India Education Services.
3. Dr. B.C. Punmia , Ashok Kumar Jain &Arun Kumar Jain - Surveying , Laxmi publications (P) Ltd , 2005.
4. Prof. T.P.Kenetkar & Prof.S.V.Kulkarni - Surveying and Levelling , Pune Vidyarthi Griha Prakashan,2004.
5. N N Basak, Surveying and Levelling, Mc GrawHill Education.

Reference books

1. Chen W.F and Liew J Y R (Eds), The Civil Engineering Handbook. II Edition CRC Press (Taylor and Francis)
2. Gopi S, Basic Civil Engineering, Pearson Publishers
3. Kandya A A, Elements of Civil Engineering, Charotar Publishing house
4. Mamlouk, M. S., and Zaniewski, J. P., Materials for Civil and Construction Engineering, Pearson Publishers
5. Mckay, W. B. and Mckay, J. K., Building Construction Volumes 1 to 4, Pearson India Educatio Services.
6. Rangwala S.C and Dalal K B Building Construction Charotar Publishing house
7. Venkatramaiah, Textbook of Surveying, Universities Press (India) Private Limited 2011
8. James M Andersen, Edward M Mikhail, Surveying Theory and Practice, McGraw Hill Education
9. Prof. T.P.Kenetkar&Prof.S.V.Kulkarni - Surveying and Levelling , Pune VidyarthiGriha Prakashan,2004
10. N NBasak, Surveying and Levelling, McGrawHill Education
11. R.Agor - A Text book of Surveying and Levelling, Khanna Publishers, 2005
12. S.K.Duggal - Surveying Vol. I, Tata McGraw Hill Ltd ,Reprint 2015.

NPTEL/SWAYAM Courses for reference:

1. Introduction to Civil Engineering Profession: https://archive.nptel.ac.in/courses/105/106/105106201/#
2. Basic Construction Materials: https://archive.nptel.ac.in/courses/105106206/ .

No.	COURSE CONTENTS AND LECTURE SCHEDULE	No. of Hours (48)
	MODULE I : Introduction (10 hours)	
1.1	Relevance of Civil Engineering in the overall infrastructural development of the country.	1
1.2	Brief introduction to major disciplines of Civil Engineering	1
1.3	Types of buildings, selection of site for buildings, components of a residential building and their functions.	3
1.4	Relevance of NBC, KBR & CRZ norms (brief discussion only).	2
1.5	Plinth area, built up area, floor area, carpet area and floor area ratio for a building as per KBR.	3
	MODULE II : Construction materials (10 hours)	
2.1	Types, properties and uses of building materials: bricks, stones, cement, sand and timber.	3
2.2	Architectural glass, ceramics, Plastics, composite materials, thermal and acoustic insulating materials, decorative panels, waterproofing materials. (brief discussion only).	3
2.3	Functions, types of flooring materials (brief discussion only).	2
2.4	Cement concrete: - Constituent materials, properties.	1
2.5	Steel: - Steel sections and steel reinforcements, types and uses.	1
	MODULE III : Surveying (14 hours)	

3.1	Foundations: Bearing capacity of soil (definition only), functions of foundations, types – shallow and deep (brief discussion only).	1
3.2	Header and stretcher bond, English bond & Flemish bond random rubble masonry.	1
3.3	Introduction to Surveying- Principles, uses and classification	2
3.4	Survey stations, Survey lines- ranging	4
3.5	Bearing of survey lines, Local attraction, Declination	6
MODULE IV : Levelling (14 hours)		
4.1	Levelling - Definitions (Level line, Horizontal line, Datum, Bench mark, Reduced Level)	2
4.2	Principles of levelling- Dumpy level, booking and reducing levels	3
4.3	Curvature and refraction –Methods of Booking (Height of collimation, Rise and fall) - Differential levelling – Reciprocal levelling.	5
4.4	Applications of levelling (profile levelling and contouring).	4
CO Assessment Questions		
CO1	1. Explain the relevance of Civil engineering in the overall infrastructural development of the country. 2. What are the major classifications of CRZ? 3. Explain with neat sketch components of the building. 4. Discuss the difference between floor area and carpet area. 5. Mention the factors to be considered while selecting the site for the building.	
CO2	1. Explain any five modern construction materials used for construction. 2. What are the properties of good building bricks? 3. What are the different types of cement available? 4. Explain any five types of cement and their uses. 5. List out five major qualities of good timber.	
CO3	1. The following readings were taken in a running closed compass traverse. Line FB BB. AB 49 °55’ 230 °00’ ,BC 177 °45’ 356 °00’ ,CD 104 °15’ 284 °55’, DE 165 °15’ 345 °15’ ,EA 259 °30’ 79 °90’. i) State the stations which were affected by local attraction. ii) Determine the corrected bearings. a. iii) Calculate the true bearings if the declination was 1° 30’ W. 2. State the objectives of surveying. 3. Explain the different of foundations. 4. Explain the process of ranging a chain line between two points which are not intervisible. 5. The following bearings were taken in a compass traverse survey. Apply correction for interior angles and local attractions and find the corrected interior angles and bearings.	

	<table><tr><th>Line</th><th>FB</th><th>BB</th></tr><tr><td>AB</td><td>80° 10′</td><td>259° 00′</td></tr><tr><td>BC</td><td>120° 20′</td><td>301° 50′</td></tr><tr><td>CD</td><td>170° 50′</td><td>350° 50′</td></tr><tr><td>DE</td><td>230° 10′</td><td>49° 30′</td></tr><tr><td>EA</td><td>310° 20′</td><td>130° 15′</td></tr></table>
CO4	1. The following readings were taken with a dumpy level and a 4 m levelling staff on a continuously sloping ground at 30m intervals. 0.685, 1.455, 1.850, 2.330, 2.885, 3.380, 1.055, 1.860, 2.265, 3.540, 0.835, 0.945, 1.530 and 2.250. The reduced level of the first point is 80.750. Rule out a page of a level book and enter the above readings. Determine RLs of all points using height of instrument method. 2. The following consecutive readings were taken with a dumpy level. The level was shifted, after 4th, 6th and 8th readings. Reduced level at the first point was 100.00. Prepare a level field work table. Calculate the reduced levels of the point by height of instrument method and apply the usual arithmetic check. 6.21, 4.92, 6.12, 8.42, 9.81, 6.63,7 .91, 8.26, 9.71, 10.21. 3. Explain with a sketch any four characteristics of contours. 4. Define a) Benchmark b) Level surface c) Reduced level. 5. State Simpson's rule and Trapezoidal rule for computation of area. A series of offsets were taken at 3m intervals in the following order from a chain line to a curved boundary 2.16, 1.53, 1.80, 1.98, 1.80, l.59, l.80, 2.52, 2.43, 2.40, 2.58, 2.70, 2.91 and 3.06 meters. Find the area between the chain line, curved boundary and the end offsets by Simpson's rule and trapezoidal rule.

Prepared by
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Asst. Prof., CE

24ESR105	ALGORITHMIC THINKING WITH PYTHON	L	T	P	R	C	Year of Introduction
		2	0	2	1	4	2024

Preamble: The syllabus is prepared with the view of preparing the engineering graduates to be capable of writing readable Python programs to solve computational problems that they may have to solve in their professional lives. The course content is decided to cover the essential programming fundamentals, which can be taught within the given slots in the curriculum.

Prerequisite: NIL

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

CO 1	Analyze and develop an algorithm for solving computational problems. **[Apply Level]**
CO 2	Articulate in design programs with interactive input and output, utilizing arithmetic expression repetitions, and decision-making. **[Understand Level]**
CO 3	Utilize modular Python programs using functions and process stored data using List, Tuples, Sets, Dictionaries. **[Apply Level]**
CO 4	Understand and implement file operations for reading input and storing output. **[Understand Level]**

CO - PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3									3
CO2	3	3	3	2			3	3				3
CO3	3											3
CO4	3											3

Assessment Pattern for Theory Component

Bloom's Category	Continuous Assessment Tools			End Semester Examination
	Test1	Test 2	Other tools	
Remember	√	√		√
Understand	√	√		√
Apply	√	√	√	√
Analyze				
Evaluate				
Create				

Assessment Pattern for Practical Component

Bloom's Category	Continuous Assessment Tools	
	Class work	Test
Remember	√	√

Understand	√	√
Apply	√	√
Analyze		
Evaluate		
Create		

Assessment Pattern for Project Component

Bloom's Category	Continuous Assessment Tools		
	Evaluation 1	Evaluation 2	Report
Remember	√	√	
Understand	√	√	
Apply	√		
Analyze			
Evaluate			
Create			

Mark Distribution of CIA

		Theory [L]			Practical [P]		Project [R]			Total Marks
Course Structure [L-T-P-R]	Attendance	Assignment	Test-1	Test-2	Class Work	Test	Evaluation 1	Evaluation-2	Report	
2-0-2-1	5	5	7.5	7.5	7.5	5		7.5	5	50

Total Marks distribution

Total Marks	CIA (Marks)	ESE (Mark)	ESE Duration
100	50	50	2 hrs

End Semester Examination [ESE]

PATTERN	PART A	PART B
PATTERN 2	2 Questions from each module. Total of 8 Questions, Answer any 6 questions. Each carrying 3 marks (6x3 =18 marks)	2 questions will be given from each module, out of which 1 question should be answered. Each question can have a maximum of 3 subdivisions. Each question carries 8 marks. (4x8 = 32 marks)

SYLLABUS

MODULE I : Fundamentals of Algorithms (5 Hours)
Problem Solving strategies — Problem analysis — formal definition of problem — Solution — top- down design — breaking a problem into sub problems- overview of the solution to the sub problems by writing step by step procedure (algorithm) - Implementation of algorithms — use of procedures to achieve modularity. **Examples for algorithms** - At least 10 problems (starting with non-numerical examples, and numeric problems like factorial, largest among three numbers, largest among N, Fibonacci.
MODULE II : Variable Expression and Statements (6 Hours)
Introduction to Python-variables, expressions and statements, evaluation of expressions, precedence, string operations Control statements, Boolean expressions and logical operators, conditional and alternative executions
MODULE III : Functions (6 Hours)
Functions, calling functions, type conversion and coercion, composition of functions, mathematical functions, user-defined functions, parameters and arguments.
MODULE IV : List, Dictionary Data Structures (6 Hours)
Strings and lists — string traversal and comparison with examples. List operations with examples tuples and dictionaries — operations and examples ,Introduction to numpy, pandas, matplotlib ,Files and exceptions - text files, directories, Introduction to classes and objects - attributes, instances
Textbooks 1. Downey, A. et al., How to think like a Computer Scientist: Learning with Python, John Wiley, 2022 2. Reema Thereja., Computer Fundamentals and Programming in C, Oxford, 2023 3. Lambert K. A., Fundamentals of Python - First Programs, Cengage Learning India, 2019 4. Rajaraman, V., Computer Basics and C Programming, Prentice-Hall India
Reference books 1. Barry, P., Head First Python, , O' Reilly Publishers 2. Dromy, R. G., How to solve it by Computer, Pearson India 3. Guzdial, M. J., Introduction to Computing and Programming in Python, Pearson India 4. Perkovic, L., Introduction to Computing Using Python, 2/e, John Wiley, 2015 5. Sprankle , M., Problem Solving & Programming Concepts, Pearson India 6. Venit, S. and Drake, E., Prelude to Programming: Concepts & Design, Pearson India 7. Zelle, J., Python Programming: An Introduction to Computer Science, Franklin, Beedle & Associates Inc.

NPTEL/SWAYAM Courses for reference:

1. The joy of Computing using Python - https://onlinecourses.nptel.ac.in/noc21_cs32/preview

No.	COURSE CONTENTS AND LECTURE SCHEDULE	No. of Hours (24)
	MODULE I: Fundamentals of Algorithms (5 Hours)	
1.1	Problem analysis — formal definition of problem	1
1.2	Solution — top- down design	1
1.3	breaking a problem into sub problems-	1
1.4	overview of the solution to the sub problems by writing step by step procedure (algorithm)	1
1.5	Examples	1
	MODULE II: Variable Expression and Statements (6 Hours)	
2.1	variables, expressions	1
2.2	statements, evaluation of expressions	1
2.3	Precedence, string operations	1
2.4	Control statements	1
2.5	Boolean expressions and logical operators	1
2.6	conditional and alternative executions	1
	MODULE III : Functions (6 Hours)	
3.1	Functions	1
3.2	Calling functions	1
3.3	Type conversion and coercion	1
3.4	Composition of functions	1
3.5	Mathematical functions	1
3.6	User-defined functions, parameters and arguments.	1
	MODULE IV: List, Dictionary Data Structures (6 Hours)	
4.1	Strings and lists, string traversal and comparison	1
4.2	List operations with examples	1
4.3	tuples and dictionaries, operations and examples	1
4.4	Files and exceptions - text files, directories	1
4.5	Introduction to numpy, pandas, matplotlib	1
4.6	Introduction to classes and objects - attributes, instances	1
Project: Mini projects can be done in the respective engineering domain.		
LESSON PLAN FOR LAB COMPONENT (8 Experiments mandatory)		

No.	Topic	No. of Hours (12)
1	Simple desktop calculator using Python. Only the five basic arithmetic operators	1
2	Create, concatenate, and print a string and access a sub-string from a given string.	1
3	Familiarize time and date in various formats (Eg. "Thu Jul 11 10:26:23 IST 2024").	1
4	Program to find the largest of three numbers.	1
5	Convert temperature values back and forth between Celsius (c), and Fahrenheit (f). [Formula: c/5 =f-32/9]	1
6	Program to find the factorial of a number	1
7	Write program to check whether the given number is Armstrong or not	1
8	Write various programs to implement numpy, Pandas and matplotlib	3
9	Write a program to implement file operations	1
10	Write a program to demonstrate OOPs concepts in python	1
LESSON PLAN FOR PROJECT COMPONENT		
No.	**Topic**	**No. of Hours (12)**
1	Introduction and awareness on various stages of a Mini Hackathon.	6
2	Final Mini Hackathon, Presentation and evaluation.	6

CO Assessment Questions	
CO1	1.Write an algorithm to compute sum of series 1 – x2/2 +x4/4-x6/6+……. n 2. Give the algorithm and flowchart for finding the largest and smallest numbers in each list of N numbers 3. Simple desktop calculator using Python. Only the five basic arithmetic operators
CO2	1. Evaluate the expression x ** y ** z. Given x = 2, y = 3, z=2 2. Write a python program to display all Armstrong numbers in each range 3. Write a python program to count the number of zeros and negative terms in each set of n numbers 4. Familiarize time and date in various formats (Eg. "Thu Jul 11 10:26:23 IST 2024").

CO3	1. Why do we need functions? What are the advantages of function 2. Write a python program to find the sum of digits of a number 3. What do you mean by mutability of data structure? Explain with example why we say that list is mutable while tuples are immutable 4. Program to find the factorial of a number
CO4	1. Write a python program to create a text file and to input a line of text to it. Display the line pf text with all punctuation mark removed. 2. Create a class rectangle with attributes length, breadth and method area () to calculate the area of the rectangle. Create two instances of the class and call the method for each instance. 3. Write a program to read numbers stored in one file and store the sorted numbers in another after deleting duplicates. 4. Write a program to implement file operations

Prepared By
Dr. Sreeraj R
Prof., CSE
Ms. Livya George
Asst.Prof. CSE

24ESL106	CIVIL ENGINEERING WORKSHOP	L	T	P	R	C	Year of Introduction
		0	0	2	0	1	2024

Preamble:
The course is designed to train the students to identify and manage the materials, tools and methods required to execute an engineering project. Students will be introduced to a team working environment where they develop the necessary skills for planning, preparing and executing an engineering project.

Prerequisite: NIL

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

CO1	Demonstrate the steps involved in basic Civil Engineering activities like plot measurement, setting out operation, evaluating the natural profile of land and undertake simple construction activities
CO2	Identify appropriate materials required for each construction activity.
CO3	Choose bonding in masonry and install various fixtures on site.

CO - PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2				2		2	3	2		2
CO2	2	2				2		2	3	2		2
CO3	2	2				2		2	3	2		2

Assessment Pattern

Bloom's Category	Continuous Assessment Tools	
	Classwork	Test1
Remember		
Understand	√	√
Apply	√	√
Analyze	√	
Evaluate	√	
Create	√	

Mark Distribution of CIA

Course Structure [L-T-P-R]	Attendance	Classwork	Lab Exam	Total Marks
0-0-2-0	5	25	20	50

Total Mark distribution

Total Marks	CIA (Marks)	ESE (Marks)	ESE Duration
50	50	0	-

SYLLABUS- DETAILS OF EXPERIMENTS

Minimum 10 experiments AND 1 ASSIGNMENT are mandatory

INTRODUCTION TO CIVIL ENGINEERING SITE MEASUREMENTS - Setting out of a building, Compute the area and/or volume, Computation of Centre of gravity, Measuring the area of a plot, Measuring the area of a building

BASIC CONSTRUCTION ACTIVITES - Aligning a road embankment, Testing of building materials, Construct at least two courses of wall, Levelling
STUDY - Introduction to plumbing and sanitary fittings, Carpentry work, welding, drilling, bolting and riveting
ASSIGNMENT - Report preparation, collect samples of building materials
Textbooks 1. Rangwala S C and Ketki B Dalal, Engineering Materials, Charotar Publishing house 2. Khanna P.N, "Indian Practical Civil Engineering Handbook", Engineers Publishers. 3. Bhavikatti. S, "Surveying and Levelling (Volume 1)", I.K. International Publishing House 4. Arora S.P and Bindra S.P, " Building Construction", Dhanpat Rai Publications 5. Fundamentals of Building Construction: Materials and Methods" by Edward Allen and Joseph Iano 6. Introduction to Civil Engineering Construction" by Richard J. C. Williams
Reference books 1. Concrete Technology: Theory and Practice" by M.S. Shetty 2. Masonry: Design and Construction, Problems and Repair" by Peter L. P. H. W. Brown and Charles J. Amstutz 3. "Surveying for Civil Engineers" by J. W. B. Barlow

LIST OF EXPERIMENTS

(Minimum 10 experiments are mandatory) 24 Hrs

No.	Experiments
1	Preparation of a centre line setting out plan of a building with dimensions and check measurements using diagonals.
2	Setting out of a building: The student should set out a building (single room only) as per the given building plan using tape.
3	Compute the area and/or volume of various features of a building/structure such as door and window size, number of bricks required to construct a wall of a building, diameter of bars used in windows etc.
4	Computation of Centre of gravity and Moment of inertia of a given rolled steel section by sketching and measurements.
5	Measuring the area of a plot with an irregular boundary using a chain and cross staff
6	Measuring the area of a building using Distomat
7	Aligning a road embankment with change in direction using a prismatic compass in the field for the given data.
8	Testing of building materials: The student should do the compression testing of any three construction materials and compare the strength.
9	Construct at least two courses of wall of thickness 1 or 1 1/2 brick thick using English bond and Flemish bond
10	Levelling - Simple Levelling (Height of Instrument & Rise and Fall Method).
11	Levelling - Differential Levelling (Height of Instrument & Rise and Fall Method).
12	Introduction to plumbing and sanitary fittings -i) Different types of pipes, joints and fixtures in plumbing ii) Drawing for Water Supply and sanitary system
13	Study on Carpentry work, welding, drilling, bolting and riveting for Civil Engineers.

14	ASSIGNMENT 1: Report preparation - The student should collect the construction details of a building, prepare and submit a detailed report with neat illustrations
15	ASSIGNMENT 2: The students should collect samples of building materials, prepare and submit a detailed report about their market rates
CO Assessment Questions	
CO1	Conduct an experiment on setting out a building. How do you use surveying tools to achieve precise alignment and layout according to the provided plans
CO2	Identify and categorize different construction materials (e.g., concrete, bricks, steel). How do you test and determine their suitability for various construction activities?
CO3	Construct small masonry wall using different bonding patterns (e.g., stretcher bond, English bond, Flemish bond). How do each of these bonding types affect the stability and appearance of the masonry?

24HUT007	Communicative English	L	T	P	R	C	Year of Introduction
		0	0	2	0	1	2024

Preamble: This course aims to enhance the communicative English skills of engineering students. The course will cover the four main language skills: listening, reading, writing, and speaking. Students will engage in various activities, including practical sessions in the language lab, to improve their proficiency in English.

Prerequisite: NIL

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

CO 1	Improve Listening Skills in English [Apply]
CO 2	Enhance Students' Reading Skills in English [Analyze]
CO 3	Develop Writing Skills in English [Create]
CO 4	Improve Speaking Skills in English [Evaluate]

CO - PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	1								2	3		
CO 2	1	2								3		
CO 3	1		2	3					2	3		
CO 4	1								3	3		

Assessment Pattern for Lab Component

Bloom's Category	Continuous Assessment Tools	
	Classwork	Test
Remember		
Understand		
Apply	√	√
Analyze	√	√
Evaluate	√	√
Create	√	√

Mark Distribution of CIA

Attendance	Lab [P]				Total Marks
	Reading Test	Writing Test	Listening Test	Speaking Test	
5	25	25	20	25	**100**

Total Marks distribution

Total Marks	CIA (Marks)	ESE (Marks)	ESE Duration
100	100	0	-

SYLLABUS

MODULE I: Introduction and Listening Skills (4 hours)

Introduction To the Theory of Communication: Types of Communication, Modes of Communication

Listening Skills: Listening: Importance And Benefits of Listening Skill, Different Types of Listening, Understanding different accents and dialects, Note-taking strategies, Strategies for Improving Listening

MODULE II: Reading Skills (4 hours)

Reading: A Passive Skill – Its Importance, Ten Important Reading Strategies and their Benefits, Skimming and scanning techniques, identifying main ideas and supporting details

MODULE III: Writing Skills (4 hours)

Different Styles of Writing, Fundamentals of English Usages, understanding different types of charts, graphs, and diagrams, describing trends and comparing data

Structuring an essay, developing arguments and supporting them with examples, Making Notes and Resumes, Report Writing, Fundamentals of Intonation, Correspondence Writing, Means to Enhance Vocabulary, Content Writing

MODULE IV: Speaking Skills and Integrated Review (8 hours)

Speaking Skills: The Importance of Speaking as an active skill; Grammar, Vocabulary, and Phonetics: Tools of Communicative English Developing fluency and coherence; Pronunciation and stress; Techniques for Effective Public Speaking; Group Discussion and Interview Skills; Presentation Skills; People Skills.

Integrated Skills and Review: Business English, Comprehension, Summary and Paraphrasing, Research Methodology and Documentation

Textbooks

1. Effective Communication Skills/Kul Bhushun Kumar, P S Salaria, Khanna Book Publishing Co (P) Ltd, New Delhi
2. Communication Skills For Engineers & Scientists/ Sangeeta Sharma, Binod Mishra, PHI Learning Pvt Ltd, New Delhi
3. Humanities & Communication Skills/Pearson Education India Pvt Ltd, New Delhi
4. Adler B. Ronald and Russell F. Proctor II. Looking Out, Looking In. Cengage Learning.2017.
5. Dianna L.Vanblerkom. College Study Skills.Wadsworth.2003
6. Aggarwal, R. (2003). Effective Communication Skills. Jaipur: Sublime Publications
7. Davies, F. 1995, Introducing Reading. Penguin Books.
8. Downs, Lisa. Listening Skills Training. USA; ASTD, 2008. Print.

Reference books

1. Dawes, L. The Essential Speaking and Listening. Routledge, 2008.
2. Cornbleet, S., and Carter, R. The Language of Speech and Writing. Routledge, 2001.
3. Harvey, I. (1951). The Technique of Persuasion. London: The Falcon Press.
4. Anderson, A. and Lynch, T. (1988) Listening, Oxford: Oxford University, Press.
5. Riggenbach, Heidi. Perspectives on Fluency. University of Michigan Press, 2000.
6. Dianna L.Vanblerkom. College Study Skills.Wadsworth.2003
7. Crystal, D. (2003). English as a Global Language. 2nd edition. Cambridge: Cambridge University Press
8. Anderson, Marilyn, Pramod K. Nayar. Critical Thinking, Academic Writing and Presentation Skills. Dorling Kindersley. India 2010
9. David Crystal Mother-tongue India Talk for Lingua Franca (ABC, Australia), January

2005 http://www.globalenglish.com/blog/2014/06/10/indian-employers-report-business-english-is-essential-totheir-workforce/ by 12/3/14 at 6:15 pm
10. Crystal, David (2003). The Cambridge Encyclopedia of the English Language (2nd Ed.). Cambridge University Press. ISBN 0-521-53033-4.

NPTEL/SWAYAM Courses for reference:

1. **https://onlinecourses.swayam2.ac.in/cec24_lg08/preview::** Communicative English By Dr. Salia Rex

LESSON PLAN FOR LAB COMPONENT

No. Topic	Topic	No. of Hours (24)
1	Listening practice using audio resources	4
2	Reading comprehension exercises and quizzes	4
3	Writing practice and peer review	4
4	Essay writing/Resume writing/Report writing and feedback sessions	4
5	Speaking practice with peers and recording for self-assessment	8

CO Assessment Questions

CO1	Listening Test: You will have to listen to four recordings (conversations and monologues) and then answer the questions asked. The recordings are of native English speakers, and various accents are used. Remember, you can hear each recording only once. • **Recording 1:** You will listen to a dialogue in daily life and context. • **Recording 2:** You will listen to a monologue about everyday life or social context. For instance, a talk on the condition of streets in an area. • **Recording 3:** You will listen to a conversation between more than two people placed in a training or educational context. For instance, a teacher discusses an assignment with students. • **Recording 4:** You will listen to a monologue on any academic subject, such as a college lecture. Answer 6 question types, including: • Multiple choice • Matching • Plan/map/diagram labelling • Note completion • Short answer questions
CO 2	The Reading test is divided into three parts, each featuring a comprehensive passage from contemporary books, journals, magazines, and newspapers. These passages reflect topics relevant to academic and professional environments in English-speaking contexts. Answer 11 question types, including: • Multiple choice • Identifying information

	• Note completion • Matching headings • Matching sentence endings • Summary completion • Sentence completion • Flow-chart completion
CO 3	**Part 1:** You are presented with a graph, table, chart, or diagram and asked to describe, summarize, or explain the information in your own words. You may be asked to describe and explain data, describe the stages of a process, explain how something works, or describe an object or event. **Part 2:** You are asked to write an essay responding to a point of view, argument or problem.
CO 4	**Part 1:** (4–5 minutes) Introduction and interview. The examiner will ask you to introduce yourself and confirm your identity. Then, the examiner will ask you generic questions about family, studies, work, and interests. **Part 2:** (3–4 minutes) Individual long turn. The examiner will give you a task card with a topic written on it, with some points you may cover in your speech. You will have one minute to think and prepare the topic; a paper and pencil will be provided to jot down your notes. Once done ideating, you will have a time of one to two minutes to speak on the subject, followed by some questions on the same by the examiner. **Part 3:** (4–5 minutes) Two-way discussion. The examiner will ask more questions related to the topic provided in Part 2 of the Speaking test. You can use this opportunity to talk about more ideas.

SEMESTER-II
SYLLABUS

24MAT231	INFINITE SERIES, VECTOR CALCULUS & STATISTICS	L	T	P	R	C	Year of Introduction
		3	0	0	0	3	2024

Preamble:
This course introduces key mathematical concepts essential for Civil engineering, including series representation of functions, multiple integrals, vector calculus, and statistical measures of central tendency and dispersion. Students will learn to apply these concepts using modern computational tools to solve real-world engineering problems. Through this course, students will develop a solid mathematical foundation necessary for advanced studies and professional engineering practice.

Prerequisite: Calculus of univariate functions and basic statistical concepts.

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

CO 1	Represent functions as power series and Fourier series and determine Radius of Convergence **[Apply]**
CO 2	Apply double integral to find areas and volumes of geometrical shapes **[Apply]**
CO 3	Evaluate derivatives and integrals of vector valued functions and explore their applications **[Apply]**
CO 4	Apply statistical methods to measure central tendency and dispersion, enabling data-driven decision-making in various contexts.**[Apply]**

CO - PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	O10	PO11	PO12
CO 1	3	3	3									
CO 2	3	2	2	2	2							
CO 3	3	3			2							
CO 4	3	3	3	3	2							

Assessment Pattern

Bloom's Category	Continuous Assessment Tools			End Semester Examination
	Test1	Test 2	Other tools	
Remember	√	√	√	√
Understand	√	√	√	√
Apply	√	√	√	√
Analyse				
Evaluate				
Create				

Mark Distribution of CIA

		Theory [L]	

Course Structure [L-T-P-R]	Attendance	Assignment	Test-1	Test-2	Total Marks
3-0-0-0	5	10	12.5	12.5	40

Total Mark distribution

Total Marks	CIA (Marks)	ESE (Marks)	ESE Duration
100	40	60	2.5 hours

End Semester Examination [ESE]: Pattern

PATTERN	PART A	PART B	ESE Marks
PATTERN 1	8 Questions (2 questions from each module)each question carries 3 marks Marks: (3x8 =24 marks)	2 questions will be given from each module, out of which 1 question should be answered. Each question can have a maximum of 2 subdivisions. Each question carries 9 marks. Marks: (9x4 = 36 marks)	60

SYLLABUS

MODULE I: Series Representation of different functions

(Text 1: Relevant topics from sections 9.3,9.8)
(Text 2: Relevant topics from sections 11.1,11.2)
Concept of convergence of an infinite series and region of convergence,Series representation of exponential, trigonometric, logarithmic functions (without proofs of convergence), Taylor series representation , Maclaurin series representation(withoutproof),Fourier series, Euler formula, Convergence of Fourier series (Dirichlet's conditions), Fourier series of 2π periodic functions, Fourier series of $2l$ periodic functions, Half range sine series expansion, Half range cosine series expansion.

MODULE II: Multiple integrals and applications

(Text 1: Relevant topics from sections 14.1, 14.2, 14.3, 14.5)
Double integrals (Cartesian), Double integrals over non rectangular regions, Reversing the order of integration, change of coordinates in double integrals(Cartesian to polar)Finding area and volume using double integrals, Triple integrals.

MODULE III:Vector Calculus

(Text 1: Relevant topics from sections 12.1,12.2,13.6,15.1,15.2)
Vector valued functions of single variable, derivative of vector function, Concept of scalar and vector fields, Gradient and its properties, directional derivative, divergence and curl, Line integrals of vector fields, work done as line integral.

MODULE IV: Measures of Central Tendency and Dispersion

(Text 3: Sections 25.5,25.6,25.9,25.10,25.11,25.12,25.14,25.16) Measures of Central Tendency-Mean, Median, Mode, Measures of Dispersion-Standard Deviation, Variance, Skewness, Kurtosis, Moments, Correlation and Lines of Regression-Rank Correlation.
Text books 1. H. Anton, I. Bivens, Davis, "Calculus", Wiley, 10th edition, 2015. 2. Kreyszig, Advanced Engineering Mathematics, 10thEdition, John Wiley & Sons, 2016. 3. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 42nd Edition, 2012.
Reference books 1. J. Stewart, Essential Calculus, Cengage, 2nd edition, 2017 2. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9 th Edition, Pearson, Reprint, 2002. 3. Peter V. O'Neil, Advanced Engineering Mathematics, Cengage, 7th Edition, 2012 4. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008. 5. D.W. Jordan& P.Smith, Mathematical Techniques,Oxford,2008 6. Richard I.Levin,David S.Rubin.et.al.,Statistics for management,7th edition,Pearson,2013
NPTEL/SWAYAM Courses for reference: 1. Descriptive Statistics with R Software by Prof. Prashant Jha, Prof. Shalabh | NIT Sikkim, IIT Kanpur https://onlinecourses.nptel.ac.in/noc24_mg133/preview (Relevant Section) 2. Advanced Calculus for Engineers By Prof. Jitendra Kumar, Prof. Somesh Kumar | IIT Kharagpur https://onlinecourses.nptel.ac.in/noc24_ma91/preview (Relevant section)

No.	COURSE CONTENTS AND LECTURE SCHEDULE	No. of Hours [36 hours]
	MODULE I [9 hours]	
1.1	Concept of convergence of an infinite series	1
1.2	Region of convergence	1
1.3	Series representation of exponential, trigonometric, logarithmic functions,Taylor series representation	1
1.4	Maclaurin series representation	1
1.5	Fourier series, Euler formulae Convergence of Fourier series (Dirichlet's conditions),	1
1.6	Fourier series of 2π periodic functions, Fourier series of 2l periodic functions	2
1.7	Half range sine series expansion, Half range cosine series expansion.	2
	MODULE II [9 hours]	
2.1	Double integrals (Cartesian)-evaluation	1
2.2	Double integrals over non rectangular region	1
2.3	Change of order of integration in double integrals	2
2.4	Change of coordinates (Cartesian to polar)	2

2.5	Finding areas and volumes using double integral	2
2.6	Triple integrals	1
MODULE III [10 hours]		
3.1	Vector-valued function of a single variable	1
3.2	Derivative of vector-valued function, Concept of scalar and vector fields	1
3.3	Gradient and its properties	2
3.4	Directional derivative	1
3.5	Divergence and curl	2
3.6	Line integrals of vector fields.	2
3.7	Work done as line integral	1
MODULE IV [8 hours]		
4.1	Measures of Central Tendency-Mean	1
4.2	Measures of Central Tendency-Median, Mode	1
4.3	Measures of Dispersion-Standard Deviation, Variance	1
4.4	Skewness, Kurtosis	1
4.5	Moments	1
4.6	Correlation	1
4.7	Lines of Regression	1
4.8	Rank Correlation.	1

CO Assessment Questions	
CO1	1. Apply Euler's formula to find the Fourier series expansion of the function $f(x) = x^2$, $-\pi<x<\pi$ 2. Using the idea of half range expansion, find the cosine series of sin x in the interval $0< x <\pi$ 3. Find Maclaurin series expansion of $\sin^2 z$ and find its radius of convergence. **Team Work**: Expand lnx in powers of (x-1) and hence find approximate value of ln1.1 Verify the answer by comparing it with actual value. Determine the number of terms in the expansion to achieve the desired accuracy.
	1. Use double integral to find the area between the parabolas $y^2=4ax$ and $x^2=4ay$ 2. Apply double integral to find the volume of the solid bounded by the cylinder $x^2+y^2=4$ and the planes $y+z = 4$ and $z = 0$ 3. Since there is no elementary antiderivative of e^{x^2} the double integral say

CO2	[redacted] cannot be evaluated by performing the x-integration first. Evaluate this integral by expressing it as an equivalent integral with the order of integration reversed. 4. Use a CAS(MATLAB/SCILAB) to sketch the area of the region enclosed by $y = \sin x$, $y = \cos x$, $x = 0$, $x = 2\pi$. **Teamwork**: Discuss the possibilities of sketching the area of the above question using different software. Also change the limits of x and find the area enclosed between the given curves. The team has to make a presentation elaborating the procedure.
CO3	1. The curl of the velocity field of a rigid body has the direction of the axis of the rotation and its magnitude is equal to twice the angular speed of the rotation. Prove. 2. Find the angle between the surfaces $x^2+y^2+z^2=9$ and $z = x^2+y^2-3$ at the point (2, -1, 2) using the idea of gradient. 3. The temperature of points in space is given by $T(x,y,z) = x^2+y^2-z$. A mosquito located at (1,1,2) desires to fly in such a direction that it will get warm as soon as possible.In what direction should it move? **Team Work**: Use MATLAB to visualize the vector field F= (2x-y, x+3y) in a 2-D plane over the region $-2 \leq x \leq 2$, $-2 \leq y \leq 2$. Change the limits of x and y and discuss and analyze the 2-D images.
CO4	1. For successive three years, a car owner purchases petrol at Rs.7.50, Rs. 8, and Rs. 8.50 a litre. If he spends Rs. 4000 per year on petrol, what is the average cost per litre? 2. The following are the marks obtained (out of 50) by a group of candidates in an employment interview held by two independent judges separately. Use a CAS(MATLAB/SCILAB) to find the variance in the marks put by judges X and Y. Candidates : A B C D E F G H I J Judge X : 20 25 18 15 12 16 11 13 14 10 Judge Y : 22 20 15 14 10 8 11 12 13 9 3. Five competitors in a beauty contest are ranked by three judges in the following order: Rank by Judge A: 1 2 3 4 5 Rank by Judge B : 2 4 1 5 3 Rank by Judge C: 1 3 5 2 4 Using rank correlation coefficient, determine which pair of judges has the nearest approach to tastes in beauty. **Teamwork**: Investigate the relationship between the amount of rain fall(x) and the

	number of flowers blooming(y) in a garden by collecting the data for 10 consecutive days. Determine the strength of the correlation.

Prepared by
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24PHC232	ENGINEERING PHYSICS	L	T	P	R	C	Year of Introduction
		3	0	2	0	4	2024

Preamble: Designed to deepen students' understanding of fundamental physics concepts and their applications in engineering and technology. It aims to build a strong foundation in physics, integrating theoretical principles with practical applications. By exploring interference, diffraction, quantum mechanics, lasers, optical fibres, and acoustics, students will develop the scientific and analytical skills necessary for interdisciplinary research and problem-solving in biotechnology and civil engineering fields.

Prerequisite: Basic knowledge in Physics and Mathematics.

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

CO 1	Use the phenomena of interference and diffraction to determine the wavelength of monochromatic light.[Apply]
CO 2	Apply the knowledge of basic Quantum Mechanics in the behaviour of matter at atomic and subatomic levels.[Apply]
CO 3	Apply the basic concepts of lasers and optical fibres to get theoretical foundations and practical aspects in engineering fields. [Apply]
CO 4	Apply the knowledge of waves in non-destructive testing and Acoustics in the design of buildings to provide a safe and healthy environment. [Apply]
CO5	Apply basic knowledge of principles and theories in physics to conduct experiments. [Apply]

CO - PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	3	3										2
CO 2	3	3										2
CO 3	3	3										2
CO 4	3	3										2
CO 5	3	3			2				2			2

Assessment Pattern for Theory Component

Bloom's Category	Continuous Assessment Tools			End Semester Examination
	Test1	Test 2	Other tools	
Remember	✓	✓	✓	✓
Understand	✓	✓	✓	✓
Apply	✓	✓	✓	✓
Analyse				

Evaluate				
Create				

Assessment Pattern for the Lab component		
Bloom's Category	**Continuous Assessment Tools**	
	Class work	**Test1**
Remember	✓	✓
Understand	✓	✓
Apply	✓	
Analyse		
Evaluate		
Create		

Mark Distribution of CIA							
Course Structure [L-T-P-R]	**Attendance**	**Assignment**	**Theory [L]**		**Practical [P]**		**Total Marks**
			Test-1	**Test-2**	**Lab work**	**Lab Exam**	
3-0-2-0	5	5	7.5	7.5	10	15	50

Total Marks distribution			
Total Marks	**CIA (Marks)**	**ESE (Marks)**	**ESE Duration**
100	50	50	2 hours

End Semester Examination [ESE]: Pattern			
PATTERN	**PART A**	**PART B**	**ESE Marks**
PATTERN 2	2 Questions from each module, 8 questions, each Question carries 3 marks. Answer any 6 Marks:(6x3=18 marks)	2 questions will be given from each module, out of which 1 question should be answered. Each question can have a maximum of 2 subdivisions. Each question carries 8 marks. Marks: (4x 8 = 32 marks)	50

SYLLABUS

MODULE I: Interference and Diffraction (9 Hours)

Introduction to wave optics, Principle of superposition, Constructive and destructive interference, Optical path, Phase difference and path difference, Cosine law- reflected system, Condition for constructive & destructive interference, Colours in thin films, Newton's rings, Measurement of refractive index of transparent liquids & wavelength, Air wedge (qualitative)

Types of Diffraction, Diffraction through grating- Construction, Grating equation, Dispersive and Resolving Power

MODULE II: Quantum Mechanics (9 Hours)

Introduction to Quantum Mechanics, Wave nature of particle, Uncertainty principle, Applications-Absence of electron inside the nucleus- Natural line broadening, Wave function- properties - physical interpretation, Formulation of time-dependent and time-independent Schrodinger equations, Particle in a one-dimensional box - Derivation of energy eigenvalues and normalised wave function, Quantum Mechanical Tunnelling(Qualitative)

MODULE III: Laser and Fibre Optics (9 Hours)

Properties of Laser, Absorption, Spontaneous emission and stimulated emission, Principle of laser - conditions for sustained lasing – Population inversion, Pumping, Metastable states, Basic components of laser - Active medium, Energy source, Optical resonant cavity, Construction and working of Ruby laser, CO_2 Laser, Applications of laser.

Optic fibre-Principle of propagation of light, Types of fibres-Step index and Graded index fibres, Multimode, Single mode, Acceptance angle, Numerical aperture – Derivation, Applications of optical fibres - Fibre optic communication system (block diagram)

MODULE IV: Waves and Acoustics (9 Hours)

Waves-Transverse and Longitudinal waves, Concept of frequency, time period, wavelength (no derivation), Transverse vibrations in stretched string-Derivation of velocity and frequency Laws of transverse vibration,

Acoustics-Reverberation and echo, Reverberation time and its significance, Sabine's Formula, Factors affecting acoustics of a building

Ultrasonics-Piezoelectric oscillator, Ultrasonic diffractometer, SONAR, NDT-Pulse echo method, Medical application-Ultrasound scanning (Qualitative)

Text books

1. M.N. Avadhanulu, P.G. Kshirsagar, TVS Arun Murthy “A Textbook of Engineering Physics”, S. Chand &Co., Revised Edition 2019.
2. H.K. Malik, A.K. Singh, “Engineering Physics” McGraw Hill Education, Second Edition 2017.

Reference books

1. G Vijayakumari, "Engineering Physics", Vikas Publications, 8th Edition, 2014
2. Gerd Keiser, "Fiber Optic Communications ", Springer, 2021
3. Arthur Beiser, "Concepts of Modern Physics ", Tata McGraw Hill Publications, 6th Edition 2003.
4. D. K. Bhattacharya, Poonam Tandon, "Engineering Physics", Oxford University Press, 2015.
5. Md.N. Khan & S. Panigrahi "Principles of Engineering Physics 1 & 2", Cambridge University Press, 2016.
6. Aruldhas G., "Engineering Physics", PHI Pvt. Ltd., 2015.
7. Ajoy Ghatak, "Optics", McGraw Hill Education, Sixth Edition, 2017.
8. Premlet B., "Advanced Engineering Physics", Phasor Books,11th edition ,2021.
9. I Dominic and. A. Nahari, "A Text Book of Engineering Physics", Owl Books Publishers, Revised edition, 2016.
10. H.D Young and R.A Freedman, "University Physics with Modern Physics" 2020, 15th Edition, Pearson, USA.

NPTEL/SWAYAM Courses for reference:

Module I- Applied Optics
https://onlinecourses.nptel.ac.in/noc24_ph39/preview

Module II - Quantum Mechanics
https://nptel.ac.in/courses/115101107
Quantum Mechanics and Applications
https://nptel.ac.in/courses/115102023

Module III- Fundamentals and Applications
https://nptel.ac.in/courses/104104085
Introduction to LASER
https://nptel.ac.in/courses/115102124

Module IV-Fundamentals of Acoustics
https://nptel.ac.in/courses/112104212
Architectural Acoustics
https://nptel.ac.in/courses/124105004
Wave Optics
https://nptel.ac.in/courses/115105537

No.	COURSE CONTENTS AND LECTURE SCHEDULE	No. of Hours [36]
	MODULE I: Interference and Diffraction (9 Hours)	
1.1	Introduction to wave optics, Principle of superposition,	1
1.2	Constructive and destructive interference, Optical path, Phase difference and path difference	1
1.3	Cosine law- reflected system	1
1.4	Condition for constructive & destructive interference, Colours in thin films	1
1.5	Newton's rings, Measurement of refractive index of transparent liquids & wavelength	1
1.6	Air wedge(qualitative)	1

1.7	Types of Diffraction, Diffraction through grating- Construction	1
1.8	Grating equation	1
1.9	Dispersive and Resolving Power	1
MODULE II: Quantum Mechanics (9 Hours)		
2.1	Introduction to Quantum Mechanics, Wave nature of particles,	1
2.2	Uncertainty principle	1
2.3	Applications-Absence of electron inside the nucleus, Natural line broadening mechanism	1
2.4	Wave function, its properties and physical interpretation,	1
2.5	Formulation of time dependent Schrodinger equations,	1
2.6	Formulation of time independent Schrodinger equations	1
2.7	Particle in a one- dimensional box - Derivation of energy eigenvalues and normalised wave function	2
2.8	Quantum Mechanical Tunnelling(Qualitative)	1
MODULE III: Laser and Fibre Optics (9 Hours)		
3.1	Properties of Laser, Absorption, Spontaneous emission and stimulated emission	1
3.2	Principle of laser - conditions for sustained lasing – Population inversion, Pumping, Metastable states	1
3.3	Basic components of laser - Active medium, Energy source, Optical resonant cavity.	1
3.4	Construction and working of Ruby laser	1
3.5	CO_2 Laser	1
3.6	Properties of laser, Applications of laser	1
3.7	Optic fibres-Principle of propagation of light, Types of fibres -Step index and Graded index fibre,	1
3.8	Multimode, Single mode, Numerical Aperture - Derivation	1
3.9	Applications of optical fibres - Fibre optic communication system (block diagram)	1
MODULE IV: Waves and Acoustics (9 Hours)		
4.1	Waves-Transverse and Longitudinal waves, Concept of frequency, time period, wavelength (no derivation)	1
4.2	Transverse vibrations in stretched string-Derivation of velocity and frequency Laws of transverse vibration,	1
4.3	Acoustics-Reverberation and echo	1
4.4	Reverberation time and its significance	1

4.5	Sabine's Formula, Factors affecting acoustics of a building	1
4.6	Ultrasonics-Piezoelectric oscillator	1
4.7	Ultrasonic diffractometer	1
4.8	SONAR, NDT-Pulse echo method	1
4.9	Medical application-Ultrasound scanning (Qualitative)	1

LESSON PLAN FOR LAB COMPONENT

No.	Topic	No. of Hours	Experiment
1	Interference and Diffraction	2	Determination of the diameter of a thin wire using the air wedge method.
		2	Determination of wavelength of monochromatic light using grating.
		2	Determination of wavelength of monochromatic light using Newton's rings setup.
2	Quantum Mechanics	2	Determine the size of lycopodium powder using a laser.
		2	Quantum mechanical tunnelling using simulation.
		2	Particle in a 1D box using simulation.
3	Laser and Fibre Optics	2	Determination of wavelength of Laser using diffraction grating.
		2	Determination of Numerical aperture and acceptance angle of optic fibre using Laser.
4	Waves and Acoustics	2	Melde's string apparatus-Measurement of frequency in the transverse and longitudinal mode
		2	Piezoelectric oscillator using simulation.
		2	To determine the frequency and amplitude of waves using CRO
(Any 2 experiments from each topic to be completed)			

CO Assessment Questions

CO1	1. Two Independent sources of light cannot produce interference fringes. Why? 2. What is a grating? Derive the grating equation. Explain how we can find the wavelength of monochromatic light using grating. What is the effect of increasing the number of lines on the dispersive power of grating? 3. Apply the principles of interference to explain the formation of Newton's rings and show that the radius of the dark ring is proportional to the square root of natural numbers. How can we use Newton's rings experiment to determine the refractive index of a liquid? 4. With Newton's rings arrangement, n^{th} dark ring formed by light of

	wavelength 6000A^0 coincides with the (n+1)th dark ring for the light of wavelength 4500A^0. If the radius of curvature of the convex surface is 90 cm, Find the diameter of the nth ring for light of wavelength 6000A^0.
CO2	1. Give the physical significance of wave function. 2. By applying Heisenberg's uncertainty principle prove the absence of electrons inside the nucleus. 3. An electron is confined to a one-dimensional potential box of length 2Å. Calculate the energies corresponding to the first and second quantum states in eV. 4. Write down the Schrodinger equation for a particle in a one-dimensional infinite square well potential and also derive the equation for normalised wave function and energy eigenvalues for a particle in 1 D Box.
CO3	1. Explain the construction and working of a ruby laser with the help of energy level diagrams by applying the concept of stimulated emission. 2. Calculate the ratio of spontaneous to stimulated emission by an incandescent bulb at 2000K. Take frequency = 6 x 10^{14} Hz. Boltzmann constant k = 1.38 x 10^{-23} J/K. 3. Why should the refractive index of cladding be of lower value in comparison with the refractive index of core in an optic fibre? 4. Define numerical aperture and acceptance angle of an optical fibre and derive expression for numerical aperture of a step index fibre with a neat diagram.
CO4	1. Discuss the propagation of a transverse wave along a stretched string and derive the expression for frequency. 2. A uniform steel wire has length 10 m and mass 2 kg. Find the Tension in the string if the speed of transverse wave on the wire is 340m/s. 3. Explain the terms absorption coefficient and reverberation time. What is the significance of reverberation time? Discuss the factors on which the Reverberation time depends and write the Sabine's formula. 4.Apply the properties of ultrasonic Write a note on SONAR. Give any two uses of it.
CO5	1.Determination of the diameter of a thin wire using the air wedge method. 2.Determine experimentally the size of lycopodium powder using a laser. 3.By applying the principle of Diffraction determine the wavelength of a laser source using a diffraction grating arrangement. 4.Determine experimentally frequency of waves in the transverse and longitudinal mode using Melde's string apparatus.

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24EST003	ENGINEERING GRAPHICS	L	T	P	R	C	Year of Introduction
		3	0	0	0	3	2024

Preamble:

Practicing Engineers require the ability to translate ideas into tangible designs and interpret existing drawings. "Engineering Graphics" covers fundamental principles such as orthographic projections, dimensioning, sectional views, surface development, isometric projections and conversion of isometric to orthographic projection. This course equips students with essential skills in engineering drawing, preparing them for careers in Engineering.

Prerequisite: Nil

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

CO1	Translate the principles of orthographic projections to prepare projections of lines and solids. [Apply]
CO2	Prepare sectional views and develop surfaces of a given solid. [Apply]
CO3	Convert between 2D orthographic views and 3D isometric projections effectively. [Apply]

CO-PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2							2		
CO2	3	3	2							3		
CO3	3	3	2							3		

Assessment Pattern for Theory

Bloom's Category	Continuous Assessment Tools			End Semester Examination
	Test1	Test2	Other tools	
Remember			✓	
Understand			✓	
Apply	✓	✓	✓	✓
Analyze				
Evaluate				
Create				

Mark Distribution of CIA

Course	Attendance	Theory[L-T]

Structure [L-T-P-R]		Test-1	Test-2	Class work/ Assignment	Total Marks
3-0-0-0	5	10	10	15	40

Total Marks distribution

Total Marks	CIA(Marks)	ESE(Marks)	ESE Duration
100	40	60	2 hrs 30min

End Semester Examination [ESE]: Pattern

	PARTA	PARTB	ESE Marks
PATTERN 3	NA	2 questions will be given from each module, out of which 1 question should be answered, each carrying 15 marks. Marks:(4x15=60marks)	60

SYLLABUS

MODULE I: Introduction to Engineering Drawing and Orthographic Projection of Points and Lines (11 Hours)

Introduction: Relevance of technical drawing in engineering field. Types of lines, Dimensioning, BIS code of practice for technical drawing. (No questions for the end semester examination)

Projection of points in different quadrants, Projection of straight lines inclined to one plane and inclined to both planes. Traces of a line. Inclination of lines with reference planes True length and true inclinations of line inclined to both the reference planes.(Questions limited to Lines in first quadrant , lines in first & second quadrants, lines in first & third quadrants, Lines in third quadrant)

MODULE II: Orthographic Projections of Solids (10 Hours)

Projection of Simple solids such as Triangular, Rectangle, Square, Pentagonal and Hexagonal Prisms, Pyramids, Cone, Cylinder and tetrahedron. Projection of solids in simple position. Projection of solids with axis inclined to one of the reference planes and with axis inclined to both reference planes.

MODULE III: Section of solids and Development of Surfaces (10 Hours)

Sections of Solids: Sections of tetrahedron, Prisms, Pyramids, Cone, Cylinder with axis in vertical position and cut by different section planes. True shape of the sections. (Exclude true shape given problems)

Development of Surfaces: Development of surfaces of the solids and solids cut by different section planes with axis of the solid perpendicular to HP. (Exclude problems with through holes and shortest distance between two points)

MODULE IV: Isometric Projection and Multi-view Projection (5 Hours)

Isometric Projection: Isometric scale- Isometric View and Projections of Prisms, Pyramids, Cone, Cylinder, Frustum of Pyramid, Frustum of Cone, Sphere, Hemisphere and their combinations.

Multi view Projection- Conversion of pictorial views to orthographic view(F.V,T.V & S.V)

Textbooks

1. P.I. Varghese, Engineering Graphics, Tata McGraw Hill Education
2. Prof. J Benjamin, Engineering Graphics, Pentex Publishers
3. John, K.C. Engineering Graphics, Prentice Hall India Publishers.
4. N.D.Bhatt, Engineering Drawing ,Charotar Publishing House
5. Agrawal, B. And Agrawal, C.M., Engineering Darwing, Tata McGraw Hill Publishers.

Reference books

1. Luzaddff, W.J. and Duff, J.M., Fundamentals of Engineering Drawing, PHI.
2. Duff, J.M. and Ross, W.A., Engineering Design and Visualisation, Cengage Learning.

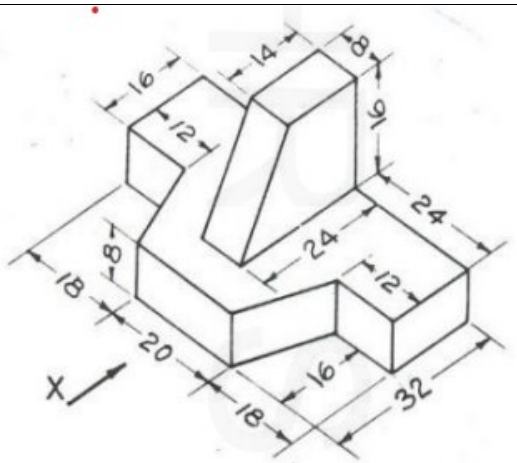
NPTEL/SWAYAM Courses for reference:

1. Engineering Drawing, Prof P.S. Robi, IIT Guwahati https://nptel.ac.in/courses/112103019
2. Engineering Graphics and Design, Naresh V Datla, Sunil R Kale, IIT Delhi https://archive.nptel.ac.in/courses/112/102/112102304/

No.	COURSE CONTENTS AND LECTURE SCHEDULE	No. of Hours (36)
	MODULE1 (11 Hours)	
1.1	Relevance of technical drawing in engineering field. Types of lines and their Uses	1
1.2	Dimensioning, BIS code of practice for technical drawing.	1
1.3	Orthographic Projection Concepts-Projection of points in different quadrants- Problems	1
1.4	Projection of straight lines parallel to both HP and VP- Problems	1
1.5	Projection of straight lines perpendicular to either HP or VP and parallel to other- Problems	1
1.6	Projection of straight lines inclined to either HP or VP and parallel to other- Problems	1
1.7	Trace of a line- Concept	1
1.8	Projection of straight lines inclined to both HP and VP – Line rotation method- Problems	2
1.9	Projection of straight lines inclined to both HP and VP – Plane rotation method- Problems	2
	MODULE II (10 Hours)	
2.1	Types of Solids	1

2.2	Projection of solid in simple position- Problems	1
2.3	Projection of solid inclined to any one reference plane. – Problems	3
2.4	Projection of solid inclined to both reference plane. - Problems	5
MODULE III (10 Hours)		
3.1	Types of Section planes and True shape of section	1
3.2	Sectional view of solids when section plane is parallel to HP and Perpendicular to VP- Problems	1
3.3	Sectional view of solids when section plane is parallel to VP and Perpendicular to HP- Problems	1
3.4	Sectional view of solids and true shape of section when section plane is inclined to HP and Perpendicular to VP- Problems	1
3.5	Sectional view of solids and true shape of section when section plane is inclined to VP and Perpendicular to HP- Problems	1
3.6	Development of surfaces- concept	1
3.7	Development of surfaces- Prism	1
3.8	Development of surfaces- Pyramid	1
3.9	Development of surfaces- Cone and Cylinder	1
3.10	Development of sectioned solids-Problems	1
MODULE IV (5 Hours)		
4.1	Isometric Projection- Isometric Scale- Isometric Drawing	1
4.2	Isometric Projection/drawing of solids- Problems	1
4.3	Isometric Projection/drawing of Combination of solids –Problems	1
4.4	Isometric Projection/drawing of sphere & hemisphere –Problems	1
4.5	Multi-view Projection Concept -Problem	1
CO Assessment Questions		
CO1	1. The distance between end projectors of a line CD is 65mm. End C is 15mm above HP and 40mm in front of VP. Its front view and top view makes an angle of 40^0 and 45^0 respectively with XY- line. Draw the projections, find the true length and true inclinations with HP and VP, and locate its traces. The line is in the first quadrant. 2. The front view of a line AB measures 70mm and makes an angle of 50^0 with XY-line. The end A is in the HP and the VT of the line is 30mm above HP. The line is inclined at 40^0 to the VP. Draw the projections of the line, find its true length and true inclination to HP, and locate its HT. 3. One end point of line AB is 12 mm above HP and is 15 mm in front of VP. The other endpoint is 50 mm above HP and is 42 mm in front of VP. Draw the	

	projections of line AB if its elevation measures 70 mm. Find out its true length and the true inclinations with respect to the reference planes. 4. A cone of base diameter 40 mm and axis 60 mm long touches the VP on a point of its base circle. The axis is inclined at 30^0 to VP and the front view of its axis is inclined at 45^0 to XY line. Draw its projections. 5. A square pyramid of base edge 30 mm and height 60 mm is resting on HP on its triangular face such that the square face edge on HP is inclined 30^0 to VP. Draw its projections. 6. A pentagonal prism 30 mm base edge and 60 mm height is on HP on one of its base edges so that the axis is inclined at 45^0 with HP and the base edge on which it rests is inclined at 30^0 with VP. Draw the projections of the solid.
CO2	1. A pentagonal pyramid side of base 30 mm, height 65 mm has its base on the ground and one of its base edge is parallel to and nearer to VP. This pyramid is cut by a section plane perpendicular to VP, passing through a point on the axis which is 20 mm below the apex and making an angle of 40^0 with HP. Draw the front view, sectional top view and true shape of the section. 2. A hexagonal prism of base side 35 mm and height 65 mm rests on its base on HP with one of the base edges parallel to VP. It is cut by a section plane inclined towards right at an angle of 30^0 to HP and perpendicular to VP. The section plane meets the axis of the prism at a height of 45 mm from the base. Draw the front view, sectional top view, and true shape of the section. 3. A pentagonal prism of base 30 mm and axis 60 mm long is kept with its base on HP with a base edge perpendicular to VP. It is cut by a plane inclined at 45^0 to HP, perpendicular to VP and passing through the midpoint of the axis. Draw the development showing the remaining portion of the solid.
CO3	1. A hemisphere of diameter 60 mm is placed centrally over a square slab of side 50mm and height 40 mm, with its flat surface facing upward. Draw the isometric view of the combination 2. A hexagonal pyramid of base edge 25 mm and height 40 mm is surmounted centrally over a cube of 50 mm side. The cube is lying on HP on one of its square faces so that one base edge of the cube and one base edge of the pyramid are parallel to VP. Draw the isometric view of the combination. 3. Draw the orthographic projections (front view, top view, and left side view) of the following figure. The front view direction is marked with a long arrow marking as X. Any missing dimension may be suitably assumed. All dimensions are in mm

Prepared by
Dr Nixon K, Principal
Mr. Mathews V J, Asst.Prof., ASH

24CER204	SURVEYING & GEOMATICS	L	T	P	R	C	Year of Introduction
		3	0	0	1	4	2024

Preamble: The objective of this course is to provide students with a comprehensive understanding of various principles and techniques, encompassing traditional surveying methods and modern technologies such as remote sensing, GIS, GPS, and EDM. Students will develop the skills to accurately collect, analyze, and interpret spatial data, and apply this knowledge to solve complex problems in civil engineering and related fields.

Prerequisite: 24EST124: Introduction to Civil Engineering & 24ESL106: Civil Engineering Workshop

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

CO 1	Apply the principle of theodolite and curve surveying to real-world civil engineering problems.
CO 2	Identify potential sources of errors in both triangulation and traverse survey and apply appropriate techniques of correction.
CO 3	Integrate modern surveying technologies such as Electronic Distance Measurement, Total Station, Global Positioning System into civil engineering projects.
CO 4	Interpret remote sensing data for various applications in surveying and comprehend the fundamental concepts of GIS, including map projections, coordinate systems, and data representation.
CO 5	Develop a detailed topographical plan using modern tools in civil engineering.

CO - PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	3	2				3		2				
CO 2	3	3		2		2		2				
CO 3	3			2	3			2				2
CO 4	3			2	3					2		
CO 5	2	2	3		3	3		3	3	3	2	2

Assessment Pattern for Theory Component

Bloom's Category	Continuous Assessment Tools			End Semester Examination
	Test1	Test 2	Other tools	
Remember	✓	✓		✓
Understand	✓	✓		✓
Apply	✓	✓	✓	✓
Analyze			✓	
Evaluate				
Create			✓	

Assessment Pattern for Project Component

Bloom's Category	Continuous Assessment Tools		
	Evaluation 1	Evaluation 2	Report
Remember	✓	✓	✓
Understand	✓	✓	✓
Apply	✓	✓	✓

Analyze		✓	
Evaluate			
Create		✓	

Mark Distribution of CIA

urse Structur (L-T-P-R)	Attendance	Theory [L]			Project [R]			Total Marks
		Assignment	Test 1	Test 2	Evaluation 1	Evaluation 2	Report	
3-0-0-1	5	10	12.5	12.5	5	10	5	60

Total Marks distribution

Total Marks	CIA (Marks)	ESE (Marks)	ESE Duration
100	50	50	2 hrs

End Semester Examination [ESE]

PATTERN	PART A	PART B	ESE Marks
PATTERN 2	2 questions from each module 8 Questions Each question carries 2 marks. Marks: (2x8 =16 marks)	2 Questions will be given from each module, out of which 1 question should be answered. Each question can have a maximum of 2 subdivisions. Each question carries 6 marks. Marks: (4x 6 = 24 marks)	50

SYLLABUS

MODULE I: Theodolite & Curve Surveying (9 hours)

Theodolite survey: Instruments, Measurement of horizontal and vertical angle.
Curve Surveying: Types of curves, Elements of simple and compound curves, Methods of setting out, Elements of Reverse curve (introduction only), Transition curve – Elements of transition curve, length & shift of curve, Vertical curve (introduction only).

MODULE II: Triangulation & Traverse Surveying (9 hours)

Triangulation: Classification, Triangulation figures, Strength of figure (introduction only), Triangulation stations - Intervisibility of stations, Types of signals, Satellite Stations and reduction to centre.
Traverse Surveying: Methods of traversing, Checks in closed traverse, Traverse computations, Balancing the traverse- Bowditch's rule, Transit rule, graphical method based on Bowditch's rule.

MODULE III: Electronic Distance Measurement, Total Station and Applications & Global Positioning System (8 hours)

Electronic Distance Measurement (EDM): Principles and Types - Applications in Surveying - Error Sources and Corrections.
Total Station and Applications: Introduction to Total Stations - Components and Functions - Data Collection and Processing - Applications in Civil Engineering.
Global Positioning System (GPS): Principles and Components - Types of GPS Surveying:

Static, Rapid Static, and Kinematic Methods - Applications in Civil Engineering.
MODULE IV: Geographical Information System & Remote Sensing (10 hours)
Geographic Information System (GIS) - Components of GIS, GIS operations, Map projections - methods, Coordinate systems - Geographic and Projected coordinate systems, Data Types - Spatial and attribute data, Raster and vector data representation - Data Input methods - Geometric Transformation - RMS error, Vector data Analysis - buffering, overlay - Applications in Civil Engineering. Remote Sensing - Principles and Types - Platforms and Sensors - Data Acquisition and Interpretation - Applications in Civil Engineering.
Textbooks 1. Prof. T.P. Kanetkar & Prof. S.V. Kulkarni - Surveying and Levelling, Pune Vidyarthi Griha Prakashan, 2010. 2. Dr. B.C. Punmia, Ashok Kumar Jain & Arun Kumar Jain - Surveying, Laxmi publications (P) Ltd., 2005. 3. R. Agor - A Textbook of Surveying and Levelling, Khanna Publishers, 2005. 4. S.K. Duggal - Surveying Vol. II, Tata McGraw Hill Ltd, Reprint 2015. 5. George Joseph, "Fundamentals of Remote Sensing", University Press, 2017. 6. Chang,K , "Introduction to Geographic Information Systems", Tata McGraw-Hill Publishing Co. Ltd, 2008.
Reference books 1. C. Venkatramaiah, Textbook of Surveying, Universities Press (India) Private Limited 2011. 2. James M Andersen, Edward M Mikhail, Surveying Theory and Practice, McGraw Hill Education, 7e, 1998. 3. Iliffe, C.J., Datums and Map Projections for Remote Sensing, GIS and Surveying, Whittles Publishing, 2006. 4. Kang-tsung Chang, Introduction to GIS, Tata McGraw-Hill Publishing Co. Ltd, 8e, 2016. 5. Lilles and M. and Kiefer W., Remote Sensing and Image Interpretation. John Wiley and Sons, Inc., 2000. 6. Satheesh Gopi, R. Sathikumar and N. Madhu, Advanced Surveying: Total Station, GIS and Remote Sensing, Pearson Education Ltd., 2nd Edition, 2017.
NPTEL/SWAYAM Courses for reference: 1. Remote Sensing and GIS https://onlinecourses.nptel.ac.in/noc24_ce60/preview 2. Advanced Geomatics Engineering: https://onlinecourses.nptel.ac.in/noc24_ce67/preview

No.	COURSE CONTENTS AND LECTURE SCHEDULE	No. of Hours (36)
MODULE I: Theodolite & Curve Surveying (9 hours)		
1.1	Theodolite survey: Instruments, Measurement of horizontal and vertical angle.	3
1.2	Curve Surveying: Types of curves, Elements of simple and compound curves	2
1.3	Method of setting out	2
1.4	Elements of Reverse curve, Transition curve – Vertical curve	2

MODULE II: Triangulation & Traverse Surveying (9 hours)		
2.1	Triangulation: Classification, Triangulation figures, Strength of figure	1
2.2	Triangulation stations - Intervisibility of stations, Types of signals	1
2.3	Satellite Stations and reduction to centre	2
2.4	Traverse Surveying: Methods of traversing	1
2.5	Checks in closed traverse, Traverse computations	2
2.6	Balancing the traverse- Bowditch's rule, Transit rule, graphical method based on Bowditch's rule	2
MODULE III: Electronic Distance Measurement, Total Station and Applications & Global Positioning System (8 hours)		
3.1	Electronic Distance Measurement (EDM): Principles and Types - Applications in Surveying - Error Sources and Corrections.	3
3.2	Total Station and Applications: Introduction to Total Stations - Components and Functions - Data Collection and Processing - Applications in Civil Engineering.	2
3.3	Global Positioning System (GPS): Principles and Components	1
3.4	Types of GPS Surveying: Static, Rapid Static, and Kinematic Methods - Applications in Civil Engineering.	2
MODULE IV: Geographical Information System & Remote Sensing (10 hours)		
4.1	Geographic Information System (GIS) - Components of GIS, GIS operations, Map projections - methods	2
4.2	Coordinate systems - Geographic and Projected coordinate systems, Data Types - Spatial and attribute data	1
4.3	Raster and vector data representation - Data Input methods - Geometric Transformation	2
4.4	RMS error, Vector data Analysis - buffering, overlay - Applications in Civil Engineering	2
4.5	Remote Sensing - Principles and Types - Platforms and Sensors	1
4.6	Data Acquisition and Interpretation - Applications in Civil Engineering	2

PROJECT

This project aims to develop a comprehensive topographical plan for a selected area using advanced modern tools and techniques in civil engineering. Topographical plans are essential for various civil engineering applications such as construction, urban planning, and environmental management.

LESSON PLAN FOR PROJECT COMPONENT

No. Topic	Topic	No. of Hours (12)
1	Preliminary Design of the Project	2
2	Zeroth presentation (4th week)	2
3	Project work - First Phase	2
4	Interim Presentation	2

<table>
<tr><td>5</td><td>Project work - Final Phase & Report writing (discussions in class during project hours)</td><td>2</td></tr>
<tr><td>6</td><td>Final Evaluation, Presentation and Exhibition (11th and 12th weeks)</td><td>2</td></tr>
<tr><td colspan="3">CO Assessment Questions</td></tr>
<tr><td>1</td><td colspan="2">1. Two tangents intersect at a chainage of 2360.50 m, the deflection angle being 50°40′. Calculate the necessary data for setting out a curve of 200 m radius to connect two tangents, if it is intended to set out the curve by Rankine's method of tangential angles. The peg interval may be taken as 20 m.
2. Explain the method of observing the horizontal angle by the method of repetition and reiteration.
3. Define a transition curve and explain the necessity of introducing such curves in highways. Discuss the methods to determine the length of the transition curve.
4. Define a compound curve and mark its elements on a sketch.
5. Explain the method of setting out of a simple circular curve using Rankine's method of tangential angles. Support the answer with a sketch.</td></tr>
<tr><td>2</td><td colspan="2">1. Two stations A and B, 160 km apart, are 450 m and 490 m above MSL. The intervening peak at C, 106 km from A has an altitude of 120 m above MSL. If the instrument at A is 8 m above ground level, find the height of signal required at B, so that the line of sight clears C by 3 m.
2. Distinguish between a) closed traverse and open traverse b) closing error and relative error of closure.
3. Explain the terms a) satellite station b) reduction to centre with the help of sketches.
4. Write a note on the checks in closed traverse.
5. Calculate latitudes, departures and closing error for the following traverse. Also, adjust the traverse using Bowditch's rule.
<table>
<tr><th>Line</th><th>Length (m)</th><th>W.C.B.</th></tr>
<tr><td>AB</td><td>79.31</td><td>47°20'</td></tr>
<tr><td>BC</td><td>237.46</td><td>70°15'</td></tr>
<tr><td>CD</td><td>162.23</td><td>168°32'</td></tr>
<tr><td>DE</td><td>171.10</td><td>246°41'</td></tr>
<tr><td>EA</td><td>234.58</td><td>310°58'</td></tr>
</table></td></tr>
<tr><td>3</td><td colspan="2">1. Describe the working principle of GPS with the help of neat sketches. Explain the concept of trilateration in GPS positioning.
2. Explain the various processes involved in the planning phase of GPS survey.
3. Discuss the horizontal and vertical control in GPS field operation.
4. Explain the principle and working of the total station.
5. Discuss the principle of EDM.</td></tr>
<tr><td>4</td><td colspan="2">1. Explain the role of remote sensing in disaster management.</td></tr>
</table>

	2. With neat sketches, differentiate between along-track and across-track multispectral scanning. 3. Explain data representation in GIS. 4. Explain any one type of map projection according to a developable surface. 5. Explain buffering and overlay in GIS.

Prepared by
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Asst.Prof., CE

24EST205	MECHANICS OF SOLIDS	L	T	P	R	C	Year of Introduction
		3	1	0	0	4	2024

Preamble

The course provides the fundamental concepts of mechanics of deformable bodies and helps students to develop their analytical and problem-solving skills. The course introduces students to the various internal effects induced in structural members and their deformations due to different types of loading. After this course, students will be able to determine the stress, strain and deformation of loaded structural elements.

Prerequisite: 24EST113- Engineering Mechanics

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

CO 1	Understand and recall the fundamental terms and theorems associated with mechanics of deformable bodies. [Understand]
CO 2	Analyse the behavior and response of structural elements under various loading conditions and choose appropriate principles or formula to find the elastic constants of materials making use of the information available. [Analyse]
CO 3	Apply the principles of solid mechanics to calculate internal stresses and strains in structural elements subjected to different loads and moments. [Apply]
CO 4	Identify principal planes/stresses and maximum shear stress in a structural member and calculate the safe load a member can carry safely. [Analyse]

CO - PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	3											
CO 2	3	3	2									
CO 3	3	3	3									
CO 4	3	3	3									

Assessment Pattern for Theory Component

Bloom's Category	Continuous Assessment Tools			End Semester Examination
	Test1	Test 2	Other tools	
Remember	✓	✓		✓
Understand	✓	✓		✓
Apply	✓	✓		✓
Analyze				
Evaluate				
Create				

Mark Distribution of CIA

Course Structure L-T-P-R	Attendance	Theory [L]			Total Marks
		Assignment	Test-1	Test-2	

3-1-0-0	5	10	12.5	12.5	40

Total Marks distribution			
Total Marks	**CIA (Marks)**	**ESE (Marks)**	**ESE Duration**
100	40	60	2.5 hrs

End Semester Examination [ESE]: Pattern 1			
PATTERN	**PART A**	**PART B**	**ESE Marks**
PATTERN 1	2 questions from each module. 8 Questions, each carries 3 marks. Marks:3x8=24 marks	2 questions will be given from each module, of which 1 should be answered. Each question can have a maximum of 2 sub-divisions. Each question carries 9 marks. Marks: (4x 9 = 36 marks) Time: 2.5 hours	60

SYLLABUS

MODULE I: (12 hours)

Concept of stress and strain – types, stress – strain relation - Hooke's law, Young's modulus of elasticity. Stress-strain diagram of mild steel. Factor of safety, working stress. Axially loaded bars with uniform and uniformly varying cross section–stress, strain and deformation.

Temperature effects, temperature stress in composite bars.

Shear stress and shear strain, Modulus of rigidity, simple shear, punching shear. Lateral strain, Poisson's ratio, volumetric strain. Bulk modulus of elasticity, relationships between elastic constants.

Strain energy – concept. Strain energy due to normal stress. Strain energy in bars carrying axial loads. Strain energy due to shear stress.

MODULE II : (12 hours)

Beams – different types. Types of loading on beams.

Concept of bending moment and shear force. Relationship between intensity of load, shear force and bending moment. Shear force and bending moment diagrams of cantilever beams, simply supported beams and overhanging beams for different type of loads. Point of contraflexure.

MODULE III : (11 hours)

Theory of simple bending, assumptions and limitations. Calculation of normal stress in beams, moment of resistance.

Shear stress in beams. Beams of uniform strength.

Strain energy due to bending – calculation of strain energy in beams.

MODULE IV : (13 hours)

Stresses on inclined planes for uniaxial and biaxial stress fields. Principal stresses and principal planes, maximum shear stress in 2D problems. Mohr's circle of stress for 2D problems.

Short columns – direct and bending stress. Kern of a section. Slender columns – Euler's buckling load, slenderness ratio, limitation of Euler's formula. Rankine's formula.

Torsion of circular and hollow circular shafts, Power transmitted by circular shafts and hollow circular shafts. Strain energy due to torsion.

Textbooks

1. R. K. Bansal, A Text book of Strength of Materials, Laxmi Publications (P) Ltd., New Delhi.
2. B. C. Punmia, Ashok K. Jain, Arun Kumar Jain, Mechanics of Materials, Laxmi Publications (P) Ltd., New Delhi.

Reference books

1. J Benjamin, A Text book of Strength of Materials, Pentex Book Publishers.
2. James M. Gere, S. P. Timoshenko, Mechanics of Materials, CBS Publishers and Distributors, New Delhi.
3. S. Ramamrutham and R. Narayanan, Strength of Materials, Dhanpat Rai Publishing Co. (P) Ltd.

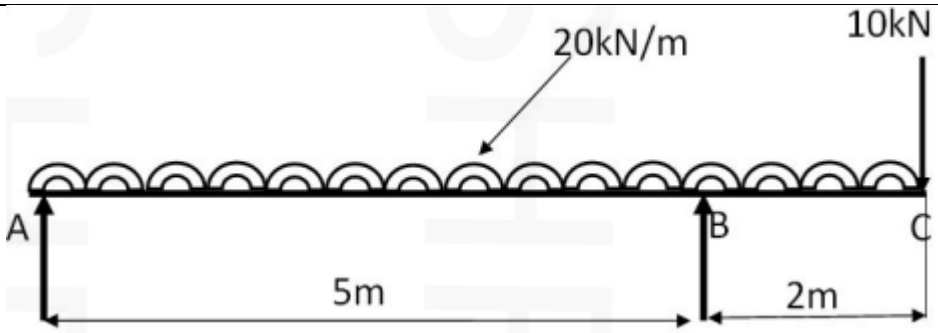
NPTEL/SWAYAM Courses for reference:

1. Mechanics of Solids
   https://onlinecourses.nptel.ac.in/noc24_ce76

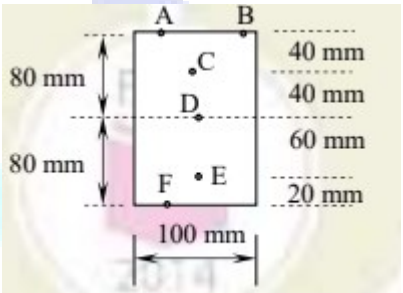
No.	COURSE CONTENTS AND LECTURE SCHEDULE	No. of Hours (48)
	MODULE I - 12 hours	
1.1	Concept of stress and strain – types, stress – strain relation	1
1.2	Hooke's law, Young's modulus of elasticity. Stress-strain diagram of mild steel-True and engineering σ – ε curve, idealized σ – ε curves. Factor of safety, working stress	1
1.3	Axially loaded bars with uniform cross section– calculation of stress, strain and deformation.	1
1.4	Deformation of axially loaded bars with varying cross section-Stepped bars, bars with tapering cross section	1
1.5	Temperature effects, temperature stress in composite bars.	2
1.6	Shear stress and shear strain, Modulus of rigidity, simple shear, punching shear.	1
1.7	Lateral strain, Poisson's ratio, volumetric strain. Bulk modulus of elasticity, relationships between elastic constants	2
1.8	Strain energy – concept. Strain energy due to normal stress.	1
1.9	Strain energy in bars carrying axial loads. Strain energy due to shear stress.	2
	MODULE II- 12 hours	
2.1	Beams – different types. Types of loading on beams.	1
2.2	Concept of bending moment and shear force. Relationship between intensity of load, shear force and bending moment.	2
2.3	Shear force and bending moment diagrams of cantilever beams subjected to point load, concentrated moments, uniformly distributed and uniformly varying loads.	3
2.4	Shear force and bending moment diagrams of simply supported beams subjected to point load, concentrated moment, uniformly distributed and uniformly varying loads.	3

2.5	Shear force and bending moment diagrams of overhanging beams subjected to point load, concentrated moment and uniformly distributed loads. Point of contraflexure.	3
MODULE III - 11 hours		
3.1	Theory of simple bending, derivation of equation, assumptions and limitations.	1
3.2	Variation of bending stress across the cross section. Maximum bending stress, section modulus, moment of resistance.	1
3.3	Calculation of normal stress in beams- numericals	1
3.4	Shear stress in beams – derivation of equation. Variation of shear stress across the cross section, numericals (Derivation required for rectangular, circular and triangular sections only)	2
3.5	Calculation of allowable loads in beams based on bending stress and shear stress criteria.	1
3.6	Proportioning beam sections to carry given load without exceeding the allowable bending stress and/ shear stress. Beams of uniform strength.	2
3.7	Strain energy due to bending – calculation of strain energy in beams- numericals (Cantilever and simply supported beams subjected to point load and uniformly distributed load)	3
MODULE IV- 13 hours		
4.1	Stresses on inclined planes for uniaxial and biaxial stress fields. Element subjected to pure shear.	2
4.2	Principal stresses and principal planes in 2D problems, maximum shear stress.	2
4.3	Mohr's circle of stress for 2D problems.	2
4.4	Short columns – direct and bending stress. Kern of a section (concept only).	1
4.5	Slender columns –Buckling, Effective length of columns with different end conditions. Eulers' buckling load for columns with different end conditions	1
4.6	Slenderness ratio, limitation of Euler's formula. Rankine's formula. Safe load calculation using Rankine's formula (demonstration only).	2
4.7	Torsion of circular and hollow circular shafts, assumptions, Torsion equation. Variation of stress across the cross section. Polar modulus.	1
4.8	Power transmitted by circular shafts and hollow circular shafts. Proportioning the shafts to transmit a given power based on shear stress and angle of twist considerations. Strain energy due to torsion.	2
CO Assessment Questions		
1	1. With help of stress-strain diagram, briefly explain Hooke's Law. 2. Define Factor of Safety. Calculate the working load on a cantilever beam if it carries an ultimate load of 100 kN with a factor of safety of 2. 3. Define Poisson's ratio. Also state the relationship between the elastic constants. 4. Define point of contraflexure? State its significance.	

	5. Using the case of a simply supported beam with constant width, illustrate the concept of beams of uniform strength.
2	1. Explain the effect of temperature change on a composite bar made of two materials. 2. Explain the concept of BM and SF in beams, with the help of a cantilever beam subjected to uniformly distributed load over the whole span. 3. Explain the behavior of slender columns under axial compressive load. 4. A concrete cylinder of diameter 150 mm and height 300 mm is tested under compression. It was found that the diameter was increased by 0.0102 mm and the height was decreased by 0.165 mm under the action of a compressive load of 200 kN. Calculate the modulus of elasticity, Poisson's ratio, bulk modulus and shear modulus of concrete. 5. An aluminium specimen has a diameter of 25mm and a gauge length of L0= 250mm. If a force of 165 kN elongates the gauge length 1.20 mm, determine the modulus of elasticity. Also, determine the contraction in diameter of the specimen caused by the force. Take G=26GPa and σy=440MPa.
3	1. A steel bar ABCD consists of three sections: AB is of 20 mm diameter and 200 mm long, BC is 25 mm square and 400 mm long and CD is of 12 mm diameter and 200 mm long. The bar is subjected to an axial compressive load which induces a stress of 30 MN/m^2 on the largest cross section. Determine total decrease in length of the bar when the load is applied. E = 210 GPa 2. A cylindrical bar with two sections of lengths 50 cm and 25 cm, and diameters 20 mm and 15 mm, respectively, is subjected to an axial pull such that the maximum stress is 150MN/m^2. Calculate the strain energy stored in the bar. E=200 GN/m^2 3. A steel rod AB of length 900mm and diameter 25 mm has a bronze sleeve BC of length 300mm and external diameter 30 mm securely bonded to it as shown in Fig. For a rise in temperature of 200 degrees Celsius, calculate: i) Stresses in steel rod and bronze sleeves, respectively. ii) Compressive force developed in bronze sleeve. iii) Elongation of bronze sleeve iv) Total elongation of steel rod Take E_S=200GPa, E_B=100GPa & α_S=1.2 x 10^{-5} per °C , α_B=2.03 x 10^{-5} per °C 4. Analyze the overhanging beam shown. Draw the shear force diagram and bending moment diagram showing all salient points, including the point of contra flexure.

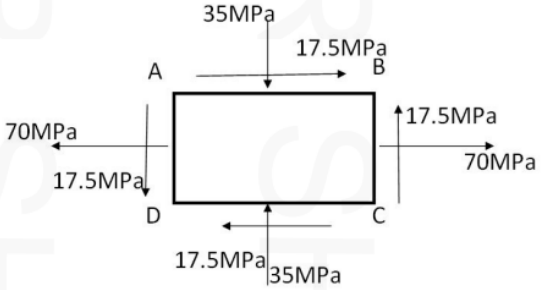


5. Figure shows the cross section of a beam. Find the stresses (both magnitude and nature) at points A,B,C,D,E and F, if the section carries a BM of 12 kNm. Draw the variation of stress across the cross section. Also calculate the shear stress at these points if the cross section carries a SF of 50 kN.



4

1. A rectangular element ABCD of an elastic material is subjected to a shear stress of 17.5 MPa. The planes at right angles carry tensile stress of 70 MPa and compressive stress of 35 MPa respectively.
   Determine:
   i) The magnitude of the principal stresses.
   ii) The direction of the principal planes.
   iii) The magnitude of maximum shear stress.
   iv) The orientation of the plane of maximum shear stress.



2. At a certain point in a strained material, the stresses on two planes at right angles to each other are 50 MPa (tensile) and 80 MPa (compressive). They are accompanied by a shear stress of magnitude 20 MPa. Find the principal stresses and locate their planes. Also find the maximum shear stress and resultant stress on the plane of maximum shear stress.
3. A bar of 12 mm diameter carries an axial pull of 15 kN. Find the normal and shear stress on a plane inclined at 60° with the axis of the bar. What is the maximum shear stress induced in the bar and the inclination of the corresponding plane?

	4. A 3 m long cantilever beam of rectangular section is required to carry a udl of 10 kN/m over the whole span. If the maximum bending stress is limited to 12 N/mm2 , find the dimensions of the cross section assuming depth to width ratio as 2. 5. A solid circular shaft transmits 80 kW power at 190 rpm. Calculate the diameter of the shaft if the twist in the shaft is not to exceed 1° in 2 m length of shaft and shear stress is limited to 60 MPa. Take G = 100 GPa.

Prepared by,
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Asst.Prof., CE

24HUT006	PROFESSIONAL ETHICS AND SUSTAINABLE DEVELOPMENT	L	T	P	R	C	Year of Introduction
		1	0	2	0	2	2024

Preamble:
Engineering Ethics enables students to explore the ethical principles and responsibilities of engineers in their professional practice, using real-world case studies. Sustainable Development transform our world, recognize interdependence, enhance quality of life, enhance human responsibilities, eliminate pollution, conserve natural resources and uplift human-nature coexistence. Relevant case studies impart students, effective ways to practically apply their skills and their understanding of learned facts to a real-world situation. The presentation of case studies will provide an opportunity to read, understand and prepare technical report about sustainable, professional and socially responsible projects.

Prerequisite: NIL

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

CO1	Understand key ethical principles and moral development theories that shape the ethical behavior of a professional.
CO2	Analyze the role and responsibility as engineers through real world case studies to solve moral and ethical problems.
CO3	Appreciate the relevance and necessity of sustainable development and recognize good practices and opportunities for an integrated approach to sustainable development
CO4	Understand case studies about sustainable and socially responsible projects which impart students an effective way to realize real-world situations

CO – PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1			1			3	2	3	2			3
CO2			1			3	2	3	2	3	2	3
CO3			1			3	3	2	2			3
CO4			1			3	3	2	2	3	2	3

Assessment Pattern

Bloom's Category	Continuous Assessment Tools			Case studies
	Test 1	Test 2	Assignment	
Remember	✓	✓		

Understand	✓	✓	✓	✓
Apply	✓	✓	✓	✓
Analyze				✓

Mark Distribution of CIA

Course Structure [L-T-P-R]	Attendance	Theory [L]			Practical [P]	Total Marks
		Assignment	Test-1	Test-2	Case Study	
1-0-2-0	5	5	20	20	50	100

SYLLABUS

MODULE 1

Introduction to Professional Ethics-Morals, Values and Ethics, Personal and Professional ethics
Key ethical Principles-Honesty, integrity, respect, responsibility
Moral Development Theories (Kohlberg's theory, Gilligan's theory)
Case studies on professional responsibility (Hyatt Regency Walkway Collapse, Ethical consideration in the design and deployment of autonomous vehicle)

MODULE 2

Engineering as Experimentation – Engineers as responsible Experimenters-Engineers as Managers, Consulting Engineers, Engineers as Expert witnesses and advisors
Codes of Ethics- Plagiarism-Professional Rights-Employee right- IPR Discrimination.
Ethical challenges posed by emerging technologies
Case Studies on emerging technologies (Artificial Intelligence)

MODULE 3

Introduction to Sustainable Development- Concept of Sustainability- pillars of sustainability- social- economic -environmental sustainability.
MDG - SDG- Nexus between Technology and sustainable development.
Case studies on SDGs. Case studies on Nexus between Technology and Sustainable development.

MODULE 4

Pathways for sustainable development - Social aspects - poverty- hunger - health - education- gender equality. Economic aspects- society- consumers - industries. Environmental aspects - renewable energy- zero waste - Carbon emission- conservation of ecosystem- global environmental issues
Case studies on Sustainable habitat, Sustainable Industry

Textbooks

1. Mike W Martin and Roland Schinzinger, Ethics in Engineering,4th edition, Tata McGraw Hill Publishing Company Pvt. Ltd, New Delhi,2014.
2. Our Common Journey: A Transition Toward Sustainability. National Academy Press.
3. Sustainable Development., Susan Baker, Taylor and Francis
4. Elliott, Jennifer. 2012. An Introduction to Sustainable Development. 4th Ed. Routledge, London
5. Rogers, Peter P., Kazi F. Jalal, and John A. Boyd. "An introduction to sustainable
6. development." (2012).

Reference books

1. Charles D Fleddermann, Engineering Ethics, Pearson Education/ Prentice Hall of India, New Jersey, 2004.
2. Charles E Harris, Michael S Protchard and Michael J Rabins, Engineering Ethics-Concepts and cases, Wadsworth Thompson Learning, United states,2005.
3. Guidelines for Professional Conduct for Civil Engineers ASCE, 2008
4. UN Millennium Project (2005) Investing in Development: A Practical Plan to Achieve the Millennium Development Goals, Overview.
5. World Bank (2006) Enhancing Agricultural Innovation: How to Go beyond the Strengthening of Research Systems, World Bank: Agriculture and Rural Development
6. World Commission on Environment and Development (1987) Our Common Future, Oxford, OUP.

NPTEL Course

1. Ethics in Engineering Practice
   https://nptel.ac.in/noc/individual_course.php?id=noc18-mg25
2. Non-Conventional Energy Sources
   https://nptel.ac.in/noc/individual_course.php?id=noc18-ge14
3. Education for Sustainable Development
   https://onlinecourses.nptel.ac.in/noc22_hs61/preview

No.	COURSE CONTENTS AND LECTURE SCHEDULE	No. of Hours (36 hours)
	MODULE 1 (4 Hours)	
1.1	Introduction to Professional Ethics-Morals, Values and Ethics	1
1.2	Personal and Professional ethics	1
1.3	Key ethical principles-Honesty, integrity, respect, responsibility. Moral Development Theories (Kohlberg's theory, Gilligan's theory)	1

1.4	Case studies on professional responsibility (Hyatt Regency Walkway Collapse, Ethical consideration in the design and deployment of autonomous vehicle)	1
MODULE 2 (4 Hours)		
2.1	Engineering as Experimentation – Engineers as responsible Experimenters-Engineers as Managers	1
2.2	Consulting Engineers, Engineers as Expert witnesses and advisors	1
2.3	Codes of Ethics- Plagiarism-Professional Rights-Employee right- IPR Discrimination.	1
2.4	Ethical challenges posed by emerging technologies. Case Studies on emerging technologies (Artificial Intelligence	1
MODULE 3 (4 Hours)		
3.1	Introduction to Sustainable Development- Concept of Sustainability- pillars of sustainability- social- economic -environmental sustainability	1
3.2	MDG - SDG- Nexus between Technology and sustainable development	1
3.3	Case studies on SDGs	1
3.4	Case studies on Nexus between Technology and Sustainable development	1
MODULE 4 (4 Hours)		
4.1	Pathways for sustainable development, social aspects - poverty- hunger - health -education- gender equality	1
4.2	Economic aspects- society- consumers - industries	1
4.3	Environmental aspects - renewable energy- zero waste - Carbon emission- conservation of ecosystem- global environmental issues	1
4.4	Case studies on Sustainable habitat, Sustainable Industry	1
LESSON PLAN FOR CASE STUDIES		
No.	**Topic**	**No. of Hours (20)**
1	Do Case studies of emerging trends in technology, sustainable, socially and professionally responsible projects	5

2	Selection of a case study for presentation and prepare a technical report	15
No.	**Case Study Assessment**	**Marks**
1	Selection of case study - Relevance of topic to the Course	10
2	Preparation of case study	15
3	Submission of Technical Report on case study	25
CO Assessment Questions		
CO1	1. Define integrity and point out ethical values. 2. Discuss in detail about moral development theories 3. Investigate the responsibilities of a professional with case studies	
CO2	1. Illustrate the role of engineers as experimenters. 2. Exemplify the engineers as managers. 3. Investigate the ethics in emerging technologies with case studies	
CO3	1. Explain the necessity for Sustainable Development. 2. Enumerate SDG. Describe the challenges and barriers to sustainable development 3. Investigate the for Nexus between Technology and Sustainable development.	
CO4	1. Describe Sustainable practices for achieving Economic sustainability 2. Enumerate global environmental issues 3. Investigate the Sustainable practices for sustainable habitat with case studies	

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24ESL007	COMPUTER AIDED DRAWING (CAD) & MANUFACTURING WORKSHOP	L	T	P	R	C	Year of Introduction
		0	0	2	0	1	2024

Preamble:
The course is designed to empower students to explore the full potential of computer-aided design, additive manufacturing, and other manufacturing techniques. Students will foster a team working environment to enhance the necessary skills for planning, preparing and executing an engineering project. In addition the students will be introduced to various tools, measuring devices, practices and different methods of manufacturing processes employed in industry for fabricating components.

Prerequisite: NIL

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

CO1	Identify mechanical operations in accordance with manufacturing of products. [Understand]
CO2	Application of advanced metrology instruments used in general workshop. Accomplish model making using modern manufacturing method.[Apply]
CO3	Execute 2D and 3D drawing using CAD software.[Apply]
CO4	Critically assess the advantages and limitations of 3D printing compared to traditional manufacturing methods. [Understand]

CO-PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2								2			
CO2					3				2			
CO3					2					3		
CO4					3							

Assessment Pattern

Bloom's Category	Continuous Assessment Tools	
	Classwork	Test1
Remember	√	√
Understand	√	√
Apply	√	√
Analyze	√	
Evaluate	√	
Create		

Mark Distribution of CIA

Course Structure [L-T-P-R]	Attendance	Classwork	Lab Exam	Total Marks
0-0-2-0	5	35	10	50

Total Mark distribution

Total Marks	CIA(Marks)	ESE(Marks)	ESE Duration

50	50	0	-

SYLLABUS-DETAILS OF EXPERIMENTS

SECTION – 1 (Manufacturing Lab Experiments)
Minimum 5 experiments are mandatory

General study of manufacturing process – Foundry – Sheet metal – Fitting – Welding – Metrology – Modern manufacturing method – Power tools.

SECTION – 2 (CAD Lab Experiments)
Minimum 5 experiments are mandatory

Introduction to Computer Aided Drawing (CAD) – 2D Drafting – 3D Modeling

Textbooks

1. Mechanical Workshop Practice, K C John PHI Learning Edition 2, 2010
2. Engineering Materials, S C Rangwala Charotar Publishing House Pvt Limited Edition 43, 2019
3. Engineering Graphics Essentials with AutoCAD 202x Instruction Kirstie Plantenberg ,SDC Publication 2023

Reference Books

1. Elements of Workshop Technology Vol-1-Manufacturing Processes S K Hajra Choudhury A K Hajra Choudhury Nirjhar Roy MPP Media Promoters and Publishers2008
2. AutoCAD 3D Modeling: Exercise Workbook Steve Heather Industrial Press Inc.,U.S

LIST OF EXPERIMENTS

Manufacturing - 12Hrs
(Minimum 5 experiments are mandatory)

No.	Experiments
1	General-Introduction to workshop practice – safety precautions – Basic first aid knowledge – Study of workshop tools
2	Welding- Understanding arc welding process and components – Experiment on horizontal bead formation.
3	Metrology- Common measuring instruments used in workshop, experiments to measure using instruments like Vernier Caliper, micrometer, Vernier Height Gauge (Ordinary & Digital).
4	Modern manufacturing method-3D printing
5	Power Tools-Demonstration of the following power tools – Portable DC inverter welding set, portable power planer, Portable jig saw machine, Portable circular saw, Portable Drilling machine, Angle grinder.
6	Foundry- Understanding of foundry tools – Experiment on Bench moulding.
7	Fitting- Understanding the tools used for fitting and knowledge of at least one model
8	Sheet Metal: Understanding sheet metal working tools and knowledge of at least one model.

CAD LAB - 12Hrs
(Minimum 5 experiments are mandatory)

1	Computer Aided Drawing (CAD): Introduction, Role of CAD in design and development of new products, Advantages of CAD. 2D Drawing Exercise I: Introduction to common drafting tools and annotations.
2	2D Drawing Exercise II: Introduction to common modification tools.
3	2D Drawing Exercise III: 2D drafting and property changing.
4	2D Drawing Exercise IV: 2D drafting using different drafting methods.
5	2D Drawing Exercise V: Drafting orthographic projection and isometric view.
6	3D Drawing: Introduction to different 3D modeling tools.
7	3D Drawing Exercise I: Introduction to solid editing.
8	3D Drawing Exercise II: Introduction to different modify tools.
CO Assessment Questions	
C01	1. Identify the tools given to you and demonstrate their proper use. 2. Choose a suitable manufacturing process to make the given model.
CO2	1. Identify the given measuring instrument and demonstrate its proper use. 2. Take the 3D printout of the given drawing.
CO3	1. Prepare 2D drawings using CAD software. 2. Prepare 3D drawings using CAD software.
CO4	1. Find the advantages of 3D printing compared to traditional manufacturing processes. 2. Find the limitations of 3D printing compared to traditional manufacturing processes.

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