ME

VIMAL JYOTHI

ENGINEERING COLLEGE (AUTONOMOUS)

CHEMPERI - KANNUR I WWW.VJEC.AC.IN

VJEC B. Tech. Syllabus 2024

Semester III

Mechanical Engineering

Branch Code: ME

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=sinz **(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 Outcomes (COs) and Assessment Tool

Course Outcomes		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 & Assignments
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: *1.' Slight (Low), 2.- Moderate (Medium), 3. Substantial (High), - No Correlation*

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

MECHANICS OF SOLIDS

Course Code	**PCMET302**	**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 acquaint with the basic concepts of stress and deformation in solids.
2. To practice the methodologies to analyze stresses and strains in simple structural members, and to apply the results in simple design problems.

SYLLABUS

Module No	Syllabus Description	Contact Hours
1	**Introduction to analysis of deformable bodies.** Types of external loads- Types of stresses- Normal, Shear, Bending and Bearing stresses. Linear and Shear strains. Hooke's law - Stress-Strain diagrams. Concepts of Isotropy, Orthotropy, Anisotropy. (Self-study) Young's Modulus, Bulk Modulus and Rigidity Modulus. Poisson's ratio - Relationship between elastic constants (No derivations required). (Self-study) Deformation in axially loaded bars –uniform cross section, varying cross section, dissimilar materials, principle of superposition. Thermal effects – basic problems only. (Thermal effects of dissimilar materials are not required)	**11**

2	**Torsion:** Shafts - torsion theory of elastic circular bars – assumptions and limitations – polar modulus - torsional rigidity – shaft design for torsional load. **Beams:** Classification - Diagrammatic conventions for supports and loading, Differential equations between load, Shear Force and Bending Moment- Shear Force and Bending Moment Diagrams of Cantilever and Simply supported beam with Point load/UDL. Point of Inflection.	**11**
3	**Stresses in Beams:** Pure Bending – Flexure formula for beams - assumptions and limitations – Section Modulus - Flexural Rigidity- derivation and problems for rectangular section only. **Shear stress formula for beams:** (Derivation not required), shear stress distribution for a rectangular section. **Deflection of Beams:** Moment-Curvature relation (Derivation is not required) – assumptions and limitations - Double Integration method – Macaulay's method.	**11**
4	Stress on an inclined plane due to Uniaxial stress- Stress on an inclined plane due to Biaxial stress- Stress on an inclined plane due to two Normal Stresses accompanied by Shear stresses- principal planes and stresses, Mohr's circle of stress. Three-dimensional state of stress at a point- stress tensor-strain tensor- Generalized Hook's law. (Introductory concepts only) Buckling and stability of long columns-Euler's buckling/crippling load for columns with different end conditions- Euler equation derivation for both ends hinged only- Rankine's formula.	**11**

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

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment	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 x 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 x 9= 36 marks)**	**60**

Course Outcomes (COs) and Assessment Tool

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

Course Outcomes		Bloom's Knowledge Level (KL)	Assessment Tool
CO1	Apply the fundamental concepts of stress, strain, and deformation in solids to solve problems involving axially loaded bars and problems involving thermal effects.	**K3**	Written Exam & Assignments
CO2	Analyze torsional effects in shafts and the shear force and bending moment distributions in beams under various loading and support conditions.	**K4**	
CO3	Apply flexure and shear stress formulas to beams and solve problems involving stress distribution and deflection using mathematical methods	**K3**	
CO4	Analyze stress transformations and principal stresses using Mohr's circle and evaluate the stability and buckling behavior of columns under various end conditions.	**K4**	

CO-PO Mapping Table

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	-	-	2	-	-	-	-	-	2
CO2	3	3	2	-	2	-	-	-	-	-	2
CO3	3	2	2	2	2	-	-	-	-	-	2
CO4	3	3	-	3	2	-	-	-	-	-	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	Mechanics of Solids	R.K. Bansal	Laxmi Publications	2012
2	Mechanics of Solids	S. S. Bhavikatti	New Age International	2013
3	Strength of Materials	Surendra Singh	S. K. Kataria & Sons	2013
4	Strength of Materials	Rattan	McGraw Hills	2011
5	Mechanics of Materials	Beer & Johnston	McGraw Hills	2017

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Mechanics of materials	R. C. Hibbeler	Pearson Higher Education	2018
2	Engineering Mechanics of Solids	Popov E	PHI	2002
3	Mechanics of Materials	Pytel A. and Kiusalaas J.	Cengage Learning India Private Limited,	2015

Video Links (NPTEL, SWAYAM…)	
Sl. No.	**Link ID**
1	https://onlinecourses.nptel.ac.in/noc22_ce46/preview

SEMESTER S3
FLUID MECHANICS AND MACHINERY

Course Code	**PCMET303**	**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)	**None**	**Course Type**	**Theory**

Course Objectives:

1. To establish fundamental knowledge of basic fluid mechanics and its simple applications.
2. To familiarize students with the relevance of turbo machines and find solutions to the associated engineering problems.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	**Introduction to fluid mechanics**-definition of fluids, stress, continuum approach, Properties of fluid: Specific gravity, Specific Weight, Specific Volume, Dynamic and Kinematic Viscosity- Types of fluids, Newton's law of viscosity. Pressure Measurement: Fluid pressure, Pressure head, Types of pressures. Piezometer, Simple, differential Manometers. Fluid statics: Pressure, density, height relationship. Hydrostatic force and pressure on plane and inclined surfaces, Centre of pressure. Buoyancy and Metacenter, Stability of immersed and floating bodies (Self –Study)	**10**
2	**Fluid kinematics:** Description of fluid motion, Eulerian and Lagrangian approaches, Types of flows, Material derivative velocity and acceleration – Streamlines, path lines and streak lines, Stream function and velocity potential function, flow net. **Fluid dynamics**: Continuity equation, Euler's, and Bernoulli's equations., Flow rate measuring instruments- Orifice meter, Venturimeter, & flow velocity measurement instruments Pitot tube, Rectangular and Triangular Notches (Self -Study) (Notches-Problems not required)	**10**

3	**Pipe flow – laminar and turbulent flows**, significance of Reynolds number, shear stress and velocity distribution in a pipe flow.– Hagen- Poiseullie equation, Darcy-Weisbach equation and Chezy's equation , Moody's chart for estimating frictional losses (Self-Study), Major and minor energy losses hydraulic gradient line and total energy line , Navier-Stokes equation and explanation (without proof), Dimensional analysis using Buckingham's π theorem. Important non dimensional numbers and their significance, Types of similarities, model analysis. Boundary layer theory, Qualitative comparison between laminar and turbulent boundary layer. Boundary layer separation.	**12**
4	**Impact of jets**: Impact of jet on fixed vertical, moving vertical flat plates. Impact of jet on curved vanes – fixed and moving. Velocity triangles. Classification of Turbines and pumps Comparison and examples. Pelton, Francis and Kaplan Turbines: Principle and working, head, work done, efficiencies (Problems using velocity triangles not required). Centrifugal Pumps: Principle and working, head, work required, efficiencies, Priming and cavitation. (Problems using velocity triangles not required). Reciprocating Pump: Principle and working – slip, negative slip, work required and efficiency (Problems using acceleration head & indicator diagrams are not required)	**12**

Course Assessment Method

(CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Micro project	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 Tool

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

Course Outcomes		Bloom's Knowledge Level (KL)	Assessment Tool
CO1	Identify the fundamental fluid properties, their relationships and apply them to estimate the fluid pressure and hydrostatic forces on bodies	K3	Written exams & Assignments
CO2	Distinguish the types of fluid flow and apply the principles of kinematics and dynamics using the conservation of mass and momentum equations.	K4	
CO3	Estimate friction and minor losses in internal flows and Analyze boundary layer formation over an external surface	K4	
CO4	Apply dimensional analysis to predict physical parameters that influence the fluid flows in model studies.	K3	
CO5	Select and design a suitable turbo machine for specific application by identifying the pertinent parameters	K4	

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	2	2	-	-	-	-	-	-	-	-
CO2	3	3	2	3	-	-	-	-	-	-	2
CO3	3	3	2	3	-	-	-	-	-	-	2
CO4	3	2	2	2	-	-	-	-	-	-	2
CO5	3	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	Fluid Mechanics	Cengel Y. A. and J.M. Cimbala	Tata McGraw Hill	2017
2	Introduction to Fluid Mechanics and Fluid Machines	Som S.K.	McGraw Hill Education India	2011
3	Fluid Mechanics and Hydraulic Machines	Bansal R.K.	Laxmi Publications	2005
4	Fluid Mechanics	Pijush K Kundu, Cohen, I. M., and Dowling,	Elsevier.	2012
5	Fluid Mechanics and Its Applications	Gupta, V., and Gupta, S. K	New Age International Private	2015

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Fluid Mechanics	Fox, McDonald, P.J Pritchard,	John Wiley and Sons.	2018
2	Mechanics of Fluids ,	Shames, I. H	McGraw Hill Education.	2013
3	Fluid Mechanics	Frank M. White, Henry Xue	McGraw-Hill Education	2021
4	Engineering applications of Fluid dynamics	Fisher and Henly	Willford Press	2023
5	Fluid Mechanics	Streeter, V., Wylie, E. B., and Bedford, K. W	McGraw Hill.	2017

Video Links (NPTEL, SWAYAM…)	
Module No.	**Link ID**
1	Fluid Statics https://www.youtube.com/watch?v=rY7bvZn75Do&list=PLwdnzlV3ogoWrAmpEcsPXayfsXnFf YY1O&index=4 Bouyancy, Metacentre and stability https://www.youtube.com/watch?v=gMuucNxc7eI&list=PLwdnzlV3ogoV-ATGY2ptuLS9mwLFOJoDw&index=7&pp=iAQB
2	Fluid kinematics https://www.youtube.com/watch?v=rY7bvZn75Do&list=PLwdnzlV3ogoWrAmpEcsPXayfsXnFfYY1O&index=4
3	Internal Viscous Flow https://www.youtube.com/watch?v=qLx7ip0eBps&list=PLCoE5wxWtHFYiVGswvsWRaHjv18vxZzE2&index=17
4	Introduction to turbomachines https://www.youtube.com/watch?v=ocVzrn4DLj8&list=PLbMVogVj5nJQQp3QLuzbcHrt0XncZZTiE&index=2

SEMESTER S3

MANUFACTURING PROCESSES

Course Code	PBMET304	CIE Marks	60
Teaching Hours/Week (L: T:P: R)	3:0:0:1	ESE Marks	40
Credits	4	Exam Hours	2 Hrs.
Prerequisites (if any)	None/ (Course code)	Course Type	Theory

Course Objectives:

1. To gain theoretical and practical knowledge in manufacturing processes and to develop an understanding of the dependent and independent variables that control production processes.
2. Provide a detailed discussion on the welding process and the physics of welding. Introduce students to different welding processes weld testing and advanced processes to be able to appreciate the practical applications of welding.
3. Generate solutions to problems that may arise in manufacturing engineering.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	General Classification of Manufacturing Processes. Casting-Characteristics of sand (Self-Study), design of patterns, cores, chaplets, solidification of metals and Chvorinov's rule, elements of gating system, risers, chills, numerical problems, defects in castings (Self-Study). Special casting process- Shell moulding, precision investment, die casting, centrifugal casting, continuous casting and squeeze casting. Powder Metallurgy- Powder Production, powder characteristics, mixing, compaction methods, sintering.	9
2	Welding: Classification, Fusion and Solid-state welding processes Gas Welding - Oxyacetylene welding (Self-Study)-chemistry, types of flame and its applications Arc welding- applications, process parameters, numerical problems, consumable and non-consumable arc welding, SMAW; GTAW; GMAW; SAW; AHW; PAW.Friction welding, electro slag welding, ultrasonic welding, electron beam welding, laser beam welding Resistance welding applications, process parameters, numerical problems Heat Affected Zone, weldability of ferrous and non-ferrous metals, residual stresses and distortion, defects in welding Brazing - soldering - adhesive bonding (Self-Study)	9

3	Metal Forming: Plastic deformation and yield criteria − hot and cold working processes Rolling- Flat-rolling process, rolling force and power, numerical problems, types of rolling mills, rolling defects, miscellaneous rolling processes. Sheet metal operations (Self-Study)- Press tool operations- Shearing, Tension, Compression, Tension and compression operations, applications, numerical problems. Types of Progressive dies, Compound dies, and Combination dies	**9**
4	Forging-Forging load, numerical problems, Various methods, applications, defects in forging - Wire, Rod, and tube drawing - mechanics of rod and wire drawing, drawing force and power, numerical problems, drawing defects – Deep drawing. Bending – Details of bending, Determination of work load, estimation of spring back, numerical problems. Extrusion- Metal flow, mechanics of extrusion, numerical problems, miscellaneous processes, defects in extrusion, applications (Self-Study)	**9**

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

Continuous Internal Evaluation Marks (CIE):

Attendance	Mini project	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Internal Examination- 3 (Written)	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 1 question should be answered. • Each question can have a maximum of 2 sub divisions. **(4x6 = 24 marks)**	**40**

Course Outcomes (COs) and Assessment Tool

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

Course Outcomes		Bloom's Knowledge Level (KL)	Assessment Tool
CO1	Classify different techniques of casting	**K2**	Written exam & Mini Project
CO2	Summarize powder metallurgy processes	**K2**	
CO3	Categorize welding processes according to welding principles and materials.	**K2**	
CO4	Determine forming load associated with rolling, forging, drawing, extrusion, and sheet metal forming	**K3**	
CO5	Develop products, processes or technologies for socially relevant applications.	**K3, K4, K5**	

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	-	-	-	-	-	-	-	2	-
CO2	3	3	-	-	-	-	-	-	-	2	-
CO3	3	3	2	-	-	-	-	-	-	2	-
CO4	2	3	2	-	-	-	-	-	-	2	-
CO5	3	3	3	-	3	3	-	2	-	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	Manufacturing Science	Amitabha Ghosh Asok Kumar Mallik	Affiliated East-West Private Limited	2nd Edition 2010
2	Manufacturing Engineering and Technology	SeropeKalpakjian Steven R. Schmid	Pearson	
3	Manufacturing Technology Volume -1	P N Rao	Tata McGraw Hill	
4	Fundamentals of Modern Manufacturing	Mikell P. Groover	JOHN WILEY & SONS, INC.	4th Edition 2010
5	Introduction to Manufacturing Processes	John A. Schey	Boston : McGraw-Hill	3 rd Edition 2010
6	Materials and Processes in Manufacturing	E. Paul DeGarmo, J. T. Black & Ronald A. Kohser	JOHN WILEY & SONS, INC	9th Edition 2012
7	Manufacturing Processes	H.N. GuptaR.& C. Gupta	New Age International (P) Ltd., Publishers	2nd Edition 2009
8	Metal Forming: Mechanics and Metallurgy	William F. Hosford and Robert M. Caddell	Cambridge University Press	Fourth Edition (2011)

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	American Society for Metals - ASM Metals Handbook, Vol. 14	Joseph R. Davis, S. L. Semiatin,	Forming and Forging ASM International	1989
2	Tool design	Donalson cyril, LeCain, Goold, Ghose:-	McGraw Hill	
3	Cold and Hot Forging Fundamentals and Applications	Taylan Altan, Gracious Ngaile, Gangshu Shen	ASM International	2004
4	Foundry Technology	Peter Beeley	Butterworth-Heinemann	
5	Manufacturing Processes and Systems.	Phillip F. Ostwald & Jairo Muñoz	JOHN WILEY & SONS, INC.	9th Edition January 1997
6	Manufacturing Science	Amitabha Ghosh and Asok Kumar Mallik	East-West Press Pvt. Ltd	2nd Edition 2010
7	Fundamentals of Metal Forming –	Robert H. Wagoner and Jean-Loup Chenot	Cambridge University Press	First Edition (2001)
8	Manufacturing Science	Amitabha Ghosh and A.K. Mallik	East-West Press	: Second Edition (2010)

PBL Course Elements

L: Lecture (3 Hrs.)	**R: Project (1 Hr.), 2 Faculty Members**		
	Tutorial	**Practical**	**Presentation**
Lecture delivery	Project identification	Simulation/ Laboratory Work/ Workshops	Presentation (Progress and Final Presentations)
Group discussion	Project Analysis	Data Collection	Evaluation
Question answer Sessions/ Brainstorming Sessions	Analytical thinking and self-learning	Testing	Project Milestone Reviews, Feedback, Project reformation (If required)
Guest Speakers (Industry Experts)	Case Study/ Field Survey Report	Prototyping	Poster Presentation / Video Presentation: Students present their results in a 2 to 5 minutes video

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**

Project Assessment and Evaluation criteria (35 Marks)

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
- Final Result

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

List of mini-projects

1. Sand Casting of a spur gear

Abstract:
This project involves designing a simple pattern, preparing a sand mold, and casting an aluminum or mild steel component. The effect of different molding sand properties on casting quality is analyzed.

2. Design and Fabrication of a Gating System

Abstract:
A well-designed gating system improves casting quality by controlling metal flow. This project optimizes sprue, runner, and riser design.

3. Powder Metallurgy – Compacting and Sintering of Metal Powders

Abstract:
Powder metallurgy is used to make precision metal parts. This project produces simple sintered parts using metal powders, compacting dies, and heat treatment.

4. Effect of Welding Current on Weld Bead Characteristics

Abstract:
This project analyzes how varying welding current affects weld bead width, penetration, and strength in SMAW welding.

5. Gas Welding – Flame Characteristics and Weld Strength Analysis

Abstract:
This project studies the effect of different oxyacetylene flames (neutral, carburizing, oxidizing) on weld quality.

6. Comparative Study of MIG, TIG, and Arc Welding

Abstract:
This project compares the strength, heat input, and distortion of welds produced by MIG, TIG, and SMAW welding.

7. Spot Welding Experiment on Thin Metal Sheets

Abstract:
Spot welding is widely used in the automobile and sheet metal industries. This project measures the strength of spot-welded joints.

8. Analysis of Heat-Affected Zone (HAZ) in Welding

Abstract:
The heat-affected zone (HAZ) influences weld properties. This project studies HAZ using a microscope and hardness tester.

9. Design and Fabrication of a Simple Hand-Operated Sheet Metal Bender

Abstract:
This project involves making a manual sheet metal bending tool for small-scale operations. The tool is designed to bend thin metal sheets at various angles.

10. Experimental Study of Extrusion Process.

Abstract:
Extrusion is a metal forming process where a billet is forced through a die to achieve a desired cross-section. This experiment investigates the direct extrusion of aluminum to analyze surface finish, defects, and material flow.

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. Recurrent networks(Self-study)	**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). Gradient Descent (Self-study)	**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) Bayesian Statistics (Self-study)	**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.	**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 Outcomes		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 & Micro Project
CO2	Apply advanced mathematical concepts such as matrix operations, singular values, and principal component analysis to analyze and solve engineering problems**.**	**K3**	
CO3	Analyze and interpret data using statistical methods including descriptive statistics, correlation, and regression analysis to derive meaningful insights and make informed decisions.	**K3**	
CO4	Integrate statistical approaches and machine learning techniques to ensure practically feasible solutions in engineering contexts.	**K3**	

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

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

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, 2022
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 //efaidnbmnnnibpcajpcglclefindmkj/ https://www.math.arizo	Preliminary Edition.

SEMESTER S3/S4
ECONOMICS FOR ENGINEERS
(Common to All Groups)

Course Code	**UCHUT346**	**CIA 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 (Self-study) – 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 (Self-study) – 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 (Self-study) - 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) and Assessment Tool

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

Course Outcomes		Bloom's Knowledge Level (KL)	Assessment Tool
CO l	Understand the fundamentals of various economic issues using laws and learn the concepts of demand, supply, elasticity and production function.	K2	Written exam & 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

	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), -NoCorrelation

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
COMPUTER AIDED MACHINE DRAWING & MODELLING

Course Code	**PCMEL307**	**CIE 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 introduce modern CAD packages for drafting and modelling of engineering components.
2. To create a digital mockup of engineering components

SYLLABUS

Expt. No.	Exercises
Part A	Understand the basics of machine drawing, including BIS code of practice, types of lines, dimensioning, scales of drawing, sectional views, geometric tolerances, and the importance of GD&T. Additionally, to practice, simple 2D sketches to familiarize with these concepts. Learn and practice drawing different types of rigid shaft couplings used for connecting shafts with collinear axes using 2D drafting software (Flange Coupling, Protected Flange Coupling etc.). Understanding Basics of Assembly Drawings using 2D drafting software and creating a 2D Assembled Drawing with required Sectional Views (Universal coupling, knuckle joint, plummer block, connecting rod etc.). Understanding Basics of Assembly Drawings using 2D drafting software and creating a 2D Assembled Drawing with required Sectional Views and prepare BOM (Stuffing Box). Use of geometrical dimensioning and tolerancing (GD & T) in drawing. (Minimum 5 Nos.)
Part B	Creating 3D machine components (Minimum 4 Nos). Creating 3D assembly models of Socket and spigot joint, Gib and Cotter Joint, Knuckle Joint, Rigid flange couplings, Bushed Pin flexible coupling, Plummer block, Screw jack etc. Modelling of surfaces of the given geometry like helmet, mouse, fender of automobiles etc. Parametric modelling of standard parts such as nuts, bolts, rivets, washers etc. (Minimum 3 Nos).
Out of 12 exercises, 5 should be from Part A and 7 should be from Part B	

LIST OF EXERCISES

Sl. No.	Name of the exercise
STUDY (COMPULSORY)	
1	Study of BIS Codes, limits, fits, geometric dimensioning and tolerancing, types of lines, bill of materials (BOM), and basics of computer aided design.
2D DRAWING USING ANY DRAFTING SOFTWARE (ANY FIVE EXERCISES)	
2	2D drawing of Unprotected Type Flange Coupling.
3	2D drawing of Protected Type Flange Coupling.
4	2D assembly drawing of Universal Coupling.

5	2D assembly drawing of Knuckle Joint.
6	2D assembly drawing of Plummer Block.
7	2D assembly drawing of Connecting Rod.
8	2D assembly drawing of Stuffing Box.
9	2D assembly drawing of Feed Check Valve.
10	2D assembly drawing of Bench Vice.
11	2D assembly drawing of Foot Step Bearing.
SOLID MODELLING USING ANY 3D MODELLING SOFTWARE (ANY FOUR EXERCISES)	
12	Solid Modelling of T – Block.
13	Solid Modelling of Latch Bracket.
14	Solid Modelling of Cylindrical Block.
15	Solid Modelling of End Bracket.
16	Solid Modelling of Cast Iron Block.
17	Solid Modelling of Bearing Block.
18	Solid Modelling of Shaft Support.
19	Solid Modelling of Machine Block.
20	Solid Modelling of Centering Bearing.
ASSEMBLY MODELLING USING ANY 3D MODELLING SOFTWARE (ANY THREE EXERCISES)	
21	Assembly modelling of Socket and Spigot Joint.
22	Assembly modelling of Rigid Flange Coupling
23	Assembly modelling of Gib and Cotter joint.
24	Assembly modelling of Bushed Pin Flexible Coupling.
25	Assembly modelling of Knuckle Joint.
26	Assembly modelling of Plummer Block.
27	Assembly modelling of Screw Jack.
28	Assembly modelling of Cross Head (Vertical – Type 1).
29	Assembly modelling of Sleeve and Cotter Joint.
30	Assembly modelling of Steam Stop Valve (Type 1).
ADVANCED EXERCISES USING ANY CAD SOFTWARE (SELF LEARNING EXERCISES FOR STUDENTS TO ENHANCE THEIR CREATIVITY AND EMPLOYABILITY) – NOT COMPULSORY IN EVALUATION	
31	Solid Modelling of a Drone Frame.
32	Solid Modelling of a Robotic Arm.
33	Solid Modelling and Assembly of a Bicycle.
34	Solid Modelling and Assembly of a Small Gearbox.
35	Solid Modelling of a Piston – Cylinder Assembly.

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

Continuous Internal Evaluation Marks (CIE):

Attendance	Daily evaluation based on drafting or modelling tool usage, dimensioning, accuracy, timely completion, and viva voce	Internal / series Examination	Total
5	25	20	50

End Semester Examination Marks (ESE):

Proper usage of drafting or modelling tool	Timely completion of given drawing with accuracy and dimensioning	Viva voce	Record	Total
10	20	10	10	50

Note: Students shall be allowed for the end semester examination only upon submitting the duly certified record by Faculty – in – charge and Head of the department (Head of the department should be the head of the faculty – in – charge). The external examiner shall endorse the record.

Course Outcomes (COs)

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

Course Outcomes		Bloom's Knowledge Level (KL)
CO1	Apply geometric dimensioning and tolerancing, types of lines, and bill of materials in drawing of various engineering components.	K3
CO2	Construct two – dimensional drawing of components using in engineering and technology with the aid of drafting software.	K3
CO3	Develop three – dimensional drawing of machine components using in engineering and technology with the aid of 3D modelling software.	K3
CO4	Develop three – dimensional assembly drawing of components using in engineering and technology with the aid of 3D modelling software.	K3

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

CO- PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	-	2	2	2	3	-	2	3	-	2
CO2	3	-	2	2	2	3	-	2	3	-	2
CO3	3	-	2	2	2	3	-	2	3	-	2
CO4	3	-	2	2	2	3	-	2	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	Geometric Dimensioning and Tolerancing	James D. Medows	James D. Meadows & Associates, Inc.	
2	Fundamentals of Geometric Dimensioning and Tolerancing	Alex Krulikowski	Delmar Cengage Learning	
3	CAD, 3D Modeling, Engineering Analysis, and Prototype Experimentation	Jeremy Zhang Li	Springer	2015th Edition

Video Links (NPTEL, SWAYAM…)	
Module No.	**Link ID**
Part A and B	Engineering Graphics and Design: https://archive.nptel.ac.in/courses/112/102/112102304/ Engineering drawing and computer graphics: https://archive.nptel.ac.in/courses/112/105/112105294/

Daily Evaluation (25 Marks)

1. **Drafting or modelling tool usage (5 Marks):**

- Clarity about the software and proper usage of commands for drawing the given exercise using drafting / modelling software.

2. **Dimensioning (5 Marks):**

- Observing and following proper dimensions of the given exercise.

3. **Accuracy (5 Marks):**

- Observing and accurately replicating the given exercise using drafting / modelling software.

4. **Timely completion (5 Marks):**

- Completing the given drawing using drafting / modelling software within the stipulated time and submitting the record with drawing or model, procedure, and result.

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

- Ability to explain the exercise, results and underlying principles or usage of the object / mechanism given during a viva voce session.

Final Marks Averaging: The final marks for daily evaluation are the average of all the specified exercises in the syllabus. The total mark out of 25 will be calculated by adding drafting or modelling tool usage, dimensions, accuracy, timely completion, and viva voce.

Category	Score	5	4	3	2	1
Drafting or modelling tool usage		Appropriate drafting or modelling tools are selected and executed for drawing the 2D drawing or Solid / Assembly modelling.	Drafting or modelling tools used are appropriate, however, are time consuming and not specific for ease of usage.	Most of the drafting or modelling tools used are appropriate. However, certain errors are generated while executing them due to inappropriate usage.	Drafting or Modelling tools used are not appropriate and errors are generated frequently.	Lack of usage of appropriate drafting modelling tools and errors are generated very frequently.
Dimensioning		All dimensions applied for generating models are matching with the draft diagram.	Almost all dimensions applied for generating models are matching with the draft diagram.	Most of the dimensions applied for generating models are matching with the draft diagram.	Frequent errors are found in dimensioning and profile of the geometry is deviating from the draft diagram.	Errors are found in dimensioning and profile of the geometry is not matching with the draft diagram.
Accuracy		2D drawing or Solid / Assembly modelling was completed accurately with all the features as given in the draft diagram.	2D drawing or Solid / Assembly modelling was completed accurately with almost all of the features as given in the draft diagram.	2D drawing or Solid / Assembly modelling was completed accurately with several of the features as given in the draft diagram.	2D drawing or Solid / Assembly modelling was completed with features as given in the draft diagram and found some errors.	2D drawing or Solid / Assembly modelling was completed with features as given in the draft diagram and found many errors.
Timely completion		Given 2D drawing or Solid / Assembly modelling was completed within the allotted time.	Almost all of the given 2D drawing or Solid / Assembly modelling was completed within the allotted time.	Most of the given 2D drawing or Solid / Assembly modelling was completed within the allotted time.	Given 2D drawing or Solid / Assembly modelling was completed within the allotted time with some missing parts.	Given 2D drawing or Solid / Assembly modelling was not completed within the allotted time.
Score out of 20						
Viva Voce		Have good knowledge and communicate the concepts clearly and fluently.	Answers are correct, having an overall idea.	Some answers are correct.	A few answers are communicated clearly or correctly.	Unable to communicate and unaware of most of the ideas.
Total Marks out of 25			**Signature of Faculty**			

Evaluation Pattern for End Semester Examination (50 Marks)

1. **Proper usage of drafting or modelling tool (10 Marks):**

- Clarity in the procedure required for drawing the given exercise and understanding each step involved.
- Clarity about the software and proper usage of commands for drawing the given exercise.

2. **Timely completion of given drawing with accuracy and dimensioning (20 Marks):**

- Completing the given drawing using drafting / modelling software within the stipulated time.

3. **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.

4. **Record (10 Marks)**

- Completeness, clarity, and accuracy of the lab record submitted.

SEMESTER S3

MATERIALS TESTING LAB

Course Code	**PCMEL308**	**CIE 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. Characterize the mechanical behavior of materials under various loading conditions.
2. Relate material properties and microstructure to engineering applications.

SYLLABUS

Expt. No.	**Experiments** (A minimum of 12 experiments are to be performed.)
1	Evaluate the tensile properties of a ductile material (mild steel, high-strength steel, or tor-steel) using a Universal Testing Machine (UTM) equipped with an extensometer.
2	Conduct compressions test on a ductile material (mild steel, tor-steel, or high-strength steel) using a Universal Testing Machine (UTM).
3	Determine the tensile properties of cast iron (a brittle material) using a Universal Testing Machine (UTM) equipped with an extensometer.
4	Determine the shear strength of a mild steel rod using a shear test.
5	Perform Brinell/Vickers/Rockwell hardness tests on a given material
6	Determine the torsional rigidity of mild steel/copper/brass rods.
7	Evaluate the flexural stiffness (flexural rigidity) of mild steel/copper/brass specimens using a three-point bend test on a Universal Testing Machine (UTM)
8	Determine the notch toughness of the material at room temperature using Izod and Charpy impact testing.
9	Investigate the effect of coil type (close-coiled vs. open-coiled) and arrangement (series vs. parallel) on spring stiffness.
10	Microstructure of mild steel/copper/ brass/aluminium using optical microscope, double disc polishing machine, emery papers and etchant.
11	Analyze the fracture surface morphology of a ductile or brittle material using an optical microscope for fractographic characterization.
12	Evaluate the fracture toughness of a material with a Universal Testing Machine (UTM)
13	To study the procedure for plotting S-N curve using Fatigue testing machine
14	Perform stress analysis using photo elasticity.

15	Measure the deformation (strain) of an object using strain gauges.
16	Perform a bending test on a wooden beam to assess its load-carrying capacity.

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

Continuous Internal Evaluation Marks (CIE):

Attendance	Daily evaluation based on drafting or modelling tool usage, dimensioning, accuracy, timely completion, and viva voce	Internal / series 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	Apply the procedures for conducting tensile and compression tests on various engineering materials using a Universal Testing Machine (UTM).	**K3**
CO2	Analyze the behavior of materials under bending and torsion by conducting bending tests on wooden or mild steel sections and torsion tests on wires and circular shafts.	**K4**
CO3	Apply appropriate methods to determine the stiffness of closed-coiled and open-coiled springs through experimentation.	**K3**
CO4	Apply metallographic techniques and standard hardness testing methods (Brinell, Vickers, and Rockwell) to evaluate the microstructural features and hardness of engineering materials.	**K3**
CO5	Analyze the fracture toughness of various engineering materials using Izod and Charpy impact testing methods.	**K3**

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

CO- PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	2	2	3	-	3	2	-	2
CO2	3	3	2	3	2	3	-	3	2	-	2
CO3	2	2	2	2	2	3	-	3	2	-	2
CO4	2	2	2	2	2	3	-	3	2	-	2
CO5	3	3	2	3	2	3	-	3	2	-	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	Callister's Materials Science and Engineering	D. Wayne Callister and David G. Rethwisch	Wiley	10th Ed (2018)
2	Mechanical Testing and Evaluation	Howard Kuhn; Dana Medlin	ASM International	Volume 8 (2000)

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Mechanics of Materials	James M. Gere and Barry J. Goodno	Cengage Learning	9th Ed (2022)
2	Introduction to Materials Science for Engineers	James F. Shackelford	Pearson	8th Ed (2022)

Video Links (NPTEL, SWAYAM…)	
Module No.	**Link ID**
1	https://onlinecourses.nptel.ac.in/noc23_mm38/preview
2	https://archive.nptel.ac.in/courses/112/107/112107146/
3	https://archive.nptel.ac.in/courses/112/106/112106293/

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)**
   - 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.

RUBRICS FOR EVALUATION

Category	Score	7	6	5	4	3	2	1
Preparation and Pre-Lab Work (7 marks)		Procedure is followed thoroughly and experiment is conducted accurately with proper documentation	Procedure is followed correctly and experiment is conducted efficiently with minimal errors.	Procedure is followed and experiment is conducted with moderate accuracy.	Procedure is followed partially and experiment is conducted with minor errors.	Procedure is not followed properly and experiment not conducted properly.	Procedure is not followed properly and experiment conducted with difficulty.	Procedure is followed and experiment conducted with difficulty but conducted in good manner.
Conduct of Experiments (7 marks)		The readings/observations are taken with excellent precision, tabulated systematically.	The readings/observations are taken with high accuracy, tabulated correctly.	The readings/observation are taken accurately and tabulated neatly.	The readings/observation are taken and tabulated	The readings/observation are taken with few errors and tabulated	The readings/observation are taken with inaccuracy and not tabulated correctly	The readings/observation taken with errors and not tabulated
Quality of Output (2 marks)		-	-	-	-	-	Formulas used correctly and steps to solutions are very accurate.	Formulas used correctly and steps and solution has no errors
Results with valid inference (2 Marks)		-	-	-	-	-	Determined results from the observations. Units are specified. Inference is completed	Results are in a range. Units are mentioned &Inference is completed
Graphs and Sketches (2 Marks)		-	-	-	-	-	Graphs and sketches are neat and clear and all points plotted very accurately	Graphs and sketches made and all points plotted accurately

Score out of 20								
Viva voce (5 marks)	-	-	-	Have good knowledge, communicates clearly and fluently	Answers are correct, have overall idea	Some answers are correct	A few answers are communicated clearly or correctly	Unable to communicate/ unaware of most of the ideas
Attendance (5 Marks)								
Total marks out of 30						**Signature of the faculty**		

CERTIFICATE OF APPROVAL

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

1. The **Board of Studies in Mechanical Engineering**, in its meeting held on **23/04/2025.**
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