Dr. MAHALINGAM
COLLEGE OF ENGINEERING AND TECHNOLOGY
Udumalai Road, Pollachi, Coimbatore District - 642003
Established in 1998 ♦ Approved by AICTE ♦ Affiliated to Anna University
(A DIVISION OF NIA EDUCATIONAL INSTITUTIONS)
NAAC A++ GRADE
Cycle 3 (2023-2030)
The Highest Grade

Curriculum and Syllabi

Semesters I to VI

Regulations 2023

Programme: B.E. Mechanical Engineering
Curriculum and Syllabi: Semester I to VI
Recommended by Board of Studies on:
Approved by Academic Council on:

Action	**Responsibility**	**Signature of Authorized Signatory**
Designed and Developed By		
Compiled By	Office of Controller of Examination	
Approved By	Principal	

Dr. Mahalingam College of Engineering and Technology, Pollachi – 642003.

(An autonomous institution approved by AICTE and affiliated to Anna University)

Department of Mechanical Engineering

Vision

To transform students from background into professional leaders of tomorrow in the field of mechanical engineering with strong sense of social commitment.

Mission

- To impart quality –engineering education leading to specialization in the emerging areas of CAD/CAM/CAE, Energy Engineering and Materials Technology.
- To provide continually updated and intellectually stimulating environment to pursue research and consultancy activities.

Dr. Mahalingam College of Engineering and Technology, Pollachi – 642003.

(An autonomous institution approved by AICTE and affiliated to Anna University)

Programme Educational Objectives (PEOs)

B.E. Mechanical Engineering graduates will:

PEO1.Technical Expertise: Actively apply technical and professional skills in engineering practices towards the progress of the organization or the entrepreneurial venture in competitive and dynamic environment.

PEO2.Lifelong Learning: Own their professional and personal development by continuous learning and apply the learning at work to create new knowledge.

PEO3.Ethical Knowledge: Conduct themselves in a responsible, professional and ethical manner supporting sustainable economic development which enhances the quality of life.

Programme Outcomes (POs)

Engineering Graduates will be able to:

1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

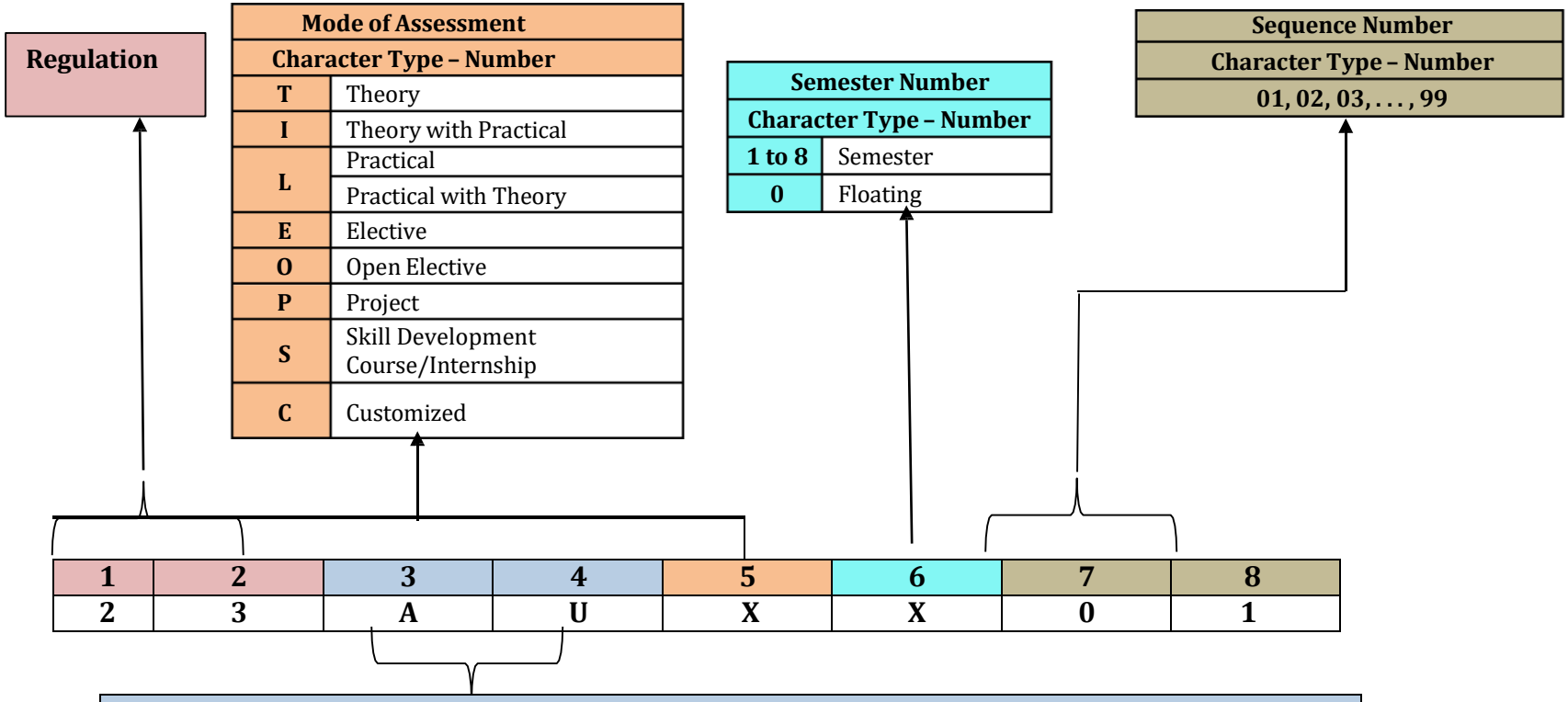
Programme Specific Outcomes (PSOs)

On successful completion of B.E. Mechanical Engineering programme, graduating students/graduates will be able to:

PSO 1: Demonstrate functional competencies for roles in design, manufacturing and service by learning through centers of excellence and industrial exposure.

PSO 2: Demonstrate behavioural competencies required for roles in design, manufacturing and service by learning through structured professional skills training.

Dr. Mahalingam College of Technology, Pollachi
2023 Regulations - Course Code Generation Procedure for UG Courses



Board/Department/Programme/Course Type			
Character Type – Alphabet			
AD	Artificial Intelligence & Data Science	**ME**	Mechanical
AM	CSE (Artificial Intelligence & Machine Learning)	**SC**	CSE (Cyber Security)
AU	Automobile	**PH**	Physics
CE	Civil	**CH**	Chemistry
CS	Computer Science	**EN**	English
EA	Advanced Communication Technology	**MA**	Mathematics
EC	Electronics and Communication	**ES**	Employability Skills
EE	Electrical and Electronics	**VA**	Value Added Course
EV	VLSI Design & Technology	**SA**	Studio Activities
IT	Information Technology		

Programme: B.E. Mechanical Engineering
2023 Regulations (2023 batch only)

Course Category	Course Code	Course Title	Duration	Credits	Marks
VAC	23VAL101	Induction Program	3 Weeks	-	100

Semester I

Course Category	Course Code	Course Title	Hours/Week			Credits	Marks	Common to Programmes
			L	T	P			
AEC	23ENI101	Communication Skills I	2	0	2	3	100	All
Minor	23MAI102	Matrices and Calculus	3	0	2	4	100	AU, EA, EC,EE, EV, ME
Minor	23PHT102	Physics for Mechanical Sciences	3	0	0	3	100	AU,ME
Multi-disciplinary	23ADT101	Python Programming for Mechanical Sciences	3	0	0	3	100	AU,ME
Major	23MEL001	Engineering Drawing	1	0	3	2.5	100	AD, AM, AU, CS, EA ,EC, EE, EV,IT,ME, SC
Minor	23PHL102	Physics for Mechanical Sciences Laboratory	0	0	3	1.5	100	AU,ME
Multi-disciplinary	23ADL101	Python Programming Laboratory for Mechanical Sciences	0	0	3	1.5	100	AU,ME
VAC	23VAL102	Wellness for Students	0	0	2	1	100	All
VAC	23VAT101	தமிழர்மரபு / Heritage of Tamils	1	0	0	1	100	All
AEC	23SAL101	Studio Activities	0	0	2	-	-	All
		Total	**13**	**0**	**17**	**20.5**	**900**	

Semester II

Course Category	Course Code	Course Title	Hours/Week			Credits	Marks	Common to Programmes
			L	T	P			
AEC	23ENI201/ 23FLT201/ 23FLT202	Communication Skills II/ Foreign Language-Japanese/ Foreign Language-German	2	0	2	3	100	All
Minor	23MAI202	Complex Variables and Transforms	3	0	2	4	100	AU,EC,EE,EV, ME
Minor	23CHT201	Chemistry for Mechanical Sciences	3	0	0	3	100	AU,ME
Major	23MEI201	Engineering Materials	3	0	2	4	100	AU,ME
Major	23MEL201	Computer Aided Drafting and Modelling Laboratory	1	0	3	2.5	100	AU,ME
Minor	23CHL201	Chemistry for Mechanical Sciences Laboratory	0	0	3	1.5	100	AU,ME
SEC	23MEL202	Engineering Practices Laboratory	0	0	3	1.5	100	AU,CE,ME
SEC	23ESL201	Professional Skills 1: Problem solving skills & Logical Thinking 1	0	0	2	1	100	All
VAC	23VAT201	தமிழரும்தொழில்நுட்பமும்/ Tamils and Technology	1	0	0	1	100	All
Multi-disciplinary	23CHT202	Environmental Sciences	1	0	0	-	100	All
AEC	23SAL201	Studio Activities	0	0	2	-	-	All
		Total	**14**	**0**	**19**	**21.5**	**1000**	

Programme: B.E. Mechanical Engineering

2023 Regulations (2024 batch onwards)

Course Category	Course Code	Course Title	Duration	Credits	Marks
VAC	23VAL101	Induction Program	3 Weeks	-	100

Semester I

Course Category	Course Code	Course Title	Hours/Week			Credits	Marks	Common to Programmes
			L	T	P			
AEC	23ENI101	Communication Skills I	2	0	2	3	100	All
Minor	23MAI102	Matrices and Calculus	3	0	2	4	100	AU,EA,EC,EE, EV, ME
Minor	23PHT102	Physics for Mechanical Sciences	3	0	0	3	100	AU,ME
Multi-disciplinary	23ADT101	Python Programming for Mechanical Sciences	3	0	0	3	100	AU,ME
Major	23MEL002	Engineering Graphics and Design	1	0	3	2.5	100	AU,ME
Minor	23PHL102	Physics for Mechanical Sciences Laboratory	0	0	3	1.5	100	AU,ME
Multi-disciplinary	23ADL101	Python Programming Laboratory for Mechanical Sciences	0	0	3	1.5	100	AU,ME
VAC	23VAL102	Wellness for Students	0	0	2	1	100	All
VAC	23VAT101	தமிழரமரபு / Heritage of Tamils	1	0	0	1	100	All
AEC	23SAL101	Studio Activities	0	0	2	-	-	All
		Total	**13**	**0**	**17**	**20.5**	**900**	

Semester II

Course Category	Course Code	Course Title	Hours/Week			Credits	Marks	Common to Programmes
			L	T	P			
AEC	23ENI201/ 23FLT201/ 23FLT202	Communication Skills II/ Foreign Language - Japanese/ Foreign Language-German	2	0	2	3	100	All
Minor	23MAI202	Complex Variables and Transforms	3	0	2	4	100	AU,EC,EE,EV,ME
Minor	23CHT201	Chemistry for Mechanical Sciences	3	0	0	3	100	AU,ME
Major	23MEI201	Engineering Materials	3	0	2	4	100	AU,ME
Major	23MEL201	Computer Aided Drafting and Modelling Laboratory	1	0	3	2.5	100	AU,ME
Minor	23CHL201	Chemistry for Mechanical Sciences Laboratory	0	0	3	1.5	100	AU,ME
SEC	23MEL202	Engineering Practices Laboratory	0	0	3	1.5	100	AU,CE,ME
SEC	23ESL201	Professional Skills 1: Problem solving skills & Logical Thinking 1	0	0	2	1	100	All
VAC	23VAT201	தமிழரும்தொழில் நுட்பமும்/ Tamils and Technology	1	0	0	1	100	All
Multi-disciplinary	23CHT202	Environmental Sciences	1	0	0	-	100	All
AEC	23SAL201	Studio Activities	0	0	2	-	-	All
		Total	**14**	**0**	**19**	**21.5**	**1000**	

Semester III

Course Category	Course Code	Course Title	Hours/Week			Credits	Marks	Common to Programmes
			L	T	P			
Minor	23MAT302	Numerical Methods	3	1	0	4	100	AU,ME
Major	23MET301	Engineering Mechanics	2	1	0	3	100	AU,ME
Major	23MEI301	Engineering Thermodynamics	2	0	2	3	100	-
Major	23MET302	Fluid Mechanics and Hydraulics Machinery	2	1	0	3	100	AU,ME
Major	23MET303	Manufacturing Processes	3	0	0	3	100	AU,ME
Major	23MEL301	Manufacturing Processes Laboratory	0	0	3	1.5	100	AU,ME
Major	23MEL302	Fluid Mechanics and Hydraulics Machinery Laboratory	0	0	3	1.5	100	All
SEC	23ESL301	Professional Skills 2:Problem Solving Skills& Logical Thinking2	0	0	2	1	100	-
VAC	23VAT301	Universal Human Values 2: Understanding Harmony	2	1	0	3	100	-
AEC	23SAL301	Studio Activities	0	0	2	-	-	All
	Total		**15**	**4**	**12**	**23**	**900**	

Semester IV

Course Category	Course Code	Course Title	Hours/Week			Credits	Marks	Common to Programmes
			L	T	P			
Minor	23MAT401	Probability and Statistics	3	1	0	4	100	AU,ME
Major	23MET401	Strength of Materials	3	0	0	3	100	AU,ME
Major	23MET402	Mechanics of Machinery	3	1	0	4	100	AU,ME
Major	23MET403	Design Thinking	3	0	0	3	100	-
Major	23MEI401	Metrology and Measurements	2	0	2	3	100	-
Major	23MEL401	Strength of Materials & Mechanics of Machinery Laboratory	0	0	3	1.5	100	AU,ME
Major	23MEL402	Computer Aided Machine Drawing Laboratory	0	0	3	1.5	100	All
SEC	23ESL401	Professional Skills 3 : Professional Development and Etiquette	0	0	2	1	100	-
AEC	23SAL401	Studio Activities	0	0	2	-	-	All
	Total		**14**	**2**	**12**	**21**	**800**	

Course Category	Course Code	Course Title	Duration	Credits	Marks	Common to Programmes
SEC	23XXXXXX	Internship - 1/ Community Internship/Skill Development	2 Weeks - 4 Weeks	1	100	-

Semester V

Course Category	Course Code	Course Title	Hours/Week			Credits	Marks	Common to Programmes
			L	T	P			
Major	23MEI501	Heat and Mass Transfer	3	0	2	4	100	-
Major	23MET501	Design of Machine Elements	3	1	0	4	100	-
Major	23MET502	Finite Element Analysis	2	2	0	3	100	AU,ME
Major	23XXXXX	Professional Elective - I	3	0	0	3	100	-
Major	23XXXXX	Professional Elective - II	3	0	0	3	100	-
Major	23MEL501	Simulation and Analysis Laboratory	0	0	3	1.5	100	AU,ME
SEC	23ESL501	Professional Skills 4: Communication Skills and Interview Essentials	0	0	2	1	100	-
Project	23MEP501	Reverse Engineering Project	0	0	6	3	100	-
AEC	23SAL501	Studio Activities	0	0	2	-	-	All
		Total	**14**	**3**	**15**	**22.5**	**800**	

Semester VI

Course Category	Course Code	Course Title	Hours/Week			Credits	Marks	Common to Programmes
			L	T	P			
Major	23MET601	Design of Transmission Systems	2	1	0	3	100	-
Minor	23MET602	Data Science and Machine Learning	3	0	0	3	100	-
Major	23MET603	Electrical and Electronics Engineering	3	0	0	3	100	-
Major	23XXXXX	Professional Elective - III	3	0	0	3	100	-
Major	23XXXXX	Professional Elective - IV	3	0	0	3	100	-
Minor	23XXXXX	Open Elective - I	3	0	0	3	100	
Minor	23MEL601	Electrical and Electronics Laboratory	0	0	3	1.5	100	-
SEC	23ESL601	Professional Skills 5: Campus to Corporate	0	0	2	1	100	All
AEC	23SAL601	Studio Activities	0	0	2	-	-	All
		Total	**17**	**1**	**7**	**20.5**	**800**	

Course Category	Course Code	Course Title	Duration	Credits	Marks
SEC	23XXXXXX	Internship - 2/ Research Internship/ Skill Development	2 Weeks - 4 Weeks	1	100

Tentative Curriculum for VII and VIII Semester

Semester VII

Course Category	Course Code	Course Title	Hours/Week			Credits	Marks	Common to Programmes
			L	T	P			
Major	23XXXXX	Mechatronics	3	0	2	4	100	-
Major	23XXXXX	Electric Vehicles	3	0	0	3	100	-
Major	23XXXXX	CNC programming & Robotics	3	0	2	4	100	
Major	23XXXXX	Professional Elective- V	3	0	0	3	100	
Major	23XXXXX	Professional Elective- VI	3	0	0	3	100	-
Multi-disciplinary	23XXXXX	Open Elective-II	3	0	0	3	100	-
Project	23MEP701	Project Phase-I	0	0	8	4	100	-
		Total	**18**	**0**	**12**	**24**	**700**	

Semester VIII

Course Category	Course Code	Course Title	Hours/Week			Credits	Marks	Common to Programmes
			L	T	P			
Major	23XXXXX	Project Phase - II	0	0	12	6	200	-
SEC	23XXXXX	Internship or Skill Development*	8 weeks			4	100	-
		Total	**0**	**0**	**12**	**10**	**300**	-

Total Credits: 165

SEMESTER 1

Course Code:23VAL101		Course Title: INDUCTION PROGRAM (Common to all B.E/B.Tech Programmes)
Course Category: VAC		Course Level: Introductory
Duration: 3 weeks	Mandatory Non-Credit Course	Max Marks:100

Pre–requisites

- NIL

Course Objectives

The course is intended to:

1. Explain various sources available to meet the needs of self, such as personal items andlearning resources
2. Explain various career opportunities, opportunity for growth of self and avenues available in the campus
3. Explain the opportunity available for professional development
4. Build universal human values and bonding amongst all the inmates of the campus and the society.

List of Activities:

1. History of Institution and Management: Overview on NIA Educational Institutions – Growth of MCET – Examination Process –OBE Practices –Code of Conduct – Centre ofExcellence.
2. Lectures, interaction sessions and Motivational Talks by Eminent people, Alumni, Employer and Industry Experts
3. Familiarisation of Department / Branch:HoD's & Senior Interaction- Department Associatio
4. Universal Human Value Modules : Aspirations and concerns, Self Management, Relations Social and Natural Environment.
5. Orientation on Professional Skills Courses
6. Proficiency Modules : Mathematics, English, Physics and Chemistry
7. Introduction to various Chapters, Cells, Clubs and its events
8. Creative Arts : Painting, Music and Dance
9. Physical Activity :Games, Sports and Yoga
10. Group Visits: Visit to local area and Campus Tour

Course Outcomes	Cognitive Leve
At the end of this course, students will be able to:	
CO1 : Explain various sources available to meet the needs of self, such as personal items and learning resources through visit to local areas and campus	Understand
CO2: Explain various career opportunities and avenues available in the campus through orientation sessions	Understand
CO3: Explain the opportunity available for professional development through professional skills, curricular, co-curricular and extracurricular activities	Understand
CO4: Build universal human values and bonding amongst all the inmates of the campus and society for having a better life	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	-	-	-	-	-	-	2	1	2	-	-	-	-
CO2	1	-	-	-	-	-	-	2	1	2	-	-	-	-
CO3	1	-	-	-	-	-	-	2	1	2	-	-	-	-
CO4	2	-	-	-	-	-	-	2	1	2	-	-	-	-

High : 3, Medium :2, Low: 1

Text Book(s):

T1. Reading material, Workbook prepared by PS team of the college

Reference Book(s):

R1. Sean Covey, “Seven habits of highly effective teenagers”, Simon & Schuster Uk, 2004.

R2. Vethathiri Maharishi Institute For Spiritual and Intuitional Education, aliyar, “value educat harmonious life (Manavalakalai Yoga)”, Vethathri Publications, Erode, 2010.

R3. Dr.R.Nagarathna, Dr.H.R. Nagendra, “ Integrated approach of yoga therapy for positive Swami Vivekananada Yoga Prakashana Bangalore,2008 Ed.

Web References:

1. https://youtube.com/playlist?list=PLYwzG2fd7hzc4HerTNkc3pS_IvcCfKznV
2. https://www.youtube.com/watch?v=P4vjfEVk&list=PLWDeKF97v9SO0frdgmpaghDMjkom1
3. https://fdp-si.aicte-india.org/download/AboutSIP/About%20SIP.pdf

Course Code: 23ENI101	Course Title: COMMUNICATION SKILLS I (Common to all B.E/B.Tech Programmes)		
Course Category: AEC		Course Level: Introductory	
L:T:P(Hours/Week) 2:0:2	Credits: 3	Total Contact Hours:60	Max Marks:100

Course Objectives

The course is intended to impart formal and informal language effectively and accurately in various real-life contexts on par with B1 level of CEFR Scale.

Module I **20 Hours**

Grammar: Synonyms & Antonyms -Tense forms - Modals - Passives – Reported Speech – Comparatives and Descriptive adjectives.

Listening: Listening for gist and specific information - Listening to past events, experiences and job preferences - Listening to descriptions of monuments - Listening for excuses - Listening to description: transportation systems and public places.

Speaking: Introducing oneself - Exchanging personal information — Effective Conversations: Role Play Situations (Describing personality traits - Describing landmarks, monuments and festivals - Making polite requests and excuses - Discussing facts - Asking for and giving information — Expressing wishes - Talking about lifestyle changes - Talking about transportation and its problems - Describing positive and negative features of things and places - Making comparisons)

Reading: Skimming and Scanning - Reading Comprehension - Reading and comprehending online posts and emails — Case Studies

Writing: Letter writing (Permission letters - Online cover letter for job applications) - Instructions - Recommendations - Write a blog (General) - Report Writing (Industrial Visit Report and Event Reports) - formal and informal emails.

Module II **20 Hours**

Grammar: Sequence adverbs - Phrasal verbs - Relative clauses – Imperatives - Infinitives - Conditionals.

Listening: Listening to review of food items - Listening to results of surveys- Listening to motivational talks & podcasts

Speaking: Expressing likes and dislikes - Describing a favourite snack - Giving advices and suggestions - Speculating about past and future Events — Group Discussion

Reading: Reading different expository texts - Reading to factual texts - Print and online media- Reading Comprehension

Writing: Process Descriptions – Email Writing (Requesting for information) - Reviewing Movie – Social media feeds/posts (Any Social Media)

List of Experiments: **20 Hours**

1. Mini Presentation and Picture Prompt Discussion
2. Debate Tournament
3. Listening, Mind Mapping & Summarization
4. Listening to Stories and Providing the Innovative Climax
5. Reading Comprehension
6. Writing - Interpretation of Visuals

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO 1 : Utilize the basic English grammar and vocabulary to acquire professional communication skills.	Apply
CO 2 : Develop listening and speaking skills through classroom activities based on listening comprehension, recapitulation, interpretation and debate on the same	Apply
CO 3 : Read and write social media posts and comments	Apply
CO 4 : Perform as a member of a team and engage in individual presentation	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	-	-	3	-	-	-	-
CO2	-	-	-	-	-	-	-	-	-	3	-	-	-	-
CO3	-	-	-	-	-	-	-	-	-	3	-	-	-	-
CO4	-	-	-	-	-	-	-	-	2	3	-	-	-	-

High-3; Medium-2;Low-1

Textbooks:

T1. Jack C. Richards, Jonathan Hull, and Susan Proctor, “Interchange - Student’s book 2”, 5thEdition, Cambridge University Press, South Asia Edition, 2022.

T2. Jack C. Richards, Jonathan Hull, and Susan Proctor, “Interchange - Student’s Book 1”, 5thEdition, Cambridge University Press, South Asia Edition, 2022.

Reference Book(s):

R1. David Bohlke, Jack C. Richards, “Four Corners”, 2nd Edition, Cambridge University Press,2018.

R2. Adrian Doff, Craig Thaine, Herbert Puchta, Jeff Stranks, Peter Lewis-Jones, Graham Burton,Empower B1 – Student’s Book, Cambridge University Press, 2020.

R3. Raymond Murphy, “Intermediate English Grammar” 30th Edition, Cambridge University Press,2022.

Web References:

1. https://speakandimprove.com/
2. https://writeandimprove.com/
3. https://www.cambridgeenglish.org/exams-and-tests/linguaskill/

Course Code: 23MAI102		Course Title: MATRICES AND CALCULUS (Common to AU, EA, EC, EE, EV & ME)	
Course Category: Minor		Course Level: Introductory	
L:T:P(Hours/Week) 3:0 :2	Credits: 4	Total Contact Hours:75	Max Marks:100

Course Objectives:

The course is intended to impart knowledge on the use of matrix algebra techniques for practical applications, familiarize with differential calculus and acquire knowledge of mathematical tools to evaluate multiple integrals.

Module I **23 Hours**

Matrices

Definitions and examples of symmetric, skew symmetric and orthogonal matrices - Eigenvalues and Eigenvectors – Properties of Eigenvalues and Eigenvectors-Diagonalization of matrices through orthogonal transformation - Cayley-Hamilton Theorem (without proof) – verification problems and properties - Transformation of quadratic forms to canonical forms through orthogonal transformation.

Differential and Integral Calculus

Curvature — Radius of curvature –Centre of curvature- Circle of curvature - Evolutes and Involutes - Evaluation of definite and improper integrals - Beta and Gamma functions — Properties and applications.

Multivariable Differentiation I

Limit — continuity - Mean value theorems and partial derivatives - Taylor's series and Maclaurin's series – Jacobian of functions of several variables.

Module II **22 Hours**

Multivariable Differentiation II

Maxima, Minima and saddle points of functions of several variables - Method of Lagrange's multipliers.

Multiple Integral

Multiple Integration: Double integrals - Change of order of integration in double integrals - Change of variables (Cartesian to polar, Cartesian to spherical and Cartesian to cylindrical) - Triple integrals - Applications: Finding areas and volumes.

Ordinary Differential Equations Of Second and Higher Orders

Second and higher order linear differential equations with constant coefficients — Second order linear differential equations with variable coefficients (Cauchy - Euler equation, Legendre's equation) — Method of variation of parameters — Solution of first order simultaneous linear ordinary differential equations

List of Experiments: **30 Hours**

1. Introduction to MATLAB.
2. Rank of matrix and solution of system of linear algebraic equations.
3. Finding Eigen values and Eigen vectors of a matrix.
4. Solving ordinary differential equation.
5. Gram Schmidt Procedure.
6. Finding Maxima, Minima of a function.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Determine the canonical form of a quadratic form using orthogonal transformation.	Apply
CO2: Identify the evolute of a curve and solve the improper integrals using beta gamma functions.	Apply
CO3: Examine the extreme value of multivariate functions.	Apply
CO4: Evaluate the area and volume using multiple integrals and solve the higher order differential equations.	Apply
CO5: Demonstrate the understanding of calculus concepts through modern tools.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	3	-	-	-	-	-	-	-	-	-

High-3; Medium-2;Low-1

Text Book(s):

T1. Erwinkreyzig, Advanced Engineering Mathematics, 9th edition, John Wiley& Sons, 2006.

T2. Veerarajan T., Engineering Mathematics for first year, 3rd edition, Tata McGraw-Hill,

Reference Book(s):

R1. G.B.Thomas and R.L Finney, Calculus and Analytic Geometry, 9th edition, Pearson, Reprint, 2002.

R2. B.S.Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.

R3. P. Sivaramakrishna Das , C. Vijayakumari , Engineering Mathematics, Pearson India, 2017.

Web References:

1. https://nptel.ac.in/courses/111107112
2. https://nptel.ac.in/courses/111104031

Course Code: 23PHT102		Course Title: PHYSICS FOR MECHANICAL SCIENCES (Common to AU & ME)	
Course Category: Minor		Course Level: Introductory	
L:T:P(Hours/Week)3: 0: 0	Credits: 3	Total Contact Hours: 45	Max Marks: 100

Course Objectives:

The course is intended to develop capacity to predict the effect of force and motion in the design functions of engineering and to impart knowledge on the fundamental concepts of heat transfer and applications of laws of thermodynamics.

Module I **22 Hours**

Basics of Mechanics: Classification of mechanics, Review of fundamental laws of mechanics — Physical quantities — scalars, vectors — Newton's law of mechanics, Gravitational law. Particles and rigid body, Resolution of forces in to components, Rectangular components of forces,-Free body diagram-principle of transmissibility-Resultant force-equilibrium conditions-equilibrium of particles subjected to coplanar and non-coplanar force system — equilibrium of particles subjected to coplanar system of forces - Triangle law, Parallelogram law and Lami's theorem.

Kinematics and Kinetics of Particles: Kinematic parameters – displacement, velocity, acceleration and time. Types of motion – uniform, non-uniform motion, motion of particles in a plane – Rectinlear and curvilinear motion of particles – motion of projectile. Kinetics of particles – Force and acceleration - D'Alembert's principle – Work energy, and impulse momentum method.

Elasticity: Introduction – Concept of Load, Stress and Strain – Hooke's law – Stress- Strain Diagram – Elastic and Plastic Materials – Factors affecting Elastic Properties – Three Moduli of Elasticity – Relation between Young's, Rigidity and Bulk moduli (Qualitative – No derivation) – Bending Moment of a Beam – Determination of Young's modulus using a Cantilever – Twisting Couple of a wire – Determination of Rigidity Modulus of a thin wire using Torsional Pendulum.

Module II **23 Hours**

Viscosity: Coefficient of Viscosity — Experimental determination of coefficient of viscosity: Poiseuille's method and Stoke's method.

Thermal Physics: Introduction – Modes of Heat Transfer – Thermal Conductivity – Newton's law of cooling – Specific Heat Capacity determination – Advantages and disadvantages of Newton's law of cooling method – Verification of Newton's law of cooling – Lee's disc method for the determination of thermal conductivity of a

bad conductor – Conduction of Heat through a compound media : Bodies in both series andParallel.

Elements of Thermodynamics: Concept of temperature – heat – thermodynamics – work – heat in thermodynamics – comparison of heat and work – internal energy – first law of thermodynamics – applications of the first law– limitations of first law, second law of thermodynamics-Statements of second law – the Carnot cycle – heat engine – heat pump – refrigerators – third law of thermodynamics.

Course Outcomes	**Cognitive Level**
At the end of the course students will able to	
CO1: **Apply** the basic concepts of mechanics and elastic properties of matter to solve the physical characteristics of an object using analytical problems.	Apply
CO2: Perform as a member of team in **analyzing** the recent advancements of mechanical engineering related to the concepts of basic mechanics, elasticity and make a presentation.	Apply
CO3: **Interpret** the concepts of viscosity, heat and thermodynamics and apply it for different real life applications.	Apply
CO4: Perform as a member of team in **articulating** the modern technologies behind the flow of fluids and different thermodynamic systems.	Apply

Course Articulation Matrix

CO PO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	1	3	-	-	-	-
CO3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	-	-	-	-	-	-	-	1	3	-	-	-	-

High-3; Medium-2; Low-1

Text Book(s):

T1. R. C. Hibbeller, “Engineering Mechanics: Combined Static and Dynamics”, Prentice Hall, 2010.

T2. M.N.Avadhanulu and P.G.Kshirsagar, “Text Book of Engineering Physics”, S. Chand & Company Ltd., New Delhi, 2018.

Reference Book(s):

R1. Balasubramaniam "Callister's Material Science and Engineering", John Wiley and Sons Inc., 2nd Edition, 2015.

R2. Yunus A Sengel, Michel A Boles, Thermodynamics: An Engineering Approach, MCGraw Hill, 9th Edition, 2017.

R3. P.K.Nag, Engineering Thermodynamics, MCGraw Hill, 6th Edition, 2017.

Web References:

1. http://www.physicsclassroom.com/class/thermal.
2. https://nptel.ac.in/courses/112105123
3. https://nptel.ac.in/courses/112106286

Course Code: 23ADT101		Course Title: PYTHON PROGRAMMING FOR MECHANICAL SCIENCES (Common to AU & ME)	
Course Category: Multidisciplinary		**Course Level: Introductory**	
L:T:P(Hours/Week) 3: 0: 0	**Credits:3**	**Total Contact Hours:45**	**Max Marks:100**

Course Objectives:

The course is intended to provide the basic knowledge of Python. The course imparts the fundamentals concepts of python for writing the simple application.

Module I **22 Hours**

Computational Thinking and Problem Solving: Fundamentals of Computing **—** Identification of Computational Problems -Algorithms, building blocks of algorithms (statements, state, control flow, functions) - notation (pseudo code, flow chart, programming language) - algorithmic problem solving - simple strategies for developing algorithms (iteration, recursion).

Data Types, Expressions, Statements: Python interpreter and interactive mode, debugging- values and data types –int, float, boolean, string and list – variables – expressions – statements

– tuple assignment – precedence of operators – comments

Control Flow : Conditionals: Boolean values and operators – conditional (if) – alternative (if- else) – chained conditional (if-elif-else) – Iteration: state, while, for, break, continue, pass

Module II **23 Hours**

Functions and Strings: Fruitful functions: return values – parameters – local and global scope – function composition – recursion – Strings: string slices – immutability – string functions and methods – string module– Lists as arrays

Lists, Tuples, Dictionaries: Lists: list operations — list slices — list methods — list loop — mutability – aliasing – cloning lists – list parameters –Tuples: tuple assignment – tuple as return value — Dictionaries: operations and methods — advanced list processing - list comprehension

Files, Modules, Packages: Files and exception: text files – reading and writing files – format operator – command line arguments – errors and exceptions – handling exceptions – modules– packages

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Develop algorithmic solutions to simple computational problems including read, write and execute the simple python programs	Apply
CO2: Apply Python programming effectively, using variables, data types, functions, recursion, and file handling to solve practical problems and build functional applications	Apply
CO3: Decompose a python program into functions for reusability and easy debugging	Apply
CO 4: Represent compound data using python lists, tuples, dictionaries	Apply
CO 5: Manipulate the data from/to files in python programs.	Apply
CO 6: Utilize built-in packages for developing simple python application	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	3	-	-	-	-	-	-	-	-	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-	-	-
CO3	-	-	3	-	-	-	-	-	-	-	-	-	-	-
CO4	-	-	-	3	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	3	-	-	-	-
CO6	-	-	-	-	-	-	-	3	3	-	3	3	3	3

High-3; Medium-2;Low-1

Text Book(s):

T1. Paul Deitel and Harvey Deitel, “Python for Programmers”, Pearson Education, 1st Edition, 2021.

T2. Allen B. Downey, “Think Python: How to Think Like a Computer Scientist”, 2nd edition, Updated for Python 3, Shroff/O‘Reilly Publishers, 2016

T3. Guido van Rossum and Fred L. Drake Jr, “An Introduction to Python – Revised and updated for Python 3.2”, Network Theory Ltd., 2011.

Reference Book(s):

R1. John V Guttag, “Introduction to Computation and Programming Using Python”, Revised and expanded Edition, MIT Press , 2013

R2. Robert Sedgewick, Kevin Wayne, Robert Dondero, “Introduction to Programming in Python: An Interdisciplinary Approach”, Pearson India Education Services Pvt. Ltd., 2016.

Web References:

1. https://www.w3schools.com/python/
2. https://realpython.com/
3. https://nptel.ac.in/courses/106106145

Course Code: 23MEL001		**Course Title: ENGINEERING DRAWING (2023 batch only)** (Common to AD,AM,AU,CS,EA ,EC,EE,EV,IT,ME, SC)	
Course Category: Major		**Course Level: Introductory**	
L:T:P(Hours/Week) 1: 0: 3	**Credits:2.5**	**Total Contact Hours: 60**	**Max Marks:100**

Course Objectives:

The course is intended to

- To impart knowledge on basic dimensioning. 2D and 3 D drawings such as points, lines, planes and solids on first quadrant.

Module I **8 Hours**

Basics of Engineering Drawing: Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning. Basic Geometrical constructions –Orthographic projection- Free hand Sketching.

Projection of Points, Lines: First angle projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method and traces by rotating object method.

Projection of Solids: Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one of the principal planes by rotating object method. Practicing three dimensional modeling of simple objects by CAD Software (Not for examination).

Module II **7 Hours**

Sectioned Solids: Sectioning of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one reference plane by cutting planes inclined to one reference plane and perpendicular to the other **—** Orthographic views of sections of simple solids.

Development of Surfaces: Development of lateral surfaces of simple and truncated solids – Prisms, pyramids, cylinders using straight line and radial line method.

Isometric Projection: Principles of isometric projection — Isometric scale –Isometric projections of simple solids and truncated solids. Practicing three dimensional modeling of isometric projection of simple objects by CAD Software (Not for examination).

List of Experiments **45 Hours**

1. Lettering & Dimensioning
2. Projection of Points & Lines
3. Orthographic projections
4. Projection of Simple Solids
5. Projection of Section of Simple Solids
6. Development of Surfaces
7. Isometric Projections

Course Outcomes:

CO 1: Apply the concepts related to free hand sketching, orthographic and Isometricprojection in first quadrant.	Understand
CO2: Apply the concepts and draw projections of points in four different quadrants and lines located first quadrant.	Apply
CO3: Apply the concepts and draw projections and sections of simple solids using rotatingobject method.	Apply
CO4: Apply the concepts and draw lateral surface of simple solids using straight line andradial line development methods.	Apply
CO5: Apply the concepts and draw isometric view of simple solids and truncated solids using principles of isometric projection.	Apply
CO6: Conduct experiments to demonstrate concepts, implement and analyze the drawing concepts using engineering tool : Using AutoCAD.	Analyze

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO6	-	3	-	-	3	-	-	-	1	1	-	1	-	-

High-3; Medium-2; Low-1

Textbook:

T1. Cencil Jensen, Jay D.Helsel and Dennis R. Short, " Engineering Drawing and Design", Tata McGraw Hill India, New Delhi, 3rd edition, 2019.

Reference Book(s):

R1. Basant Agarwal and Agarwal C.M., "Engineering Drawing", Tata McGraw Hill India, New Delhi, 2nd edition, 2014.

R2. Dhananjay A. Jolhe, "Engineering Drawing with an introduction to AutoCAD" Tata McGraw India, New Delhi, 3rd edition, 2010.

R3. Bhatt N.D. and Panchal V.M., "Engineering Drawing", Charotar Publishing House, Gujarat, 54rd edition, 2023.

PUBLICATIONS OF BUREAU OF INDIAN STANDARDS

1. IS 10711 – 2001: Technical products Documentation – Size and lay out of drawing sheets.IS9609 (Parts 0 & 1) – 2001: Technical products Documentation – Lettering.
2. IS 10714 (Part 20) – 2001 & SP 46 – 2003: Lines for technical drawings.IS 11669 – 1986 &SP 46 – 2003: Dimensioning of Technical Drawings.
3. IS 15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods. The mode ofdelivery is like practical.

Web References:

1 http://nptel.ac.in/courses/112103019/

2 https://www.coursera.org/specializations/autodesk-cad-cam-cae-mechanical-engineering

Course Code:23MEL002	**Course Title: ENGINEERING GRAPHICS AND DESIGN** (Common to all programs)		
Course Category: Major	**Course Level: Introductory**		
L:T:P(Hours/Week) :1: 0: 3	**Credits: 2.5**	**Total Contact Hours: 60**	**Max Marks: 100**

Course Objectives:

The course is intended to impart knowledge and skills on creating 2D and 3D objects using CAD tool.

Module I **20 Hours**

Basics of Engineering Graphics: Importance of graphics in engineering applications – BIS conventions and specifications – Standards and symbols. Basic Geometrical constructions – principles of projections – free hand sketching Isometric to Orthographic and Orthographic to Isometric.

Introduction to data collaboration and management: Account creation and verification, Tool overview, and navigation to user interface- data storage, open, close, and saving a file. Import, and export project files, navigation through workspaces, data collaboration and customizing of the tool bars.

Introduction to modeling: Create a new project, create and edit a sketch; create and edit a 3D model.

Introduction to parametric sketching: Create parameter-based sketches, Sketch splines and slots, Sketch text.

Module II **10 Hours**

Introduction to parametric modeling Create a 3D mechanical link, add sketch Canvas images, Create 3D model solid trigger, Manage physical materials and appearances.

Introduction to Assembly modelling: Create a component Create a joint, Edit a joint limit, Drive a joint.

Introduction to technical drawing: Explode a 3D model for a drawing, create a drawing sheet and views, Add geometry and dimensions to a drawing, Add text and symbols, Place an exploded view, Edit a title block.

Introduction to rendering: Set up a render scene, Set up a render appearances, Create rendered images and turntable animations.

Electronics design: Copy and manage an electronics library, Create a new electronics design schematic, Create an electronics layout, Generate 3D models and gerber files. (Electrical CAD)

Practice on drafting tool: **30 Hours**

Projects

1. Create a 3D model of a wallet
2. Create a 3D model of a storage bin
3. Create a 3D model of a water pump impeller
4. Create a printed circuit board design with connectors, transistors, voltage regulator, and an LED. (Electrical CAD)
5. Model a simple coffee table with a rectangular top and four legs (Civil)
6. Model a chair with a curved backrest and seat (Civil)
7. Model a truss bridge, focusing on the arrangement of the trusses and the connections between them (Civil)

Course Outcomes:

CO1: Apply the concepts related to free hand sketching, orthographicand Isometric projection in first quadrant.	Apply
CO2: Apply the concept of CAD to create 2D and 3D models	Apply
CO3: Create 3D model and print using a 3D printer.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	3	-	-	-	-	-	-	-	-	-
CO3	3	-	-	-	3	-	-	-	-	-	-	-	-	-

Textbook(s):

T1. Bhatt N.D. and Panchal V.M., “Engineering Drawing”, Charotar Publishing House,Gujarat, 54rd edition, 2023.

T2. Autodesk Fusion 360 Black Book (V 2.0.15293) – Part 1 by Gaurav Verma andMatt Weber

Reference Book(s):

R1. Autodesk Fusion 360 Black Book (V 2.0.12670) – Part 2 by Gaurav Verma andMatt Weber.

R2. Autodesk Fusion 360 – The Master Guide by Samar Malik.

R3. Parametric Modeling with Autodesk Fusion 360 by Randy H. Shih.

R4. AUTODESK FUSION 360 EXERCISES: 200 Practice drawings for Fusion 360 by Sachidanand Jha.

R5. Autodesk Fusion 360: A Tutorial Approach – 2nd edition by Prof. Sham Tickoo , Purdue University, Northwest , USA

Learning online resources:

1. Introduction to 3D Modeling for Manufacturing: https://www.autodesk.com/learn/ondemand/course/fusion360-intro-to-3d-modeling-associate.

2. Rendering: https://www.autodesk.com/learn/ondemand/module/fusion-rendering

3. Assembly modeling: https://www.autodesk.com/learn/ondemand/module/fusion-assembly-modeling

4. Electronics Design: Electronics design | Autodesk

Course Code: 23PHL102		Course Title: PHYSICS FOR MECHANICAL SCIENCES LABORATORY (Common to AU & ME)	
Course Category: Minor		Course Level: Introductory	
L:T:P (Hours/Week) 0:0:3	Credits: 1.5	Total Contact Hours: 45	Max Marks: 100

Course Objectives

The course is intended to expose the students to various experimental skills which is very essential for an Engineering student.

List of Experiments (Any ten):

1. Verify Lami's theorem using triangle law of forces.
2. Verify the parallelogram law of forces.
3. Determination of Young's modulus of the Material – Cantilever bending method.
4. Determination of Young's modulus of the Material – Uniform bending method.
5. Determination of Young's Modulus of the material – Non-Uniform bending method.
6. Determination of Rigidity modulus of the metallic wire – Torsion Pendulum.
7. Determination of viscosity of low viscous liquid – Poiseuille's method.
8. Determination of viscosity of high viscous liquid – Stoke's method.
9. Determination of thermal conductivity of the bad conductor – Lee's Disc method.
10. Determination of specific heat capacity of the given liquid — Newton's law of coolingmethod.
11. Determination of velocity of ultrasonic waves and compressibility of the given liquid —Ultrasonic interferometer.
12. Determination of Wavelength of laser using plane transmission grating and hence estimate particle size of lycopodium powder.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Elucidate the basic principles involved in the given experiments	Understand
CO2: Conduct, analyze and interpret the data and results from physics experiment	Evaluate

Course Articulation Matrix

CO PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	-	3	-	-	-	-	-	-	-	-	-	-

High-3; Medium-2; Low-1

Reference Book(s):

R1. Physics Laboratory Manual Prepared by Faculty of Physics, Dr. Mahalingam College of Engineering and Technology

R2. Engineering Physics Laboratory Manual, Dr. R. Jayaraman, V. Umadevi, S. Maruthamuthu, B. Saravanakumar, Pearson India Education Services Pvt. Ltd, 2022.

R3. B.Sc., Practical Physics, C.L. Arora, S. Chand and Co, 2012.

Web References:

1. https://archive.nptel.ac.in/courses/115/105/115105110/
2. https://vlab.amrita.edu/index.php?sub=1&brch=280
3. https://vlab.amrita.edu/index.php?sub=1&brch=194

Course Code:23ADL101	Course Title: PYTHON PROGRAMMING LABORATORY FOR MECHANICAL SCIENCES (Common to AU & ME)		
Course Category: Multi-displicinary		**Course Level: Introductory**	
L:T:P (Hours/Week) 0:0:3	**Credits:1.5**	**Total Contact Hours:45**	**Max Marks:100**

Course Objectives

The course is intended to impart the programming knowledge. This will enable the students to develop simple applications in Python.

List of Experiments:

1. Draw the flowchart and algorithm for finding the weight of a steel bar for the given crosssection, length and density of the material
2. Implement programs using data types, operators and expressions
3. Implement programs using branching statements
4. Implement programs using looping statements to form a pyramid pattern
5. Develop programs with all the list/tuple operations for the given list/ tuples
6. Develop a dictionary consisting of auto components and apply the dictionary operations
7. Implement program to find the factorial of the given number using function
8. Implement program for string operations.
9. Develop the program to count the number of words and characters in the given TXT fileusing file handling methods.
10. Implement the program to plot the components of a given force for the different angleranges.

.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Construct the flowchart and algorithm for any given scenario	Apply
CO2: Develop programs using branching and looping statements for simple business logic	Apply
CO3: Apply advanced data structure techniques in Python, utilizing functions, methods, and operators to efficiently manipulate lists, tuples, sets, dictionaries, and strings for various computational tasks	Apply
CO4: Employ the Matplotlib library function for data visualization, enabling to present data and to get insights of visual impactful method on data	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	3	-	-	-	-	-	-	-		
CO2	-	3	-	-	-	-	-	-	-	-	-	-		
CO3	-	-	3	-	-	-	-	-	3	-	-	-		
CO4	-	-	-	3	-	-	-	-	3	-	-	-		

High-3; Medium-2;Low-1

Text Book(s):

T1. Paul Deitel and Harvey Deitel, “Python for Programmers”, Pearson Education, 1st Edition, 2021.

T2. Peter Wentworth, Jeffrey Elkner, Allen B. Downey, and Chris Meyers, “How to Think Like a Computer Scientist: Learning with Python”,3rd Edition, O’Reilly, 2016.

T3. Mark Lutz, “Powerful Object Oriented Programming Python”, 4th Edition, O’Reilly, 2012.

Reference Book(s):

R1. Mark Lutz, “Learning Python, Powerful OOPs”, 5th Edition, O’Reilly, 2013.

R2. Zelle, John M, “Python Programming: An Introduction to Computer Science”, Franklin Beedle& Associates, 2003.

Web References

1. https://docs.python.org/3/tutorial/
2. https://www.learnpython.org/
3. https://www.pyschools.com/

Course Code: 23VAL102		Course Title: WELLNESS FOR STUDENTS (Common to all B.E/B.Tech Programmes)	
Course Category: VAC		Course Level: Introductory	
L:T:P(Hours/Week) 0: 0 :2	Credits:1	Total Contact Hours:30	Max Marks:100

Course Objectives:

The course is intended to impart knowledge on setting SMART goals for academic, career and life, applying time management techniques, articulating the importance of wellness for success in life and understanding the dimensions of wellbeing and relevant practices.

Module I **15 Hours**

GOAL SETTING Understanding Vision and mission statements - Writing personal mission statements — „Focus" as a way of life of most successful people. Clarifying personal values, interests and orientations — Awareness of opportunities ahead — Personal SWOT analysis - Principles driving goal setting: Principle of response and stimuli, Circle of influence and circle of concern, What you see depends on the role you assume. Potential obstacles to setting and reaching your goals - Five steps to goals setting: SMART goals, Inclusive goals, Positive stretch, Pain vs gain, Gun-point commitment.

TIME MANAGEMENT - TOOLS AND TECHNIQUES Importance of planning and working to time. Pareto 80-20 principle of prioritization — Time quadrants as a way to prioritize weekly tasks – The glass jar principle - Handling time wasters – Assertiveness, the art of saying "NO"– Managing procrastination.

CONCEPT OF WELLNESS — impact of absence of wellness - Wellness as important component to achieve success. Wellbeing as per WHO - Dimensions of Wellbeing: Physical, Mental, Social, Spiritual – indicators and assessment methods

Module II **15 Hours**

Simplified Physical Exercises. Fitness as a subset of Wellness — health related physical fitness - skill related physical fitness. Joint movements, Warm up exercises, simple asanas, WCSC simplified exercises.

PRACTICES FOR MENTAL WELLNESS

Meditation: Mind and its functions - mind wave frequency – Simple basic meditation – WCSC meditation and introspection tables. Greatness of friendship and social welfare – individual, family and world peace – blessings and benefits.

Food & sleep for wellness: balanced diet - good food habits for better health (anatomic therapy) – hazards of junk food - food and the gunas.

PUTTING INTO PRACTICE

Practicals: Using the weekly journal – Executing and achieving short term goals – Periodic reviews.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO 1: Set well-articulated goals for academics, career, and personal aspirations	Apply
CO 2: Apply time management techniques to complete planned tasks on time	Apply
CO 3: Explain the concept of wellness and its importance to be successful in career and life	Apply
CO 4: Explain the dimensions of wellness and practices that can promote wellness	Apply
CO 5: Demonstrate the practices that can promote wellness	Valuing

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	-	1	1	-	-	1	1
CO2	-	-	-	-	-	-	-	-	1	-	1	1	1	1
CO3	-	-	-	-	-	-	-	-	1	-	-	-	1	1
CO4	-	-	-	-	-	-	-	-	1	-	-	-	1	1
CO5	-	-	-	-	-	1	1	-	1	-	-	-	1	1

High-3; Medium-2;Low-1

Text Book(s):

T1. Reading material, workbook and journal prepared by PS team of the college

Reference Book(s):

R1. Stephen R Covey, “First things first”, Simon & Schuster UK, Aug 1997

R2. Sean Covey, “Seven habits of highly effective teenagers”, Simon & Schuster UK, 2004.

R3. Vethathiri Maharishi Institute for Spiritual and Intuitional Education, Aliyar, “Value education for harmonious life (Manavalakalai Yoga)”, Vethathiri Publications, Erode, I Ed. (2010).

R4. Dr. R. Nagarathna, Dr. H.R. Nagendra, “Integrated approach of yoga therapy for positive health”, Swami Vivekananda Yoga Prakashana, Bangalore, 2008 Ed.

R5. Tony Buzan, Harper Collins, “The Power of Physical Intelligence English”

Course Code: 23VAT101	Course Title: HERITAGE OF TAMILS (Common to all B.E/B.Tech Programmes)		
Course Category: VAC		Course Level: Introductory	
L:T:P (Hours/Week) 1: 0 :0	Credit: 1	Total Contact Hours: 15	Max Marks:100

Pre–requisites

- NIL

Course Objectives

மாணவர்கள் இப்பாடத்தை கற்றலின் மூலம்

CO.1 மொழி மற்றும் இலக்கியம், பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை – சிற்பக் கலை , நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள் , திணைக் கோட்பாடுகள் மூலம் தமிழர் மரபை அறிந்து கொள்ள இயலும்.

CO.2இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பை அறிந்து கொள்ள இயலும்.

தமிழர் மரபு

அலகு 1 – மொழி மற்றும் இலக்கியம் 3

இந்திய மொழிக் குடும்பங்கள் – திராவிட மொழிகள் – தமிழ் ஒரு செம்மொழி – தமிழ் செவ்விலக்கியங்கள் – சங்க இலக்கியத்தின் சமயச் சார்பற்ற தன்மை – சங்க இலக்கியத்தில் பகிர்தல் அறம் – திருக்குறளில் மேலாண்மைக் கருத்துக்கள் – தமிழ்க் காப்பியங்கள், தமிழகத்தில் சமண பௌத்த சமயங்களின் தாக்கம் – பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள் – சிற்றிலக்கியங்கள் – தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி – தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு.

அலகு 2 – மரபு – பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை – சிற்பக் கலை 3

நடுகல் முதல் நவீன சிற்பங்கள் வரை – ஐம்பொன் சிலைகள் – பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள், பொம்மைகள் – தேர் செய்யும் கலை – சுடுமண் சிற்பங்கள் – நாட்டுப்புறத் தெய்வங்கள் – குமரிமுனையில் திருவள்ளுவர் சிலை – இசைக் கருவிகள் – மிருதங்கம், பறை, வீணை, யாழ், நாதஸ்வரம் – தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு.

அலகு 3 – நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள் 3

தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஒயிலாட்டம், தோல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள்.

அலகு 4 – தமிழர்களின் திணைக் கோட்பாடுகள் **3**

தமிழகத்தின் தாவரங்களும், விலங்குகளும் – தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக் கோட்பாடுகள் – தமிழர்கள் போற்றிய அறக் கோட்பாடு – சங்க காலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும் – சங்ககால நகரங்களும் துறைமுகங்களும் – சங்க காலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி – கடல் கடந்த நாடுகளில் சோழர்களின் வெற்றி.

அலகு 5 – இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு **3**

இந்திய விடுதலைப் போரில் தமிழர்களின் பங்கு – இந்தியாவின் பிறபகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் – சுய மரியாதை இயக்கம் – இந்திய மருத்துவத்தில் சித்த மருத்துவத்தின் பங்கு – கல்வெட்டுகள், கையெழுத்துப் படிகள்– தமிழ்ப் புத்தகங்களின் அச்சு வரலாறு.

TOTAL : 15 PERIODS

Course Outcomes	**Cognitive Level**
மாணவர்கள் இப்பாடத்தை கற்றபின்	
CO.1 மொழி மற்றும் இலக்கியம், பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை – சிற்பக் கலை , நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள் , திணைக் கோட்பாடுகள் மூலம் தமிழர் மரபை அறிந்து கொள்வார்கள்.	அறிதல் (Understand)
CO.2 இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பை அறிந்து கொள்வார்கள்.	அறிதல் (Understand)

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	-	-	-	-	1	-	-
CO2	-	-	-	-	-	-	-	-	-	-	-	1	-	-

High–3; Medium–2; Low–1

TEXT - CUM REFERENCE BOOKS

1 தமிழக வரலாறு – மக்களும் பண்பாடும் – கே.கே.பிள்ளை
(வெளியீடு. தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்)

2. கணினித் தமிழ் – முனைவர் இல. சுந்தரம் (விகடன் பிரசுரம்)

3. கீழடி – வைகை நதிக்கரையில் சங்க கால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)

4. பொருநை – ஆற்றங்கரை நாகரிகம் (தொல்லியல் துறை வெளியீடு)

5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)

6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.

7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).

8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)

9. Keeladi - 'Sangam City C ivilization on the banks of river Vaigai' (Jointly Published by:
Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)

10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)

11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)

12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

Course Code: 23VAT101	Course Title: HERITAGE OF TAMILS (Common to all B.E/B.Tech Programmes)		
Course Category: VAC		Course Level: Introductory	
L:T:P (Hours/Week) 1: 0 :0	Credit: 1	Total Contact Hours: 15	Max Marks:100

Pre–requisites

- NIL

Course Objectives

The course is intended to:

1. Understand the Heritage of Tamils in terms of Language and Literature, Rock Art Paintings to Modern Art – Sculpture, Folk and Martial Arts, Thinai Concept.
2. Understand the Contribution of Tamils to Indian National Movement and Indian Culture.

HERITAGE OF TAMILS

UNIT I LANGUAGE AND LITERATURE 3

Language Families in India - Dravidian Languages – Tamil as a Classical Language – Classical Literature in Tamil – Secular Nature of Sangam Literature – Distributive Justice in Sangam Literature - Management Principles in Thirukural - Tamil Epics and Impact of Buddhism & Jainism in Tamil Land - Bakthi Literature Azhwars and Nayanmars - Forms of minor Poetry - Development of Modern literature in Tamil - Contribution of Bharathiyar and Bharathidhasan.

UNIT II HERITAGE - ROCK ART PAINTINGS TO MODERN ART – SCULPTURE 3

Hero stone to modern sculpture - Bronze icons - Tribes and their handicrafts - Art of temple car making - - Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments - Mridhangam, Parai, Veenai, Yazh and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils.

UNIT III FOLK AND MARTIAL ARTS **3**

Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leather puppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.

UNIT IV THINAI CONCEPT OF TAMILS **3**

Flora and Fauna of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature - Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas.

UNIT V CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE **3**

Contribution of Tamils to Indian Freedom Struggle - The Cultural Influence of Tamils over the other parts of India – Self-Respect Movement - Role of Siddha Medicine in Indigenous Systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil Books.

TOTAL : 15 PERIODS

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO.1 Understand the Heritage of Tamils in terms of Language and Literature, Rock Art Paintings to Modern Art – Sculpture, Folk and Martial Arts, Thinai Concept.	Understand
CO.2 Understand the Contribution of Tamils to Indian National Movement and Indian Culture.	Understand

Course Articulation Matrix

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	-	-	-	-	-	-	-	-	-	-	-	1	-	-
CO2	-	-	-	-	-	-	-	-	-	-	-	1	-	-

High–3; Medium–2; Low–1

TEXT - CUM REFERENCE BOOKS

1 தமிழக வரலாறு – மக்களும் பண்பாடும் – கே.கே.பிள்ளை
(வெளியீடு. தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்)

2. கணினித் தமிழ் – முனைவர் இல. சுந்தரம் (விகடன் பிரசுரம்)

3. கீழடி – வைகை நதிக்கரையில் சங்க கால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)

4. பொருநை – ஆற்றங்கரை நாகரிகம் (தொல்லியல் துறை வெளியீடு)

5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)

6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.

7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).

8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)

9. Keeladi - 'Sangam City C ivilization on the banks of river Vaigai' (Jointly Published by:
Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)

10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)

11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)

12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

SEMESTER 2

Course Code: 23ENI201		Course Title: COMMUNICATION SKILLS II (Common to all B.E/B.Tech Programmes)	
Course Category: AEC		Course Level: Introductory	
L:T:P(Hours/Week) 2:0:2	Credits: 3	Total ContactHours:60	Max Marks:100

Course Objectives

The course is intended to impart effective and accurate language in business correspondence on par with B2 level of CEFR Scale.

20 Hours

Module I

Grammar: Linking Words - Collocations –Sentence Completion - Articles –Adverbs– Indefinite Pronoun

Listening: Listening to short conversations - Listening for gist and summarizing - Listening fordetail - Responding to straightforward questions.

Speaking: Making statements of facts - Agreeing and disagreeing to opinions - Respond to queries - Group Discussion.

Reading: Read and select (phrasal verbs & relative clause)- Cloze Test - Gapped sentences - Multiple- choice gap-fill

Writing: Paragraph Writing: Descriptive, narrative, persuasive and argumentative - Emails: Giving information - Making enquiries - Responding to enquiries - Power Point Presentation

Module II **20 Hours**

Grammar: Expressions of cause and result – Concord - Error Spotting (Parts of Speech & Indian English) - Prepositions

Listening: Listening for identifying main points - Responding to a range of questions about different topics - Listening to identify relevant information

Speaking: Empathetic Enunciation – Situation handling – Visual Interpretation - - Short presentations

Reading: Intensive Reading: Comprehending business articles, reports and proposals and company websites-- Open gap-fill - Extended reading

Writing: – Report Writing - Memo – Complaint letter - Business Letters (Seeking permission & Providing Information)

List of Experiments: **20 Hours**

1. Listening to Monologue and Extended Listening Activity I
2. Listening to Monologue and Extended Listening Activity II
3. Expressing Opinions and Situational based speaking
4. Mini Presentation and Visual Interpretation
5. Reading Comprehension
6. Writing letter, email and report

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Identify the common errors in written and spoken correspondence.	Apply
CO2: Develop listening, reading and speaking skills through task based activities in listening, reading comprehension, recapitulation, interpretation and discussion.	Apply
CO3: Read business correspondences like memo, Email, letter, proposals and write reports and website entries and product launches.	Apply
CO4: Perform as an individual and member of a team and engage effectively in group discussion and individual presentation.	Apply

Course Articulation Matrix

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	-	-	-	-	-	-	-	-	-	3	-	-	-	-
CO2	-	-	-	-	-	-	-	-	-	3	-	-	-	-
CO3	-	-	-	-	-	-	-	-	-	3	-	-	-	-
CO4	-	-	-	-	-	-	-	-	2	3	-	-	-	-

High-3; Medium-2;Low-1

Textbooks:

T1. Guy Brook- Hart, “Business Benchmark Upper Intermediate”, 2nd Edition, SouthAsian, Cambridge University Press, 2020.

T2. Norman Whitby, “Business Benchmark pre-intermediate to Intermediate”, 2nd Edition, South Asian, Cambridge University Press, 2014.

Reference Book(s):

R1. Hewings Martin - Advanced Grammar in use Upper-intermediate Proficiency, CUP,3rd Edition,2013.

R2. Clark David – Essential BULATS (Business Language Testing Service), CUP, 2006. R3. Adrian Doff, Craig Thaine, Herbert Puchta, Jeff Stranks, Peter Lewis-Jones, Rachel Godfrey,Gareth Davies, Empower B1+ – Student’s Book, Cambridge University Press,2015.

Web References:

1. https://speakandimprove.com/
2. https://writeandimprove.com/
3. https://www.cambridgeenglish.org/exams-and-tests/linguaskill/

Course Code:23FLT201	Course Title: FOREIGN LANGUAGE - JAPANESE (Common to all B.E/B.Tech Programmes)		
Course Category: AES		**Course Level: Introductory**	
L:T:P (Hours/Week) 3: 0: 0	**Credits:3**	**Total Contact Hours:45**	**Max. Marks:100**

Course Objectives:

The course objectives intended to:

1. Express a basic exposure on Japanese language and culture
2. Express thoughts and communicate in the beginner level of Japanese with native Japanese speaker
3. Identify the kanji etymology as well as use it in basic vocabulary required for the JLPT/NAT 5 examination level
4. Read and write 100 kanji of the official JLPT N5
5. Choose the appropriate verb forms for learning and practicing the Japanese language

UNIT I Introduction to Japan and greetings 9 Hours

Japan : Land and culture - Introduction to Japanese language – Greetings – Seasons - Days of the week - Months of the year – Dates of the month - Self introduction – Numbers (Upto 99,999) – Expressing time – Conversation audio and video.

Listening: Listening to Greetings - Listening for Specific Information: Numbers, Time. Speaking: Self-Introduction

UNIT II Building vocabulary 9 Hours

Family relationships - Colours - Parts of body - Profession - Directions - Time expressions (today, tomorrow, yesterday, day before, day after) - Japanese housing and living style - Food and transport (vocabulary) - Stationery, fruits and vegetables

Listening: Listening for Specific Information: Directions, Family Members, Parts of body Speaking: Introducing one’s family.

UNIT III Writing systems 9 Hours

Hiragana Chart 1 - vowels and consonants and related vocabulary – Hiragana Charts 2&3, double consonants, vowel elongation and related vocabulary – Introduction to Kanji – Basic Vocabulary – Basic Conversational Phrases.

Listening: Listening to Japanese Alphabet Pronunciation, Simple Conversation. Speaking: Pair Activity (Day to day situational conversation)

UNIT IV Kanji and preposition 9 Hours

Katakana script and related vocabulary – Basic kanjis: naka, ue, shita, kawa , yama , numbers (1- 10, 100, 1000, 10,000 and yen) , person, man, woman, child, tree , book , hidari, migi, kuchi , 4 directions - Usage of particles wa, no, mo and ka and exercises - Usage of kore, sore, are, kono, sono, ano, arimasu and imasu - Particles – ni (location) and ga , donata and dare - Particles ni (time), kara, made , ne , koko, soko, asoko and doko - Directions : kochira, sochira, achira and dochira , associated vocabulary (mae, ushiro, ue, shita, tonari, soba, etc.)

Listening: Listening to conversation with related particles

UNIT V Verb forms 9 Hours

Introduction to Verbs - Verbs –Past tense, negative - i-ending and na-ending adjectives introduction - ~masen ka, mashou - Usage of particles de, e , o, to, ga(but) and exercises - Adjectives (present/past – affirmative and negative) – Counters - ~te form

Listening: Listening to different counters, simple conversations with verbs and adjectives. Speaking: Pair Activity (Explaining one's daily routine by using appropriate particles and verbs)

Course Outcomes		**Cognitive Level**
At the end of this course, students will be able to:		
CO1:	Recognize and write Japanese alphabet	Understand
CO2:	Comprehend the conversation and give correct meaning	Understand
CO3:	Apply appropriate vocabulary needed for simple conversation in Japanese language	Apply
CO4:	Apply appropriate grammar to write and speak in Japanese language	Apply
CO5:	Speak using words of the Japanese language	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	-	-	-	-	-	-	-	-	-	3	-	1	-	-
CO4	-	-	-	-	-	-	-	-	-	3	-	1	-	-
CO5	-	-	-	-	-	-	-	-	2	3	-	1	--	-

High-3; Medium-2; Low-1

Text Book:

T1. Genki 1 Textbook: An Integrated Course in Elementary Japanese by EriBanno, Yoko Ikeda, Yutaka Ohno, Yoko Sakane, Chikako Shinagawa, Kyoko Tokashiki published by The Japan Times

T2. Genki 1 Workbook: An Integrated Course in Elementary Japanese by Eri Banno published by The Japan Times

Reference:

1. Japan**e**se for Everyone: Elementary Main Textbook1-1, Goyal Publishers and Distributors Pvt. Ltd., Delhi, 2007
2. Japanese for Everyone: Elementary Main Textbook1-2, Goyal Publishers and Distributors Pvt. Ltd., Delhi, 2007
3. www.japaneselifestyle.com
4. www.learn-japanese.info/
5. www.learn.hiragana-katakana.com/typing-hiragana-characters/
6. www.kanjisite.com/

Course Code:23FLT202	Course Title: FOREIGN LANGUAGE - GERMAN (Common to all B.E/B.Tech Programmes)		
Course Category: AEC		Course Level: Introductory	
L:T:P (Hours/Week) 2: 0: 2	Credits:3	Total Contact Hours:45	Max. Marks:100

Course Objectives:

The course is intended to:

1. Listen and understand numbers, names and dialogues of a native speaker on par with A1 level.
2. Speak and introduce self in simple sentences to convey their opinion and ideas on par with A1 level.
3. Read simple passages and given text on par with A1 level.
4. Write letter and simple sentences on par with A1 level.

UNIT I BASIC INTRODUCTION TO GERMAN SCRIPTS 9

Theme and Text (Introduction to German - German script, Deutsche Namen, Daily Greetings and Expressions) – Grammar ('wh' questions, das Alphabet)– Speak Action (Buchstabieren, sich und andere vorstellen nach Namen und Herkunft fragen, internationale Wörter auf Deutsch verstehen, jemanden begrüßen)– pronunciation (Buchstabieren J,V,W,Y, - Long vowels A,E,I,O,U - Pronunciation of Ä,Ü,Ö) – To learn (internationale Wörter in Texten finden, Wörter sortieren)

Theme and Text (Gespräche im caf'e, Getränkekarte, Telefon-buch, Namen, Rechnungen) – Grammar (Frägesatze mit wie, woher, wo, was Verben in präsens Singular und Plural, das Verb Sein, Personalpronomen und Verben)– Speak Action (eine Gespräch beginnen sich und andere vorstellen zählen, etwas bestellen und bezhalen Telefonnummern und verstehen)– pronunciation (Wortakzent in Verben und in Zahlen) – To learn (Grammatiktabelle ergänzen, mit einem Redemittelkasten arbeiten)

UNIT II NUMBERS AND NOMINATIVE CASE 9

Theme and Text (Numbers – 1 to 12 (Eins bis Zwolf) – 20, 30, 40, 90 (zwanzig-Neunzig) – All Numbers (1-10000) – German Currency (Euro) – Basic Mathematics (plus, Minus, Malen, Geteilt durch)) – Grammar (Introduction of verbs –Have Verb – To Come, To Speak, To Read, To Drive, To Fly, To write, To Eat, To sleep, To take etc.,)

Theme and Text (Communication in course) – Grammar (Singular and Plural, Artikel: der,das,die/ ein,eine, verneinung: kein, keine, Komposita: das Kursbuch) – Speak Action (Gegenständen fragen/ Gegenstände benennen im kurs:) – pronunciation (word accent Marking, Umlaute ö ä ü hören und sprechen) – To learn (Lernkarten schreiben, Memotipps, eine Regel selbst finden)

Theme and Text (City, Town, Language: Nachbar, Sprachen, Sehenswürdigkeiten in Europa) – Grammar (Past tense for Sein, W-Frage, Aussagesatz und Satzfrage) – Speak Action (about city and siteseeing) – pronunciation (Satzakzent in Frage- und Aussagesätzen) – To learn (eine Regel ergänzen, eine Grammatiktabelle erarbeiten, Notizen machen)

UNIT III AKKUSATIVE CASE AND PREPOSITIONS 9

Theme and Text (Menschen und Hauser, Furniture catalogue, E-Mail, Houseinformation) – Grammar (possesivartikel im Nominativ, Artikel im Akkusativ, Adjektive im satz, Graduierung mit zu)– Speak Action (Whonung bescreiben about perons andthings)– pronunciation (consonant - ch) – To learn (wortschatz systematisch)

Theme and Text (Termine - Appointment and punctuality in Germany) – Grammar (questions with wann?, Preposition (am, um, von... bis), verneinung mit nicht, trennbare verben, präteritum von haben) – Speak Action (Daily plan making, time commitment, excuse for late coming) – pronunciation (consonants- p,b,t,d / k,g) – To learn (Rollenkarten arbeiten)

Theme and Text (orientation in working area, go for work, floor plan city plan, office and computer) – Grammar (preposition: in,neben, unter, auf, vor, hinter, an, zwischen, bei und mit + Datic)– Speak Action (work place, work, giving appointments)– pronunciation (consonants: f,w und v) – To learn (Making notice in calender)

UNIT IV DATIV CASE AND PREPOSITIONS 9

Theme and Text (Holiday and Party, holiday plan, party plan in Germany) – Grammar (regular and iregular verbs) – Speak Action (holiday speak, accident, Ich-Text schreiben) – pronunciation (lange und kurze vokale markieren) – To learn (Text Order)

Theme and Text (organising an Excursion to Berlin through city orientation, Bus plan, City plan, post card, Excursion programme) – Grammar (preposition: in, durch, über + Akkusativ: zu, an... vorbei + Dativ, Modalverb wollen) – Speak Action (Tourism, culture, postcard preparation, travel description) – pronunciation (r and l)– To learn (plaket making)Theme and Text (Beruf und all Tag, Visiten karten, wörterbuch) – Grammar – Speak Action (profession, statistic speaking) – pronunciation (n,ng and nk)– To learn (wörterbuch , text information in tabel)

UNIT V ADJECTIVES AND PRONUNCIATION 9

Theme and Text (Haushaltstipp, kochrezept, maße und gewichte, Mahlzeiten und Gerichte) – Grammar (jeden Tag, manchmal, nie, Question - welche, Comparison – viel, gut, gern) – Speak Action (about eat, drink question and answers) – pronunciation (e,en,el,er) – To learn (Text auswerten und zusammenfassen)

Theme and Text (Clothing , colour, weather) – Grammar (Adjecktive im Akkusativ, unbestimmer Artikel) – Speak Action (weather, dress and colour understanding) – pronunciation (e-o- ö and ie-u- ü) – To learn (wetter and Farben interkulturelle)

Theme and Text (in super market,purchase, House Maintainence, Emotion, Sports, Body parts) – Grammar (Modal Verb) – Speak Action (Body parts) – To learn (Rollenkarten arbeiten)

Course Outcomes		**Cognitive Level**
At the end of this course, students will be able to:		
CO1	Recognize and write German alphabet, numbers.	Understand
CO2	Comprehend the conversation and give correct meaning	Understand
CO3	Apply appropriate grammar and vocabulary to write and speak.	Apply
CO4	Apply appropriate cases and texts to listen, write and speak.	Apply
CO5	Speak and read using words of the German language	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	-	-	-	-	-	-	-	-	-	3	-	1	-	-
CO4	-	-	-	-	-	-	-	-	-	3	-	1	-	-
CO5	-	-	-	-	-	-	-	-	2	3	-	1	--	-

High-3; Medium-2;Low-1

TEXT BOOK(s)

T1. Netzwerk, “Deutsch als Fremdsprache” by Stefanie Dengler, Paul Rusch, Helen Schmitz published by Goyal Publishers & Distributors Pvt Ltd;

T2. Funk, Kuhn, Demme, “Studio D A1 Deutsch als Fremdsprache” published by Goyal Publishers & Distributors Pvt Ltd;

REFERENCES(s)

R1. Hueber, “Fit for Goethe- Zertifikat A1 (Start Deutsch 1)” by GOYAL PUBLISHERS AND DISTRIBUTORS; 2016

Course Code: 23MAI202		Course Title: COMPLEX VARIABLES AND TRANSFORMS (Common to AU, EC, EE, EV & ME)	
Course Category: Minor		**Course Level: Introductory**	
L:T:P(Hours/Week) 3:0 :2	**Credits: 4**	**Total Contact Hours:75**	**Max Marks:100**

Course Objectives:

This course is intended to enable the student to acquire the knowledge on the calculus of functions of complex variables and continuous, discrete transforms.

Module I **23 Hours**

Vector Calculus

Gradient – Divergence – Curl – Line integrals – Surface integrals – Volume integrals – Theorems of Green, Gauss and Stokes (without proof) and their applications.

Complex Variables (Differentiation)

Cauchy-Riemann equations – Analytic functions – Properties – Harmonic functions – Finding harmonic conjugate – Conformal mapping (w=z+a, w= az, w=1/z,) – Mobius transformation and their properties.

Complex Variables I (Integration)

Cauchy Integral formula – Cauchy Integral theorem – Taylor's series – Singularities of analytic functions – Laurent's series.

Module II **22 Hours**

Complex Variables II (Integration)

Residues – Cauchy Residue theorem – Contour integrals – Evaluation of real definite integrals around unit circle and semi-circle (Excluding poles on the real axis).

Laplace Transform

Laplace Transform – Properties of Laplace Transform – Laplace transform of derivatives and integrals – Laplace transform of periodic functions -Inverse Laplace transforms - Convolution theorem – Solution of ordinary differential equations by Laplace Transform method.

Fourier Series

Dirichlet's condition -Fourier series – Even and odd functions- Half range sine and cosine series - Parseval's identity--Harmonic Analysis.

List of Experiments(Using Python) **30 Hours**

1. Find gradient of a given scalar function, divergence and curl of a vector function.
2. Verify Green's theorem in a plane.
3. Graphically plot time and frequency domain of standard functions and compute Laplace transform of In- built functions.
4. Find the Fourier series of a periodic function.
5. Compute Inverse Laplace transform of In- built functions.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Explain the concepts of Vector Differentiation and Integration.	Apply
CO2: Using the concept of complex variables to construct analytical functions and evaluate definite integrals.	Apply
CO3: Apply Laplace transform techniques to solve ordinary differential equations.	Apply
CO4: Compute the Fourier series expansion for given periodicfunctions.	Apply
CO5: Develop programs using Complex Variables and Transforms concepts through modern tool.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	3	-	-	-	-	-	-	-	-	-

High-3; Medium-2;Low-1

Text Book(s):

T1. Erwinkreyzig, Advanced Engineering Mathematics, 10th edition, John Wiley& Sons, 2011.

T2. Veerarajan T., Engineering Mathematics for first year, 3rd edition, Tata McGraw-Hill, New Delhi, 2019.

Reference Book(s):

R1. G.B.Thomas and R.L Finney, Calculus and Analytic Geometry, 9th edition, Pearson, Reprint, 2002.

R2. B.S.Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.

R3. P. Sivaramakrishna Das , C. Vijayakumari , Engineering Mathematics, Pearson India, 2017.

Web References:

1. https://nptel.ac.in/courses/111107112
2. https://nptel.ac.in/courses/111104031

Course Code : 23CHT201		Course Title: CHEMISTRY FOR MECHANICALSCIENCES (Common to ME & AU)	
Type of Course: Minor		Course Level: Introductory	
L:T:P(Hours/Week):3:0:0	Credits: 3	Total Contact Hours :45	Max Marks:100

Course Objectives

The Course is intended to impart the knowledge of Chemistry involved in water technology, Electrochemical cells, Corrosion and its control, Engineering materials and fuels and lubricants.

Module I **23 Hours**

Water Technology: Water quality parameters- Hardness (Definition, types, units)- Estimation of Hardness (EDTA method). Boiler feed water -formation of deposits in steam boilers and heat exchangers (scale, sludge and caustic embrittlement). Water softening- Demineralization (Ion exchange method)- Desalination- Reverse Osmosis method. Roles and responsibility of women and individual in conservation of water.

Batteries and Fuel cells: Electrochemistry- Basic Terminologies - Conductometric, Potentiometric and pH titrations- Batteries- types and Characteristics. Construction, working and applications of Alkaline, Lead acid, and Lithium-ion batteries. Fuels cells- H_2O_2 fuel cell.

Corrosion and control: Corrosion- dry and wet corrosion, Galvanic series, Galvanic corrosion, differential aeration corrosion. Factors influencing corrosion.

Module II **22 Hours**

Corrosion and control: Corrosion control method- material selection and design, cathodic protection techniques. Metallic coating- Galvanizing and Tinning, Electroplating- Nickel plating.

Engineering materials: Polymer-Classification, Functionality, degree of polymerization, number and weight average molecular weight (definition only). Thermo plastic and thermosets, Compounding of plastics. Polymer processing by injection and blow techniques. Polymer composites. Nano materials- Introduction – Difference between bulk

and nanomaterials, size dependent properties. Applications of nanomaterials in electronics, energy science and medicine.

Fuels and Lubricants: Automotive fuels- Petrol, diesel, CNG, blended fuels – Composition, properties and uses. Petroleum- refining, knocking in petrol and diesel engine- octane and cetane rating of fuels. Calorific value- Gross and Net calorific value. Catalytic converters. Lubricants- Importance and classification, properties of liquid lubricants and their significance. Greases – common greases, types, and properties.

Course Outcomes	
At the end of this course, students will be able to:	**Cognitive Level**
CO1: Interpret the concepts involved in water treatment, batteriesand fuel cells, corrosion.	Apply
CO2: Apply the acquired knowledge of chemistry to solve theEngineering problems.	Apply
CO3: Analyze the Engineering problems through the concept of electro chemistry, water technology, Engineering materialsand fuels.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	-	-	-	-	-	-	-	-	-	-	-	-	-

High-3; Medium-2; Low-1

Text Book(s):

T1. Jain&Jain, Engineering Chemistry (All India), 17th Edition, Dhanpat RaiPublishing Company Pvt Ltd, New Delhi, 2018.

T2. Wiley Engineering Chemistry, 2nd edition, Wiley India Pvt Ltd, New Delhi, 2011.

Reference Book(s):

R1. Dara S.S., and Umare S.S., A text book of Engineering Chemistry, S. Chand & Co Ltd, New Delhi , 2014.

R2. V.R.Gowariker, N.V.Viswanathan and Jayadev Sreedhar, Polymer Science, New Age International Pvt Ltd, Chennai , 2006.

R3. Renu Bapna and Renu Gupta, Engineering Chemistry, Macmillan India Publisher Ltd, 2010.

Web References:

1. http://nptel.ac.in/courses/122101001/downloads/lec.23.pdf
2. https://nptel.ac.in/courses/104106075/Week1/MODULE%201.pdf
3. https://nptel.ac.in/courses/103102015/

Course Code:23MEI201		Course Title: ENGINEERING MATERIALS (Common to AU,ME)	
Course Category: Major		Course Level: Introductory	
L:T:P (Hours/Week) 3: 0: 2	Credits: 4	Total Contact Hours:60	Max Marks:100

Course Objectives:

The course is intended to impart knowledge on crystal structure, phase analysis and heat treatment of ferrous alloy.

Module I **15 Hours**

Crystal Physics: Crystalline and Non crystalline materials. Single crystal, Polycrystalline materials Anisotrophic crystal parameters: Atomic radius, Number of atoms per unit cell, Coordination number, atomic packing factor for SC , BCC , FCC and HCP- Crystal planes: Miller indices, Braggs law . Interplanar distance- Polymorphism and allotrophy. Crystal imperfections: Point, line , surface and volume, grain boundary and its role in mechanical properties.

Ferrous alloy: Effect of alloying elements on properties of steel (Mn, Si, Cr, Mg, V and W). Properties and applications of stainless steel and Tool steel, Cast Iron-White, Malleable, Grey and Spheroidal Cast Iron-Properties and Applications

Non-Ferrous: Aluminium and its alloys, Copper and its alloys, Magnesium and its alloys, Titanium and its alloys, Nickel and its alloys- Composition, Properties and Applications. Industrial standards for alloys and other materials - alloying elements and inclusion of ceramics materials.

Module II **15 Hours**

Constitution of Alloys and Phase diagram: Constitution of alloys- Solid solutions- Substitutional and Interstitial. Phase diagrams- Interpretation of Phase diagram, Lever rule, Gibbs phase rule. cooling curve for pure metal, binary solid solution and binary eutectic system. Iron – Iron Carbide equilibrium diagram. Micro constituents in Fe_3C diagram (Austenite, Ferrite, Cementite, Pearlite, Martensite,Bainite), Pearlite transformation.

Heat Treatment: Heat treatment process-purpose of heat treatment – Process parameters. Bulk treatment: Annealing, Normalizing, Tempering, Quenching (Process parameter, application). Isothermal transformation Diagram (TTT Diagram). Cooling curves superimposed on TTT diagram. CCR - CCT. Hardenability- Jominy end quench test. Austempering, martempering — case hardening, carburizing, Nitriding, cyaniding, carbonitriding — Flame and Induction hardening.

List of Experiments **30 Hours**

1. Conduct the annealing operation for given ferrous alloy and analyze the microstructure.
2. Conduct the normalizing operation for given ferrous alloy and analyze the microstructure.
3. Conduct the Quenching operation for given ferrous alloy and analyze the microstructure.
4. Analyze the microstructure on non-ferrous alloy.
5. Analyze the hardness of the given material (Brinell and Rockwell).
5. Determine the micro hardness for the given sample.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO 1: Choose the suitable alloying elements for Ferrous and Non Ferrous alloys for industrial standard and analyze the crystal structures.	Apply
CO2: Apply the knowledge of composition changes in phase diagram and analyze the microstructure.	Apply
CO3: Analyze the heat treatment process for given ferrous material to meet industrial standards.	Analyze
CO4: Conduct experiments to demonstrate concepts related to heat treatment process and analyze the variations of microstructure.	Analyze

Course Articulation Matrix

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	-	3	-	-	-	-	-	-	-	-	-	-	-	-
CO4	-	3	-	-	-	-	-	-	2	2	-	-	-	-

High-3; Medium-2; Low-1

Textbook(s):

T1. William D Callister “Material Science and Engineering”, John Wiley and Sons, 2014.

Reference Book(s):

R1. Dieter G. E., “Mechanical Metallurgy”, McGraw Hill Book Company, 2013.

R2. Sidney H Avner “Introduction to Physical Metallurgy”, Tata McGRAW-Hill, 2017.

R3. Raghavan.V “Materials Science and Engineering”, Prentice Hall of India Pvt., Ltd., 2015.

Web References:

1 http://nptel.ac.in/courses/113106032/

2 https://www.coursera.org/specializations/ physical metallurgy

Course Code: 23MEL201		Course Title: COMPUTER AIDED DRAFTING AND MODELLING LABORATORY (Common to AU,ME)	
Course Category: Major		**Course Level: Introductory**	
L:T:P(Hours/Week) 1: 0: 3	**Credits:2.5**	**Total Contact Hours: 60**	**Max Marks:100**

Course Objectives:

The course is intended to create CAD model and 3D print the given part/assembly drawing.

Module I **15 Hours**

The basics of modelling: Create a basic sketch, Fully define a complex sketch, Create and shell a drafted part, Create a Revolve, Apply fillets to a model, Create a feature pattern, Create parameters, Link parameters and dimensions, Use symmetry and construction, geometry, Create construction planes, Create extruded features, Create extruded cuts, Project edges vs. including them, Useboundary fill, Create sheet metal parts.

The basics of assemblies: The different ways to create components, Use scripts to create gears, Component color swatch and color cycling, Use McMaster-Carr parts in a design, Copy, paste, and paste new, Distributed designs, Create as-built joints, Create joints, Joint origins and mid plane joints, Drive joints and motion studies, Interference detection and contact sets, Isolation and opacity control, Create groups and organize a timeline.

Exploring design tools for production : Create draft during a feature, Create draft as a feature, Add ribs and plastic supports, Analyze draft on a design, Create holes and threads, Use a coil feature, Mirrors and patterns, Surface creation for complex geometry, Use surfaces to replace faces, Use surfaces to split bodies and faces.

Module II **15 Hours**

Creating complex designs with form tools: Introduction to forms, Create a form primitive, Add or remove symmetry, Manipulate faces edges and vertices, Convert BREP faces to forms, Crease or uncrease an edge,Insert edges and subdivisions, Repairs and modifications, Add a bevel, Work with a form as a BREP. Additive Manufacturing: Create an additive CAM setup, Create custom material presets, Validate slicingthrough simulation, Generate G-Code for a 3D printer.

List of Experiments **30 Hours**

1. Develop the part drawing of 3D components using CAD tools.
2. Develop the production drawing of given machine components using CAD tools.
3. Develop the assembly model of the simple coupling
4. Model a laundry detergent bottle and print the same using 3D printer.
5. Model and 3D print a device stand Design an adjustable device stand that can be customized to hold any smart phone or small tablet.

Course Outcomes:

CO1: Develop the 3D model for the given concept and print the same using 3D printer as a team.	Apply
CO2: Create the part model and assemble the given parts using CAD tools.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	2	-	-	-	3	-	-	-	2	_
CO2	3	-	-	-	2	-	-	-	-	-	-	-	2	_

Text book(s):

T1. Parametric Modeling with Autodesk Fusion 360 by Randy H. Shih.

T2. Autodesk Fusion 360 Black Book (V 2.0.15293) – Part 1 by Gaurav Verma and Matt Weber.

T3. Autodesk Fusion 360 Black Book (V 2.0.12670) – Part 2 by Gaurav Verma and Matt Weber.

T4. Autodesk Fusion 360 – The Master Guide by Samar Malik.

T5. Autodesk Fusion 360 Exercises: 200 Practice drawings for Fusion 360 by Sachidanand Jha.

T6. Autodesk Fusion 360: A Tutorial Approach – 2nd edition by Prof. Sham Tickoo , Purdue University, Northwest , USA

Web References:

1. Introduction to Modeling and Design for Manufacturing: https://www.autodesk.com/learn/ondemand/course/fusion360-intro-modeling-design-professional
2. CAM additive manufacturing https://www.autodesk.com/learn/ondemand/module/fusion-cam-additive-manufacturing

Course Code: 23CHL201		Course Title: CHEMISTRY FOR MECHANICAL SCIENCES LABORATORY (Common to ME &AU)	
Course Category: Minor		**Course Level: Introductory**	
L:T:P (Hours/Week): 0:0:3	**credits:1.5**	**Total Contact Hours :45**	**Max Marks:100**

Course Objectives:

The Course is intended to analyze the Dissolved Oxygen, Hardness, Iron, Chloride content, and Corrosion rate, Molecular weight of polymer and Properties of various lubricants.

List of experiments: (Any 10 experiments)

1. Determination of Total, Temporary and Permanent Hardness of water by EDTA method.
2. Determination of alkalinity in water sample.
3. Determination of DO content of water sample by Winkler's method.
4. Determination of chloride content of the water sample by Argentometric method.
5. Estimation of iron content of the water sample using Spectrophotometer.
6. Conductometric titration of strong acid Vs strong base.
7. Estimation of Fe^{2+} by potentiometric titration.
8. Determination of strength of given hydrochloric acid using p^H metry.
9. Corrosion experiment - weight loss method.
10. Determination of molecular weight of Polyvinyl alcohol using Ostwald viscometer.
11. Green synthesis of silver nanoparticles by Neem leaf
12. Determination of Cloud and Pour Point.

Course Outcomes At the end of this course, students will able to:	Cognitive Level
CO1: Understand the concept of volumetric and instrumental methods through chemistry laboratory.	Understand
CO2: Apply the knowledge of chemistry to investigate engineeringmaterials by volumetric and instrumental methods and analyze, interpret the data to assess and address the issues of Environmental Problems.	Evaluate

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	-	-	3	-	-	-	-	-	-	-	-	-	-

High-3; Medium-2; Low-1

Reference Book(s):

R1. A Text book on Experiments and calculations in Engineering Chemistry by SS Dara, 9th Edition, S Chand publications, 2015.

R2. Instrumental methods of chemical analysis, Chatwal and Anand, 5th Himalaya Publications,2023.

R3. Lab manual of Chemistry for Mechanical Sciences Laboratory prepared by Chemistry faculty members.

Web References:

1. https://archive.nptel.ac.in/courses/104/106/104106121/

2. https://academic.oup.com/book/42038/chapter-bstract/355779823?redirectedFrom=fulltext

Course Code: 23MEL202		Course Title: ENGINEERING PRACTICESLABORATORY (Common to AU,CE,ME)	
Course Category: SEC		Course Level: Practice	
L:T:P(Hours/Week) 0: 0: 3	Credits:1.5	Total Contact Hours:45	Max Marks:100

Course Objectives:

The course is intended to impart knowledge on basic electrical, mechanical and civil operations.

List of Experiments

Electrical & Electronics

1) Symbols of electrical and electronic components and study of electrical drawing.
2) Insulation Testing using Megger.
3) Soldering practice of simple circuit and testing.
4) Fluorescent tube, staircase and house wiring.
5) Verification of Kirchhoff's current and voltage law.

Civil & Mechanical

1. Make a wooden Tee joint to the required dimension.
2. Make a "V" filling to the required dimension using fitting tools.
3. Make a tray in sheet metal to the required dimension.
4. Assemble the pipeline connections with different joining components for the given layout.
5. Demonstrate a butt joint using welding process to the required dimension.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply engineering knowledge to conduct experiments and analyze the electrical and electronic connections as per the given circuit.	Analyze
CO2: Apply to make wooden 'T' joint, and pipeline connection individually using various workshop tools as per the given dimensions.	Apply
CO3: Apply to make metal 'V' joint with various joining components and a permanent joint as per the given dimensions using modern workshop tools and engineering principles.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	2	-	2	-	-	-	-	2	-	-	-	-	-
CO2	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	2	-	-	-	2	-	-	-	-	-	-	-	-	-

High-3; Medium-2; Low-1

Reference Book(s):

R1. Jeyachandran.K, Natarajan.S & Balasubramanian.S, "A Primer on Engineering Practices Laboratory", Anuradha Publications, TamilNadu (India), 2016.

R2. 19EPL21 - Engineering practices laboratory Manual.

Web References:

1. http://nptel.ac.in/courses/112103019/
2. https://www.aaaenggcoll.ac.in/engineering-practices-lab/
3. https://www.coursera.org/courses?query=engineering

Course Code: 23ESL201		Course Title: PROFESSIONAL SKILLS 1: PROBLEM SOLVING SKILLS &LOGICAL THINKING 1 (Common to all B.E/B.Tech Programmes)	
Course Category: SEC		**Course Level: Introductory**	
L:T:P(Hours/Week) 0: 0: 2	**Credits: 1**	**Total Contact Hours:30**	**Max Marks:100**

Course Objectives:

The course is intended to enhance the students' numerical, analytical and logical reasoning ability. Also course focus to make learners prepare for various public and private sector exams and placement drives.

Module I Quantitative Ability **20 Hours**

Number System and LCM & HCF- Percentage- Ratio and Proportion - Average- Progressions- Ages- Partnership- Mixture & Allegation - Profit and loss- Interest calculation- Data interpretation.

Module II Reasoning Ability **10 Hours**

Seating Arrangement- Linear, circular and Complex – Direction Problems- Blood Relation- Puzzles- Crypt arithmetic- Venn diagrams- Statement and conclusion- Statement and

Textbook(s):

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Build the competence in numerical, analytical and logical reasoning ability argument- Causes and effects- Self-Learning.	**Apply**

T1: Dr. R. S. Aggarwal. "Quantitative Aptitude for Competitive Examinations" Sultan Chand & Sons Pvt. Ltd,New Delhi, 2018.

T2**:** Dr. R. S. Aggarwal. "A Modern Approach to Logical Reasoning", Sultan Chand & Sons Pvt. Ltd, New Delhi,2018

Reference Book(s):

R1: R. V. Praveen. “Quantitative Aptitude and Reasoning” 2nd Revised Edition, Prentice-Hall of India Pvt.Ltd,2013

R2: Arun Sharma. “Quantitative Aptitude for Common Aptitude Test”, McGraw Hill Publications, 5th Edition,2020

R3**:** Arun Sharma. “Logical Reasoning for Common Aptitude Test”, McGraw Hill Publications, 6th Edition, 2021.

Web References:

1 https://www.indiabix.com/aptitude/questions-and-answers/

2 https://www.geeksforgeeks.org/aptitude-questions-and-answers/

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	3	-	-

High-3; Medium-2; Low-1

Course Code: 23VAT201	Course Title: TAMILS AND TECHNOLOGY (Common to all B.E/B.Tech Programmes)		
Course Category: VAC		Course Level: Introductory	
L:T:P (Hours/Week) 1: 0 :0	Credit: 1	Total Contact Hours: 15	Max Marks:100

Pre–requisites

- NIL

Course Objectives

மாணவர்கள் இப்பாடத்தை கற்றலின் மூலம்

CO.1 நெசவு மற்றும் பானைத் தொழில்நுட்பம், வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம், உற்பத்தித் தொழில்நுட்பம், வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில்நுட்பம் ஆகியன குறித்து அறிந்து கொள்ள இயலும்.

CO.2 அறிவியல் தமிழ் மற்றும் கணினித் தமிழ் குறித்து அறிந்து கொள்ள இயலும்.

தமிழரும் தொழில்நுட்பமும்

அலகு 1 – நெசவு மற்றும் பானைத் தொழில்நுட்பம் 3

சங்க காலத்தில் நெசவுத் தொழில் – பானைத் தொழில்நுட்பம் – கருப்பு சிவப்பு பாண்டங்கள் – பாண்டங்களில் கீறல் குறியீடுகள்

அலகு 2 – வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம் 3

சங்க காலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் ஷ சங்க காலத்தில் வீட்டுப் பொருட்களில் வடிவமைப்பு – சங்க காலத்தில் கட்டுமானப் பொருட்களும் நடுகல்லும் – சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள் – மாமல்லபுரச் சிற்பங்களும், கோவில்களும் – சோழர் காலத்துப் பெருங்கோயில்கள் மற்றும் பிற வழிபாட்டுத் தலங்கள் – நாயக்கர் காலக் கோயில்கள் – மாதிரி கட்டமைப்புகள் பற்றி அறிதல், மதுரை மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர் மஹால் – செட்டிநாட்டு வீடுகள், பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தோ – சாரோசெனிக் கட்டிடக் கலை.

அலகு 3 – உற்பத்தித் தொழில்நுட்பம் 3

கப்பல் கட்டும் கலை – உலோகவியல் – இரும்புத் தொழிற்சாலை – இரும்பை உருக்குதல், எஃகு – வரலாற்றுச் சான்றுகளாக செம்பு மற்றும் தங்க நாணயங்கள் – நாணயங்கள் அச்சடித்தல் – மணி உருவாக்கும் தொழிற்சாலைகள் – கல்மணிகள், கண்ணாடி மணிகள் – சுடுமண் மணிகள் – சங்கு மணிகள் – எலும்புத் துண்டுகள் – தொல்லியல் சான்றுகள் – சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.

அலகு 4 வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில்நுட்பம் 3

அணை, ஏரி, குளங்கள், மதகு – சோழர்காலக் குமுழித் தூம்பின் முக்கியத்துவம் – கால்நடை பராமரிப்பு – கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள் – வேளாண்மை மற்றும வேளாண்மைச் சார்ந்த செயல்பாடுகள் – கடல்சார் அறிவு – மீன் வளம் – முத்து மற்றும் முத்துக் குளித்தல் – பெருங்கடல் குறித்த பண்டைய அறிவு – அறிவுசார் சமூகம்.

அலகு 5 – அறிவியல் தமிழ் மற்றும் கணினித் தமிழ் 3

அறிவியல் தமிழின் வளர்ச்சி – கணினித் தமிழ் வளர்ச்சி – தமிழ் நூல்களை மின் பதிப்பு செய்தல் – தமிழ் மென் பொருட்கள் உருவாக்கம் – தமிழ் இணையக் கல்விக் கழகம் – தமிழ் மின் நூலகம் – இணையத்தில் தமிழ் அகராதிகள் – சொற்குவைத் திட்டம்.

TOTAL : 15 PERIODS

Course Outcomes	**Cognitive Level**
மாணவர்கள் இப்பாடத்தை கற்றபின்	
CO.1 நெசவு மற்றும் பானைத் தொழில்நுட்பம், வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம், உற்பத்தித் தொழில்நுட்பம், வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில்நுட்பம் ஆகியன குறித்து அறிந்து கொள்வார்கள்.	அறிதல் (Understand)
CO.2 அறிவியல் தமிழ் மற்றும் கணினித் தமிழ் குறித்து அறிந்து கொள்வார்கள்.	அறிதல் (Understand)

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	-	-	-	-	1	-	-
CO2	-	-	-	-	-	-	-	-	-	-	-	1	-	-

High–3; Medium–2; Low–1

TEXT - CUM REFERENCE BOOKS

1 தமிழக வரலாறு – மக்களும் பண்பாடும் – கே.கே.பிள்ளை
(வெளியீடு. தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்)

2. கணினித் தமிழ் – முனைவர் இல. சுந்தரம் (விகடன் பிரசுரம்)

3. கீழடி – வைகை நதிக்கரையில் சங்க கால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)

4. பொருநை – ஆற்றங்கரை நாகரிகம் (தொல்லியல் துறை வெளியீடு)

5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)

6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.

7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).

8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)

9. Keeladi - 'Sangam City C ivilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)

10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)

11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)

12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

Course Code: 23VAT201	Course Title: TAMILS AND TECHNOLOGY (Common to all B.E/B.Tech Programmes)		
Course Category: VAC		Course Level: Introductory	
L:T:P (Hours/Week) 1: 0 :0	Credit: 1	Total Contact Hours: 15	Max Marks:100

Pre–requisites

- NIL

Course Objectives

The course is intended to:

1. Understand Weaving and Ceramic Technology, Design and Construction Technology, Manufacturing Technology, Agriculture and Irrigation Technology.
2. Understand the Scientific Tamil & Tamil Computing.

TAMILS AND TECHNOLOGY

UNIT I WEAVING AND CERAMIC TECHNOLOGY 3

Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries.

UNIT II DESIGN AND CONSTRUCTION TECHNOLOGY 3

Designing and Structural construction House & Designs in household materials during Sangam Age - Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram - Sculptures and Temples of Mamallapuram - Great Temples of Cholas and other worship places - Temples of Nayaka Period - Type study (Madurai Meenakshi Temple)- Thirumalai Nayakar Mahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period.

UNIT III MANUFACTURING TECHNOLOGY 3

Art of Ship Building - Metallurgical studies - Iron industry - Iron smelting, steel -Copper and gold- Coins as source of history - Minting of Coins – Beads making-industries Stone beads -Glass beads - Terracotta beads -Shell beads/ bone beats - Archeological evidences - Gem stone types described in Silappathikaram.

UNIT IV AGRICULTURE AND IRRIGATION TECHNOLOGY 3

Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompu of Chola Period, Animal Husbandry - Wells designed for cattle use - Agriculture and Agro Processing - Knowledge of Sea - Fisheries – Pearl - Conche diving - Ancient Knowledge of Ocean - Knowledge Specific Society.

UNIT V SCIENTIFIC TAMIL & TAMIL COMPUTING 3

Development of Scientific Tamil - Tamil computing – Digitalization of Tamil Books – Development of Tamil Software – Tamil Virtual Academy – Tamil Digital Library – Online Tamil Dictionaries – Sorkuvai Project.

TOTAL : 15 PERIODS

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO.1 Understand Weaving and Ceramic Technology, Design and Construction Technology, Manufacturing Technology, Agriculture and Irrigation Technology.	Understand
CO.2 Understand the Scientific Tamil & Tamil Computing.	Understand

Course Articulation Matrix

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	-	-	-	-	-	-	-	-	-	-	-	1	-	-
CO2	-	-	-	-	-	-	-	-	-	-	-	1	-	-

High–3; Medium–2; Low–1

TEXT - CUM REFERENCE BOOKS

1 தமிழக வரலாறு – மக்களும் பண்பாடும் – கே.கே.பிள்ளை
(வெளியீடு. தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்)

2. கணினித் தமிழ் – முனைவர் இல. சுந்தரம் (விகடன் பிரசுரம்)

3. கீழடி – வைகை நதிக்கரையில் சங்க கால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)

4. பொருநை – ஆற்றங்கரை நாகரிகம் (தொல்லியல் துறை வெளியீடு)

5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)

6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.

7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).

8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)

9. Keeladi - 'Sangam City C ivilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)

10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)

11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)

12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

Course Code: 23CHT202		Course Title: ENVIRONMENTAL SCIENCES (Common to all B.E/B.Tech Programmes)	
Course Category: Multidisciplinary		Course Level: Introductory	
L:T:P(Hours/Week) 1: 0: 0	Mandatory NonCredit Course	Total Contact Hours: 15	Max Marks:100

Course Objectives:

The course is intended to impart knowledge on sustainable utilization of natural resources, prevention of pollution, disaster management and environmental issues & public awareness on ecosystem.

Module I **8 Hours**

Natural Resources

Role of individual in conservation of natural resources; Equitable use of resources for sustainable lifestyles.

Environmental Pollution and Disaster Management

Role of an individual in prevention of pollution; Disaster management : floods, earthquake, cyclone and landslides.

Environmental Ethics and Legislations

Environmental ethics : Environment Protection Act; Air Act; Water Act ; Wildlife Protection Act; Forest Conservation Act; Issues involved in enforcement of environmental legislation.

Module II **7 Hours**

Environmental Issues and Public Awareness

Public awareness - Environment and human health.

Environmental Activities

(a) Awareness Activities:

i. Small group meetings about water management, promotion of recycle use, generation of less waste, avoiding electricity waste.
ii. Slogan making event.
iii. Poster making event.

(b) Actual Activities:

i. Plantation.
ii. Cleanliness drive.
iii. Drive for segregation of waste.
iv. To know about the different varieties of plants.
v. Shutting down the fans and ACs of the campus for an hour or so.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO 1: Explain the use of natural resources for a sustainable life as an individual in prevention of pollution.	Understand
CO 2: Apply the environmental ethics and legislations for various environmental issues.	Apply
CO 3: Create the public awareness on environment and human health as an individual or team through various activity based learning.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	-	-	-	-	-		
CO2	3	-	-	-	-	-	3	3	-	-	-	-		
CO3	3	-	-	-	-	3	3	-	3	3	-	-		

High-3; Medium-2;Low-1

Text Book(s):

T1. Benny Joseph, “Environmental Studies", Tata McGraw Hill, New Delhi, 2006.

T2. Mackenzie Davis and Susan Masten, “Principles of environmental engineering and science”, Mc-Graw Hill, 3rd Edition, 2014.

Reference Book(s):

R1. Trivedi R.K. “Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards", Vol.I and II, Enviro Media.

R2. Cunningham, W.P.Cooper, T.H. Gorhani, “Environmental Encyclopedia", Jaico Publishing House, Mumbai, 2001.

Web References:

1. https://onlinecourses.nptel.ac.in/noc23_hs155/preview.
2. https://en.wikipedia.org/wiki/Environmental_science.

SEMESTER III

Course Code: 23MAT302		Course Title: NUMERICAL METHODS (Common to AE,ME)	
Course Category: Minor		Course Level: Intermediate	
L:T:P(Hours/Week) 3:1 :0	Credits: 4	Total Contact Hours:60	Max Marks:100

Course Objectives:

The students able to solve the system of linear equations and nonlinear equations use of matrix algebra techniques that is needed by engineers for practical applications and familiarize with Interpolate the given data and calculate the numerical derivatives and integration. To familiarize and solve the initial value and boundary value problems using numerical techniques.

Module I **30 Hours**

Solution of System of Linear Equations and Eigenvalue

Solution of system of linear equations, Gauss elimination method, Crout's method, iterative methods of Gauss Jacobi and Gauss Seidal method, Eigen values of matrix by power method.

Solution Of Non-Linear Equations And Curve Fitting

Solution of non-linear equations: Method of false position, Newton Raphson method, order of convergence. Curve fitting: Method of least square fit a straight line, fitting a curve.

Interpolation, Polynomial Approximation

Interpolation with equal intervals, Newton's forward and backward difference formulae, interpolation with unequal interval, Lagrange's interpolation, numerical differentiation

Module II **30 Hours**

Numerical Integration

Numerical integration, trapezoidal rule, Simpson's rule, double integration using trapezoidal rule and Simpson's rule.

Initial Value Problem for Ordinary Differential Equations

Single step methods,Taylor's series method, Euler's method, Modified Euler's method,

Fourth order Runge-Kutta method for solving first order equations, Multi step methods, Milne's and Adams method.

Boundary Value Problems in Partial Differential Equations

Solution of two-dimensional Laplace's and Poisson's equations, one dimensional heat flow equation by explicit and implicit (Crank Nicholson) methods, one dimensional wave equation by explicit method.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Demonstrate the concepts of numerical methods to engineering problems.	Understanding
CO2: Apply the concept of various numerical techniques for solving non-linear equations and system of linear equations.	Apply
CO3: Apply the knowledge of Interpolation and determine the integration and differentiation of the function by using the numerical data.	Apply
CO4: Determine the solution of initial and boundary value problems using numerical techniques.	Apply

Course Articulation Matrix

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	1	-	-	-	-	-	-	-	1	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	-	-	-	-	-	-	-	-	-	-	-	-	-

Text Book(s):

T1. Erwin Kreyzig, "Advanced Engineering Mathematics", 10th edition, John Wiley & Sons, 2015.

T2. Veerarajan T., "Engineering Mathematics for First Year", Tata McGraw-Hill, New Delhi, 2011.

T3. Ramana B.V., "Higher Engineering Mathematics", Tata McGraw-Hill, New Delhi, 1st edition, 2017.

Reference Book(s):

R1. Thomas G.B. and Finney R.L., “Calculus and Analytic Geometry”, 9th edition, Pearson, Reprint, 2010.

R2. Bali N.P. and Manish Goyel, “A Text book of Engineering Mathematics”, Laxmi Publication, 9th edition, 2010.

R3. B.S. Grewal, “Higher Engineering Mathematics”, Khanna Publishers, 43rd Edition, 2014.

Web References:

1. https://onlinecourses.nptel.ac.in/noc16_ma05
2. https://nptel.ac.in/courses/122101003/2

Course Code: 23MET301	Course Title: ENGINEERING MECHANICS (Common to ME & AU)		
Course Category: Major	Course Level: Intermediate		
L:T:P(Hours/Week) 2: 1: 0	Credits: 3	Total Contact Hours: 45	Max Marks: 100

Course Objectives:

The course is intended to impart knowledge on Static force analysis on simple elements, Kinematics of mechanisms and Kinetics of rigid bodies.

Module I **23 Hours**

Force Analysis of Beams, Frames and Machines: Fundamental laws of mechanics (Review) -Free body diagram-Statics-Particles and Rigid bodies-Types of forces Action(Point, UDL, UVL and couples)-Reaction (Supports, Friction) Governing equations of equilibrium-Equivalent force and couple moment-Types of beams-Determining reactions in statically determinate beams-Bending moment diagram and Shear force diagram of cantilever, simply supported beam and over hanging beams-Analysis of frames-Machines-Laws of dry friction-ladder and wedge frictions.

Geometric Properties of Lamina and Bodies: Properties of surfaces – centroid of composite planes such as L, I and T-Moment of Inertia (MI)-Parallel and perpendicular axis theorem – MI of composite sections involving simple geometries such as rectangle, circle and triangle -Centre of gravity and mass moment of inertia of composite solids involving block, cylinder, cone and sphere. Center of gravity for simple machine structures.

Module II **22 Hours**

Introduction to Mechanisms: Mechanism and structure ––links-pairs-chains – fourbar and slider crank mechanisms –degrees of freedom of linkages – Gruebler's criterion– Grashof's condition of rotatability - transmission angle and

mechanical advantage-special lower pair mechanisms: Peucelliar straight line mechanism, Ackermann steering mechanism, pantograph, Geneva mechanism.

Kinetics of Rigid Body: Dynamic equilibrium of rigid bodies– Planar kinetics of rigid body– Force and Acceleration, Work and energy, Impulse and momentum.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Determine various forces on rigid bodies such as beams, frames and machines under static conditions.	Apply
CO2: Calculate centroids, center of gravity and moment of inertia of simple Shapes and machine structures	Apply
CO3: Determine the degrees of freedom of given mechanism.	Apply
CO4: Calculate the kinetic parameters of rigid bodies for dynamic equilibrium.	Apply
CO5: Prepare and present a case study on the analysis of the forces in a real world application	Evaluate

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	3	-	-	2	-	-	-	2	3	-	3	-	-

Text Book(s):

T1. R C Hibbeler, “Engineering mechanics – Statics and Dynamics”, 14th Edition, Pearson, New Delhi, 2017.

T2. S.S. Rattan, “Theory of Machines”, McGraw Hill Education, 4thEdition.2017.

Reference Book(s):

R1. F.P. Beer and Jr. E.R. Johnston, “Vector Mechanics for Engineers — Statics and Dynamics”, 10th Edition Tata McGraw Hill publishing company, New Delhi,2017.

R2. R.S. Khurmi, J.K Gupta, “Theory of Machines” , S.Chand, 14th Edition. 2005.

R3. Irving H. Shames, “Engineering mechanics — Statics and Dynamics”, 14th Edition, Pearson, New Delhi, 2014.

Web References:

1. http://hyperphysics.phy-astr.gsu.edu/hbase/hframe.html
2. https://nptel.ac.in/courses/122104015/

Course Code: 23MEI301	Course Title: ENGINEERING THERMODYNAMICS		
Course Category: Major		Course Level: Intermediate	
L:T:P(Hours/Week) 2: 0: 2	Credits: 3	Total Contact Hours: 60	Max Marks:100

Course Objectives:

This course aims to impart knowledge on the fundamentals of Thermodynamics including thermodynamic systems and properties, relationships among the thermo-physical properties, the laws of thermodynamics and applications of these basic laws for the design, analysis and performance improvement of various thermodynamics systems.

Module I **15 Hours**

Basics of Thermodynamics - Thermodynamics systems, Properties and processes, Thermodynamic Equilibrium, Calculation of work and heat in various processes, Zeroth law of thermodynamics, First law of thermodynamics — application to closed and open systems, steady and unsteady flow processes and Limitations. Second Law of thermodynamics — Need, Statements of second law, Carnot cycle and Applications of second law- Heat Engine, Refrigerator and Heat Pump - high and low grade energy, Availability and Irreversibility for open and closed system processes, Concept of Entropy - I & II law's efficiency and Third law of thermodynamics, **Properties of Pure Substances** - Formation of steam and its thermodynamic properties, P-V, P-T, T-V, T- S and h-s diagrams. Use of Steam table and Mollier chart, Determination of dryness fraction of steam.

Module II **15 Hours**

Air standard cycles - Otto, Diesel, Dual and Brayton cycles - Calculation of mean effective pressure and air standard efficiency.

Performance of IC Engines – Performance characteristics, Engine Performance Tests and Heat balance test.

Air Compressors - Introduction to air compressors, Reciprocating air compressor, performance characteristics, effect of clearance volume, multistage compressors with intercooler- Introduction to Gas compressors and its applications,

Rotary compressors — working principle of vane type, roots blower, screw compressor, centrifugal and axial flow compressors. Applications of various types of compressors.

Refrigeration - Fundamentals of Refrigeration, vapor compression and vapor absorption

refrigeration systems, Properties of refrigerants, COP, performance calculations.

Psychrometry and Air-conditioning — Psychrometric properties of air and water vapour mixtures, smart cooling systems, summer, winter and centralized air-conditioning systems,simple cooling load and heating load calculations.

List of Experiments **30 Hours**

1. Valve timing and Port timing diagrams
2. Performance test on single cylinder, four stroke diesel engine
3. Performance and emission test on single cylinder, four stroke VCR diesel engine
4. Performance test on centrifugal air blower
5. Performance test on two-stage reciprocating air compressor
6. Determination of COP of refrigeration system
7. Determination of viscosity of lubricating oil using Redwood viscometer

Course Outcomes	**Cognitive Level**
At the end of the course students will able to	
CO1: Analyze the performance of thermodynamics systems using first and second law analysis	Apply
CO2: Evaluate the thermodynamic characteristics of IC engines	Apply
CO3: Evaluate the performance characteristics of air compressors, refrigeration and air Conditioning systems.	Apply
CO4: Study a domestic/industrial refrigerating unit and present a report about its working principle, major components, technical specifications, critical factors affecting its thermal performance and various energy conservation opportunities for improving its performance as a team.	Analyze
CO5: Present a case study of comparing smart cooling systems with conventional air-conditioning systems with respect to construction, working principle, performance, cost and environmental impact as a team.	Analyze

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	3	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	3	-	3	-	3	2	-	3	3	-	3	-	-
CO5	3	3	-	3	-	3	3	-	3	3	-	3	-	-

Text Book(s):

T1. P.K.Nag, “Engineering Thermodynamics”, Mc Graw Hill, 6th edition, 2017.

T2. R.K.Rajput, “Thermal Engineering”, Laxmi Publications (P) Ltd., New Delhi, 10th edition, 2020.

Reference Book(s):

R1. Yunus A Cengel, Michael A Boles and Mehmet Kanoglu. “Thermodynamics – An Engineering Approach”, Mc Graw Hill, 9th edition, 2019.

R2. Mahesh M.Rathore, “Thermal Engineering”, Ta Mc Graw Hill, 3rd edition, 2013.

Web Reference(s):

1. https://nptel.ac.in/courses/112106419
2. https://nptel.ac.in/courses/112107216
3. https://nptel.ac.in/courses/112106310

Course Code: 23MET302	Course Title: FLUID MECHANICS AND HYDRAULICS MACHINERY (Common to ME & AU)		
Course Category: Major		**Course Level : Intermediate**	
L:T:P(Hours/Week) 2: 1:0	**Credits: 3**	**Total Contact Hours:45**	**Max Marks:100**

Course Objectives:

The course is intended to enable the impart knowledge on laws of fluid mechanics and evaluate pressure, velocity and acceleration fields for various fluid flows and performance parameters for hydraulic machinery.

Module I **24 Hours**

Fluid properties

Fluid- definition, classification of fluids, units and dimensions, Properties of fluids- density, specific weight, specific volume, specific gravity, viscosity, compressibility, vapor pressure, capillarity and surface tension.

Flow characteristics

Continuity equation and Bernoulli's equation, Application- venturi meters, orifice meters, Pitot tube, flow through pipes.

Laminar flow- boundary layer concepts, boundary layer thickness, Turbulent flow –losses- Darcy-Weisbach equation, Friction factor and Moody diagram, Minor losses, Flow through pipes in series and in parallel, Hydraulic and energy gradient.

Module II **21 Hours**

Dimensional analysis and Model analysis

Dimensional analysis- Need and methods - Buckingham's π theorem. Similitude, types of similitude, Dimensionless parameters, application of dimensionless parameters, Model analysis.

Pumps

Classification of pumps- Centrifugal pump- working principle, velocity triangles, Efficiencies and performance curves. Reciprocating pump- classification, working principle, indicator diagram, Air vessels and performance curves , Dismantle and assembly of various types of pumps.

Turbines

Classification of turbines, heads and efficiencies, velocity triangles, Pelton, Francis and Kaplan turbines, working principle and construction, work done by water on the runner, draft tube, performance curves, governing of turbines.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Apply mathematical knowledge to predict the properties and characteristics of a fluid.	Apply
CO2: Calculate the major and minor losses associated with pipe flow in piping networks.	Apply
CO3: Prepare and present a demonstrate on the dismantle and assembly of various types of pumps	Apply
CO4: Select a suitable hydraulic turbine and pump for the customer specifications	Analyze

Course Articulation Matrix

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	-	-	-	-	-	-	-	3	-	-	-	3	2
CO4	3	3	-	-	-	-	-	-	-	-	-	-	-	-

Text Book(s):

T1 Bansal, R.K., “Fluid Mechanics and Hydraulics Machines”, Laxmi Publications

(P) Ltd., New Delhi,Ninth Edition, 2017.

T2 YunusCengel, John Cimbalal , “Fluid Mechanics- Fundamentals and Applications”, Tata McGraw-Hill Education, 2014.

Reference Book(s):

R1. White, F.M., "Fluid Mechanics", 5th Edition Tata McGraw-Hill,New Delhi, 2013 R2.

Streeter, V.L., and Wylie, E.B., "Fluid Mechanics", 9th Edition McGraw-Hill education,2017.

R3. Kumar, K.L., "Engineering Fluid Mechanics", 7th edition Eurasia Publishing House (P)Ltd., New Delhi, 2014.

Web Reference(s):

1. https://nptel.ac.in/courses/112104118
2. https://nptel.ac.in/courses/112105171

Course Code: 23MET303	Course Title: MANUFACTURING PROCESSES (Common to ME & AU)		
Course Category: Major	Course Level: Intermediate		
L:T:P(Hours/Week): 3:0: 0	Credits: 3	Total Contact Hours: 45	Max Marks: 100

Course objectives

The course aims to empower students to effectively apply concepts of manufacturing process.

Module I **22 hours**

Casting process - Introduction, Types, Sand casting - Solidification and Cooling, Patterns, Molds and Cores, Gating system and functions, Runner and riser, Die casting, Centrifugal casting, Casting defects. Moulding of Plastic Components - Injection molding, Blow molding, Compression molding, Molding defects, Testing and inspection of casting.

Forming process Introduction, Types, Fundamentals of Hot and Cold Working Processes, Plastic Deformation and Yield Criteria, Load Estimation for Bulk (Forging, Extrusion, Rolling, and Drawing) and Sheet metal (Blanking, Piercing, Bending, Drawing) forming processes, Explosive Forming, Electro - hydraulic forming, Defects, Introduction of Powder Metallurgy process.

Joining Process - Operating principle, basic equipment, Electrodes and its Coatings, Manual metal arc welding, Gas Tungsten arc welding, Gas metal arc welding, Submerged arc welding, Gas welding, Flame characteristics, Resistance welding, Weld defects, Brazing and soldering, Testing of welded joints.

Module II **23 hours**

Theory of metal cutting - Types of chips, oblique cutting, orthogonal cutting, cutting forces, cutting tools nomenclature, tool wear, tool life, machinability, cutting tool materials, surface finishand machinability, cutting fluids.

Machining Processes: Centre lathe - Constructional features, operations – machining time and power estimation. Drilling machine - Constructional features, operations. Milling machine - Constructional features, operations. Abrasive processes: grinding

wheel, specification. Grinding process cylindrical grinding, surface grinding, centerless grinding- dressing, truing and balancing of grinding wheels. process parameters and process planning.

Advanced Manufacturing Methods: EDM, 3D Printing, Digital Manufacturing – Application and Advantages, Automation and Robotics in Manufacturing.

Course Outcomes:

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

CO1: Select appropriate manufacturing processes for the specified design requirement.	Apply
CO2: Estimate the process parameters for forming of bulk, sheet metal Components.	Apply
CO3: Calculate the process parameters for the machining of circular and prismatic components.	Apply
CO4: Prepare and present a process plan for manufacturing the specified design requirement as a team.	Analyze

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	3	-	-	-	2	2	-	3	3	2	3	-	-

Text Book(s):

1. Hajra Choudhury S.K, Hajra Choudhury. AK., and Nirjhar Roy "Elements of workshop Technology volume I: Manufacturing Processes", Media promoters and Publishers PrivateLimited, 2023
2. Kalpakjian. S, Steven R. Schmid, “Manufacturing Engineering and Technology”, PearsonEducation India, 8th edition, 2023
3. Rao. P.N “Manufacturing Technology - Metal Cutting and Machine Tools", 4th Edition, McGraw Hill Education (India) Private Limited, 2018.

Reference Book(s):

1. Hajra Choudhury S.K and Nirjhar Roy, "Elements of workshop Technology

volume II:MachineTools", Media promoters and Publishers Private Limited, 2023.

2. Rao, P.N. "Manufacturing Technology - Foundry, Forming and Welding", 4th Edition,McGrawHill Education (India) Private Limited, 2018.
3. Sharma, P.C., "A Text book of production Technology", S.Chand and Co. Ltd., 2014.

Web References:

1. https://archive.nptel.ac.in/courses/112/107/112107219/
2. https://onlinecourses.nptel.ac.in/noc22_me28/preview

Course Code: 23MEL301	Course Title: MANUFACTURING PROCESSES LABORATORY (Common to ME & AU)		
Course Category: Major	Course Level: Intermediate		
L:T:P(Hours/Week) 0:0:3	Credits: 1.5	Total Contact Hours: 45	Max. Marks: 100

Course Objectives

To study and practice the various operations that can be performed in lathe, drilling, milling, grinding, pressing etc. and to equip with the practical knowledge required in the core industries.

List of Experiments:

1. Make a sand mold using the given pattern.
2. Make a component as per the drawing using Hydraulic / Mechanical Press.
3. Join the given thick metal sheets using suitable welding process.
4. Make a shaft as per the drawing using the lathe machine.
5. Make a hole as per the drawing using drilling machine.
6. Perform the milling operation on the part as per the drawing using Vertical milling machine
7. Perform the milling operation on the part as per the drawing using Horizontal milling machine
8. Perform grinding operation on the shaft as per the drawing
9. Perform surface grinding operation as per the drawing
10. Assemble the parts to produce a product as per the drawing.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Select suitable process parameter and prepare process planning sheet for the components in the given drawing.	Apply
CO2: Produce a product as per the given dimensions using various manufacturing processes.	Evaluate

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	3	-	-	-	-	-	-	-	-	-	-
CO2	3	3	3	3	2	-	-	2	-	-	-	-	-	-

Reference Book(s):

1. Hajra Choudhury S.K, Hajra Choudhury. AK., and Nirjhar Roy "Elements of workshop Technology volume I: Manufacturing Processes", Media promoters and Publishers PrivateLimited, 2023
2. Kalpakjian. S, Steven R. Schmid, “Manufacturing Engineering and Technology”, PearsonEducation India, 8th edition, 2023
3. Rao. P.N “Manufacturing Technology - Metal Cutting and Machine Tools", 4th Edition, McGraw Hill Education (India) Private Limited, 2018.
4. Hajra Choudhury S.K and Nirjhar Roy, "Elements of workshop Technology volume II: Machine Tools", Media promoters and Publishers Private Limited, 2023.
5. Rao, P.N. "Manufacturing Technology - Foundry, Forming and Welding", 4th Edition, McGrawHill Education (India) Private Limited, 2018.
6. Sharma, P.C., "A Text book of production Technology", S.Chand and Co. Ltd., 2014.

Web References:

1. https://archive.nptel.ac.in/courses/112/107/112107219/
2. https://onlinecourses.nptel.ac.in/noc22_me28/preview

Course Code: 23MEL302		Course Title: FLUID MECHANICS AND HYDRAULICS MACHINERY LABORATORY (Common to ME & AU)	
Course Category: Major		Course Level : Intermediate	
L:T:P(Hours/Week) 0:0:3	Credits: 1.5	Total Contact Hours:45	Max Marks:100

Course Objectives:

The course is intended to provide practical knowledge in verification of principles of fluid flow, pressure, discharge and velocity of fluid flow, Major and Minor Losses and gain knowledge in performance testing of Hydraulic Turbines and Hydraulic Pumps at constant speed and Head.

List of Experiments: **45 Hours**

1. Determination of coefficient of discharge of given Orifice meter.
2. Determination of coefficient of discharge of given Venturi meter.
3. Determination of the velocity of flow using Pitot Tube
4. Determination of friction factor of given set of pipes.
5. Performance study of Centrifugal pumps
6. Performance study of curves of Gear pump.
7. Performance study of reciprocating pumps.
8. Performance characteristics of a Pelton wheel.
9. Performance test on a Francis Turbine.
10. Performance test on a Kaplan Turbine

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1:Determine the actual and theoretical discharge of fluid flow using various flow measuring devices.	Apply
CO2: Determine friction factor and Reynolds Number for a fluid flow through pipe.	Apply
CO3: Conduct performance tests and draw the characteristics curves of pumps and turbines	Analyze

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	2	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	2	-	-	-	-	-	-	-	-	-	-
CO3	3	3	-	2	2	-	-	-	2	-	-	-	3	2

Text Book(s):

T1 Bansal, R.K., “Fluid Mechanics and Hydraulics Machines”, Laxmi Publications (P) Ltd., NewDelhi, Ninth Edition, 2017.

T2 YunusCengel, John Cimbalal , “Fluid Mechanics- Fundamentals and Applications”, Tata McGraw-Hill Education, 2014.

Reference Book(s):

R1. White, F.M., "Fluid Mechanics", 5th Edition Tata McGraw-Hill,New Delhi, 2013 R2.

Streeter, V.L., and Wylie, E.B., "Fluid Mechanics", 9th Edition McGraw-Hill education,2017.

Web References:

1. https://nptel.ac.in/courses/112104118
2. https://archive.nptel.ac.in/courses/112/106/112106311/
3. https://www.youtube.com/watch?v=8iZe_UiBtTc&list=PLZ5iF05Ly-kgGWarGh0iIdUIu4cz7Hrdw

Course Code: 23ESL301		Course Title: PROFESSIONAL SKILLS 2: PROBLEM SOLVING SKILLS & LOGICAL THINKING 2 (Common to all B.E/B.Tech programmes)	
Course Category: SEC		**Course Level : Intermediate**	
L:T:P(Hours/Week) 0: 0: 2	**Credits: 1**	**Total Contact Hours:30**	**Max Marks:100**

Course Objectives:

The course is intended to enhance the students' numerical, analytical and logical reasoning ability. Also course focus to make learners prepare for various public and private sector exams and placement drives.

Module I Quantitative Ability **20 Hours**

Time and work –Pipes and cisterns- Time Speed Distance-Problems on Trains-Boats and Streams- Permutation and Combination-Probability, Menstruation- Heights and distance- Logarithms- Clocks and Calendars Data Sufficiency

Module II Reasoning Ability **10 Hours**

Number & Alpha series- Odd man out-Coding and Decoding-Syllogisms- Problems on Cubes and Dices- Logical Venn diagram -Visual Reasoning- Element & logical series- Analogies.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Enhance their problem solving skills & Logical thinking Skills	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	3	-	-

Text Book(s):

T1: Dr. R. S. Aggarwal. "Quantitative Aptitude for Competitive Examinations" Sultan Chand & Sons Pvt. Ltd, New Delhi, 2018.

T2: Dr. R. S. Aggarwal. "A Modern Approach to Logical Reasoning", Sultan Chand & Sons Pvt. Ltd, New Delhi, 2018

Reference Book(s):

R1: R. V. Praveen. “Quantitative Aptitude and Reasoning” 2nd Revised Edition, Prentice-Hall of India Pvt.Ltd, 2013

R2: Arun Sharma. “Quantitative Aptitude for Common Aptitude Test”, McGraw Hill Publications, 5th Edition, 2020

R3: Arun Sharma. “Logical Reasoning for Common Aptitude Test”, McGraw Hill Publications, 6th Edition, 2021.

Web References:

1 https://www.indiabix.com/aptitude/questions-and-answers/

2 https://www.geeksforgeeks.org/aptitude-questions-and-answers/

Course Code:23VAT301	Course Title: UNIVERSAL HUMAN VALUES 2 : UNDERSTANDING HARMONY (Common to all B.E/B.Tech Programmes)		
Course Category: VAC		**Course Level: Intermediate**	
L:T:P (Hours/Week) 2: 1: 0	**Credits:3**	**Total Contact Hours:45**	**Max. Marks:100**

Pre-requisites

- Induction Program

Course Objectives

The course is intended to:

1. Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.
2. Strengthening of self-reflection
3. Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence
4. Development of commitment and courage to act
5. Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.

Unit I Introduction to Value Education 9 Hours

Need for the Value Education;. Self -exploration as the process for value education ; Continuous Happiness and Prosperity: A look at basic Human Aspirations; Right understanding: Relationship and Physical Facilities ; Happiness and Prosperity: current scenario ; Method to fulfill the Basic human aspirations

Unit II Harmony in Human Being 9Hours

Human being as a co-existence of self (‘I’) and the material ‘Body’; needs of Self ('I') and 'Body'; The Body as an instrument of 'I' ; Harmony in the self(‘I’); Harmony of the self(‘I’) with body ;Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail. Programs to ensure Sanyam and Swasthya.

Unit III Harmony in the Family and Society 9Hours

Harmony in the Family the basic unit of human interaction; Values in human to human relationship;Trust as the foundational values of relationship; Respect as the right evaluation ;Understanding harmonyin the society (society being an extension of family); Vision for the universal human order.

Unit IV Harmony in the Nature 9 Hours

Understanding the harmony in the Nature Interconnectedness, self-regulation and mutual fulfillment among the four orders of nature; Existence as Co-existence at all levels; Holistic perception of harmony in existence.

Unit V Harmony on Professional Ethics 9 Hours

Natural acceptance of human values ;Definitiveness of Ethical Human Conduct; Basic for Humanistic Education, Humanistic Constitution and Humanistic Universal Order; Competence in professional ethics ;Case study: holistic technologies, management models and production systems ;Strategy for transition towards value based life and profession.

Course Outcomes	**Affective Level**
At the end of this course, students will be able to:	
CO1. Reflect on values, aspiration, relationships and hence identify strengths and weaknesses.	Responding
CO2. Appraise physical, mental and social well being of self and practice techniques to promote well being.	Responding
CO3. Value human relationships in family and society and maintain harmonious relationships.	Valuing
CO4. Respect nature and its existence for survival and sustainable of all life forms and hence practice conservation of nature	Valuing
CO5. Appreciate ethical behaviour as a result of value system in personal and professional situations	Receiving

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	1	2	2	-	-	2	-	-
CO2	-	-	-	-	-	1	2	2	2	1	-	2	-	-
CO3	-	-	-	-	-	2	2	2	2	1	-	2	-	-
CO4	-	-	-	-	-	2	2	2	2	-	-	2	-	-
CO5	-	-	-	-	-	1	2	2	2	-	-	2	-	-

Text Book(s):

T1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, NewDelhi, 2010.

Reference Book(s):

R1.Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.

R2.Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004. R3. The story of stuff, Annie Leonard, Free Press, New York 2010.

Web References:

1 https://aktu.ac.in/hvpe/ResourceVideo.aspx

2 http://hvpenotes.blogspot.com/

3 https://nptel.ac.in/courses/109/104/109104068/

SEMESTER IV

Course Code: 23MAT401		**Course Title: PROBABILITY AND STATISTICS** (Common to EC, EE, ME, AU, CS, AM, SC, IT &EV)	
Course Category: Minor		**Course Level: Intermediate**	
L: T: P (Hours/Week) 3:1:0	**Credits: 4**	**Total Contact Hours:60**	**Max Marks:100**

Course Objectives:

This course aims at helping the students to gain knowledge on random variables, probability distributions and hypothesis testing for data.

Module I **22+8 Hours**

Probability and Random Variables: Axioms of Probability- Conditional Probability- Total Probability -Baye's Theorem- Random Variables-One Dimensional Randon variables- Probability Mass Function- Probability Density Functions- Properties - Moments- Moment generating functions and their properties- Two Dimensional Random Variables - Joint distributions-Marginal and conditional distributions-Covariance-Correlation and linear regression using least square method – Transformation of random variables.

Standard Distributions: Discrete Distributions - Binomial- Poisson- Properties, Moment generating functions -Continuous Distribution-Uniform- Exponential-Normal Distributions and their properties.

Module II **23+7 Hours**

Testing of Hypotheses: Sampling distributions, Estimation of parameters, Statistical hypothesis, Large sample test based on Normal distribution for single mean and difference of means, Tests based on t-test, Chi-square distributions and F distributions for mean, variance and proportion, Contingency table (test for independent), Goodness of fit.

Design of Experiments: Analysis of Variance (ANOVA) - One-way Classification – Completely Randomized Design (CRD) – Two-way Classification – Randomized Block Design (RBD) – Latin square.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Demonstrate the concepts of probability theory to engineering problems.	Understand
CO2: Calculate the expected values, variances and correlation coefficient of random variables	Apply
CO3: Use the theoretical discrete and continuous probability distributions in the relevant application areas.	Apply
CO4: Apply the concepts of testing the hypothesis and design of experiments to solve real life problems.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	-	-	-	-	-	-	-	-	1	-	-	-	-
CO2	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	1	-	-	-	-	-	-	-	-	1	-	-	-	-

Text Book(s):

T1. Veerajan T, “Probability, Statistics and Random process”, 3rd Edition, Tata McGraw-Hill, New Delhi, 2017.

T2. Dr.J.Ravichandran, “Probability and Statistics for Engineers”, 1stEdition, Wiley India Pvt. Ltd., 2010.

Reference Book(s):

R1. R.E. Walpole, R.H. Myers, S.L. Myers, and K Ye, “Probability and Statistics for Engineers and Scientists”, 9th Edition Pearson Education, Asia, 2013.

R2. M.R. Spiegel, J. Schiller and R.A. Srinivasan, “Schaum's Outlines Probability and Statistics”, 4th Edition Tata McGraw Hill edition, 2012.

R3. Morris DeGroot, Mark Schervish, “Probability and Statistics”, Pearson Educational Ltd,4th Edition, 2014, India.

Web References:

1 https://archive.nptel.ac.in/courses/111/105/111105090/

2. https://archive.nptel.ac.in/courses/111/105/111105041/

Course Code: 23MET401		Course Title: STRENGTH OF MATERIALS (Common to ME & AU)	
Course Category: Major		Course Level: Intermediate	
L:T:P(Hours/Week) 3: 0: 0	Credits: 3	Total Contact Hours: 45	Max Marks: 100

Course Objectives:

The course is intended to provide knowledge in mechanics of materials so that the students can solve real engineering problems and design engineering systems.

Module I **23 Hours**

Deformation of Solids and Bi-axial State of Stress: Stress and Strain-Types - Hooke's law - Factor of Safety - Poisson's ratio. Deformation of simple and compound bars under axial load. Strain energy - resilience, proof resilience and modulus of resilience - Strain energy due to axial load. Stresses due to gradual load, sudden load and impact load. Principal planes and stresses- Maximum shear stress and planes of maximum shear stress - Mohr’s circle.

Flexure in Beams and Deflection of Beams: Theory of simple bending - Bending stress and Shear stress variation in beams of standard section like 'I', 'L' and 'T'. Evaluation of beam deflection and slope for cantilever and simply supported beams- Macaulay and Moment-area methods.

Thin-wall pressure vessels: Longitudinal Stress, Hoop stress - application - Stresses and Strain in cylindrical thin shells.

Module II **22 Hours**

Theories of Failure: Introduction to theories of failure - Maximum Principal Stress theory - Maximum Principal Strain theory - Maximum Strain Energy Theory - Maximum Distortion Energy theory - Maximum Shear Stress theory.

Shafts and Springs: Theory of torsion and assumptions - torsion equation- polar moment of inertia and polar modulus - Shear stress distribution in solid and hollow circular shafts, Equivalent bending moment and equivalent twisting moment, Stresses in circular shaft with

combined bending, axial loading and torsion.

Helical compression springs - terminology, types of end - stress and deflection equation.

Leaf springs - terminology - stress and deflection equation - Nipping of leaf springs.

Columns and Struts: Introduction, short and long columns. Euler's theory; Assumptions, Derivation for Euler's Buckling load for different end conditions, Limitations of Euler's theory. Rankine-Gordon's formula for columns.

Course Outcomes	**Cognitive Level**
At the end of the course students will able to	
CO1: Apply the concepts of stresses at a point in a material of structural elements.	Apply
CO2: Select the appropriate theories of failure for the materials.	Analyze
CO3: Evaluate the behavior of torsional members and deflection in beam members.	Apply
CO4: Evaluate the behavior of columns and struts.	Apply
CO5: Present an oral presentation on terms involved in stresses induced and failure of the given component**.**	Evaluate

Course Articulation Matrix

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	3	-	-	-	-	-	-	3	-	-	-	-	-

Text Book(s):

T1. F. Beer, E. R. Johnston, J. De Wolf, —Mechanics of Materials, Tata McGraw-Hill Publishing Company Limited, New Delhi, Indian 1st Edition, 2008.

T2. S. S. Rattan, —Strength of Materials, Tata McGraw-Hill Publishers, 4th Edition, 2011.

Reference Book(s):

R1. R. K. Rajput, —Strength of Materials: Mechanics of Solids, S. Chand & Co Limited, New Delhi, 3rdEdition, 2007.

R2. S. S. Bhavikatti, —Strength of Materials, Vikas Publishing House Pvt. Ltd., New Delhi, 3rd Edition,2013.

Web References:

1. https://nptel.ac.in/courses/112107146

2. https://nptel.ac.in/courses/112106141

Course Code 23MET402		Course Title : MECHANICS OF MACHINERY (Common to ME & AU)	
Course category: Major		Course level: Intermediate	
L:T:P (hrs/week): 3:1:0	Credits: 4	Total contact Hours: 60	Maximum Marks:100

Course Objective

The course is intended to impart knowledge on mechanism/machine and its kinematics including vibration.

Module 1 **36 Hours**

Velocity and Acceleration in Simple Mechanisms: Basics of kinematics- Link- pair-chain-mechanisms. Configuration/kinematic diagram, degrees of freedom of planar mechanisms — Linear and angular velocities- absolute and relative velocities- rubbing velocity- tangential, radial and Coriolis components of acceleration, graphical method for determination of velocity and acceleration of the links in four bar mechanism and single slider crank mechanism.

Kinematics of cam: Types of cams, types of followers, radial cam, terminology of radial cam, types of follower motions: uniform velocity motion, simple harmonic motion, constant acceleration/deceleration motion, cycloidal motion, construction of cam profile for knife edge, roller and flat faced followers — Graphical method.

Gear Kinematics: Types of gears- Spur, Helical, Bevel and worm gear –its terminologies, law of gearing, Classification of gear trains, calculation of Gear ratio, number of teeth for the gears in the gear trains, velocities of the gears in gear trains such as Simple, Compound, Reverted & Epicyclic (using tabulation method) gear trains, Differential gear train (theory only).

Module II **24 Hours**

Mechanism for Control: Gyroscopes –Gyroscopic forces and torques – Gyroscopic stabilization– Gyroscopic effects in Automobiles

Balancing of masses: Static and dynamic balancing - Balancing of rotating masses – Balancing of single rotating mass, Balancing of several masses in single or several planes- Balancing of reciprocating masses (Introduction only).

Vibration: Introduction- Terminology- types of vibrations- Types of free vibration- Natural frequency of free longitudinal, transverse and torsional vibrations. Effect of inertia- natural frequency of free transverse vibration due to point load on a simply supported shaft. Introduction to Critical speed and damping. Torsion vibration in single, two and three rotor system- Torsion ally equivalent shaft.

Course Outcome	**Cognitive level**
At the end of the course the students will be able to	
CO1: Calculate the kinematics parameters of simple mechanisms, Cam , gear and gear trains	Apply
CO2: Estimate the gyroscopic effect on automobiles	Apply
CO3: Determine the balancing masses required for balancing rotating masses in single or several planes.	Apply
CO4: Determine the natural frequency of a free longitudinal, transverse and torsional vibrating system.	Apply
CO5: Form teams and develop a model of a simple mechanism and demonstrate its working both written and orally.	Evaluate

Course Articulation Matrix

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	-	-	2	-	-	-	-	-	-	-	-	-	-
CO5	3	2	2	-	-	-	-	-	3	3	-	-	-	-

Text Book(s):

1. Rattan S.S., "Theory of Machines", 4th Edition, McGraw Hill Education, New Delhi, 2017.
2. Kurmi.R.S., Textbook Of Theory of Machines, 5TH Edition, S.CHAND, 2020.

Reference Book(s):

1. Norton R.L., "Kinematics and Dynamics of Machinery", Special Indian Edition, McGraw Hill Education,New Delhi, 2017.

2. Shigley J.E, Pennock G.R, Uicker J.J Cornwell & Sanjeev Sanghi., "Theory of Machines and Mechanisms",5th Edition, Oxford University Press, Oxford, 2017.

3. Dayvid H Myszka, —Machines and Mechanisms Applied Kinematic Analysis, Pearson Prentice Hall, 2012.

Web Reference(s):

1. https://onlinecourses.nptel.ac.in/noc23_me64/preview
2. https://onlinecourses.nptel.ac.in/noc23_me36/preview
3. https://kdm-iitkgp.vlabs.ac.in/

Course Code: 23MET403		Course Title: DESIGN THINKING	
Course Category: Major		Course Level: Intermediate	
L:T:P(Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours: 45	Max Marks:100

Course Objectives:

This course intended to give knowledge on basics of design thinking including empathize, define, ideate, prototyping, testing and implementation.

Module I **23 Hours**

Introduction- Importance of Design Thinking, Human Centered Design, Six-Step Design Thinking Process Empathize- Design Thinking Methodologies, Traits of Design Thinker, Integrate Empathy and Understanding into Design Thinking Process and understanding customer needs.
Define- Uncover Opportunities, definition of a Good Problem Statement, 5W+1H Questions, define needs through the stages of Design Thinking process.
Ideate- Ideating, Metrics, Creative Ideation and Pattern Recognition and Creative Thinking Techniques. Iterative Design and a case study.

Module II **22 Hours**

Prototyping- Proof of Concept, Prototype Methodologies, Critical Stages in Prototyping, MVP, stages in New Product Development, types of Prototypes, innovation-types of innovation, Tools- concept sketching, CAD , Mechatronics, Augmented and Virtual Reality and 3D printing.

Testing- Testing in realtime, market potential, market segmentation, market sizing- TAM- SAM-SOM-EVG Implementing- Implement a solution, redesign and design for X.

Course Outcomes	Cognitive Level
At the end of the course students will be able to	
CO1: Apply the principle of design thinking to empathize a need, define a problem and ideate a solution.	Apply
CO2: Apply the fundamentals of prototyping, testing of a concept for real time application.	Apply
CO3: Implement a design thinking approach by forming a team and presenting an idea.	Evaluate

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	2	-	3	-	2	2	3	3	-	-	-	-

Text Book(s):

T1. Sabell Osann, Lena Mayer , Inga Wiele ,The Design Thinking Quick Start Guide: A 6-Step Processfor Generating and Implementing Creative Solutions, Wiley, 2020.

T2. Christian Müller-Roterberg, Handbook of Design Thinking, Kindle Direct Publishing,2018.

Reference Book(s):

R1. Teun den Dekker, Design Thinking, Taylor & Francis, International edition, 2020.

R2. Kaushik Kumar, Divya Zindani, J.Paulo Davim, Design Thinking to Digital Thinking, Springer, 2019.R3.S. Balaram, Thinking Design, SAGE Publications, 2011.

Web Reference(s):

1. https://onlinecourses.nptel.ac.in/noc22_mg32/preview
2. https://onlinecourses.nptel.ac.in/noc23_me52/preview

Course Code: 23MEI401		Course Title: METROLOGY AND MEASUREMENTS	
Course Category: Major		Course Level: Intermediate	
L:T:P(Hours/Week) 2: 0: 2	Credits:3	Total Contact Hours: 60	Max Marks:100

Course Objectives:

The course is intended to develop capacity to select the appropriate measuring instrument for the given application and to impart knowledge on the advanced measuring instruments and also applications of tolerances and fits.

Module I **23 Hours**

MEASUREMENT SYSTEM

Basics of Metrology: Measurement – Need, Process, Role in quality control; Factors affecting measurement-SWIPE, Precision and Accuracy, Standards-types of standards, Errors in Measurements-Types, Control, Measurement uncertainty-Types, Estimation, Calibration of measuring instruments.

Tolerance Analysis: Tolerancing, Interchangeability, Selective assembly, Tolerance representation, Terminology, Limits and Fits, Design of Limit gauges, Problems. Tolerance analysis in manufacturing, Process capability, tolerance stackup, tolerance charting.

Measurement Of Power, Flow and Temperature: Force, torque, power-Mechanical, Pneumatic, Hydraulic and Electrical type. Flow measurement- rotameter, Temperature-bimetallic strip, thermocouples, electrical resistance thermometer, Reliability and Calibration, Readability and Reliability.

Module II **22 Hours**

Metrology

Measurement Of Linear, Angular Dimensions and Form Measurements: Linear Measuring Instruments – Vernier caliper, Micrometer, Vernier height gauge, Depth Micrometer, Bore gauge, Telescoping gauge, Gauges, Comparators-Working and advantages; Opto-mechanical measurements using measuring microscope and Profile projector, Angular measuring instruments-Bevel protractor, Clinometer, Sine bar, Autocollimator, Angle dekkor, Alignment telescope. Principles and Methods of straightness, Flatness measurement, Thread measurement, gear measurement, surface finish measurement, Roundness measurement and Applications.

Advances in Metrology: Lasers in metrology, Advantages of lasers, Laser scan micrometers, Laser interferometers – Applications, Computer Aided Metrology, Basic concept of CMM, Types of CMM, Constructional features–Probes , Accessories, Software and Applications. Machine Vision– Basic concepts of Machine Vision System-Elements– Applications - On-line and in-line process monitoring in production - Computed tomography – White light Scanners and Blue light scanner.

List of Experiments **30 Hours**

1. Measure the dimension of the given component using Vernier Caliper
2. Determine the diameter of a cylindrical component of accuracy 0.01 mm using Micrometer
3. Measure the thickness of gear tooth using Gear Tooth Vernier
4. Measure the height of the given component using Vernier Height Gauge
5. Measure the thread parameter using Profile Projector.
6. Measure the dimensions of components in the given mechanical assembly and prepare bill of materials.

Course Outcomes	**Cognitive Level**
At the end of the course students will able to	
CO1: Apply the concepts of measurements to apply in various metrological instruments.	Apply
CO2: Apply the principle of basic and advanced metrology to measure the various parameters for the given applications	Apply
CO3: Perform the tolerance analysis for various applications	Analyze
CO4: Conduct an experiment to measure the real life application using the appropriate instruments/tools related to the concepts of basic measuring instrument and prepare the bill of material as a team.	Analyze

Course Articulation Matrix

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	2	-	-	-	-	2	-	-	-	-	-
CO3	3	2	-	2	-	-	-	-	3	-	-	-	-	-
CO4	3	3	-	2	-	-	-	-	3	-	-	-	-	-

Text Book(s):

T1. Dotson Connie, —Dimensional Metrology, Cengage Learning, First edition, 2012.

T2. Mark Curtis, Francis T. Farago, —Handbook of Dimensional Measurement, IndustrialPress, Fifth edition, 2013.

Reference Book(s):

R1. Ammar Grous, J —Applied Metrology for Manufacturing Engineering, Wiley-ISTE, 2011.

R2. Galyer, J.F.W. Charles Reginald Shot bolt, —Metrology for Engineers, Cengage Learning EMEA; 5th revised edition, 1990.

R3. National Physical Laboratory Guide No. 40, No. 41, No. 42, No. 43, No. 80, No. 118, No. 130,No.131. http://www.npl.co.uk.

Web Reference(s):

1. https://onlinecourses.nptel.ac.in/noc19_me70/preview
2. https://www.classcentral.com/course/swayam-engineering-metrology-14037

Course Code: 23MEL401		Course Title: STRENGTH OF MATERIALS & MECHANICS OF MACHINERY LABORATORY (Common to AU,ME)	
Course Category: Major		Course Level: Intermediate	
L:T:P(Hours/Week) 0:0:3	Credits: 1.5	Total Contact Hours: 45	Max. Marks: 100

Course Objectives

To provide hands on training for testing the mechanical strength of materials and determining the kinematic parameters of machines such as velocity, acceleration, frequency etc.

List of Experiments:

Strength of Materials Laboratory

1. Conduct tensile test on the given mild steel rod using universal testing machine.
2. Determine the maximum shear strength of Mild steel / Aluminium rod by Double shear test.
3. Calculate the modulus of rigidity of mild steel rod by Torsion test.
4. Determine the toughness of the given mild steel specimen using IZOD and CHARPY impact test.
5. Estimate the stiffness and modulus of rigidity of the helical spring by Compression test.

List of Experiments:

Mechanics of Machines Laboratory

1. Draw the velocity and acceleration diagram for the given configuration for four bar/slider crank mechanism and verify the same with Vlab
2. Balance the unbalance mass available in a single and multiple planes in the rotor and verify the same with VLab
3. Find the natural frequency of the spring mass system

4. Find the torsional frequency of the two rotor system
5. Find the gear ratios of the given gear train and verify the same with theoretical values
6. Determine the experimental and theoretical values of critical (or) whirling speed of a given shaft.
7. Draw the profile of the cam and find the jump speed
8. Demonstration of use of FFT analyzer in vibration measurement

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Form a team and evaluate tensile, shear, impact strength and stiffness of the given test specimen experimentally and compare the results with virtual lab.	Evaluate
CO2: Determine the velocity and acceleration of a simple mechanisms, jump speed of the given cam mechanism and gear ratio of the simple gear train.	Apply
CO3: Analyze the natural frequencies of longitudinal, transverse, and torsional systems, and Interpret the significance of vibration measurement in mechanical systems through both written and oral explanations.	Analyze

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	3	-	-	-	-	3	-	-	-	-	-
CO2	3	3	-	3	-	-	-	-	3	-	-	-	-	-
CO3	3	3	-	3	-	2	2	-	3	-	-	-	-	-

Reference Book(s):

1. S. S. Bhavikatti, —Strength of Materialsǁ, Vikas Publishing House Pvt. Ltd., NewDelhi, 5thEdition, 2021.

2. R. K. Rajput, —A Text book of Strength of Materialsǁ, S. Chand & Co Limited, New Delhi,Revised Edition, 2018.

3. Rattan S.S., "Theory of Machines", 4th Edition, McGraw Hill Education, New Delhi, 2017.

4. Norton R.L., "Kinematics and Dynamics of Machinery", Special Indian Edition, McGraw HillEducation , New Delhi, 2017.

5. Shigley J.E, Pennock G.R, Uicker J.J Cornwell & Sanjeev Sanghi., "Theory of Machines andMechanisms", 5th Edition, Oxford University Press, Oxford, 2017.

Web References:

1. https://sm-nitk.vlabs.ac.in/
2. https://dom-nitk.vlabs.ac.in/
3. https://mdmv-nitk.vlabs.ac.in/
4. https://mm-nitk.vlabs.ac.in/
5. https://va-coep.vlabs.ac.in/

Course Code: 23MEL402		Course Title: COMPUTER AIDED MACHINE DRAWING LABORATORY	
Course Category: Major		Course Level: Intermediate	
L:T:P(Hours/Week) 0:0:3	Credits: 1.5	Total Contact Hours: 45	Max. Marks: 100

Course Objectives

To provide hands on training on model preparation of orthogonal views of machine components, assembled components, and apply the standard design practice by using fits and tolerance for real time application.

List of Experiments:

1. Prepare Part modelling of knuckle joint
2. Prepare Part modelling of Screw jack.
3. Prepare Part modelling of Bush pin type flange coupling
4. Prepare assembly drawing of knuckle joint
5. Prepare assembly drawing of Screw jack.
6. Prepare assembly drawing of Bush pin type flange coupling
7. Tear down the given product and measure critical dimensions and prepare part and assembly drawing.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Develop the part models and assembled drawing of machine components as per the design specification.	Apply
CO2: Create a product model for the given machine components using modeling software.	Analyze

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	2	-	3	-	-	-	3	-	-	-	3	-
CO2	3	2	2	-	3	-	-	-	3	-	-	-	3	-

Reference Book(s):

1. K L Narayana, P Kannaiah,K Venkata reddy , Machine Drawing 5th Edition, Newageinternational (p) limited, publishers, New Delhi,2016
2. Gopalakrishna K.R. —Machine Drawing, 22 nd Edition, Subhas Stores Books Corner, Bangalore,2013.N. D. Bhatt and V.M. Panchal —Machine Drawing , 48th Edition, Charotar Publishers,2013
3. Junnarkar, N.D. Machine Drawing, 1st Edition, Pearson Education, 2004.
4. N. Siddeshwar, P. Kanniah, V.V.S. Sastri, —Machine Drawing, published by TataMc GrawHill,2006
5. S. Trymbaka Murthy, A Text Book of Computer Aided Machine Drawing ,CBS Publishers,New Delhi, 2007

Web References:

1. https://nptel.ac.in/courses/112105294
2. https://archive.nptel.ac.in/courses/

Course Code: 23ESL401		Course Title : PROFESSIONAL SKILLS 3 : PROFESSIONAL DEVELOPMENT AND ETIQUETTE (Common to all B.E/B.Tech Programmes)	
Course Category: SEC		**Course Level: Intermediate**	
L:T:P(Hours/Week) **0: 0: 2**	**Credits: 1**	**Total Contact Hours:30**	**Max Marks:100**

Course Objectives:

The course is intended to cultivate students' appropriate etiquette across various personaland professional contexts, fostering professionalism and effective communication.

Module I **15 Hours**

Emotional Intelligence

Intrapersonal Skill: Goal Setting- Self-management- Emotional Intelligence: Understanding & Developing EI for Effective Communication and Relationships Enhancing Social Skills

Professional Development

Introduction to Professional Development - Career State Assessment - Set Career Goals- Stay on Industry Trends - Self & Lifelong learning –Creativity - Problem Solving Skills - Strong Fundamentals – Using/ Creating Opportunities – Work & Life Balancing - Revisiting Goals.

Teamness and Interpersonal skills

Paraphrasing: Techniques for Active Listening -Paraphrasing as a Tool for Effective Understanding and Communication-Collaboration and Team Building: Building Trust and Rapport - Self-paced learning.

Module II **15 Hours**

Effective Communication

Effective Verbal Communication - Assertive Communication - Elements of Effective Communication - Barriers to Effective Communication - Persuasion Skills - Effective Presentation: Oral and visual presentation – Drafting formal reports.

Professional Etiquette

Introduction - Types of professional Etiquette- Personal Grooming: Importance of Personal Grooming in Professional Settings- Dress Codes and Professional Appearance Guidelines- Body language - Social – Email – Telephonic – Dining

– Classroom - Business.

Activities:

- Emotional Intelligence: Scenario based role play, Debate
- Paraphrasing: Listening, Reading
- Effective Presentation:
  - Oral Presentation: Self-Introduction, JAM , Extempore speech
  - Visual presentation: Email Writing, Power Point Presentation, Vlog
- Professional Etiquette: Demonstrate required Professional Etiquette in all the above activities.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Communicate effectively and exhibit Professional etiquettes in various social forums.	**Apply**

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	2	2	3	-	1	-	-

Textbook(s):

T1. Sabina Pillai, Agna Fernandez, “Soft Skills & Employability Skills”, Cambridge University Press2018

T2. Peggy Post &Peter Post, “The Etiquette Advantage in Business: Personal Skills for ProfessionalSuccess”, 2nd edition (May 3, 2005), William Morrow.

Reference Book(s):

R1. Ashraf Rizvi, "Effective Technical Communication" 2nd Edition, McGraw-Hill India, 2018 R2.

Maithry Shinde, Jyotsna Sreenath, “Life Skills & Personality Development”, Cambridge UniversityPress 2022

Web References:

1. https://www.indeed.com/career-advice/career-development/etiquette-at-work
2. https://www.skillsyouneed.com/interpersonal-skills.html

Course Code:23XXXX		Course Title: DESIGN OF MACHINE ELEMENTS	
Course Category: Core		Course Level: Mastery	
L: T: P Hours/Week) 3:1: 0	Credits: 4	Total Contact Hours: 60	Max Marks:100

Course Objectives:

The course is intended to equip students to design machine elements such as shafts, keys, and couplings helical and leaf springs and bearings subjected to simple, combined static loads, fluctuating loads, and impact loads.

MODULE I **30 Hours**

DESIGN FOR STATIC LOAD OR STEADY STRESSES

Design Processes and its types, factor of safety - selection. Preferred numbers, Selection of materials and its properties, Fits and Tolerances - eccentric loading-stress due to eccentric loading, curved beams - problems

DESIGN FOR FLUCTUATING AND IMPACT LOADS

Fatigue, types, Endurance limit, modifying factors, relation between endurance limit, ultimate tensile strength and yield strength, problems on different fatigue loading conditions. Stress concentration, stress concentration factor, causes of stress concentration, method of reducing stress concentration, stress concentration factor for different material configuration. Notch sensitivity, factors affecting of notch sensitivity. Impact loading, shock loading, simple problems

DESIGN OF SHAFTS, KEYS

Difference between shaft, axle and spindle, Shaft materials, criteria of shaft design, different transmitting elements on a shaft, shaft design against static loading for given application. Shaft design for fatigue loading. Keys, types of keys, stresses developed in the key. Spline, stresses in spline shaft, design of shunk key and spline.

MODULE II **30 Hours**

DESIGN OF COUPLINGS

Couplings, types of coupling, design of coupling based on given speed and load conditions, Design of flexible coupling based on given speed and load conditions

DESIGN OF SPRINGS

Springs, types of springs, applications, spring terminology. Stresses in helical springs, Design of helical for given loading. Leaf springs, NIP in leaf springs Design of leaf spring for given application

DESIGN OF BEARING

Bearings, bearing types, Parts of the bearing, rolling contact bearing, its applications. Load carrying capacity, equivalent load, Life of bearing, Load life relationship, Problems. Selection of ball bearings from manufacturing catalogue. Sliding contact bearings, types and Nomenclature. Hydrodynamic bearing, load carrying capacity, lubrication, selection of lubricant, equivalent load, minimum oil film thickness- length to diameter ratio- bearing pressure, radial clearance. Mckees equation, - problems.

Course Outcomes	**Cognitive Level**
At the end of the course students will able to	
CO1: Design machine elements for simple, combined static loads, fluctuating loads, and impact loads.	**Apply**
CO2: Calculate the design parameters for power transmitting element such as shaft, key, and coupling.	**Apply**
CO3: Estimate the design parameters of helical and leaf spring for given application.	**Apply**
CO4: Design/Select a suitable bearing for the given application.	**Apply**
CO5:Develop a design procedure for the specified automobile components.	**Apply**

Text Book(s):

T1. V.B. Bhandari. “Design of Machine Elements” Tata McGraw Hills Education, 5th edition, 2020.

T2. Shigley J.E and Mischke C.R., “Mechanical Engineering Design”, Tenth Edition, Tata McGraw Hill, 2017.

Reference Book(s):

R1. P. C Sharma and A. K Agarwal. “Machine Design” (SI units). S.K. Kataria& Sons, Reprint 2018.

R2. Patil H. G,. Pilli S. C, Ravindra R. Malagi, M. S. Patil , “Design of Machine Elements”, Krishan Makhijani.,2020

Course Code: 23XXXXX		Course Title: FINITE ELEMENT ANALYSIS	
Course Category: Professional Core		Course Level: Mastery	
L:T:P(Hours/Week) 2: 2: 0	Credits: 3	Total Contact Hours: 60	Max Marks:100

Course Objective:

The course is intended to formulate and solve physical problems by developing mathematical models, and analyze one-dimensional and two-dimensional scalar and vector problems.

MODULE I **22 Hours**

Finite element method- formulation methods, Weighted residual technique and Raleigh Ritz method – general applicability of the methods, degree of freedom, coordinates systems, step by step procedure, basic element shapes function – derivation of element stiffness matrices, global stiffness matrix and force vector, boundary conditions and convergence criteria - minimum potential energy principle, FEA solution to spring, bar, truss, beam - problems. Scalar variable problems- steady state heat transfer- problems.

MODULE II **23 Hours**

Finite element modeling – Constant strain triangular element – Plane stress and plane strain conditions, Element stiffness matrix and force vector – global stiffness matrix and force vector – boundary condition –problems. Axisymmetric formulation- Element stiffness matrix and force vector – global stiffness matrix and force vector, boundary condition –problems. – Iso-parametric elements - Four node quadrilateral element- derivation of shape function, element stiffness matrix and force vector- global stiffness matrix and force vector – boundary condition problems. Scalar variable problems – 2D conduction & convection – global stiffness matrix and global thermal load vector – boundary condition – problems.

Course Outcomes	Cognitive Level
At the end of the course students will able to	
CO1: Solve structural problems involving bar, truss, beam, CST and Quadrilateral element using natural co-ordinate system.	**Apply**
CO2: Solve the 1D and 2D scalar variable problems by applying conduction and convection condition.	**Apply**
CO3: Analyze the vector and scalar variable problems by using FEA solver tool.	**Analyze**

Text Book(s):

T1. Chandrupatla & Belagundu, “Introduction to Finite Elements in Engineering”, 3rd Edition, Prentice-Hall of India, Eastern Economy Editions 2011.

T2. T2.NRR.Anbusagar & K.Palani Kumar., “Finite Element Analysis”, Sahara Publication., 2016.

Reference Book(s):

R1. David V.Hutton, “Fundamentals of Finite Element Analysis”, Tata McGraw-Hill Edition 2005.

R2. J.N.Reddy, “An Introduction to the Finite Element Method”, McGraw-Hill International Editions(Engineering Mechanics Series), 2005.

R3. Seshu, P, “Text Book of Finite Element Analysis”, Prentice-Hall of India Pvt. Ltd., New Delhi, 2007.

Course Code: 23XXXXX		Course Title: SIMULATION AND ANALYSIS LABORATORY	
Course Category: Major		Course Level: Practice	
L:T:P(Hours/Week) 0:0:3	Credits: 1.5	Total Contact Hours: 45	Max. Marks: 100

Course Objectives

To provide hands on training in structural and thermal analysis by using FEA tool and simulate simple problems using Mat lab.

List of Experiments:

1. Stress analysis of beams (Cantilever, Simply supported, Fixed ends)
2. Plot a stress concentration chart for flat plate with shoulder fillet in axial tension.
3. Stress analysis of an Axi-symmetric component by varying element sizes and plot the no.of elements vs stress graph.
4. Mode frequency analysis of a 2D component.
5. Harmonic analysis of a 2D component.
6. Thermal stress analysis of a 2D component.
7. Conductive and Convective heat transfer analysis of a 2D component.
8. Stress analysis of a 3D component.
9. Simulation of Air conditioning system with condenser temperature and evaporator temperatures as input to get COP using Simulation software.
10. Simulation of free vibration characteristics of spring, mass and damper system using Simulation software.
11. Simulation of cam and follower mechanism using Mat lab.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply finite element simulation software to solve simple problems such as structural, thermal and vibration problems in Mechanical Engineering.	**Apply**
CO2: Write programs in a mathematical simulation software to solve mathematical model of mechanical engineering applications	**Apply**

Course Code:23XXXX		Course Title: DESIGN OF TRANSMISSION SYSTEMS	
Course Category: Core		Course Level: Mastery	
L: T: P (Hours/Week) 2: 1: 0	Credits: 3	Total Contact Hours: 60	Max Marks:100

Course Objective:

The course is intended to equip students with the ability to design and analyze power transmission systems, including flexible element drives, gear drives, and sliding mesh gearboxes, while considering strength, durability, and functionality, and to develop efficient clutches and braking systems for diverse applications.

MODULE I **30 Hours**

SELECTION OF FLEXIBLE ELEMENT DRIVES

Mechanical drives-types of drives -power and motion transmission drives-stepped and step-less transmission-speed ratio-under direct and over drives and its applications-reversible and irreversible drives and its applications-belt drives and its applications-Select suitable flat belt and V-belt drives and pulleys for industrial applications.

DESIGN OF SPUR GEAR, HELICAL AND BEVEL GEAR DRIVES

Toothed gearing and its applications- failures in gears- gear materials- tooth forces and stresses- Design of spur gear for given situations using strength calculations and Lewis-Buchkingham equations. Helical gear - Tooth terminology - equivalent number of teeth – Design of Helical Gear drives for given situations.

Types of bevel gear - Tooth terminology - equivalent number of teeth gear, Design the bevel

MODULE II **30 Hours**

DESIGN OF WORM GEAR DRIVES.

Worm Gear terminology, Materials , Types of worm gears - equivalent number of teeth, gear Materials, - Tooth forces and stresses of worm gears ,Thermal capacity, Efficiency. Design of worm gear drives.

DESIGN OF SLIDING MESH GEAR BOX

Preferred numbers- Geometric progression- standard step ratio- kinematic layout- ray diagram- Design 3, 6, 9 and 12 sliding mesh speed gear box.

DESIGN OF CLUTCHES AND BRAKES

Needs and role of clutch- types of clutch-positive clutch- square jaw clutch- spiral jaw clutch- friction clutch- types of friction clutch-plate clutches- cone clutch- centrifugal clutch- Design of plate clutches. Needs and role of brakes- types of brakes -single block or shoe brake- pivoted block or shoe brake- double block or shoe brake- simple band brake- differential band brake- band and block brake- internal expanding brake- Design of shoe brake, band brake.

Course Outcomes	**Cognitive Level**
At the end of the course students will able to	
CO1: Design a suitable flexible element drives such as flat belt, V-belt drives for power transmitting applications.	**Apply**
CO2: Design spur, helical, bevel, and worm gear drives considering strength and surface durability for various applications.	**Apply**
CO3: Design sliding mesh gearboxes, clutches and brake systems for automotive applications.	**Apply**
CO4: Present design steps of transmission elements of automotive vehicles in a team.	**Apply**

Text Book(s)

T1. Bhandari V.B, “Design of Machine Elements” 5th Edition, Tata McGraw-Hill, 2020.
T2. Shigley J.E and Mischke C.R, “Mechanical Engineering Design” 10th Edition, Tata McGraw-Hill,2017

Reference Book(s):

R1. Norton R L, “Machine Design an Integrated Approach”, 5th Edition Pearson Education India,2013
R2. GitinMaitra, L. Prasad “Hand book of Mechanical Design”, 2nd Edition, Tata McGraw-Hill, 2021

Course Code: 23XXXXX		Course Title: HEAT AND MASS TRANSFER	
Course Category: Professional Core		Course Level: Mastery	
L:T:P(Hours/Week) 2: 0: 2	Credits: 3	Total Contact Hours: 60	Max Marks

Course Objectives:

The course is intended to understand the mechanisms of heat transfer under steady state and transient conditions in order to design and optimize the

MODULE I **23 Hours**

Conduction: Basic concepts - Modes of heat transfer – Conduction, Convection and Radiation-Cartesian coordinate- Simple geometries-Plane wall, Cylinder, Composite wall and Composite cylinder – simple problems- Applications.

Fins – Types, Applications, Short fin end insulated, Short fin end not insulated and long fin –-Simple problems.

Convection: Basics – dimensionless numbers, boundary layer concepts - Forced Convection-external flow – flow over plates, cylinders – Simple problems, internal flow – flow through cylinders – simple problems- Applications.

Free convection – flow over horizontal plate, flow over vertical plate and flow through cylinders – simple problems.

Phase change heat transfer – boiling- pool and flow boiling - condensation – simple problems – Applications

MODULE II **22 Hours**

Heat exchangers: Classifications, applications - parallel flow, counter flow and cross flow- LMTD and NTU methods –-simple problems.

Radiation: Basic concepts – absorptivity, reflectivity and transmissivity – black body and grey body concepts – Laws of radiation – Stefan Boltzmann law, Kirchoff's law, Planck's law, Wien's law and Lambert's cosine law – shape factor algebra – between plates and discs – simple problems, Radiation shield – single and 'n' number of shields – simple problems.

Mass Transfer: Basic concepts – properties of mixtures – mass concentration and mass fraction – mole concentration and mole fraction – diffusion mass transfer – Fick's law of diffusion – diffusion through plane membrane- simple problems - Applications.

Course Outcomes	Cognitive Level
At the end of the course students will able to	
CO1: Solve one dimensional steady state conduction heat transfer in simple geometries and fins.	**Apply**
CO2: Design heat exchanger for forced and natural convection under external and internal flows.	**Apply**
CO3: Estimate the radiation heat transfer between different sections	**Apply**
CO4: Estimate diffusion mass transfer through plane membrane	**Apply**
CO5: Demonstrate a case study in a team for real time heat transfer applications.	**Apply**

List of Experiments **15 Hours**

1. Thermal conductivity measurement for composite wall.
2. Thermal conductivity measurement of pipe insulation using lagged pipe approach.
3. Thermal conductivity measurement of insulating powder using concentric sphere.
4. Determination of heat transfer coefficient under natural convection and forced convection.
5. Determination of Stefan Boltzman constant.
6. Determination of emissivity of the given plate.

Text Book(s):

1. Kothandaraman C.P “Fundamentals of Heat and Mass Transfer” New Age International, New Delhi, Fourth edition, 2012
2. Nag P.K, “ Heat Transfer”, Tata McGraw-Hill, Third Edition, 2016
3. Yunus A.Cengel, Afshin J.Ghajar, “Heat and Mass Transfer” , McGraw-Hill, 4th edition, 2011.

Reference Book(s):

1. Sachdeva R C, “Fundamentals of Engineering Heat and Mass Transfer” New Age International, Fifth edition, 2017.
2. Holman J.P “Heat and Mass Transfer” Tata McGraw-Hill, Tenth Edition, 2010.

Course Code: 23XXXX		Course Title: ELECTRICAL AND ELECTRONICS ENGINEERING	
Course Category: Multidisciplinary		Course Level: Intermediate	
L:T:P(Hours/Week) 3:0:0	Credits:3	Total Contact Hours:45	Max Marks:100

Course Objectives:

The course is intended to impart knowledge on engineering fundamentals of DC&AC circuits, Electrical machines, analog and digital electronics.

Module I **22 Hours**

Fundamentals of DC Circuits: Active and Passive elements – Ohm's Law: statement, – Kirchhoff's Laws: statement and illustration – Resistance in series and voltage division rule – Resistance in parallel and current division rule

AC Fundamentals: Law of electromagnetic induction – Generation of single phase alternating EMF –Single Phase and Three Phase Balanced Circuits-Power and Power Factor

Measuring Instruments: Classification of Measuring Instruments

DC Machines: DC Generator and DC Motor: Construction, Working Principle.

Module II **23 Hours**

AC Machines: Single phase transformer: Construction, working principle - Single phase induction motor -Three phase induction motor: An introduction.

Special Machines: Stepper motor, Servo Motor, BLDC motor

Semiconductor Devices: PN junction diode, Forward Bias Conduction, Reverse Bias Conduction, V-I Characteristics – Zener Diode as Voltage Regulator-Half and Full Wave Rectifier Bipolar Junction Transistor: Operation of NPN and PNP Transistor, CB,CC,CE Configuration

Digital Electronics: Number Systems-Boolean Algebra-Postulates and Theorems-Introduction to combinational and sequential circuits-Flip-flop-Digital Signal Processor-Block Diagram and Working.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO 1: Apply the basic laws and simplification techniques of electrical engineering in DC and AC Circuits.	Apply
CO2: Apply the law of induction in the construction and working of motor, generator and transformer.	Apply
CO3: Analyze and submit the self-motivated report about the characteristics of diodes in rectifier applications and transistors in amplifier applications using a suitable hardware/software.	Analyze

CO4: Apply the Boolean concepts in realization of simple digital circuits.	Apply
CO5: Examine and report the application of analog and digital concepts in the development of digital signal processor as a case study.	Analyze

Textbooks:

T1. R.Muthusubramanian and S.Salivahanan, “Basic Electrical and Electronics Engineering”, McGraw Hill India Limited, New Delhi, 2014.

T2. S. K. Sadhev, “Basic Electrical Engineering and Electronics”, Tata Mcgraw Hill, 2017.

T3. D.P Kothari and I J Nagarath,”Basic Electrical and Electronics Engineering “ Fourth Edition Tata Mcgraw Hill, 2019.

Reference Book(s):

R1. B.L Theraja, “Fundamental of Electrical Engineering and Electronics”, S. Chand Limited, 2022.

R2. J.B.Gupta, “Basic Electrical and Electronics Engineering”, S.K.Kataria & Sons, 2013.

R3. Smarajit Ghosh, “Fundamental of Electrical and Electronics Engineering”, Second Edition, PHI Learning Private Limited New Delhi, 2010.

Web References:

1. https://www.nptel.ac.in/courses/108108076
2. https://archive.nptel.ac.in/courses/108/105/108105112
3. https://archive.nptel.ac.in/courses/108/101/108101091

Course Code:23MECXXX		Course Title: Electrical and Electronics Engineering Laboratory	
Course Category: Practice		Course Level: Intermediate	
L:T:P(Hours/Week) 0:0:3	Credits:1.5	Total Contact Hours:45	Max Marks:100

Course Objectives

The course is intended to impart practical knowledge on DC & AC circuits, Electrical machines, analog and digital electronics.

List of Experiments:

1. Verification of KCL and KVL.
2. Energy meter wiring and related calculations/calibration.
3. Load test on DC shunt motor
4. Load test on Single Phase Transformer.
5. V-I characteristics of PN Diode
6. Zener diode as voltage regulator
7. Half wave rectifier
8. V-I characteristics of CE configuration
9. Working of logic gates.
10. Working of D flip-flop and T flip-flop

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply the KCL and KVL in simple circuits and record the theoretical and practical values.	Apply
CO2: Examine and report the working of different electrical equipment with its technical advancements and sustainable development.	Analyze
CO3:Construct the circuit using PN junction for rectifier application and zener diode for voltage regulation application	Apply
CO4:Examine the V-I characteristics of CE configuration, working of logic gates and flip-flops and report the inference	Analyze

Textbooks:

T1. R.Muthusubramanian and S.Salivahanan, “Basic Electrical and Electronics Engineering”, McGraw Hill India Limited, New Delhi, 2014.

T2. S. K. Sadhev, “Basic Electrical Engineering and Electronics”, Tata Mcgraw Hill, 2017.

T3. D.P Kothari and I J Nagarath,”Basic Electrical and Electronics Engineering “ Fourth Edition Tata Mcgraw Hill, 2019.

Reference Book(s):

R1. B.L Theraja, “Fundamental of Electrical Engineering and Electronics”, S. Chand Limited, 2022.

R2. J.B.Gupta, “Basic Electrical and Electronics Engineering”, S.K.Kataria & Sons, 2013.

R3. Smarajit Ghosh, “Fundamental of Electrical and Electronics Engineering”, Second Edition, PHI Learning Private Limited New Delhi, 2010.

Web References:

1. https://www.nptel.ac.in/courses/108108076
2. https://archive.nptel.ac.in/courses/108/105/108105112
3. https://archive.nptel.ac.in/courses/108/101/108101091

Course Code: 23XXXX	Course Title: MECHATRONICS		
Course Category: Professional Core		Course Level: Mastery	
L:T:P(Hours/Week) 3: 0: 2	Credits:4	Total Contact Hours: 60	Max Marks:100

Course Objective

The course is intended to understanding of mechatronics systems by exploring their fundamentals, selecting appropriate sensors for various measurements, writing logic programs, and analyzing their diverse applications.

MODULE I **22 Hours**

Introduction to Mechatronics- Systems- Concepts of Mechatronics approach-Need for Mechatronics- Emerging area of Mechatronics- Classification of Mechatronics - Control system- Open Loop and Feedback Control –PID Control.

SENSORS AND SIGNAL CONDITIONING

Introduction – Performance Terminology- Potentiometers-LVDT- Capacitance sensors-Strain gauges- Eddy current sensor-Hall effect sensor- Temperature sensors-Pressure sensors-Flow sensors- Light sensors- Selection of sensors- Signal processing.

MODULE II **23 Hours**

Introduction- Basic structure- Input and output processing- PLC Programming - Timers, Counters and internal relays- Data handling and manipulation – subroutine – Master control reset- Selection of PLC, HMI.

SYTEM DESIGN USING VIRTUAL INSTRUMENTATION

Front Panel and Block Diagram – Tools, Controls and Functions palette. Modular programming – SubVI. Formula node. DAQ hardware – AI, AO, DIO. DAQ Assistant and configuration.

CASE STUDY

Pick and place Robot- Autonomous mobile robot-Wireless surveillance balloon-Engine Management system- Automatic car park barrier.

List of Experiments **15 Hours**

1. Design a Pneumatic circuit for speed regulation of double acting.
2. Basics logic using PLC Programming - AND, OR, Latch, Interlock
3. Control of multiple actuators in Hydraulic and pneumatic System by using PLC TIA portal V14
4. Creating simple VIs, Editing and Debugging
5. Creating Sub VI using Lab VIEW

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Select sensors for various measurements including pressure, temperature, flow, level and light used in different systems	Apply
CO2: Write logic programs for real time applications such as home automation, machine tool control, process control using PLC	Apply
CO3: Design user interface for arithmetic, logical, sequencing data acquisition operations in analog and digital modes using virtual instrumentation.	Apply
CO4: Prepare and present a case study on mechatronics approach for the given application.	Apply

Text Book(s):

T1 Bolton,W, “Mechatronics” , Pearson Education, 6th edition, 2019.

T2 Jovitha Jerome, ‘Virtual Instrumentation using Lab VIEW’, PHI Learning Private Limited, New Delhi, Second Printing, 2011.

Reference(s):

R1. Godfrey C. Onwubolu, "Mechatronics Principles and Applications", Elsevier, 2006.

R2. Devadas Shetty and Richard A.Kolk, “Mechatronics systems design”, PWS Publishing company 2007.

R3. Nitaigour Premchand Mahalik, “Mechatronics Principles, Concepts and Applications” Tata McGraw-Hill Publishing company Limited, 2017.

Web References

1. https://en.wikipedia.org/wiki/Mechatronics
2. http://www.cedrat.com/en/publications/categories/devicesystems/systems/mechatronics.html
3. http://nptel.ac.in/courses/112103174/

Course Code:23XXXX		Course Title: ELECTRIC VEHICLES	
Course Category: Professional Core		Course Level: Mastery	
L:T:P(Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Course Objectives

This course is impart learners to analyze the need and performance of electric vehicles, identify architectures in electric and hybrid vehicles, apply knowledge of electric propulsion systems and motor control techniques.

Module I **23 Hours**

Electric Vehicles

Layout of an electric vehicle, performance of electric vehicles – Traction motor characteristics, Tractive effort, Transmission requirements, Vehicle performance, Energy consumption, Advantage and limitations, Specifications, System components, Electronic control system.

Hybrid Vehicles

Concepts of hybrid electric drive train, Architecture of series and parallel hybrid electric drive train, Merits and demerits, Series and parallel hybrid electric drive train design.

Electric Propulsion System and Motor Control

DC motors, AC motors, Permanent magnet motors, Brushless DC and Reluctance motors, Characteristics ,Regenerative braking, Control system principles, Speed and torque control – DC motors and AC Motors.

Module II **22 Hours**

Energy Storages & Generators

Electromechanical batteries – Types of batteries – Lead acid batteries, Nickel based batteries, Lithium based batteries, Electrochemical reactions, Thermodynamic voltage, Specific Energy, Specific Power, Energy efficiency, Ultra capacitors – DC Generators, AC Generators, Voltage and frequency regulations.

Fuel Cells & Solar Cars

Fuel cell, Construction, Working, Equations, Possible fuel sources, Fuel reformer, Design, Solar cars, Photovoltaic cells, Tracking, Efficiency and cost comparison, Plug In Vehicles (PIV).

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Categorize the need and performances of Electric vehicles.	Apply
CO2: Classify the various architectures of electric hybrid vehicles.	Apply
CO3: Exemplify the electric propulsion system and motor controlling Techniques.	Apply
CO4: Prepare a case study on the energy storage system and generators in electric hybridVehicle.	Apply

Text Book(s)

T1. Mehrdad Ehsani, Yimin Gao, Sebatien Gay and Ali Emadi, " Modern Electric, Hybrid, Electric and Fuel cell vehicles: Fundamentals, Theory and Design", CRC press, 2004

T2.James Larminie and John Loury, " Electric Vehicle Technology – Explained", John Wiley & Sons . McGraw-Hill Book company,1994.

Reference Book(s)

R1. Sandeep Dhameja, "Electric Vehicle Battery Systems", Butterworth – Heinemann, 2002.

R2. Ronald K Jurgen, "Electric and Hybrid – Electric Vehicles", SAE, 2002.

R3. Ron Hodkinson and John Fenton, "Light Weight Electric/Hybrid Vehicle Design" Butterworth –Heinemann, 2001.

Web References

1. http://nptel.ac.in/courses/108103009/1
2. http://nptel.ac.in/courses/108103009/4
3. http://nptel.ac.in/courses/108103009/9
4. http://nptel.ac.in/courses/108103009/32
5. http://www.engnetbase.com/books/4675/3154fm.pdf

Course Code: 23XXXX		Course Title: CNC MACHINES AND ROBOTICS	
Course Category: Professional Core		Course Level: Mastery	
L:T:P(Hours/Week) 3: 0: 2	Credits: 4	Total Contact Hours: 60	Max Marks:100

Course Objectives:

This course is intended to study different CNC machines, part programming, parts of robots, and robot programming languages.

MODULE I CNC MACHINE TOOLS AND PART PROGRAMMING 22 Hours

Introduction to CNC

CNC and DNC – principles, features, and applications – CNC machine tools: turning centre, machining centre, CNC controllers, parts of CNC machines, tool turrets, tool magazines, ATC, APC, chip conveyors, encoders, work holding devices.

Part Programming

Turning centre programming, coordinate systems, structure of part programs, absolute and incremental programming, G and M codes, tool offset information, tool nose radius compensation, canned cycles (facing, turning, threading, peck drilling) – Machining centre programming: cutter radius and tool length compensation, sub-programs, drilling, tapping, boring cycles, programming for circular and rectangular pocketing – CAD/CAM integration: features of CAM packages and CNC code generation.

MODULE II INTRODUCTION TO ROBOTICS AND KINEMATICS OF ROBOT MANIPULATOR 23 Hours

Robotics and Automation - Laws of Robotics, definition, types, and components, Classification of Robots, Kinematic Systems, Mechanisms, and Manipulators, Degrees of Freedom in Manipulators, Power Transmission and Control Systems, Robot Drive Mechanisms and Mechanical Transmission Methods, End Effectors and Types, Sensors and Actuators.

Robot Kinematics:

Rotation Matrix and Inverse Transformations, Homogeneous Transformations, Robotic Manipulator Joint Coordinate System, Euler Angles and Euler Transformations, Roll Pitch Yaw (RPY) Transformation, Denavit-Hartenberg (D-H) Representation, Displacement Matrices for Standard Configurations, Robot Programming Types and Interlocking, Real-Time Applications of Robot Programming

List of Experiments **15 Hours**

1. Develop CNC Program and produce a part using CNC turning centre.
2. Develop CNC Program and produce a part using CNC milling machine.
3. Develop CNC Program and produce a hole using CNC drilling machine.
4. Develop Robot program and perform the process of material handling in robot.
5. Develop Robot program and perform the welding operation by using robot.

Course Outcomes	**Cognitive Level**
At the end of the course students will able to	
CO1:. Select the suitable CNC machine for the given operation.	Apply
CO2: Write the part programs for CNC lathe and CNC machining centers to produce components.	Apply
CO3: Select the suitable robot configurations and programming for different applications.	Apply
CO4: Develop CNC programs to perform turning, milling, and drilling operations, and write robot programs for material handling operations.	Apply

Text Book(s):

T1**.** "Computer Numerical Control Machines and Computer Aided Manufacture" by P. Radhakrishnan (2014)

T2**.** "Introduction to Robotics" by S.K. Saha (2014)

Reference Book(s):

R1. Yoram Koren, “Computer Control of Manufacturing Systems”, Mc-Graw Hill,1st Edition, 2017.

R2. Richard D Klafter, “Robotic engineering: an integrated approach”, Prentice Hall Pvt. Ltd., 2011.