CE

VIMAL JYOTHI
ENGINEERING COLLEGE (AUTONOMOUS)
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VJEC B. Tech. Syllabus 2024

Semester III

Civil Engineering
Branch Code: CE

SEMESTER S3
MATHEMATICS FOR ELECTRICAL SCIENCE AND PHYSICAL SCIENCE-3
(Common to B & C Groups)

Course code	GYMAT301	CIE Marks	40
Teaching Hours/Week (L:T:P:R)	3:0:0:0	ESE Marks	60
Credits	3	Exam Hours	2Hrs. 30 MIn
Prerequisites (if any)	Basic knowledge in complex numbers	Course Type	Theory

Course Objectives:

1. To introduce the concept and applications of Fourier transforms in various engineering fields.
2. To introduce the basic theory of function of a complex variable, including residue integration and conformal transforms, and their applications.

Module No.	Syllabus Description	Contact Hours
1	Fourier integral,From Fourier series to Fourier integral, Fourier cosine and Sine integrals,Fourier Cosine and Sine transforms,Linearity,Transforms of Derivatives,Fourier Transform and its inverse,Linearity, Transforms of Derivative. **(Text1: Relevant topics from sections 11.7, 11.8, 11.9)**	9
2	Complex Function, Limit, Continuity, Derivative, Analytic functions, Cauchy-Riemann Equations(without proof), Laplace's Equations, Harmonic functions, Finding harmonic conjugate, Conformal mapping, Mappings of $w=z^2$, $w=e^z$, $w=\frac{1}{z}$, $w=\sin z$ **(Text1: Relevant topics from sections 13.3,13.4,17.1,17.2,17.4)**	9
3	Complex Integration: Line integrals in the complex plane (Definition& Basic properties), First evaluation method, Second evaluation method, Cauchy's integral theorem(without proof) on simply connected domain, Independence of path, Cauchy integral theorem on multiply connected Domain (without proof), Cauchy Integral formula(without proof) **(Text1: Relevant topics from sections 14.1,14.2,14.3)**	9
4	Taylor series and maclaurin series, Laurent series(without proof), Singularities and Zeros-Isolated Singularity, Poles, essential Singularities, Removable singularities, Zeros of Analytic functions-Poles and Zeros, Formulas for Residues, Residue theorem(without proof), Residue integration-Integral of rational Functions of $\cos\theta$ & $\sin\theta$ **(Text1: Relevant topics from sections 15.4.16.1,16.2,16.3,16.4)**	9

Course Assessment Method
(CIE:40 marks,ESE:60 Marks)
Continuous Internal Evaluation Marks(CIE):

Attendance	Assignment/ Microproject	Internal Examination-1(written)	Internal Examination-2(written)	Internal examination 3 (written)	Total
5	15	5	10	5	40

End Semester Examination Marks(ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions.

Part A	Part B	Total
• 2 Questions from each module • Total of 8 Questions, each carrying 3 Marks $(8\times 3 = 24\ Marks)$	• Each question carries 9 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 3 sub divisions. $(4\times 9 = 36\ Marks)$	60

Course Outcome(Cos)

	Course Outcome	Bloom's Knowledge Level (KL)	Assessment Tool
CO1	Determine the Fourier transforms of functions and apply them to solve problems arising in engineering.	K3	Written exam,Assignment
CO2	Understand the analyticity of complex functions and apply it in conformal mapping.	K3	
C03	Compute complex integrals using Cauchy's integral theorem and Cauchy's integral formula.	K3	
CO4	Understand the series expansion of complex function about a singularity and apply residue theorem to compute real integrals.	K3	

Note: K1-Remember,K2-Understand,K3-Apply, K4-Analyse,K5-Evalaute, K6-Create

CO-PO MAPPING TABLE

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

Text Book				
Sl.No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Advanced Engineering Mathematics	Erwin Kreyszig	John Wily &Sons	10th edition,2016

REFERENCE BOOKS				
Sl.No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Complex Analysis	Dennis G.Zill, Patrick D.Shanahan	Jones& Bartlett	3rd edition,2015
2	Higher Engineering Mathematics	B.V Ramana	McGraw-Hill Education	39th edition,2023
3	Higher Engineering Mathematics	B.S Grewal	Khanna Publishers	44th edition, 2018
4	Fast Fourier Transforms- Algorithms and applications	K.R.Rao, Do Nyeon Kim, Jae Jeong Hwang	Springer	1st edition, 2011

SEMESTER S3

FLUID MECHANICS

Course Code	PCCET302	CIE Marks	40
Teaching Hours/Week (L: T:P: R)	3-1-0-0	ESE Marks	60
Credits	4	Exam Hours	2 Hrs. 30 Min.
Prerequisites (if any)	GCEST103(Engineering mechanics)	Course Type	Theory

Course Objectives:

1. To familiarize the fundamental concepts of fluid mechanics and hydraulics in pipes and open

   channels, pressure measurement and flow measurement systems

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	**Fluid properties**, Newton's law of viscosity, types of fluids (description only) **Fluid Statics**: Fluid pressure, Pascal's Law, Hydrostatic law, Measurement of fluid pressure using manometers -Simple manometer (Piezo meter and U tube manometers) and Differential manometers (U tube differential manometer and inverted U tube differential manometer) (include numerical problems), Mechanical gauges (brief description only).	11
2	**Determination of total pressure and centre of pressure on surfaces (include numerical problems)**: Vertical plane surface, Horizontal plane surface, inclined plane surface, curved surfaces **Buoyancy and Floatation**: Basic concepts, centre of buoyancy, meta-centre and meta-centric height of floating bodies, conditions for stability of floating and submerged bodies **Dimensional analysis and hydraulic similitude:** Methods of dimensional analysis, model analysis, Similitude-types of similarities.	11
3	**Fluid Kinematics**: Methods of describing fluid motion, Lagrangian and Eulerian methods. types of fluid flow, continuity equation in one, two and three dimensions(include derivation and numerical problems) Determination of velocity and acceleration at a point in fluid flow (include numerical problems), Description of streamline, pathline and streakline, velocity potential, stream function and flow net **Fluid dynamics**: Forces in fluid motion, Derivation of Bernoulli's equation from Eulers's equation of motion with assumptions, Practical Applications of Bernoulli's equation- Venturimeter, orifice meter and Pitot tube (include numerical problems), Momentum equations and forces on Pipe bends	11
4	**Flow through Orifices**: hydraulic coefficients and experimental determination of hydraulic coefficients (associated numerical problems) Discharge through large orifices- rectangular orifice (discharging freely, fully submerged and partially submerged), time of emptying of a rectangular tank through an orifice at its bottom (include numerical problems).	11

	Pipe flow- Computation of major losses in pipes (derivation of Darcy Weisbach equation) - Computation of minor losses in pipes (equations only) ,hydraulic gradient line and total energy line, pipes in series and parallel -equivalent pipes (include numerical problems from all sections)	
	Flow in Open channel: Comparison between pipe flow and open channel flow, classification of flow in open channels	
	Flow through Notches and weirs: classification of notches and weirs, discharge over a rectangular notch/weir, discharge over a triangular notch/weir, discharge over a trapezoidal notch/weir, velocity of approach and end contraction (include numerical problems). Brief introduction on specific energy, gradually varied flow and rapidly varied flow and hydraulic jump	

Course Assessment Method(CIE:40 marks, ESE: 60 marks)
Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Internal Examination- 3 (Written)	Total
5	15	5	10	5	40

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
• 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks **(8x3 =24marks)**	• Each question carries 9 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 3 sub divisions. **(4x9 = 36 marks)**	**60**

Course Outcomes (COs) and Assessment Tools

At the end of the course students should be able to:

CO	Course Outcome	Bloom's Knowledge Level (KL)	Assessment Tool
CO1	To understand the basic properties of fluids	**K2**	Written exam
CO2	To apply the fundamental principles of fluid statics and dynamics in the solution of practical problems in Hydraulics Engineering	**K3**	Written exam and Assignment

CO3	To evaluate the stability of floating and submerged bodies	**K3**	Written exam
CO4	To estimate the forces in pipe bends	**K3**	Written exam and Assignment
CO5	To explain the fluid flow properties in pipes and open channels	**K3**	Written exam and Assignment

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

CO-PO Mapping Table:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3									
CO2	3	3									
CO3	3	3									
CO4	3	3									
CO5	3	3									

Note: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -: No Correlation

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Hydraulics and Fluid Mechanics including Hydraulic machines	Modi P. N. and S.M. seth	S.B.H. Publishers , New Delhi	22nd edition,2019
2	Flow in open channels	Subramanya K	Tata McGraw - Hill	5th edition, 2019
3	Open-channel flow	Hanif Chaudhari M	Springer	2nd edition,2007
4	Fluid mechanics and hydraulic machines	R K Bansal	Laxmi Publications	10th edition, 2020
5	Fluid mechanics	John F Douglas, Janusz, Gasiorek, John A swaffield, Lynne B Jack	Pearson Publications	6th edition,2011

		Reference Books		
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Fluid Mechanics	Victor Streeter, E. Benjamin Wylie, K. W. Bedford	Mc Graw Hill Publishers	9th edition,2017
2	Munson, Young and Okiishi's Fundamentals of Fluid Mechanics	Philip M Gerhart, John I . Hochstein, Andrew L Gerhart	John Wiley & Sons Inc	9th edition, 2020
3	Fundamentals of Fluid mechanics	Bruce R. Munson, Donald F. Young,Theodore H. Okiishi	John Wiley & Sons Inc	5th edition 2005
4	Introductory Fluid Mechaniucs	Joseph Katz	Cambridge University Press	2015
5	Fluid Mechanics, Hydraulics and hydraulic Machines	Arora.K.R,	Standard Publishers	2005
6	A First Course in Fluid Mechanics	Narasimhan S.	University Press (India)	2006
7	Fluid Mechanics	Frank.M.White	Mc Graw Hill Publishers.	9 th edition 2022
8	Fluid Mechanics	Mohanty.A.K.	Prentice Hall, New Delhi	2011
9	Principles of Fluid Mechanics and Fluid Machines	Narayana Pillai,N	University Press	2011
10	Fluid mechanics and Fluid Power Engineering	Kumar.D.N.	S.K.Kataria & sons	2013
11	Theory and Applications of Fluid Machines	Subramanya K	Tata McGraw-Hill	1993

	Video Links (NPTEL, SWAYAM…)
Module No.	**Link ID**
1	https://onlinecourses.nptel.ac.in/noc22_me31/preview https://www.youtube.com/playlist?list=PLPALMYFm0ysmjNIuw7eJ2ZGz_XSFkv6CI https://drive.google.com/drive/folders/1DcQjcxeUCHyOqJh5x4lSjwhUbbQn2UI?usp=sharing
2	https://nptel.ac.in/courses/105103095
3	https://nptel.ac.in/courses/105103095
4	https://nptel.ac.in/courses/105107059

SEMESTER S3

STRUCTURAL ANALYSIS - I

Course Code	PCCET303	CIE Marks	40
Teaching Hours/Week (L: T:P: R)	3:1:0:0	**ESE Marks**	60
Credits	4	**Exam Hours**	2 Hrs. 30 Min.
Prerequisites (if any)	PCCET205 Mechanics of solids	**Course Type**	Theory

Course Objectives:

1. To provide students with a thorough understanding of the fundamental theory of structural analysis

2. To develop the student's ability to both model and analyse statically determinate and indeterminate structures and to provide realistic applications encountered in professional practice

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	**Statically determinate trusses:** Analysis using method of joints and method of sections. **Deformation of Statically Determinate Structures:** Moment area method–Mohr's theorems, Applications to determinate deformations of cantilever and simply supported beams (prismatic and beams of varying cross section) subjected to concentrated and uniformly distributed loads. Unit load method: Applications to determinate determinations of deflection of statically determinate beams, frames and trusses.	12
2	**Energy Principles and Energy Theorems:** Castigliano's theorem I, Principle of virtual work, Betti's theorem, Maxwell's law of reciprocal deflections. **Indeterminate Structures:** Introduction to force method of analysis. Static indeterminacy **Analysis of statically indeterminate structures** Castigliano's theorem II, Minimum strain energy method for analysing statically indeterminate structures (Illustration only) **Method of consistent deformations:** Analysis of beams, frames and trusses. (simple problems with one redundant, illustration only for tworedundant problems). Concepts of effect of pre-strain, lack of fit, temperature changes and support settlement. (Illustration only).	12
3	**Three Hinged Arches:** Action of an arch - Eddy's theorem – Three hinged, parabolic and circular arches (with supports at same level) - determination of horizontal thrust, bending moment, normal thrust and radial shear.	10

	Cables and Suspension bridges: Forces in loaded (concentrated and uniformly distributed) cables - length of cables – supports at same and different levels – maximum tension in the suspension cable and backstays, pressure on towers. Simple suspension bridges with three hinged stiffening girders - bending moments and shear force diagrams	
4	**Moving Loads and influence lines:** Introduction to moving loads - concept of influence lines - influence lines for reaction, shear force and bending moment in simply supported beams and over hanging beams – analysis for different types of moving loads (single concentrated load - several concentrated loads - uniformly distributed load shorter and longer than the span) conditions for maximum bending moment and shear force.	10

Course Assessment Method
(CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment	Internal Examination-1	Internal Examination- 2	Internal Examination- 3	Total
5	15	5	10	5	40

End Semester Examination Marks (ESE):

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
• 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks **(8x3 =24 marks)**	• Each question carries 9 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 3 sub divisions. **(4x9 = 36 marks)**	60

Course Outcomes (COs)

At the end of the course students should be able to:

CO	Course Outcome	Bloom's Knowledge Level (KL)	Assessment Tool
CO1	Apply appropriate structural mechanics principles for estimation of force and deformation response of structural elements.	K3	Written Exam and Assignment
CO2	Apply energy-based techniques for estimation of deformation response of structural elements and simple structural systems.	K3	Written Exam
CO3	Analyse statically indeterminate structures using force method`	K3	Written Exam and Assignment
CO4	Analyse the effects of moving loads on structures using influence lines	K3	Written Exam

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

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

Note: *1.' Slight (Low), 2.- Moderate (Medium), 3. Substantial (High), - No Correlation*

Textbooks			
Sl.No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Structural Analysis-I	SS Bhavikatti	Vikas Publishing House Pvt. Lmt.	2016
2	Mechanics of Structures Vol I & II	S.B. Junnarkar & H.J. Shah	Charotar Publishing House	2015
3	Structural Analysis	Devdas Menon	Publishers, NewDelhi	Narosa 3rd edition 2023
4	Structural Analysis	R.C. Hibbler	Pearson Education	10 th edn. 2022
5	Basic Structural Analysis	C.S. Reddy	New Delhi: Tata McGrawHill, NewDelhi	3 rd Edn. ,2017

Reference Books			
Sl. No.	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Intermediate Structural Analysis	C.K. Wang Tata	McGraw Hill Publishers	2017
2	Elementary Structural Analysis	J.B. Wilbur, C.H. Norris, and S. Utku	McGraw Hill, NewYork	2006
3	Structural Analysis	L.S. Negi and R.S. Jangid	Tata McGraw Hill	2006

Video Links (NPTEL, SWAYAM…)	
Sl.No.	Link ID
1	https://nptel.ac.in/courses/105105166
2	https://nptel.ac.in/courses/105105109

SEMESTER S3
SURVEYING & GEOMATICS

Course Code	PBCET304	CIE Marks	60
Teaching Hours/Week (L:T:P: R)	3:0:0:1	ESE Marks	40
Credits	4	Exam Hours	2Hrs.30Min.
Prerequisites(if any)	GCESTl04	Course Type	Theory

Course Objectives:

1. To impart awareness on the principles of surveying, various methods, errors associated with the field observations and advanced surveying techniques.

2. To impart practical knowledge on various surveying methods and enable students to utilize advanced surveying techniques in field surveying

SYLLABUS

Module No	Syllabus Description	Contact Hours
1	**Introduction to Surveying** : Principles, Linear, angular and graphical methods, Survey stations, Survey lines- ranging, Bearing of survey lines, Local attraction, Declination, **Levelling:** Principles of levelling- Dumpy level, booking and reducing levels, Methods- simple, differential, reciprocal levelling, profile levelling and cross sectioning. Digital and Auto Level, Errors in levelling	9
	Contouring: Characteristics, methods, uses. **Areas and Volumes**: computation of area by offsets to base line, by dividing area into number of triangles; volume of level section by	

2	prismoidal and trapezoidal formulae. **Mass diagram** : Construction, Characteristics and uses **Triangulation:** Triangulation figures, Triangulation stations, Inter visibility of stations, Satellite Stations and reduction to centre.	**9**
3	**Theory of Errors:** Types, theory of least squares, Weighting of observations, Most probable value, Computation of indirectly observed quantities - method of normal equations. **Total Station :** Concept of EDM, principles and working, advantages and applications, Global Positioning Systems-Components and principles, satellite ranging-calculating position, signal structure, application of GPS, GPS Surveying methods-Static, Rapid static, Kinematic methods – DGPS, **Recent trends in Surveying :** GNSS, Smart Station and LIDAR	**9**
4	**Remote Sensing :** Definition- Electromagnetic spectrum-Energy interactions with atmosphere and earth surface features-spectral reflectance of vegetation, soil and water- Classification of sensors- Active and Passive, Resolution-spatial, spectral radiometric and Temporal resolution, Multi spectral scanning-Along track and across track scanning **Geographical Information System** : 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	**9**

Suggestion on Project Topics (8 hrs)

- On the first class before starting the first module, direct the students to select a land region with defined boundary. The faculty in charge should ensure that the selected region is appropriate for learning the concepts and methods through the project.

- The students should locate the geographic coordinate systems for the selected region using applications like Bhuvan.

- Conduct the land surveying using linear measurements (tape or distomat).

- Determine the errors in traverse and apply corrections.

- Prepare the survey sketch.

- Determine the reduced levels and prepare the contour maps using conventional (level or theodolite) methods.

- Conduct the total station survey of the same region and prepare the contour maps.

- Compare the results of the two methods.

- Determine the earthwork quantity – the faculty shall help the students by suggesting either a region to fill or cut to find the earthwork quantity estimation requirement.

- Application of advanced surveying techniques including LIDAR is advised but not mandatory.

- Prepare the survey report, print it and submit to the faculty.

Course Assessment Method
(CIE: 60marks, ESE: 40marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Project	Internal Examination-1	Internal Examination-2	Internal Examination- 3	Total
5	35	5	10	5	60

End Semester Examination Marks (ESE):

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
• 2 Questions from each module. • Total of 8 Questions, each carrying 2 marks **(8x2=16marks)**	• Each question carries 6 marks. • Two questions will be given from each module, out of which l question should be answered. • Each question can have a maximum of 2 sub divisions. **(4x6=24marks)**	**40**

Course Outcomes (COs)

At the end of the course students should be able to:

CO	COURSE OUTCOME	Bloom's Knowledge Level(KL)	Assessment Tool
CO1	Understand and apply the principles and techniques of surveying.	K2, K3	Written Exam and project
CO2	Apply the principles of surveying for triangulation, area and volume computation, contour maps preparation and in the construction of mass diagram.	K3	Written Exam , project and Assignment
CO3	Understand the concept of least squares, weight of observations and to identify the possible errors in the field observations	K2, K3	Written Exam , project and Assignment
CO4	Understand different surveying techniques using advanced surveying equipments..	K2	Written Exam and project
CO5	Prepare a survey report incorporating various concepts of surveying	K6	Project

CO-PO Mapping Table:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	1	1							
CO2	3	3	1	1							
CO3	3	3						3	3		
CO4	3	3			3			3	3		
CO5	3	3	3	3	3	3		3	3		3

Note:*1.'Slight (Low), 2.-Moderate (Medium), 3.Substantial (High), - No Correlation*

Assessment and Evaluation for Project Activity

Sl. No	Evaluation for	Allotted Marks
1	Project Planning and Proposal	5
2	Contribution in Progress Presentations and Question Answer Sessions	5
3	Involvement in the project work and Team Work	5
4	Execution and Implementation	10
5	Final Presentations	5
6	Project Quality, Innovation and Creativity	5
	Total	**35**

1. Project Planning and Proposal (5 Marks)

- Clarity and feasibility of the project plan
- Research and background understanding
- Defined objectives and methodology

2. Contribution in Progress Presentation and Question Answer Sessions (5 Marks)

- Individual contribution to the presentation
- Effectiveness in answering questions and handling feedback

3. Involvement in the Project Work and Team Work (5 Marks)

- Active participation and individual contribution
- Teamwork and collaboration

4. Execution and Implementation (10 Marks)

- Adherence to the project timeline and milestones
- Application of theoretical knowledge and problem-solving
- Prepare a detailed survey report including Data analysis and diagrams.

5. Final Presentation (5 Marks)

- Quality and clarity of the overall presentation
- Individual contribution to the presentation
- Effectiveness in answering questions

6. Project Quality, Innovation, and Creativity (5 Marks)

- Overall quality and technical excellence of the project
- Innovation and originality in the project
- Creativity in solutions and approaches

Textbooks				
Sl.No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Surveying Vol 1	Dr. B C Punmia,Ashok Kumar Jain & Arun Kumar Jain	Laxmi Publications (P) Ltd.	Seventeenth Edition Jan 2016
2	Surveying Vol II	Dr. B C Punmia,Ashok Kumar Jain & Arun Kumar Jain	Laxmi Publications (P) Ltd.	July 2018
3	Introduction to Geographic Information Systems	Kang-Tsung Chang	Mc Graw Hill Education	Indian Edition, July 2017
4	Fundamentals of Remote Sensing	George Joseph	Universities Press	2005

Reference Books				
Sl.No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Textbook of Surveying	C Venketaramaiah	Universities Press	2011
2	Surveying Vol I	S K Duggal	Mc Graw Hill	Fifth Edition,2019
3	Surveying Vol II	S K Duggal	Mc Graw Hill	Fifth

				Edition,2019
4	A textbook of Surveying and Levelling	R Agor	Khanna Publishers	2005
5	Textbook of Remote Sensing And Geographical Information Systems	Ms. Anji Reddy	B.S Publications	Fourth Edition,2012
6	Remote Sensing and Image Interpretation,7 Ed(An Indian Adaptation)	Thomas M Lillesand, Ralph W. Kiefer	Wiley	Seventh Edition,2000
7	Principles of Geographical Information Systems	Burrough P	Oxford University Press	1998

Video Links (NPTEL, SWAYAM…)	
Sl.No.	**Link ID**
1	https://nptel.ac.in/courses/105107122 Surveying Nptel IIT Roorkee , J K Ghosh
2	https://nptel.ac.in/courses/105107122 Surveying Nptel IIT Roorkee , J K Ghosh
3	https://archive.nptel.ac.in/courses/105/104/105104100/ Nptel Modern Surveying Techniques,IIT Kanpur
4	https://onlinecourses.nptel.ac.in/noc22_ce84/preview Nptel Swayam Remote Sensing and GIS , Prof. Rishikesh Bharti ,IIT Guwahati

SEMESTER S3

INTRODUCTION TO ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

(Common to Group B and C)

Course Code	GYEST305	CIA Marks	40
Teaching Hours/Week (L: T:P: R)	3:1:0:0	ESE Marks	60
Credits	4	Exam Hours	2 Hrs. 30 Min.
Prerequisites (if any)	None	Course Type	Theory

Course Objectives:

1. Demonstrate a solid understanding of advanced linear algebra concepts, machine learning algorithms and statistical analysis techniques relevant to engineering applications, principles and algorithms.

2. Apply theoretical concepts to solve practical engineering problems, analyze data to extract meaningful insights, Implement appropriate mathematical and computational techniques for AI and data science applications.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	**Introduction to AI and Machine Learning**: Basics of Machine Learning - types of Machine Learning systems-challenges in ML- Supervised learning model example- regression models- Classification model example- Logistic regression-unsupervised model example- K-means clustering. Artificial Neural Network, Types of Neural networks - Perceptron - Universal Approximation Theorem (statement only)- Multi-Layer Perceptron - Deep Neural Network- demonstration of regression and classification problems using MLP.(Text-2).	11

2	**Mathematical Foundations of AI and Data science:**Role of linear algebra in Data representation and analysis – Matrix decomposition- Singular Value Decomposition (SVD)- Spectral decomposition- Dimensionality reduction technique-Principal Component Analysis (PCA). (Text-1)	**11**
3	**Applied Probability and Statistics for AI and Data Science:**Basics of probability-random variables and statistical measures - rules in probability-Bayes theorem and its applications- statistical estimation-Maximum Likelihood Estimator (MLE) - statistical summaries- Correlation analysis-linear correlation (direct problems only)- regression analysis- linear regression (using least square method) (Text book 4)	**11**
4	**Basics of Data Science:** Benefits of data science - use of statistics and Machine Learning in Data Science - data science process - applications of Machine Learning in Data Science - modelling process- demonstration of ML applications in data science - Big Data and Data Science. (Text book-5)	**11**

Course Assessment Method (CIA: 40 marks, ESE: 60 marks)

Continuous Internal Assessment Marks (CIA):

Attendance	Assignment/ Micro project/ IBM data science certification	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Internal Examination- 3 (Written)	Total
5	15	5	10	5	40

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
• 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks **(8x3 =24 marks)**	• Each question carries 9 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 3 subdivisions. **(4x9 = 36 marks)**	**60**

Course Outcomes (COs) and Assessment Tool

At the end of the course students should be able to:

	Course Outcome	Bloom's Knowledge Level (KL)	Assessment Tool
CO1	Apply the concept of machine learning algorithms including neural networks and supervised/unsupervised learning techniques for engineering applications.	**K3**	Written exam
CO2	Apply advanced mathematical concepts such as matrix operations, singular values, and principal component analysis to analyze and solve engineering problems**.**	**K3**	Written exam
CO3	Analyze and interpret data using statistical methods including descriptive statistics, correlation, and regression analysis to derive meaningful insights and make informed decisions.	**K3**	Written exam
CO4	Integrate statistical approaches and machine learning techniques to ensure practically feasible solutions in engineering contexts.	**K3**	Written exam

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

CO-PO Mapping Table:

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

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Introduction to Linear Algebra	Gilbert Strang	Wellesley-Cambridge Press	6th edition, 2023
2	Hands-on machine learning with Scikit-Learn, Keras, and TensorFlow	Aurélien Géron	O'Reilly Media, Inc.	2nd edition,20 2 2
3	Mathematics for machine learning	Deisenroth, Marc Peter,A. Aldo Faisal, and Cheng Soon Ong	Cambridge University Press	1st edition. 2020
4	Fundamentals of mathematical statistics	Gupta, S. C., and V. K. Kapoor	Sultan Chand & Sons	9th edition, 2020
5	Introducing data science: big data, machine learning, and more, using Python tools	Cielen, Davy, and Arno Meysman	Simon and Schuster	1st edition, 2016

Reference Books				
1	Data science: concepts and practice	Kotu, Vijay, and Bala Deshpande	Morgan Kaufmann	2nd edition, 2018
2	Probability and Statistics for Data Science	Carlos Fernandez - Granda	Center for Data Science in NYU	1st edition, 2017
3	Foundations of Data Science	Avrim Blum, John Hopcroft, and Ravi Kannan	Cambridge University Press	1st edition, 2020
4	Statistics For Data Science	James D. Miller	Packt Publishing	1st edition, 2019
5	Probability and Statistics - The Science of Uncertainty	Michael J. Evans and Jeffrey S. Rosenthal	University of Toronto	1st edition, 2009
6	An Introduction to the Science of Statistics: From Theory to Implementation	Joseph C. Watkins	chrome-extension://efaidnbmnnnibpcajpcglclefindmka https://www.math. arizo	Preliminary Edition.

SEMESTER S3/S4

ECONOMICS FOR ENGINEERS

(Common to All Groups)

Course Code	UCHUT346	CIE Marks	50
Teaching Hours/Week (L: T:P: R)	2:0:0:0	ESE Marks	50
Credits	2	Exam Hours	2 Hrs. 30 Min.
Prerequisites (if any)	None	Course Type	Theory

Course Objectives:

1. Understanding of finance and costing for engineering operation, budgetary planning and control
2. Provide fundamental concept of micro and macroeconomics related to engineering industry.
3. Deliver the basic concepts of Value Engineering

SYLLABUS

Module No	Syllabus Description	Contact Hours
1	Basic Economics Concepts - Basic economic problems – Production Possibility Curve – Utility – Law of diminishing marginal utility – Law of Demand - Law of supply – Elasticity - measurement of elasticity and its applications – Equilibrium- Changes in demand and supply and its effects Production function - Law of variable proportion – Economies of Scale – Internal and External Economies – Cobb-Douglas Production Function	6
2	Cost concepts – Social cost, private cost – Explicit and implicit cost – Sunk cost - Opportunity cost - short run cost curves - Revenue concepts Firms and their objectives – Types of firms – Markets – Perfect Competition – Monopoly - Monopolistic Competition - Oligopoly (features and equilibrium of a firm) Behavioral Economics – Decision-making biases, bounded rationality, and engineering applications.	7
3	Monetary System – Money – Functions - Central Banking – Inflation - Causes and Effects – Measures to Control Inflation - Monetary and Fiscal policies – Deflation Taxation – Direct and Indirect taxes (merits and demerits) – GST, National income – Concepts - Circular Flow – Methods of Estimation and Difficulties - Stock Market – Functions- Problems faced by the Indian stock market – Demat Account and Trading Account – Stock market Indicators SENSEX and NIFTY	6

| 4 | Value Analysis and value Engineering - Cost Value, Exchange Value, Use Value, Esteem Value - Aims, Advantages and Application areas of Value Engineering - Value Engineering Procedure - Break-even Analysis – Cost Benefit Analysis - Capital Budgeting - Process planning | 6 |

Course Assessment Method
(CIE: 50 marks, ESE: 50 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Micro Project	Internal Examination-1	Internal Examination- 2	Internal Examination- 3	Total
5	25	5	10	5	50

End Semester Examination Marks (ESE):

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
• Minimum 1 and Maximum 2 Questions from each module • Total of 6 Questions, each carrying 3 marks **(6x3 =18 marks)**	• Two questions will be given from each module, out of which l question should be answered. • Each question can have a maximum of 2 sub divisions. • Each question carries 8 marks **(4x8 = 32 marks)**	50

Course Outcomes (COs)
At the end of the course students should be able to:

CO	Course Outcome	Bloom's Knowledge Level (KL)	Assessment Tool
CO 1	Understand the fundamentals of various economic issues using laws and learn the concepts of demand, supply, elasticity and production function.	K2	Internal Exams and Micro Project
CO 2	Develop decision making capability by applying concepts relating to costs and revenue, and acquire knowledge regarding the functioning of firms in different market situations.	K3	
CO 3	Outline the macroeconomic principles of monetary and fiscal systems, national income and stock market.	K2	
CO 4	Make use of the possibilities of value analysis and engineering, and solve simple business problems using break even analysis, cost benefit analysis and capital budgeting techniques.	K3	

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

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

Note: *1.' Slight (Low), 2.- Moderate (Medium), 3. Substantial (High), - No Correlation*

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Managerial Economics	Geetika, Piyali Ghosh and Chodhury	Tata McGraw Hill	2015
2	Engineering Economy	H. G. Thuesen, W. J. Fabrycky	PHI	1966
3	Engineering Economics	R. Paneerselvam	PHI	2012
4	Thinking, Fast and Slow	Daniel Kahneman	Farrar, Straus and Giroux	2011
5	An Introduction to Behavioral Economics (3rd ed.)	Wilkinson, N., & Klaes M	Macmillan International Higher Education	2018

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Engineering Economy	Leland Blank P.E, Anthony Tarquin P. E	Mc Graw Hill	7TH Edition
2	Indian Financial System	Khan M. Y.	Tata McGraw Hill	2011
3	Engineering Economics and analysis	Donald G. Newman, Jerome P. Lavelle	Engg. Press, Texas	2002
4	Contemporary Engineering Economics	Chan S. Park	Prentice Hall of India Ltd	2001

SEMESTER S3/S4

ENGINEERING ETHICS AND SUSTAINABLE DEVELOPMENT

(Common to All Groups)

Course Code	UCHUT347	CIE Marks	50
Teaching Hour/Week (L:T:P:R)	2:0:0:0	ESE Marks	50
Credits	2	Exam Hours	2Hrs. 30 Min.
Prerequisites (if any)	None	Course Type	Theory

Course Objectives:

1. Equip with the knowledge and skills to make ethical decision and implement gender-sensitive practices in their professional lives.

2. Develop a holistic and comprehensive interdisciplinary approach to understanding engineering ethics principles from a prospective of Environment Protection and sustainable development.

3. Develop the ability to find Strategies for implementing sustainable Engineering solutions.

SYLLABUS

Module No.	Syllabus Description	Contact Hour
1	**Fundamentals of ethics** – personal vs professional ethics, civic virtue, Respect for others, **Profession and professionalism** ingenuity, diligence and responsibility, integrity in design, development, and Research domains, Plagiarism, a balanced outlook on law - challenges - case studies, **Technology and digital revolution –** data, information and knowledge, Cybertrust and cybersecurity, data collection and Management, **High Technologies: connecting people and places** – accessibility and social impacts, **managing conflict**, Collective bargaining, **Confidentiality**, role of confidentiality in moral integrity, **Codes of Ethics.** **Basic concepts in Gender Studies** – sex, gender, sexuality, gender spectrum: beyond the binary, gender identity, gender expression, gender stereotypes, Gender Disparity and discrimination in education, employment and everyday life, History of women in science and technology, Gendered technology and innovations, Ethical value and practices in connection with gender – equity diversity & gender justice, **Gender policy and women/transgender empowerment initiatives**.	6
2	**Introduction to Environmental Ethics:** Definition, importance and historical development of environmental ethics, key philosophical theories (anthropocentrism, biocentrism, ecocentrism). **Sustainable Engineering Principles:** Definition and scope, triple bottom line (economic, social and environmental sustainability), life cycle analysis and sustainability metrics. **Ecosystems and Biodiversity:** Basics of ecosystems and their functions, Importance of biodiversity and its conservation, Human impact on ecosystems	6

	and biodiversity loss, An overview of various ecosystems in Kerala/India, and its significance. **Landscape and Urban Ecology:** Principles of landscape ecology, Urbanization and its environmental impact, Sustainable urban planning and green infrastructure.	
3	**Hydrology and Water Management:** Basics of hydrology and water cycle, Water scarcity and pollution issues, Sustainable water management practices, Environmental flow, disruptions and disasters. **Zero Waste Concepts and Practices:** Definition of zero waste and its principles, Strategies for waste reduction, reuse, reduce and recycling, Case studies of successful zero waste initiatives. **Circular Economy and Degrowth:** Introduction to the circular economy model, Differences between linear and circular economies, degrowth principles, Strategies for implementing circular economy practices and degrowth principles in engineering. **Mobility and Sustainable Transportation:** Impacts of transportation on the environment and climate, Basic tenets of a Sustainable Transportation design, Sustainable urban mobility solutions, Integrated mobility systems, E-Mobility, Existing and upcoming models of sustainable mobility solutions.	6
4	**Renewable Energy and Sustainable Technologies:** Overview of renewable energy sources (solar, wind, hydro, biomass), Sustainable technologies in energy production and consumption, Challenges and opportunities in renewable energy adoption. **Climate Change and Engineering Solutions:** Basics of climate change science, Impact of climate change on natural and human systems, Kerala/India and the Climate crisis, Engineering solutions to mitigate, adapt and build resilience to climate change. **Environmental Policies and Regulations:** Overview of key environmental policies and regulations (national and international), Role of engineers in policy implementation and compliance, Ethical considerations in environmental policy-making. **Case Studies and Future Directions:** Analysis of real-world case studies, Emerging trends and future directions in environmental ethics and sustainability, Discussion on the role of engineers in promoting a sustainable future.	6

Course Assessment Method
(CIE: 50 marks, ESE: 50)
Continuous Internal Evaluation Marks (CIE):

Attendance	Portfolio	Internal Examination-1	Internal Examination- 2	Internal Examination- 3	Total
5	25	5	10	5	50

Continuous internal evaluation will be based on individual and group activities undertaken throughout the course and the portfolio created documenting their work and learning. The portfolio will include reflections, project reports, case studies, and all other relevant materials.

- The students should be grouped into groups of size 4 to 6 at the beginning of the semester. These groups can be the same ones they have formed in the previous semester.

- Activities are to be distributed between 2 class hours and 3 Self-study hours.

- The portfolio and reflective journal should be carried forward and displayed during the 7th Semester Seminar course as a part of the experience sharing regarding the skills developed through various courses.

Sl No	Item	Particulars	Group/Individual (G/I)	Marks
1	Reflective Journal	Weekly entries reflecting on what was learned, personal insights, and how it can be applied to local contexts.	I	5
2	Micro Project (Detailed documentation of the project, including methodologies, findings and reflections)	1 a) Perform an Engineering ethics Case Study analysis and prepare a report 1 b) Conduct a literature survey on 'Code of Ethics for Engineers' and prepare a sample code of ethics	G	8
		2. Listen to a TED talk on a Gender-related topic, do a literature survey on that topic and make a report citing the relevant papers with a specific analysis of the Kerala context	G	5
		3. Undertake a project study based on the concepts of sustainable development* - Module II, Module III & Module IV	G	12
3	Activities	One activity* each from Module II, Module III & Module IV	G	15
4	Final Presentation	A comprehensive presentation summarising the key takeaways from the course, personal reflections, and proposed future actions based on the learnings.	G	5
		Total Marks		**50**

*Can be taken from the given sample activities/projects

Evaluation Criteria:

- **Depth of Analysis:** Quality and depth of reflections and analysis in project reports and case studies.
- **Application of Concepts**: Ability to apply course concepts to real-world problems and local contexts.
- **Creativity**: Innovative approaches and creative solutions proposed in projects and reflections.
- **Presentation Skills**: Clarity, coherence, and professionalism in the final presentation.

End Semester Examination Marks (ESE):

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
• Minimum of one question from each module. • Total of 6 questions, each carrying 3 marks. **(6 x 3 = 18 marks)**	• Each question carries 8 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 3 subdivisions. **(4 x 8 = 32 marks)**	**50**

Course Outcomes (COs)

At the end of the course students should be able to:

	Course Outcomes	Bloom's Knowledge Level (KL)	Assessment Tool
CO1	Develop the ability to apply the principles of engineering ethics in their professional life.	K3	Written exam, Portfolio and course end survey
CO2	Develop the ability to exercise gender-sensitive practices in their professional lives	K4	
CO3	Develop the ability to explore contemporary environmental issues and sustainable practices.	K3	
CO4	Develop the ability to analyse the role of engineers in promoting sustainability and climate resilience.	K4	
CO5	Develop interest and skills in addressing pertinent environmental and climate-related challenges through a sustainable engineering approach.	K3	

Note: K1- Remember, K2 - understand, K3 – Apply, K4 – Analysis, K5 – Evaluate, K6 – Create

CO-PO Mapping Table:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	-	-	-	-	-	3	3	3	2	-	-
CO2	-	2	-	-	-	3	3	3	2	-	-
CO3	-	-	-	-	-	3	2	3	2	-	-
CO4	-	2	-	-	-	3	2	3	2	-	-
CO5	-	-	-	-	-	3	2	3	2	-	-

Note: *1.' Slight (Low), 2.- Moderate (Medium), 3. Substantial (High), - No Correlation*

	Reference Books			
Sl No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition & Year**
1	Ethics in Engineering Practice and Research	Caroline Whitbeck	Cambridge University Press & Assessment	2nd edition & August 2011
2	Virtue Ethics and Professional Roles	Justin Oakley	Cambridge University Press & Assessment	November 2006
3	Sustainability Science	Bert J. M. de Vries	Cambridge University Press & Assessment	2nd edition & December 2023
4	Sustainable Engineering Principles and Practice	Bhavik R. Bakshi	Cambridge University Press & Assessment	2019
5	Engineering Ethics	M Govindarajan, S Natarajan and V S Senthil Kumar	PHI Learning Private Ltd, New Delhi	2012

| 6 | Professional ethics and human values | RS Naagarazan | New age international (P) limited New Delhi | 2006 |
| 7 | Ethics in Engineering | Mike W Martin and Roland Schinzinger, | Tata McGraw Hill Publishing Company Pvt Ltd, New Delhi | 4" edition, 2014 |

Suggested Activities/Projects:

Module-II

- Write a reflection on a local environmental issue (e.g., plastic waste in Kerala backwaters or oceans) from different ethical perspectives (anthropocentric, biocentric, ecocentric).
- Write a life cycle analysis report of a common product used in Kerala (e.g., a coconut, bamboo or rubber-based product) and present findings on its sustainability.
- Create a sustainability report for a local business, assessing its environmental, social, and economic impacts
- Presentation on biodiversity in a nearby area (e.g., a local park, a wetland, mangroves, college campus etc) and propose conservation strategies to protect it.
- Develop a conservation plan for an endangered species found in Kerala.
- Analyze the green spaces in a local urban area and propose a plan to enhance urban
- ecology using native plants and sustainable design.
- Create a model of a sustainable urban landscape for a chosen locality in Kerala.

Module-III

- Study a local water body (e.g., a river or lake) for signs of pollution or natural flow disruption and suggest sustainable management and restoration practices.
- Analyse the effectiveness of water management in the college campus and propose improvements - calculate the water footprint, how to reduce the footprint, how to increase supply through rainwater harvesting, and how to decrease the supply-demand ratio.
- Implement a zero waste initiative on the college campus for one week and document the challenges and outcomes.
- Develop a waste audit report for the campus. Suggest a plan for a zero-waste approach.
- Create a circular economy model for a common product used in Kerala (e.g., coconut oil, cloth etc)
- Design a product or service based on circular economy and degrowth principles and present a business plan.
- Develop a plan to improve pedestrian and cycling infrastructure in a chosen locality in Kerala

Module-IV

- Evaluate the potential for installing solar panels on the college campus including cost-benefit analysis and feasibility study.
- Analyse the energy consumption patterns of the college campus and propose sustainable alternatives to reduce consumption - What gadgets are being used? How can we reduce demand using energy-saving gadgets?
- Analyse a local infrastructure project for its climate resilience and suggest improvements.
- Analyse a specific environmental regulation in India (e.g., Coastal Regulation Zone) and its impact on local communities and ecosystems.
- Research and present a case study of a successful sustainable engineering project in Kerala/India (e.g., sustainable building design, water management project, infrastructure project).
- Research and present a case study of an unsustainable engineering project in Kerala/India highlighting design and implementation faults and possible corrections/alternatives (e.g., a housing complex with water logging, a water management project causing frequent floods, infrastructure project that affects surrounding landscapes or ecosystems).

SEMESTER S3

MATERIAL TESTING LAB

Course Code	PCCEL307	CIE Marks	50
Teaching Hours/Week (L:T:P: R)	0:0:3:0	ESE Marks	50
Credits	2	Exam Hours	2Hrs.30Min.
Prerequisites(if any)	PCCET205	Course Type	Lab

Course Objectives:

1. To provide hands-on experience for the students to determine the mechanical material properties using standard testing methods.

2. To impart knowledge of material properties to identify and make use of it in various fields of engineering.

3. To introduce students to sustainable material practices and modern instrumentation and digital testing techniques for precise measurements.

Expt. No.	Experiments
1	Test on stress-strain characteristics of mild steel and Tor Steel by conducting uniaxial tension test on rod specimens using UTM.
2	Shear test on mild steel rod (Compression Testing Machine and Shear Shackle)
3	Estimation of modulus of rigidity of steel material utilizing the principles of torsional vibrations – Torsion Pendulum.
4	Estimation of modulus of rigidity of copper material utilizing the principles of torsional vibrations – Torsion Pendulum.
5	Estimation of toughness of steel specimens by conducting Izod impact test.
6	Estimation of toughness of steel specimens by conducting Charpy impact test.
7	Estimation of hardness properties of engineering materials such as brass, aluminium, copper, steel etc.by performing Brinell hardness test.
8	Estimation of Hardness properties of engineering materials such as brass, aluminium, copper, steel etc.by performing Rockwell hardness test.
9	Estimation of Hardness properties of engineering materials such as brass, aluminium, copper, steel etc.by performing Vicker's hardness test

10	Estimation of modulus of rigidity of steel by performing tension test on spring specimens.
11	Estimation of modulus of rigidity of steel by performing compression test on spring specimens.
12	Flexural behaviour of timber material by performing bending tests on beam specimens.
13	Experiment on verification of Maxwell's reciprocal theorem.
14	Study/demonstration of Strain Gauges and load cells.
15	Study of Universal Testing Machine (UTM).
16	Digital Strain Measurement using Electronic Strain Gauges.
17	Machine Learning-Driven material classification (Assignment).

* A minimum of 12 experiments is to be completed.

Course Assessment Method
(CIE: 50marks, ESE: 50marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Preparation/Pre-Lab Work experiments, Viva and Timely completion of Lab Reports / Record (Continuous Assessment)	Internal Examination	Total
5	**25**	**20**	**50**

End Semester Examination Marks (ESE):

Procedure/ Preparatory work/Design/ Algorithm	Conduct of experiment/ Execution of work/ troubleshooting/ Programming	Result with valid inference/ Quality of Output	Viva voce	Record	Total
10	**15**	**10**	**10**	**5**	**50**

- Submission of Record: Students shall be allowed for the end semester examination only upon submitting the duly certified record.
- Endorsement by External Examiner: The external examiner shall endorse the record

Course Outcomes (COs)

At the end of the course students should be able to:

CO	COURSE OUTCOME	Bloom's Knowledge Level(KL)
CO1	Identify the behaviour of engineering materials under various forms and stages of loading	K3
CO2	Characterize the elastic properties of various materials.	K3
CO3	Evaluate the strength and stiffness properties of engineering materials under various loading conditions.	K3

Note: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create

CO-PO Mapping Table:

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

Note:*1. Slight (Low), 2. Moderate (Medium), 3. Substantial (High), - No Correlation*

Textbooks				
Sl.No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	History of Strength of Materials	S.P. Timoshenko	Dover publications	2003
2	Engineering Mechanics of Solids	Egor P. Popov	Pearson	2015

Sl.No.	Title, Edition and Year
1	IS 1608 : Part 1 : 2022 Metallic materials - Tensile testing - Part 1 : Method of test at room temperature
2	IS 1598 (1977): Method for Izod Impact test of Metals, (Reaffirmed 2020)
3	IS 1757 Part:1(2020) : Metallic materials – Charpy Pendulum Impact test Method
4	IS 5242 (1979) Method of Test for determining Shear Strength of Metals, (Reaffirmed 2022)
5	IS 1500 Part:1 (2019): Metallic materials – Brinnel Hardness test Part 1 Test method
6	IS 1500 Part:4 (2019): Metallic materials – Brinnel Hardness test Part 4 table of hardness values
7	IS 1501 Part 1 (2020) : Metallic materials – Vickers Hardness test Part 1 Test method

8	IS 1501 Part 4 (2020) : Metallic materials – Vickers Hardness test Part 4 table of hardness values
9	IS 1586 Part 1 (2018) : Metallic materials – Rockwell Hardness test Part 1 Test method
10	IS 1586 Part 3 (2018) : Metallic materials – Rockwell Hardness test Part 3 Calibration of reference blocks (Scale A, B, C, D, E, F, G, H, K, N, T)
11	IS 1717 (2018): Metallic Materials – Wire – Simple Torsion Test
12	IS 883 (2016): Design of Structural Timber in Building- Code of Practice. (Reaffirmed 2021)
13	IS 13325 (1992) Determination of Tensile Properties of Extruded Polymer Geogrids Using the Wide Strip - Test Method (Reaffirmed Year : 2019)
14	IS17415(2023) Metallic Materials torsion test at room temperature.

Video Links (NPTEL, SWAYAM…)	
Sl.No.	**Link ID**
1	www.sm-nitk.vlab.ac.in
2	www.eerc01-iiith.vlabs.ac.in

Continuous Assessment (25 Marks)

1. **Preparation and Pre-Lab Work (7 Marks)**

   • Pre-Lab Assignments: Assessment of pre-lab assignments or quizzes that test understanding of the upcoming experiment.

   • Understanding of Theory: Evaluation based on students' preparation and understanding of the theoretical background related to the experiments.

2. **Conduct of Experiments (7 Marks)**

   • Procedure and Execution: Adherence to correct procedures, accurate execution of experiments, and following safety protocols.

   • Skill Proficiency: Proficiency in handling equipment, accuracy in observations, and troubleshooting skills during the experiments.

   • Teamwork: Collaboration and participation in group experiments.

3. **Lab Reports and Record Keeping (6 Marks)**

   • Quality of Reports: Clarity, completeness and accuracy of lab reports. Proper documentation of experiments, data analysis and conclusions.

   • Timely Submission: Adhering to deadlines for submitting lab reports/rough record and

maintaining a well-organized fair record.

4. **Viva Voce (5 Marks)**

• Oral Examination: Ability to explain the experiment, results and underlying principles during a viva voce session.

ASSESSMENT RUBRICS-MATERIAL TESTING LAB 1 (PCCEL307)

Category	Score	7	6	5	4	3	2	1
Preparation and Pre-Lab Work (7)		Pre-lab complete, excellent theory grasp	Minor gaps in preparation, strong understanding	Good attempt, basic theoretical clarity	Incomplete preparation, limited understanding	Weak theory, minimal pre-lab effort	Very poor preparation, lacks concepts	No preparation work, no theory awareness
Conduct of Experiments (7)		Flawless procedure, accurate conduction	Very good execution, minor slips	Correct steps, average handling	Errors in process, needs guidance	Poor handling, partial participation	Multiple errors, unsafe practices	No contribution, major issues
Lab Reports and Record Keeping (6)		-	Clear, complete, on time, well-presented	Mostly accurate, timely, minor issues	Adequate content, some errors	Incomplete or late	Poor format, lacking data	Missing or irrelevant report
Viva Voce (5)		-	-	Confident, accurate, insightful answers	Good response, minor errors	Basic understanding, lacks depth	Hesitant, confused	Cannot answer questions
TOTAL MARKS (25)					**Signature of Faculty**			

Final Marks Averaging: The final marks for preparation, conduct of experiments, viva, and record are the average of all the specified experiments in the syllabus.

Evaluation Pattern for End Semester Examination (50 Marks)

1. **Procedure/Preliminary Work/Design/Algorithm (10 Marks)**

    • Procedure Understanding and Description: Clarity in explaining the procedure and understanding each step involved.

    • Preliminary Work and Planning: Thoroughness in planning and organizing materials/equipment.

    • Algorithm Development: Correctness and efficiency of the algorithm related to the experiment.

    • Creativity and logic in algorithm or experimental design.

2. **Conduct of Experiment/Execution of Work/Programming (15 Marks)**

    • Setup and Execution: Proper setup and accurate execution of the experiment or programming task.

3. **Result with Valid Inference/Quality of Output (10 Marks)**

    • Accuracy of Results: Precision and correctness of the obtained results.

    • Analysis and Interpretation: Validity of inferences drawn from the experiment or quality of program output.

4. **Viva Voce (10 Marks)**

    • Ability to explain the experiment, procedure results and answer related questions

    • Proficiency in answering questions related to theoretical and practical aspects of the subject.

5. **Record (5 Marks)**

    • Completeness, clarity, and accuracy of the lab record submitted

SEMESTER S3

FLUID MECHANICS LAB

Course Code	PCCEL308	CIA Marks	50
Teaching Hours/Week (L: T:P: R)	0:0:3:0	ESE Marks	50
Credits	2	Exam Hours	2 Hrs. 30 Min.
Prerequisites (if any)	None	Course Type	Lab

Course Objectives:

1. To familiarize and understand the different flow measurement equipment, pumps and turbines and the laboratory procedures of experimentation with them.
2. To develop the necessary skills of experimentation techniques for the study of flow phenomena in channels/pipes.

Expt. No.	Experiments
1	Study of taps, valves, pipe fittings, gauges, Pitot tubes, water meters and current meters.
2	Determination of metacentric height and radius of gyration of floating bodies.
3	Verification of Bernoulli's theorem
4	Hydraulic coefficients of orifices under constant head method.
5	Calibration of Venturi meter.
6	Calibration of Orifice meter.
7	Calibration of water meter.
8	Calibration of rectangular notch.
9	Calibration of triangular notch.
10	Determination of friction co-efficient in pipes.
11	Determination of loss co-efficient for pipe fittings.
12	Calibration of Pressure gauges.
13	Performance test on turbines (Francis turbines).
14	Performance test on pumps (Rotodynamic pumps).

Note: A minimum of 12 Experiments to be completed

Course Assessment Method
(CIA: 50 marks, ESE: 50 marks)

Continuous Internal Assessment Marks (CIA):

Attendance	Preparation / Pre - Lab Work experiments, Viva and Timely completion of Lab Reports / Record (Continuous Assessment)	Internal Examination	Total
5	**25**	**20**	**50**

End Semester Examination Marks (ESE):

Procedure/ Preparatory work/Design/ Algorithm	Conduct of experiment/ Execution of work/ troubleshooting/ Programming	Result with valid inference/ Quality of Output	Viva voce	Record	Total
10	**15**	**10**	**10**	**5**	**50**

- *Submission of Record: Students shall be allowed for the end semester examination only upon submitting the duly certified record.*

- *Endorsement by External Examiner: The external examiner shall endorse the record.*

Course Outcomes (COs)

At the end of the course students should be able to:

	Course Outcome	Bloom's Knowledge Level(KL)
CO1	To apply theoretical concepts in Fluid Mechanics to conduct laboratory experiments.	**K3**
CO2	To analyse experimental data and interpret the result.	**K4**
CO3	To document the experimentation in a prescribed manner.	**K3**
CO4	To study the performance characteristics curve of turbines and pumps.	**K2**

Note*: K1-Remember, K2-Understand, K3-Apply, K4-Analyse, K5-Evaluate, K6-Create*

CO-PO Mapping (Mapping of Course Outcomes with Program Outcomes)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	-	-	-	-	-	3	-	-	2
CO2	3	3	-	-	-	-	-	3	-	-	2
CO3	1	2	-	-	-	-	-	2	-	-	2
CO4	3	1	-	-	-	-	-	-	-	-	2

1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -: No Correlation

Text Books

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Hydraulics and Fluid Mechanics including Hydraulic machines	Modi P. N. and S. M. Seth	S.B.H Publishers, New Delhi	22nd edition 2019
2	Flow in Open channels	Subramanya K	Tata McGraw-Hill	5th edition 2019
3	Theory and Applications of Fluid Mechanics	Subramanya K	Tata McGraw-Hill	1993

Reference Books

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Fluid Mechanics	Victor Streeter , E. Benjamin Wylie , K.W. Bedford	McGraw Hill Publishers.	9th edition 2017
2	Munson, Young and Okiishi's Fundamentals of Fluid Mechanics	Philip M. Gerhart John I. Hochstein, Andrew L. Gerhart	John Wiley & Sons Inc	9th edition 2020
3	Fundamentals Of Fluid Mechanics	Bruce R. Munson, Donald F. Young, Theodore H. Okiishi	John Wiley & Sons Inc	5th edition 2005
4	Fluid Mechanics	Frank.M.White	McGraw Hill Publishers	9th edition 2022

Video Links (NPTEL, SWAYAM…)

Module No.	Link ID
1	https://fm-nitk.vlabs.ac.in/

Continuous Assessment (25 Marks)

1. Preparation and Pre-Lab Work (7 Marks)
- Pre-Lab Assignments: Assessment of pre-lab assignments or quizzes that test understanding of the upcoming experiment.
- Understanding of Theory: Evaluation based on students' preparation and understanding of the theoretical background related to the experiments.

2. Conduct of Experiments (7 Marks)
- Procedure and Execution: Adherence to correct procedures, accurate execution of experiments, and following safety protocols.
- Skill Proficiency: Proficiency in handling equipment, accuracy in observations, and troubleshooting skills during the experiments.
- Teamwork: Collaboration and participation in group experiments.

3. Lab Reports and Record Keeping (6 Marks)
- Quality of Reports: Clarity, completeness and accuracy of lab reports. Proper documentation of experiments, data analysis and conclusions.
- Timely Submission: Adhering to deadlines for submitting lab reports/rough record and maintaining a well-organized fair record.

4. Viva Voce (5 Marks)
- Oral Examination: Ability to explain the experiment, results and underlying principles during a viva voce session.

Final Marks Averaging: The final marks for preparation, conduct of experiments, viva, and record are the average of all the specified experiments in the syllabus.

Evaluation Pattern for End Semester Examination (50 Marks)

1. Procedure / Preliminary Work / Design / Algorithm (10 Marks)
- Procedure Understanding and Description: Clarity in explaining the procedure and understanding each step involved.
- Preliminary Work and Planning: Thoroughness in planning and organizing materials/equipment.
- Algorithm Development: Correctness and efficiency of the algorithm related to the experiment.
- Creativity and logic in algorithm or experimental design.

2. Conduct of Experiment/Execution of Work/Programming (15 Marks)
- Set up and Execution: Proper set up and accurate execution of the experiment or programming task.

3. Result with Valid Inference/Quality of Output (10 Marks)
- Accuracy of Results: Precision and correctness of the obtained results.
- Analysis and Interpretation: Validity of inferences drawn from the experiment or quality of program output.

4. Viva Voce (10 Marks)
- Ability to explain the experiment, procedure results and answer related questions.
- Proficiency in answering questions related to theoretical and practical aspects of the subject.

5. Record (5 Marks)
- Completeness, clarity, and accuracy of the lab record submitted.

ASSESSMENT RUBRICS

Preparation and Pre-Lab Work (7 Marks)

Description	Score	Marks Scored
Fully prepared, pre-lab work complete and detailed.	7	
Well prepared with minor omissions.	6	
Good preparation, some missing points.	5	
Partially prepared, pre-lab work incomplete.	4	
Minimal preparation.	3	
Very poor preparation.	2	
Almost no preparation.	1	
Not prepared at all.	0	

Conduct of Experiments (7 Marks)

Description	Score	Marks Scored
Excellent execution, all steps followed with precision.	7	
Experiment conducted very well with minor slips.	6	
Good execution with some errors.	5	
Basic experiment done but lacks accuracy.	4	
Poor conduct, key steps missed.	3	
Very poor execution.	2	
Attempted but largely incorrect.	1	
Not done.	0	

Lab Reports and Record Keeping (6 Marks)

Description	Score	Marks Scored
Complete, neat, and accurate records.	6	
Well written with small errors.	5	
Good, but needs improvements.	4	
Incomplete or untidy.	3	
Major parts missing.	2	
Very poor record.	1	
No report submitted.	0	

Viva Voce (5 Marks)
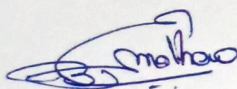
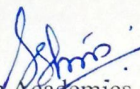| Description	Score	Marks Scored
Excellent understanding and confident answers.	5	
Good understanding with minor mistakes.	4	
Moderate knowledge with some difficulty.	3	
Poor understanding.	2	
Very limited responses.	1	
Did not attend or answer.	0	
Total marks (out of 25)		
Signature of the staff		

CERTIFICATE OF APPROVAL

This is to certify that the syllabus for the courses of **Semester 3 of the B.Tech Programme in Civil Engineering** has been reviewed and duly approved by the following academic bodies of **Vimal Jyothi Engineering College**:

1. The **Board of Studies of Civil Engineering**, in its meeting held on **29/04/2025**.

2. The **Academic Council**, in its meeting held on **12/5/2025**.
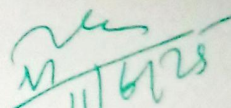
This syllabus shall be implemented **with effect from the academic year 2025–2026 onwards**.

HoD/Program Coordinator   Dean Academics   Principal