Shree Warana Vibhag Shikshan Mandal's

WARANA UNIVERSITY,

WARANANAGAR

(A State Public University established under Section 3 (6) of MPUA, 2016)

।। विद्या सर्वस्य भूषणम् ।।

Warana University

Established:2025

Structure & Syllabus For

Second Year of B. Tech. Mechanical Engineering

Semester- III and IV

Department of Mechanical Engineering

UNDER

Faculty of Science & Technology

(As Per National Education Policy – 2020)

With Effect from Academic Year 2026-27Onwards

Shree Warana Vibhag Shikshan Mandal's

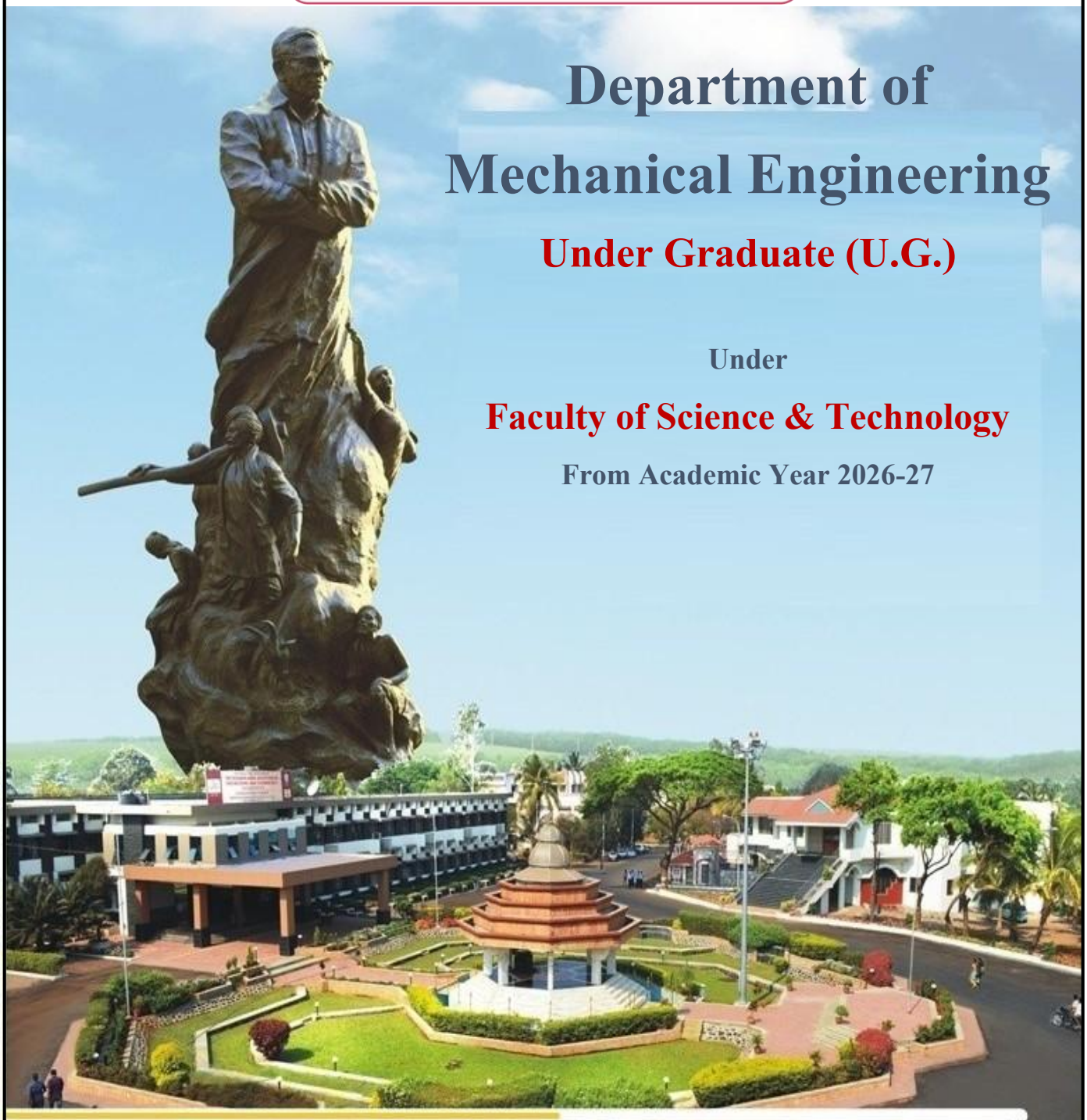
TATYASAHEB KORE INSTITUTE OF ENGINEERING AND TECHNOLOGY
(AUTONOMOUS), WARANANAGAR, KOLHAPUR

TKIET
Estd. 1983



Lead Institute of

WARANA UNIVERSITY, WARANANAGAR
(A State Public University)



Department of Mechanical Engineering

Under Graduate (U.G.)

Under

Faculty of Science & Technology

From Academic Year 2026-27

S. Y. B. Tech. In Mechanical Engineering

Structure and Syllabus under Autonomy as per NEP Policy 2020

Contents

Preface 1

Program Outcomes 2

Duration 3

Eligibility 3

Medium of Instruction 3

Abbreviations 4

Examination& Evaluation Pattern 5

Grading System 10

Curriculum Structure & Evaluation Scheme for Semester-III 11

Curriculum Structure & Evaluation Scheme for Semester-IV 12

Engineering Economics / Entrepreneurship Course (EEC) and Modern Indian Language (MIL) Basket 13

Open Electives Basket Offered 14

Exit Option to Qualify Diploma completion of S. Y. B. Tech. 14

Course Code: 2501UMEHPCC3301 Course Name: Mathematics for Mechanical Engineering 15

Course Code: 2501UMEHPCC3302 Course Name: Applied Thermodynamics 17

Course Code: 2501UMEHPCC3303 Course Name: Fluid Mechanics 20

Course Code: 2501UMEHPCC3304 Course Name: Material Science and Metallurgy 23

Course Code: 2501UMEHEEC3305X Course Name: Fundamentals of Engineering Economics 26

Course Code: 2501U0MEHVEC3306T Course Name: Personal Values and Ethics 29

Course Code: 2501UMEHMDM13307T Course Name: Multidisciplinary Minor-1 31

Course Code: 2501UMEHCEP3308T Course Name: Community Connected Project 33

Course Code: 2501UMEHPCC3302T Course Name: Applied Thermodynamics Lab 35

Course Code: 2501UMEHPCC3303P Course Name: Fluid Mechanics Lab. 37

Course Code: 2501UMEHPCC3304TP Course Name: Material Science and Metallurgy Lab. 39

Course Code: 2501UMEHPCC3309T Course Name: Machine Drawing & Geometric Modelling Lab 41

Course Code: 2501UMEHPCC4401 Course Name: Analysis of Mechanical Elements 44

Course Code: 2501UMEHPCC4402 Course Name: Theory of Machines-I 47

Course Code: 2501UMEHPCC4403 Course Name: Manufacturing Processes & Machine Tools 49

Course Code: 2501UMEHEEC44041 Course Name: Industrial Management and 52

Operation Research 52

Course Code: 2501UMEHEECC44042 Course Name: Intellectual Property Rights and Patents 55

Course Code: 2501UMEHEEC44043 Course Name: Start up Management 57

Course Code: 2501UMEHOE144052 Course Name: Open Elective-I Renewable Energy Systems 59

Course Code: 2501UMEHMDM24406T Course Name: Multidisciplinary Minor-2 Materials and Applications 62
Course Code: 2501UMEHSEC4407T Course Name: C++ Programming Lab 64
Course Code: 2501UMEHAEC44081T Course Name: Modern Indian Language Kannada 66
Course Code: 2501UMEHAEC44082T Course Name: Modern Indian Language Marathi..... 68
Course Code: 2501UMEHAEC44083T Course Name: Modern Indian Language Hindi 70
Course Code: 2501UMEHVEC4409T Course Name: Sustainability Engineering in Mechanical System 72
Course Code: 2501UMEHPCC4401T Course Name: Analysis of Mechanical Elements Lab 74
Course Code: 2501UMEHPCC4402TP Course Name: Theory of Machines-I Lab..... 76
Course Code: 2501UMEHPCC440TP Course Name: Manufacturing Process Lab..... 78
Course Code: 2501UMEHA4411A Course Name: Audit Course Environment Studies 80

Preface

The National Education Policy (NEP) 2020 has marked a significant transformation in India's education system, aiming to align higher education with the evolving needs of the 21st century. Warana University is firmly committed to the effective implementation of NEP 2020 in its true spirit, with a strong emphasis on holistic, multidisciplinary, and outcome-based education in accordance with the guidelines of various statutory and regulatory bodies.

We are pleased to present the Second-Year B. Tech Mechanical Engineering Syllabus, meticulously crafted to align with the core philosophy of NEP 2020, effective from the Academic Year 2026-27. This curriculum builds upon the foundational knowledge gained in the first year and equips students with core mechanical engineering competencies through courses in Applied Thermodynamics, Fluid Mechanics, Material Science and Metallurgy, Analysis of Mechanical Elements, Theory of Machines, and Manufacturing Processes & Machine Tools, complemented by Machine Drawing & Geometric Modeling. The curriculum further integrates Multidisciplinary Minors, Entrepreneurship and Economics Management, Open Electives, and a Community Connected Project, along with Skill Enhancement, Ability Enhancement, and Value Education courses, to nurture well-rounded engineers who possess both technical excellence and the adaptability required for global demands.

Special emphasis has been given to experiential learning, where theoretical concepts are reinforced through extensive laboratory work in thermodynamics, fluid mechanics, material science, theory of machines, and manufacturing processes, as well as through project-based and industry-oriented activities. The syllabus also promotes research, innovation, sustainability, and entrepreneurship, encouraging students to engage in creative and investigative pursuits while remaining mindful of environmental and societal responsibility, including through a dedicated course on Sustainability Engineering in Mechanical Systems.

We extend our sincere gratitude to the Chairperson and members of the Boards of Studies for their dedicated efforts in designing this forward-looking curriculum.

Program Outcomes

1. **Engineering Knowledge** Graduates will possess a strong foundation in engineering fundamentals and apply this knowledge to identify, analyze, and solve complex engineering problems. They will be able to understand and apply principles of mathematics, science, and engineering to a variety of real-world situations.
2. **Problem Analysis and Solution Design** Graduates will be able to critically analyze engineering problems and design effective solutions. Using their skills in problem-solving and analytical thinking, they will develop innovative solutions while considering factors such as feasibility, sustainability, and societal impact.
3. **Design and Development of Solutions** Graduates will be able to design and develop solutions for complex engineering problems by selecting and applying appropriate engineering design principles, tools, and techniques. They will also consider ethical, cultural, and environmental aspects in their designs, contributing to sustainable solutions.
4. **Investigation and Research** Students will be equipped with the skills to conduct in-depth investigations and research into engineering problems, using appropriate research methodologies, experiments, and data analysis. This ability will help them to evaluate solutions, optimize designs, and innovate within their field.
5. **Modern Tool Usage** Graduates will be proficient in using modern engineering tools, technologies, and software relevant to their specialization. They will understand the limitations and appropriate application of these tools in solving engineering problems and designing systems, products, and processes.
6. **The Engineer and Society** Graduates will be aware of the impact of engineering solutions on society, the environment, and public safety. They will be equipped to practice engineering in a socially responsible manner, adhering to professional ethics, and contributing positively to the welfare of society.
7. **Environment and Sustainability** Graduates will understand the importance of sustainability and the need to consider environmental impact when designing solutions. They will be capable of creating engineering solutions that promote environmental sustainability, using renewable resources, and minimizing waste and pollution.
8. **Ethics and Professionalism** Graduates will demonstrate professional ethics in their engineering practices, showing integrity, accountability, and social responsibility. They will follow industry standards, uphold ethical decision-making, and work in a manner that reflects the values of the engineering profession.
9. **Teamwork and Communication** Graduates will have strong interpersonal skills, working effectively in multidisciplinary teams. They will communicate ideas and solutions clearly, both in written and oral forms, and be able to collaborate with peers, colleagues, and stakeholders in a professional manner.
10. **Life-Long Learning** Graduates will have a mindset of continuous improvement and lifelong learning. They will be capable of adapting to new technological advancements, seeking out opportunities for professional development, and staying current with industry trends throughout their careers.
11. **Leadership and Innovation** Graduates will demonstrate leadership qualities, take initiative in projects, and contribute to innovative solutions within their field. They will foster creativity, encourage new ideas, and embrace challenges with an entrepreneurial mindset

Duration

- The Bachelor of Technology (B.Tech.) Programme is a full-time undergraduate programme of four years' duration.
- The programme is structured into eight semesters, with each academic year comprising two semesters. Each semester includes theory courses, laboratory work, skill-based training, project components, and industry-oriented activities as prescribed in the curriculum.
- Second Year B.Tech. consists of the third and fourth semesters, which build upon the foundational knowledge acquired in the First Year and provide students with core Mechanical Engineering knowledge, practical skills, multidisciplinary exposure, and professional competencies required for subsequent years of study.

Eligibility

Eligibility for Second Year B.Tech

1. Admission through Regular Progression (from First Year B.Tech)

A candidate who has been admitted to the First Year B.Tech programme of this Institute and has completed the First Year coursework shall be eligible for admission to Second Year B.Tech, subject to the following:

(a) Satisfactory attendance of at least 75% in the First Year, as per University regulations.

(b) Earning at least 50% of the total credits of First Year B.Tech. Students who meet this requirement shall be Allowed to Keep Terms (ATKT) in Second Year B.Tech, as per University regulations.

2. Admission Directly to Second Year B.Tech (Lateral Entry)

A candidate seeking direct admission to Second Year B.Tech shall satisfy the following:
(a) The candidate shall be an Indian national.
(b) The candidate shall have passed a Diploma course in Engineering and Technology, in an appropriate branch, with at least 45% marks for the Open category (40% for Reserved category, EWS and PwD), from an institution approved by AICTE or by the Central or State Government, or an equivalent qualification;
OR
(c) The candidate shall have passed a B.Sc. degree from a university recognised by the University Grants Commission (UGC), with at least 45% marks (40% for Reserved category, EWS and PwD), with Mathematics as a subject at the 10+2 or graduation level.

Medium of Instruction

The medium of instruction for the Second-Year B.Tech. program shall be English.

Abbreviations

Acronym	Full Form
ISE	In-Semester Examination
ISE-I	In-Semester Examination-I
ISE-II	In-Semester Examination-II
ESE	End Semester Examination
ISA	In-Semester Assessment (Term Work)
L	Lecture
T	Tutorial
P	Practical
CH	Contact Hours
C	Credit
BSC	Basic Science Course
ESC	Engineering Science Course
EEC	Engineering Economics Course
PCC	Program Core Courses
HSSM	Humanities Social Science and Management
VSEC	Vocational and Skill Enhancement Course
VEC	Value Education Course
CC	Co-curricular course
CEP	Community Engagement Project
AEC	Ability Enhancement Course
IKS	Indian Knowledge System
MAC	Mandatory Audit Course

Examination& Evaluation Pattern

Evaluation toolsused for the evaluation of a student for each course is as follows:

For Theory Courses	In-Semester Examination (ISE) And End Semester Examination (ESE)
For Lab/Tutorial Courses	In-Semester Assessment (ISA) And/Or Practical and Oral Examination (POE)

Refer course structure for specific evaluation tools used for each course.

In-Semester Examination (ISE)

The In-Semester Examination (ISE) will be conducted at the departmental level. There will be two tests in each semester for every theory course: ISE-I and ISE-II.

- Each test will be of 40 marks.
- The duration of each test will be 1 hour and 30 minutes.

The total ISE marks will be calculated as the average of ISE-I and ISE-II. These rules may be modified from time to time as per the guidelines of the concerned regulatory authorities.

- ISE-I will cover Unit I and Unit II.
- ISE-II will cover Unit III and Unit IV.

  - **Minimum Passing Criteria**

    Students must score a minimum of 40% marks in the ISE. If a student fails to secure the minimum required marks, he/she must appear for a Make-up Examination.

    The Make-up Examination will be conducted in the same semester for:

    - Students who fail to secure minimum passing marks.
    - Students who were absent due to valid reasons such as medical issues, natural calamities, or participation in NSS, NCC, or similar activities (subject to verification of absence and recommendation from the Head of Department).

- **Special Provision**

  If a failed student appears for three tests (including the Make-up test) and scores more than 16 marks when calculating the average of the best two out of the three tests, the student will be awarded the minimum passing marks of 16 only.

  For students absent with valid reasons:

  - If absent in one test, the average of the attempted test and the Make-up test will be considered.
  - If absent in two tests, the decision will be taken after reviewing the reasons and based on the recommendation of the Head of Department.

End Semester Examination (ESE):

The End Semester Examination (ESE) will be conducted for 60 marks and will be based on the entire syllabus. The duration of each examination will be 2 hours.

Weightage of Units

The weightage of units in the ESE question paper will be as follows:

a) Units that are not covered in ISE-I or ISE-II will carry 30% weightage each.

b) Units that are covered in ISE-I and ISE-II will carry 10% weightage each.

Backlog Examination

Students who fail in the End Semester Examination (ESE) of either the odd or even semester within an academic year will be allowed to appear for the Backlog Examination, which will be conducted along with the regular ESE of the respective semester.

- **Re-Examination of ESE**

  A Re-Examination (Make-up Examination) for all courses (UG and PG), including both theory and laboratory courses, will be conducted once a year before the commencement of the odd semester of the next academic year.

  - A one-grade penalty will be applied to students appearing for the Make-up/Re-Examination.
  - However, no grade penalty will be applied if a student secures a ‘P’ grade in the Make-up/Re-Examination.
  - Grace marks will not be awarded for the Make-up/Re-Examination.
  - Exception: Grace marks may be considered if the student is appearing for the ESE for the first time.

- **Eligibility Criteria for ESE**

  To be eligible for the End Semester Examination (ESE), a student must:

- Secure at least 40% marks in ISE and ISA of the concerned course.
- Fulfil the attendance requirements as per the norms of Warana University, Warananagar.

If a student does not meet these requirements, he/she will not be eligible to appear for the ESE.

Nature of Question Paper: General (For all subject except Engineering Mechanics &Computer Aided Engineering Drawing)

Q. No.		Marks	BL	CO
1	**Attempt any Four**	**8**		
a	Unit -1			
b	Unit -2			
c	Unit -3			
d	Unit -4			
e	Unit -1/2/3/4			
f	Unit -1/2/3/4			
2	**Attempt All**	**16**		
a	Unit -1			
b	Unit -2			
c	Unit -3			
d	Unit -4			
3	**Attempt any Three**	**18**		
a	Unit -5			
b	Unit -5			
c	Unit -5			
d	Unit -5			
4	**Attempt any Three**	**18**		
a	Unit -6			
b	Unit -6			
c	Unit -6			
d	Unit -6			

Nature of Question Paper: Engineering Mechanics

Q. No.		Marks	BL	CO
1	**Attempt any Two (Unit 1 to 4)**	**6**		
a		3		
b		3		
c		3		
2	**Attempt all (Unit 1 to 4)**	**18**		
a		9		
b		9		
3	**Attempt the following**	**18**		
a	Unit -5	10		
b	Unit -5	8		
	OR			
b	Unit -5	8		
4	**Attempt any Three**	**18**		
a	Unit -6	10		
b	Unit -6	8		
	OR			
b	Unit -6	8		

Nature of Question Paper: Engineering Mechanics

Q. No.		Marks	BL	CO
1	**Attempt All (Unit 1 to 4)**	**24**		
a		8		
b		8		
c		8		
2	**Attempt the following**	**18**		
a	Unit -5	10		
b	Unit -5	8		
	OR			
b	**Unit -5**	8		
3	**Attempt the following**	**18**		
a	Unit -6	10		
b	Unit -6	8		
	OR			
b	Unit -6	8		

In Semester Assessment (ISA):

ISA for laboratory courses will be conducted as a continuous assessment throughout the semester. The assessment will be based on the following:

1. Performance in laboratory work.
2. Submission of experiments in the form of a properly maintained journal or report.
3. Timely completion of assigned experiments.
4. Attendance in laboratory sessions.
5. Understanding of the experiments conducted, evaluated through methods such as quizzes, oral examinations, case studies, field work, surveys, open-book tests, model preparation, programming, projects, or any other criteria specified by the course teacher.

Practical Oral Examination (POE):

POE for laboratory courses will be conducted immediately after the end of the semester. The duration of the practical examination will be as specified in the curriculum structure. The POE will be conducted jointly by an Internal Examiner and an External Examiner.

The examination may be conducted in any one of the following ways:

1. **Oral Examination Only**

   Both the Internal and External Examiners will ask questions based on the practical content of the course to assess the student's practical knowledge.

2. **Practical Examination Only**

   Students will be required to perform a given experiment, complete a workshop task, prepare a drawing, or develop a computer program, as applicable. In this case, the student's performance will be evaluated by the External Examiner only.

3. **Practical and Oral Examination**

   Students will first perform a given practical task. This will be followed by an oral examination (viva voce) based on the practical content of the course. The student's performance will be evaluated jointly by both the Internal and External Examiners.

Grading System

The University follows a **10-Point Grading System** to evaluate student performance.

- **Conversion of Marks into Grades**
  In every semester, the marks you get in each subject (out of 100) are converted into **grade points** as per the table below. You need at least **40% marks** to pass a subject.

Marks Obtained (Out of 100)	Grade Point	Letter Grade	Meaning
Absent	0	AB	Absent
0 – 39	0	F	Fail
40 – 44	4	P	Pass
45 – 49	5	C	Average
50 – 59	6	B	Above Average
60 – 69	7	B+	Good
70 – 79	8	A	Very Good
80 – 89	9	A+	Excellent
90 – 100	10	O	Outstanding

Note:

1. If decimal marks are 0.5 or more, they will be rounded off to the next higher number. (Example: 59.5 will become 60)
2. For courses of 50 marks or 200 marks, marks will be converted proportionally to 100 marks before assigning grade points.

- **Calculation of Semester Grade Point Average (SGPA)**
  SGPA is calculated at the end of each semester**.** It shows your average performance in one semester.

$$SGPA = \frac{\sum(Credit \times Grade\ Point)\ for\ each\ course\ of\ a\ Semester}{\sum(Credits)\ for\ a\ Semester}$$

- **Calculation of Cumulative Grade Point Average (CGPA)**
  CGPA is calculated after completing multiple semesters.CGPA reflects the overall academic performance of the student in the program.

$$CGPA = \frac{\sum\left(\begin{matrix}Total\ Credits\ of\ a\ Semester \times \\ SGPA\ of\ Respective\ Sememster\end{matrix}\right)\ of\ all\ semesters}{\sum(Course\ Credits)\ of\ all\ Semesters}$$

Note: The SGPA & CGPA shall be rounded off to 2 decimal points.



Second Year B. Tech. Mechanical Engineering)

Curriculum Structure & Evaluation Scheme for Semester-III

Category	Course Code	Course Title	Teaching and Credit Scheme					Examination & Evaluation Scheme			
			L	T	P	C	CH	Component	Marks	Min for Passing	
PCC	2501UMEHPCC301	Mathematics for Mechanical Engineering	3	--	--	2	3	ESE	60	24	40
								ISE	40	16	
	2501UMEHPCC302	Applied Thermodynamics	3	--	--	2	3	ESE	60	24	40
								ISE	40	16	
	2501UMEHPCC303	Fluid Mechanics	3	--	--	3	3	ESE	60	24	40
								ISE	40	16	
	2501UMEHPCC304	Material Science and Metallurgy	3	--	--	2	3	ESE	60	24	40
								ISE	40	16	
EEC	2501UMEHEEC305X	Engineering Economics Course -I ((Specify EEC-1 Basket))	3	--	--	2	3	ESE	60	24	40
								ISE	40	16	
VEC	2501UMEHVEC306T	Personal Values and Ethics	2	--	--	2	2	ISA	50	20	20
MDM-1	2501UMEHMDM1307T	Multidisciplinary Minor-1 (Specify MDM Basket)	2	--	--	2	2	ISA	50	20	20
CEP	2501UMEHCEP308T	Community Connected Project	--	--	2	2	2	ISA	50	20	20
PCC	2501UMEHPCC302T	Applied Thermodynamics Lab	--	--	2	1	2	ISA	25	10	10
	2501UMEHPCC303P	Fluid Mechanics Lab	--	--	2	1	2	ISA	25	10	20
								POE	25	10	
	2501UMEHPCC304TP	Material Science and Metallurgy Lab	--	--	2	1	2	ISA	25	10	20
								POE	25	10	
	2501UMEHPCC309T	Machine Drawing & Geometric Modeling Lab	--	--	2	1	2	ISA	25	10	10
Total			**19**	**0**	**10**	**21**	**29**	**0**	**800**		

Note : 'X' indicates the sequence number of PE/OE offered by the respective department.



Second Year B. Tech. Mechanical Engineering

Curriculum Structure & Evaluation Scheme for Semester-IV

Category	Course Code	Course Title	Teaching Scheme					Examination & Evaluation Scheme			
			L	T	P	C	CH	Component	Marks	Min for Passing	
PCC	2501UMEHPCC401	Analysis of Mechanical Elements	3	--	--	2	3	ESE	60	24	40
								ISE	40	16	
	2501UMEHPCC402	Theory of Machines-I	3	--	--	2	3	ESE	60	24	40
								ISE	40	16	
	2501UMEHPCC403	Manufacturing Processes and Machine Tools	3	--	--	2	3	ESE	60	24	40
								ISE	40	16	
EEC	2501UMEHEEC404X	Engineering Economics Course -II (Specify EEC-2 Basket)	3	--	--	2	3	ESE	60	24	40
								ISE	40	16	
OE	2501UMEHOE1405X	Open Elective (OE-1) (Specify OE Basket)	3	--	--	3	3	ESE	60	24	40
								ISE	40	16	
MDM-2	2501UMEHMDM2406T	Multidisciplinary Minor-2	2	--	--	2	2	ISA	50	20	20
VSEC	2501UMEHSEC407T	C++ Programming Lab	--	--	2	1	2	ISA	50	20	20
AEC	2501UMEHSEC408XT	Modern Indian language (Specify MIL Basket)	2	--	--	2	2	ISA	25	10	10
VEC	2501UMEHVEC409T	Sustainability Engineering in Mechanical System	1	--	2	2	2	ISA	50	20	20
PCC	2501UMEHPCC401T	Analysis of Mechanical Elements Lab	--	--	2	1	2	ISA	25	10	10
	2501UMEHPCC402TP	Theory of Machines-I Lab	--	--	2	1	--	ISA	25	10	20
								POE	25	10	
	2501UMEHPCC410TP	Manufacturing Process Lab	--	--	2	1	--	ISA	25	10	20
								POE	25	10	
MAC	2501UMEHA411A	Audit Course (Environment Studies)	1	--	--	--	--	--	--	--	--
Total			**21**	**0**	**10**	**21**	**25**		**800**		



Second Year B. Tech. Mechanical Engineering

Engineering Economics / Entrepreneurship Course (EEC) and Modern Indian Language (MIL) Basket

Engineering Economics Course Basket Sem. -III			
Category	**Sub Category**	**Course Code**	**Name of Course**
Humanities Social Science and Management	**EEC - 1**	2501UMEHEEC3051	Economic Analysis of Engineering Projects
		2501UMEHEEC3052	Fundamentals of Engineering Economics
		2501UMEHEEC3053	Engineering Economics for Mechanical Engineers

Engineering Economics Course Basket Sem. -IV			
Category	**Sub Category**	**Course Code**	**Name of Course**
Humanities Social Science and Management	**EEC -2**	2501UMEHEEC4041	Industrial Management and Operation Research
		2501UMEHEEC4042	Intellectual Property Rights and Patents
		2501UMEHEEC4043	Start up Management

Modern Indian Language			
Category	**Sub Category**	**Course Code**	**Name of Course**
Humanities Social Science and Management	**AEC**	2501UMEHAEC4081T	Kanada
		2501UMEHAEC4082T	Marathi
		2501UMEHAEC4083T	Hindi



Second Year B. Tech. Mechanical Engineering

Open Electives Basket Offered

Category	Course Code	Name of Course	Teaching Scheme					Examination & Evaluation Scheme			
			L	T	P	C	CH	Component	Marks	Min for Passing	
OE-1	2501UMEH OE14051	Machining Processes (Including CNC)	3	--	--	3	3	ESE	60	24	40
								ISE	40	16	
OE-1	2501UMEH OE14052	Renewable Energy Systems	3	--	--	3	3	ESE	60	24	40
								ISE	40	16	
			6	**0**	**--**	**6**	**6**		**200**	**80**	**80**

Exit Option to Qualify Diploma completion of S. Y. B. Tech.

Category	Sub Category	Course Code	Name of Course	Teaching Scheme					Examination & Evaluation Scheme			
				L	T	P	C	CH	Component	Marks	Min for Passing	
Skill Courses	VSEC	2501UMEH VSEC412T	CNC Programming	2	--	2	3	4	ISA	50	20	20
Experiential Learning Courses	ELC	2501UMEH VSEC413T	Mini Project	2	--	2	3	4	ISA	50	20	20
	ELC	2501UMEH VSEC414T	Internship (2 Weeks)	--	--	6	2	6	ISA	50	20	20
				4	**0**	**10**	**8**	**14**	**0**	**150**	**60**	**60**

Tatyasaheb Kore Institute of Engineering and Technology, Warananagar Second Year B. Tech. Department of Mechanical Engineering				
Course Code: 2501UMEHPCC301 Course Name: Mathematics for Mechanical Engineering				
Teaching Scheme		**Credit**	**Evaluation Scheme**	
Lectures:	03 Hours/Week	02	**ISE:**	40 Marks
			ESE:	60 Marks
Prerequisites, if any:				
Course Objectives: The objective of the course is to				
1)	Deliver the basics of Differential equation, Laplace transforms, Fourier series, and Statistics			
2)	Provide the knowledge to identify and solve different problems of Mechanical engineering			
Course Outcomes: At the end of successful completion of the course, the student will be able to				

		Blooms Taxonomy
CO1	Solve Linear Differential Equation of higher order	Understand
CO2	Calculate divergence, curl, gradient and directional derivative of a vector And scalar point function	Understand
CO3	Compute Laplace transform and apply them to solve Ordinary differential equations	Apply
CO4	Expand functions in terms of sine and cosine	Understand
CO5	Describe and interpret the statistical data numerically by using statistical methods.	Apply
CO6	Use Binomial, Poisson and Normal distributions to calculate probabilities	Apply

Course Description:

This course contains Mathematical methods and techniquesthat are used to solve complex Mechanical engineering problems. This course has six units namely i) Linear Differential equation, ii) Vector Differentiation iii) Laplace Transformation, iv) Fourier Series and, v) Correlation, Regression and curve fitting. vi) Probability Distribution

Course Content

Unit 1	**Linear Differential Equations**	**7 Hrs**
Linear Differential Equation with constant coefficients-Definition, Complementary Function, particular integrals, short cut methods for finding Particular integral.		
Unit 2	**Vector Differentiation**	**6 Hrs**
Differentiation of vectors, Gradient of scalar point function and Directional derivative, Divergence of vector point function, Curl of a vector point function, Solenoidal and Irrotational vector fields, Scalar Potential		
Unit 3	**Laplace Transformation**	**8 Hrs**

Definition and Laplace transforms of elementary functions, properties of Laplace transforms, transforms of derivatives and integrals, Multiplication by t, division by t, Evaluation of integrals by Laplace transforms, Inverse Laplace transform using method of partial fraction and convolution theorem (without proof), Solution of Ordinary differential equation by transform method.

Unit 4	**Fourier Series**	**7 Hrs**

Introduction, Dirchlet's conditions, Euler's formulae. Fourier Series of functions of period 2l, even and odd functions, half range sine and cosine series.

Unit 5	**Correlation, Regression and Curve Fitting**	**7 Hrs**

Introduction, Karl Pearson's Coefficient of Correlation, Lines of regression of bi-variate data, Fitting of Curves by method of Least-squares: Fitting of Straight line, fitting of second-degree Parabolic curve, Fitting of exponential curve.

Unit 6	**Probability Distributions**	**7 Hrs**

Random variable discrete random variable, continuous random variable, Probability distribution, Binomial distribution, Poisson distribution and Normal distribution.

Learning Resources:

Text Books

1	Higher Engineering Mathematics, Dr. B. S. Grewal, S. Chand and Company,40th Edition.
2	Advanced Engineering Mathematics, H. K. Das, S. Chand Publication, 8th Edition.

Reference Books

1	Higher Engineering Mathematics, B. V. Ramana, Tata McGraw Hill, New Delhi
2	A Text Book of Applied Mathematics, Vol.I and II, P. N. Wartikar and J. N. Wartikar, Vidyarthi Griha Prakashan, Pune.
3	A text book of Engineering Mathematics, N. P. Bali, Iyengar, Laxmi Publications(P) Ltd, New Delhi
4	Advanced Engineering Mathematics, Erwin Kreyszig, Wiley India Pvt. Ltd

CO-PO Mapping:

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	PSO 3
CO1	2	1	--	--	--	--	--	---	--	--	--	--	--	--	--
CO2	2	2	--	--	--	--	--	--	--	--	--	--	--	--	--
CO3	2	1	--	--	--	--	--	--	--	--	--	--	--	--	--
CO4	2	1	--	--	--	--	--	--	--	--	--	--	--	--	--
CO5	2	1	--	--	--	--	--	--	--	--	--	--	--	--	--
CO6	2	1	-	--	--	--	--	--	--	--	--	--	--	--	--

Tatyasaheb Kore Institute of Engineering and Technology, Warananagar Second Year B. Tech. Department of Mechanical Engineering				
Course Code: 2501UMEHPCC302 Course Name: Applied Thermodynamics				
Teaching Scheme		**Credit**	**Evaluation Scheme**	
Lectures:	03 Hours/Week	02	**ISE:**	40 Marks
			ESE:	60 Marks
Prerequisites, if any:				
Course Objectives: The objective of the course is to				
1)	To learn about energy interactions in a system and energy balance between system and surrounding.			
2)	To learn about the application of First law to various energy conversion devices.			
3)	To understand properties of a pure substance and evaluate the performance of Vapour power cycle using steam table.			
4)	To understand the working of various gas power cycles.			
Course Outcomes: At the end of successful completion of the course, the student will be able to				

		Blooms Taxonomy
CO1	Understand concepts of energy transformation, basic concepts, fundamental laws and principles	Knowledge Understand
CO2	Understand the properties of pure substance and evaluate Rankine vapour power cycle by using steam table.	Understand Apply Evaluate
CO3	Evaluate condenser performance through concepts like vacuum efficiency and condenser efficiency, and estimate cooling water requirements.	Evaluate
CO4	Analyze nozzle performance through concepts of maximum discharge and design of throat and exit area.	Analyze
CO5	Analyze flow through steam turbine blades using velocity diagrams, and calculate work done and efficiencies.	Analyze
CO6	Understand basic concepts and working of various gas power cycles	Understand

Course Description:

Thermodynamics is the science of energy that explores the concept of energy and energy transfer particularly between heat and work and their inter conversion. All activities in nature involve some interaction between energy and matter; thus, it is hard to imagine an area that does not relate to thermodynamics. Therefore, developing a good understanding of basic principles of thermodynamics is an essential part of engineering education. This Course covers aspect of thermodynamics for power generation specifically steam power generation. Hence it is essential for Mechanical engineering students to understand thermodynamic cycle, principles, fundamentals that are useful to engineering applications. The student will learn basic thermodynamic concepts, definitions, cycles, laws, heat and work interaction,

enthalpy, entropy etc. By applying thermodynamic concepts for steam power plant (Boiler, Steam nozzles, Steam turbines, steam condensers) students are able to understand, analyze and evaluate the performance of a steam power plant.

Course Content

Unit 1	**Basic Concepts of Thermodynamics:**	**07 Hrs**

Introduction, thermodynamic system, control volume, thermodynamic property, state & process, Zeroth law, temperature scales, various thermometers, first law, its limitations, Second law of thermodynamics, Kelvin-Plank and Clausius Statements. Statement of thirdlaw of thermodynamics. Corollaries of Second law. Numerical treatment on second law of Thermodynamics (Heatengine, Refrigerator and Heat Pump). Introduction of Entropy, Calculation of entropy change sinb gases (Numerical Treatment)

Unit 2	**Pure Substances and Vapour Power Cycles**	**07 Hrs**

Pure substances, ideal and real gases, formation of steam, Properties of steam, Use of steam table and Mollier chart, p-v, T-s and Mollier diagram for steam, Carnot cycle, Limitations of Carnot cycle, Rankine cycle, p-v, T-s & h-s diagram, Thermal efficiency, Specific steam consumption. Work ratio, Effect of superheat, boiler and condenser pressure on the performance of Rankine cycle. (Numerical Treatment)

Unit 3	**Steam Condensers**	**06 Hrs**

Steam Condenser, Functions, Elements of condensing plant, Types of steam condensers, surface and jet condensers, Comparison, Vacuum efficiency, Condenser efficiency, Sources of air leakages, Methods of leak detection Estimation of cooling water required (Numerical Treatment)

Unit 4	**Steam Nozzles**	**07 Hrs**

Functions, Shapes, Critical pressure ratio, Maximum discharge condition, Effect of friction, Design of throat and exit areas, Nozzle efficiency, Velocity coefficient, Coefficient of discharge, Supersaturated flow, Degree of under-cooling and degree of super saturation, Effects of super Saturation (Numerical Treatment without friction)

Unit 5	**Steam Turbines**	**07 Hrs**

Principles of operation, Classification, Impulse and reaction steam turbine, compounding of steam, turbines Comparison between impulse and reaction turbine. Flow through impulse turbine blades, Velocity diagrams, Flow through impulse reaction blades, Velocity diagram, degree of reaction, and Parson's reaction turbine, losses in steam turbines (Numerical Treatment on Single stage turbine)

Unit 6	**Gas Power Cycles**	**06 Hrs**

Introduction, Carnot cycle, Stirling cycle, Ericsson cycle, Air standard Otto cycle, Air standard Diesel cycle, Limited pressure cycle or Dual cycle, Comparison of Otto, Diesel and Dual cycles, Brayton Cycle (Simple GasTurbine Cycle), Reversed Brayton Cycle, p-v and T-s diagrams description.

Learning Resources:

Text Books

1	“Thermal Engineering”, Kumar and Vasandani, D. S. Publisher Metropolitan Book Co, Delhi, 3rdEdition.
2	“Thermal Engineering", BallaneyP.L, Khanna Publishers, New Delhi, 27thEdition.
3	“Engineering Thermodynamics”, P. K. Nag., Tata McGraw Hill, New Delhi, 4thEdition.

4	“Thermal Engineering”, R. K. Rajput, Laxmi Publications, 3rdEdition.
5	“Steamand Gas Turbines”, R. Yadav, CPH Allahabad, 2ndEdition, 2005.
Reference Books	
1	Y.A. Cengel & M.A. Boles, Thermodynamics: An Engineering Approach, 8th Ed., McGraw Hill Education (India) Pvt. Ltd., New Delhi,2016.
2	R.E. Sonntag, C. Borgnakke & G.J. Van Wylen, Fundamentals of Thermodynamics, 6th Ed., John Wiley, 2003. 3. T.D. Eastop& A.
3	McConkey, Applied Thermodynamics, 5th Ed., Pearson Education Ltd., New Delhi, 2014.

CO-PO Mapping:

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	PSO 3
CO1	3	--	--	--	--	--	--	--	--	--	--	--	--	3	--
CO2	3	3	3	--	--	--	--	--	--	--	--	--	--	3	--
CO3	3	3	3	--	--	--	--	--	--	--	--	--	--	2	--
CO4	3	3	3	--	--	--	--	--	--	--	--	--	--	3	--
CO5	3	3	3	--	--	--	--	--	--	--	--	--	--	3	--
CO6	3	2	2	--	--	--	--	--	--	--	--	--	--	3	--

Tatyasaheb Kore Institute of Engineering and Technology, Warananagar Second Year B. Tech. Department of Mechanical Engineering				
Course Code: 2501UMEHPCC303 Course Name: Fluid Mechanics				
Teaching Scheme		**Credit**	**Evaluation Scheme**	
Lectures:	03 Hours/Week	02	**ISE:**	40 Marks
			ESE:	60 Marks
Prerequisites, if any:				
Course Objectives: The objective of this course is to				
1)	Introduce fundamental aspects of fluid properties, fluid flow behaviour and develop energy balance equation for fluid flow systems.			
2)	Apply the fundamental equations on fluid flow such as Continuity equation, Bernoulli's equation and Momentum equation to analyze its characteristics.			
3)	Understand the fluid flow in pipe and determine the different head losses in pipe.			
4)	Study the concept of boundary layer developed in fluid flow over the surface.			
Course Outcomes: At the end of successful completion of the course the student will be able to				
				Blooms Taxonomy
CO1	State and define the different properties of the fluid and fluid flow.			Knowledge
CO2	Describe the principles of continuity, momentum and energy as applied to fluid motions.			Understand
CO3	Derive and apply the governing equations of Fluid Kinematics and Fluid Dynamics.			Apply
CO4	Determine different head losses in flow through pipe and apply this on practical problems associated with fluid systems.			Apply Analyze
CO5	Understand the boundary layer theory of fluid flow as well as estimate the lift and drag coefficient of the fluid flow.			Understand Apply
CO6	Derive and analyze the mathematical expressions related to fluid statics, kinematics, dynamics, pipe flow systems.			Analyze
Course Description:				
Fluid Mechanics is offered as the engineering science course. This course contains basic principles and applications in Mechanical Engineering. In this course students will learn about fundamentals, properties, principles and governing equations of fluid behaviour in statics and in motion. Students will get new problem-solving approaches like control volume concept, streamline patterns and fluid flow analysis. This course has six units namely i) Fluid Statics ii) Fluid Kinematics iii) Fluid Dynamics iv) Momentum Equation and Laminar Flow v) Flow through pipes vi) Boundary Layer Theory and Forces on Immersed bodies.				
Course Content				
Unit 1	**Fluid Properties and Fluid Statics:**			**7 Hrs.**

A) Fluid Properties: Definition of fluid, Properties of fluid Mass Density, Weight Density, Specific Volume, Specific Gravity, Dynamic Viscosity, Kinematic Viscosity, Surface Tension, Capillarity and Compressibility, Types of fluid.

B) Fluid Statics: Statement of Pascal's law, Hydrostatic law of pressure, Definition of Buoyancy, Meta-center Condition of Equilibrium of floating and submerged bodies (No Numerical Treatment on fluid Statics).

Unit 2	**Fluid Kinematics:**	**6 Hrs.**

Eulerian and Langragian approach of fluid flow, Flow visualization, Types of flow, Streamlines, Path lines, streak lines, Stream tube, Continuity Equation in Cartesian coordinates in three dimensional flows, Velocity and Acceleration of fluid particles, Stream function and velocity potential function.

Unit 3	**Fluid Dynamics:**	**7 Hrs.**

Euler's Equation of motion, Integration of Euler's equation as energy equation. Applications of Bernoulli's equation venturimeter, orificemeter, Definition of Notch, Classification and its Applications, Derivation of Flow over triangular and rectangular notches only. Definition of Orifice, classification and its Applications, Hydraulic Coefficients Cd, Cc and Cv and Cr.

Unit 4	**Momentum Equation and Laminar Flow:**	**7 Hrs.**

A) Momentum Equation: Applications of momentum equation, Definition of kinetic energy correction factor, Definition of momentum correction factor, Analysis of fluid flow through pipe bends. (No Numerical Treatment).

B) Laminar Flow: Laminar flow through circular pipes and derivation of Hagen Poiseuille's equation, Laminar flow through parallel plates, Introduction of CFD and its applications.

Unit 5	**Fluid Flow through Pipes:**	**7 Hrs.**

Different energy losses in flow through pipe, Losses due to friction: Darcy's Weisbach equation and Chezy's equation, Minor Losses due to expansion, contraction, pipe fittings, at entrance, at exit, due to obstruction etc, Flow through Series pipe, Parallel pipe, Siphon pipes, Branching pipes and equivalent pipes

Unit 6	**Boundary Layer Theory and Forces on Immersed Body:**	**6 Hrs.**

A) Boundary Layer Theory: Boundary layer thickness, its characteristics, laminar and turbulent boundary layers, Displacement thickness, Momentum thickness, Energy thickness, separation, boundary layer control. (No Numerical Treatment)

B) Forces on Immersed Bodies: Lift and Drag, Drag on a flat plate and on aerofoil, Types of drags, Development of lift. (Magnus effect) stalling Condition of aerofoil.

Learning Resources:

Text Books

1	Fluid Mechanics, R. K. Bansal, Laxmi publications. New Delhi, 1998.
2	Fluid mechanics and Hydraulic Machinery, R. K. Rajput, Laxmi publishers
3	Introduction to Fluid Mechanics and Fluid Machines, S. K. Som, Gautam Biswas, Suman Chakraborty, Tata McGraw-Hill Publication. 3rdEdition 2012.
4	Hydraulics and Fluid Mechanics including Hydraulic Machines, Dr. P. N. Modi and Dr. S. M.

	Seth, Standard Book House.
Reference Books	
1	Fluid Mechanics–Fundamentals and Application,Y.A.Cengel, J.M.Cimbala, TMI,
2	Fluid Mechanics, K.L.Kumar, S.Chand Publication. New Delhi, 2ndEdition, 2000.
3	Fluid Mechanics,V.L.Streeter and E.B.Wylie,Tata Mc Graw Hill Pvt Ltd., New Delhi, 2ndEdition1997.

CO-PO Mapping:

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	PSO 3
CO1	2	-	-	-	-	-	1	-	-	-	-	-	-	1	-
CO2	3	3	2	1	-	-	2	-	-	-	-	-	-	2	-
CO3	3	2	2	1	-	-	2	-	-	-	-	-	-	3	-
CO4	2	2	3	1	-	-	2	-	-	-	-	-	-	3	-
CO5	2	2	2	1	-	-	2	-	-	-	-	-	-	3	-
CO6	1	3	2	1	-	-	1	-	-	-	-	-	-	2	-

Tatyasaheb Kore Institute of Engineering and Technology, Warananagar Second Year B. Tech. Department of Mechanical Engineering				
Course Code: 2501UMEHPCC304 Course Name: Material Science and Metallurgy				
Teaching Scheme		**Credit**	**Evaluation Scheme**	
Lectures:	03 Hours/Week	02	**ISE:**	40 Marks
			ESE:	60 Marks
Prerequisites, if any:				
Course Objectives: The objective of the course is to				
1)				
2)				
3)				

Course Outcomes: At the end of successful completion of the course, the student will be able to

		Bloom's Level
CO1	Visualize the fundamental structure of materials and understand different material defects.	
CO2	Explain nucleation & grain growth and draw Iron – Iron Carbide equilibrium diagram.	
CO3	Explain various destructive and non destructive testing techniques.	
CO4	Understand transformation of austenite into Pearlite, Bainite and Martensite on cooling.	
CO5	Compare the heat treatment processes used in mechanical components.	
C56	Discuss the various stages of techniques used in manufacturing of Powder Metallurgy components.	

Course Description:

Life of the Mechanical Components is greatly influenced by the material properties and heat treatment provided for it. Hence Material selection is the important task in manufacturing process to select the appropriate material, One should know about required properties for specified task. This course deals with different engineering material and their properties. It also includes knowledge of heat treatment to change the properties as per the requirement.

Course Content

Unit 1	**Introduction to Metals and alloy systems**	**07 Hrs**

Introduction to Metallic and Non-metallic materials and its classification (metals/alloys, polymers and composites)

Imperfections in crystals, Defects-Point, Line, Planar, Volume- Slip planes and slip systems.

Alloy formation by crystallization, Nucleation and growth, Cooling curves, Dendritic structure and coring.

c) Solid solutions and intermediate phases.

Phases and Gibbs phase rule.

Construction of equilibrium diagrams from cooling curves, Isomorphous system (Solid Solution), Eutectic, Partial solubility Peritectic and Intermetallic Compounds Lever arm principles.

Unit 2	**Study of Phase Diagrams**	**11 Hrs**

(With respect to typical compositions, Properties and Applications for the following alloys.) a) Fe- Fe3C equilibrium diagram - Ferrous alloys (Plain carbon steels, cast iron) Alloy steels- Free cutting steels, HSLA high carbon low alloy steels, maraging steels. creep resisting steels, Stainless steels- different types. Tool steels- types, Selection of materials and Specifications based on -IS, BS, SAE, AISI, Copper based alloys brasses Cu- Zn, Bronzes Cu- Sn, , Cu- Be, Cu-Ni. Aluminum based alloys Al- Cu(Duralumin) - Al-Si (Modification), Pb- Sn (Solders and fusible alloys)

Unit 3	**Principles of Mechanical Testing**	**11 Hrs**

Destructive Testing methods: Tensile, Compressive, Impact, Fatigue, Creep, Hardness (Rockwell, Brinell and Vickers) Non- Destructive Testing: Dye Penetrant test, Magnetic particle test, sonic and ultrasonic test, Radiography test, Eddy Current testing

Unit 4	**Principles of Heat Treatment & heat treatment of Ferrous Alloys**	**04 Hrs**

Transformation of austenite into Pearlite, Bainite and Martensite on cooling. TTT –Diagram and CCT - Diagrams - significance, Effect of alloying elements on TTT diagram and its significance. Heat treatment furnaces and equipments.

Unit 5	**Heat Treatment Processes**	**06 Hrs**

Heat Treatment of Steels Annealing – Types-Full, Partial and Sub critical annealing (Various types) and purposes. Normalising- Purposes Hardening (Hardening types), Purposes, Austempering and Martempering, Mechanism of quenching and Quenching media, Hardenability- Concept and methods of determination of hardenability- Grossmans critical diameter method. Tempering Types, Structural transformations during tempering, purposes sub zero treatment. Surface hardening - Flame and Induction Chemical heat treatments for case hardening - Carburising, Nitriding, Cyniding, Carbonitriding Heat treatment defects and remedies

Unit 6	**Powder Metallurgy**	**08 Hrs**

Advantages, Limitations and Applications of Powder Metallurgy Powder manufacturing types- Mechanical, Physical, Chemical and Electro- Chemical

Mixing/ Blending. Compaction- types- Conventional, Powder rolling and extrusion Sintering - Types liquid stage and solid stage sintering.

Learning Resources:

Text Books

1	S. H. Avner, “Introduction to physical metallurgy”, Mcgraw Hill Book Company Inc, Edition, 2nd, 1974.
2	Vijendrasingh, “Physical metallurgy”, Standard Publishers Delhi
3	Materials Science and – An Introduction by William D. Callister Jr. and David G. Rethwisch, Wiley, Tenth Edition, 2010.
4	V. D. Kodgire, “Material science and metallurgy for engineers”, EverestPublishersPune,12th Edition

5	T. V. Rajan / C. P. Sharma, "Heat Treatments Principles and Practices", Prentice Hall of India Pvt Ltd, New Delhi
6	V. Raghwan, "Material ScienceandEngineering", Prentice Hall of India Pvt. Ltd, New Delhi ,3rd Edition,1995.
Reference Books	
1	V. Raghvan, "Materials Science & Engineering", PHI 5th Edition, Prentice Hall of India(P) Ltd.
2	W. Callister, "Materials Science & Engineering", John Wiley & sons
3	R. A. Higgins, "Engineering Metallurgy", Viva Books Pvt. Ltd., New Delhi, 1st Edition
4	Foundations of Materials Science and Engineering by William F. Smith, McGrawHill, Third Edition, 2004.
5	Elements of Materials Science and Engineering by H. Van Vlack, Addison – Wesley, Fifth Edition, 2006.
6	Introduction to Materials Science for Engineers by James F. Shackelford, Pearson, Eighth Edition, 2015.
7	Characterization of Materials by P. K. Mitra, PHI Learning, 2014.
8	Mechanical Metallurgy by George E. Dieter, Tata McGraw Hill, 3rd edition, 2013.

CO-PO Mapping:

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	PSO 3
CO1	3	--	--	--	--	--	1	--	--	--	--	--	--	--	--
CO2	2	2	2	--	--	--	1	--	--	--	--	--	--	--	--
CO3	2	--	--	2	--	--	--	--	--	--	--	--	--	--	3
CO4	2	2	3	1	--	--	--	--	--	--	--	--	--	--	2
CO5	2	2	1	--	--	--	--	--	--	--	--	--	--	--	1
CO6	1	--	3	2	--	--	--	--	--	--	--	--	--	--	3

Tatyasaheb Kore Institute of Engineering and Technology, Warananagar Second Year B. Tech. Department of Mechanical Engineering				
Course Code: 2501UMEHEEC3052 Course Name: Fundamentals of Engineering Economics				
Teaching Scheme		**Credit**	**Evaluation Scheme**	
Lectures:	03 Hours/Week	02	**ISE:**	40 Marks
			ESE:	60 Marks

Prerequisites, if any:

Basic Mathematics

Course Objectives: This course enables the student to

1)	Acquaint with basic concepts of economics.
2)	Educate students about various cost elements of manufactured product or service.
3)	Understand the concepts of time value of money and equivalence.
4)	Explore different methods for evaluating engineering projects.
5)	Acquire basic knowledge of replacement study considering inflation.
6)	Perform break even analysis and understand strategies to control the inventory

Course Outcomes: At the end of successful completion of the course, the student will be able to

		Bloom's Level
CO1	Relate basic concepts of economics to real life	Understand
CO2	Classify different cost elements of manufactured product or service	Understand
CO3	Utilize the concepts of time value of money and equivalence in economic decision making	Understand Apply
CO4	Identify appropriate method to evaluate an engineering project.	Understand Apply
CO5	Make use of replacement study considering inflation to make decisions	Understand Apply
CO5	Utilize concepts of break-even analysis and inventory control strategies	Understand Apply

Course Description:

The course focuses on economic and cost analysis of engineering projects. The basic purpose of this course is to introduce students with concepts and principles of engineering economy and with methods for making rational decisions regarding problems likely to be encountered in professional practice.

Course Content

Unit 1	**Introduction:**	**4Hrs**

Introduction to Engineering Economy-Flow in an economy, Law of supply and demand, Definition and

Role of Engineering Economics

Economic decision-making process, Importance of Ethics in Engineering Economy.

Unit 2	Elements of Costs:	8Hrs

Fixed, Variable, Marginal, and Average Costs. Sunk costs, Opportunity costs, Recurring and non-recurring costs, Incremental Costs. Cost estimating, Estimating models.

Criteria for make or buy, Approaches for make or buy decision. Concept of depreciation and methods of depreciation.

Unit 3	Interest and Equivalence:	4Hrs

Time value of money- simple and compound interest, repaying a debt.

Cash flow diagram, Concept of equivalence.

Unit 4	Evaluation of Engineering Projects:	8Hrs

Present worth method, Future worth method, Annual worth method, Internal rate of return method

Unit 5	Replacement Analysis:	6Hrs

Basics of replacement study, determining economic service life, Performing replacement study.

Inflation adjusted decisions

Unit 6	Break Even Analysis and Inventory Control	6 Hrs

Breakeven Analysis for a Single Project and two alternatives.

Payback analysis.

Purchase model with and without shortages, Manufacturing model with and without shortages.

Learning Resources:

Text Books

1	R. Paneerselvam, "Engineering Economics", PHI Learning Private Ltd., 2010
2	William G. Sullivan, Elin M. Wicks, & C. Patrick Koelling., "Engineering Economy", Pearson Higher Education Inc., 2015.

Reference Books

1	Leland Blank, Anthony Tarquin, "Engineering Economy", McGraw Hill,2012
2	Chan S. Park, "Contemporary Engineering Economics", Pearson Prentice Hall, 2018
3	Donald G. Newman, Ted G. Eschenbach, & Jerome P. Lavelle, "Engineering Economic Analysis", Oxford University Press, Inc.,2012.

CO-PO Mapping:

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	PSO 3
CO1	--	--	--	--	--	--	--	---	--	--	--	--	--	--	--
CO2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
CO3	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

CO4	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
CO5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
CO6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Tatyasaheb Kore Institute of Engineering and Technology, Warananagar Second Year B. Tech. Department of Mechanical Engineering				
Course Code: 2501U0MEHVEC306T Course Name: Personal Values and Ethics				
Teaching Scheme		**Credit**	**Evaluation Scheme**	
Lectures:	02 Hours/Week	02	**ISA:**	50 Marks
Prerequisites, if any:				
Course Objectives: The objective of the course is to				
1)	To raise consciousness of human principles and ethics in engineering			
2)	To ingrain loyalty, moral principles, and social values			
3)	To respect other people's rights.			
4)	To raise awareness about safety and risk evaluations			
Course Outcomes: At the end of successful completion of the course, the student will be able to				
				Bloom's Level
CO1	Determine and evaluate an ethical dilemma in the area of study or in a related topic.			Knowledge
CO2	Analyze the numerous ethical concerns that are raised by a certain scenario or activity in the actual world.			Understand
CO3	Describe what makes a specific course of conduct morally justifiable.			Understand
CO4	Evaluate the societal context of the issues and their own ethical principles.			Knowledge
CO5	Determine which ethical issues, such as academic integrity, the usage and citation of sources, the impartial presentation of facts, and the treatment of people			Understand Apply
CO6	Show your understanding of moral principles in extracurricular activities like field work, internships, and service learning. Integrate, synthesize, and apply your understanding of moral conundrums and answers in academic contexts like focused and multidisciplinary study.			Knowledge Apply Evaluate
Course Description:				
The course provides an in-depth exploration of personal values and ethics, focusing on the development, analysis, and application of ethical principles in personal and professional contexts. Students will engage with various ethical theories, reflect on their own values and learn to navigate complex moral dilemmas.				
Course Content				
Unit I	**Human Values:**			**04 Hrs**
Morals, Values and Ethics-Integrity-Work Ethic-Service learning – Civic Virtue – Respect for others – Living Peacefully –Caring –Sharing –Honesty -Courage-Cooperation– Commitment – Empathy –Self Confidence Character –Spirituality-Case Study.				

Unit II	Engineering Ethics:	04 Hrs
Senses of 'Engineering Ethics-Variety of moral issued –Types of inquiry –Moral dilemmas – Moral autonomy –Models of professional roles-Theories about right action-Self-interest -Customs and religion – Uses of Ethical theories –Valuing time –Cooperation –Commitment-Case Study		
Unit III	**Engineering As Social Experimentation**	**04 Hrs**
Engineering As Social Experimentation –Framing the problem –Determining the facts – Codes of Ethics – Clarifying Concepts –Application issues –Common Ground –General Principles –Utilitarian thinking respect for persons-Case study		
Unit IV	**Variety of Moral Issues**	**04 Hrs**
Understanding the Harmony in the Society (society being an extension of family), Integrity, Work Ethic, Courage, Empathy, Self Confidence, Moral Autonomy, Concensensus and Controversy, Professional and Professionalism, Professional Ideas and Virtues		
Unit V	**Principals of Ethics and Morality**	**04 Hrs**
Ethics as a Subset of Morality, Ethics and Organizations, Employee Duties and Rights, Discriminatory and Pre-judicial Employee Practices, Understanding Harmony in Nature, Natural Acceptance of Human Values.		
Unit VI	**Risk Benefit Analysis**	**04 Hrs**
Reducing Risk, The Government Regulators Approach to Risk, Handling Ethical Dilemmas at Work, Market Strategy and Ethics, Ethical Practice in Market Place, Ethics in Finance, Ethics in Business and Environment.		

Learning Resources:

Text Books

1	Mike W. Martin and Roland Schinzinger "Ethics in Engineering" Tata McGraw-Hill–2003.
2	Prof. A. R. Aryasri, Dharanikota Suyodhana "Professional Ethics and Morals". Maruthi Publications
3	PSR Murthy "Indian Culture, Values and Professional Ethics" BS Publication.
4	Alavudeen, R. Kalil Rahman and M. Jayakumaran "Professional Ethics and Human Values" –Laxmi Publications.

Reference Books

1	M. Govindarajan, S. Natarajananad, V. S. Senthil Kumar "Engineering Ethics includes Human Values" -PHI Learning Pvt. Ltd-2009
2	Prof. D. R. Kiran "Professional Ethics and Human Values
3	Harris, Pritchard and Rabins "Engineering Ethics", CENGAGE Learning, India Edition, 2009.

CO-PO Mapping:

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	PSO 3
CO1	-	1	-	1	-	-	-	1	2	-	-	1	-	-	1
CO2	1	1	-	2	-	-	2	-	1	-	-	2	-	-	-
CO3	2	-	-	2	-	1	-	3	-	3	1	-	-	1	-
CO4	1	-	2	-	1	-	2	-	-	-	-	2	1	-	-
CO5	-	2	1	-	-	1	-	2	3	2	-	-	-	-	-
CO6	-	-	-	1	-	3	-	1	-	-	2	1	-	1	-

Tatyasaheb Kore Institute of Engineering and Technology, Warananagar
Second Year B. Tech. Department of Mechanical Engineering

Course Code: 2501UMEHMDM1307T Course Name: Multidisciplinary Minor-1

Teaching Scheme		Credit	Evaluation Scheme	
Lectures:	02 Hours/Week	02	**ISA:**	50 Marks

Prerequisites, if any:

Course Objectives: The objective of the course is to

1)	Develop an ability to create constrained 2-D Sketches.
2)	Create 3D Part models of industrial components.
3)	Prepare Assemblies comprising various Part models.
4)	Transform 3D views into Orthographic views.

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

		Bloom's Level
CO1	Sketch a 2D drawing conducive to 3D modelling.	Remember Understand
CO2	Create Part models from 2D drawings.	Remember Understand
CO3	Create Assemblies containing Parts and Sub-assemblies.	Remember Understand
CO4	Generate Orthographic views from 3D Part model & Assembly.	Remember Understand

Course Description:

The concept of 3D CAD Modelling is applicable to almost all the branches of Engineering, as the constituent components of any system, small or large, has to be modelled and manufactured, which makes this subject essential. This Course has been offered by Mechanical Engineering Program as one of the Multidisciplinary MINOR courses and is one of the courses to be studied by Third Semester students pertaining to the Program other than Mechanical Engineering. The Course contains Five Units namely, Introduction to CAD, Sketcher Workbench, Part Design Workbench, Assembly Design Workbench and Drafting Workbench.

Course Content

Unit 1	**Introduction to CAD**	**02 Hrs.**

Introduction to the concept of CAD, CAM and CAE, Applications of CAD in view of CAM and CAE, 2D Drawings and 3D CAD Model, Importance of CAD data, Various CAD Softwares and their specific domain, Introduction to CATIA-GUI, Specification Tree, Sketch planes, Navigations through various Workbenches.

Unit 2	**Sketcher Workbench**	**03 Hrs.**

Profile Toolbar: Line, Circle, Rectangle, Profile line. Operation Toolbar:Trim, Extend, Fillet, Offset, Mirror

Constraint Toolbar: Geometrical Constraints: Tangent, Parallel, Perpendicular. Dimensional Constraints: Length, Radius, Diameter, Angle, etc.

Unit 3	**Part Design Workbench**	**05 Hrs.**

Sketch-based Features: Pad, Pocket, Shaft, Grove

Dress-up Features: Draft, Fillet, Chamfer

Transformation Features: Pattern (Rectangular & Circular)

Unit 4	**Assembly Design Workbench**	**03 Hrs.**

Building assembly using existing Part models

Building Assembly as a part of another Assembly.

Manipulation and Constraints

Unit 5	**Drafting Workbench**	**02 Hrs.**

Setting up Sheet for Drafting, Inserting Primary View, Inserting additional views, Dimensions, Title blocks

Learning Resources:

Text Books

1	CATIA V5R20 for Engineers and Designers, Shyam Tickoo &Deepak Maini,DreamTech Press.
2	CAD/CAM and Automation, Farazdak Haideri, Nirali Prakashan
3	CAD/CAM Theory and Concepts, Kuldeep Sarin, Chandandeep Grewal, S. Chand

Reference Books

1	CAD/CAM- Theory and Practice by Ibrahim Zeid, R. Sivasubramanian,McGraw-Hill, India
2	Respective Software manuals.

CO-PO Mapping:

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	PSO 3
CO1	3	2	2	-	3	1	-	-	3	1	3	2	1	-	1
CO2	3	2	2	-	3	1	-	-	3	1	3	2	3	-	3
CO3	3	2	2	-	3	1	-	-	3	1	3	2	3	-	2
CO4	3	2	2	-	3	1	-	-	3	1	3	2	3	-	3

Tatyasaheb Kore Institute of Engineering and Technology, Warananagar Second Year B. Tech. Department of Mechanical Engineering				
Course Code: 2501UMEHCEP308T Course Name: Community Connected Project				
Teaching Scheme		**Credit**	**Evaluation Scheme**	
Practicals:	02 Hours/Week	02	**ISA:**	50 Marks
Prerequisites, if any:				
Course Objectives: The objective of the course is to				
1)	Gain a thorough understanding of community engagement principles and ethics, with a focus on local dynamics and rural culture.			
2)	Assess the roles of NGOs and self-help groups in promoting rural development and their contributions to community improvement.			
3)	Exhibit the ability to communicate effectively and work collaboratively with community members, local authorities, and other stakeholders to achieve common goals.			
Course Outcomes: At the end of successful completion of the course the student will be able to				
				Bloom's Level
CO1	Understand Community Engagement Concepts			Knowledge, Understand,
CO2	Identify community issues, needs, problems, strengths, and resources & recognize the value of service and social responsibility			Knowledge, Understand,
CO3	Understand how NGOs and self-help groups contribute to rural development			Understand
CO4	Demonstrate the ability to communicate effectively and collaborate with others			Application,
Course Description:				
The NGO Internship Program is designed to provide students with practical experience in community engagement and rural development. Through this program, students will gain insights into the functioning of NGOs, the challenges faced by rural communities, and the social impact of various government programs. The internship emphasizes the importance of ethical practices, community involvement, and the application of theoretical knowledge to real-world settings. By working closely with NGOs, students will develop a deeper understanding of local community needs and the strategies employed to address these needs effectively.				
Course Content				
Learning Resources:				
CO-PO Mapping:				

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	PSO 3
CO1	--	--	--	--	--	3	--	--	--	--	--	--	--	--	--
CO2	--	--	--	--	--	3	--	--	--	--	--	--	--	--	--
CO3	--	--	--	--	--	3	--	--	--	--	--	--	--	--	--
CO4	--	--	--	--	--	2	--	--	3	3	--	--	--	--	--
CO5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
CO6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Tatyasaheb Kore Institute of Engineering and Technology, Warananagar Second Year B. Tech. Department of Mechanical Engineering				
Course Code: 2501UMEHPCC302T Course Name: Applied Thermodynamics Lab				
Teaching Scheme		**Credit**	**Evaluation Scheme**	
Practicals:	02 Hours/Week	01	**ISA:**	25 Marks
Prerequisites, if any:				
Course Objectives: The objective of the course is to				
1)	Learn about the detailed construction working of steam power plant			
2)	Learn about different types of boilers, mountings and accessories			
3)	Learn about different types of steam condensers and cooling tower.			

Course Outcomes: At the end of successful completion of the course, the student will be able to

		Bloom's Level
CO1	Understand the construction and working of steam power plant	Knowledge Understand
CO2	Understand the construction, working and classification of different types of steam boilers.	Understand
CO3	Understand the use and functioning of Boiler mountings used in steam power plant	Understand
CO4	Understand the use and functioning of Boiler Accessories used in steam power plant	Understand
CO5	Understand construction, working and classification of different types of steam condensers and cooling towers used in steam power	Understand
CO6	Analyse and evaluate Heat balance sheet of steam power plant	Analysis Evaluate

Course Description:

The Applied thermodynamics laboratory consists of a number of models of steam boiler, steam condenser, steam turbines, various boiler mountings and accessories. Students are able to enhance their basic and fundamental knowledge of applied thermodynamics by effective using of these demo models.

Course Content

Sr. No.	**Topic of Practical / Experiment / Tutorial**	**Hours**
1	Study of steam power plant	2
2	Study and Demonstration of water tube and fire tube boilers.	2
3	Study and Demonstration of boiler mountings	2
4	Study and Demonstration of boiler accessories	2
5	Study and demonstration of steam condensers and cooling towers used in steam power plants	2
6	Heat balance sheet of steam power plant	2

7	Industrial visit to steam generating unit/cogeneration plant	2

Learning Resources:

Text Books

1	"Thermal Engineering", Kumarand Vasandani, D. S. Publisher Metropolitan Book Co, Delhi, 3rd Edition.
2	"Thermal Engineering", Ballaney P. L, Khanna Publishers, New Delhi, 27th Edition.
3	"Engineering Thermodynamics", P. K. Nag., Tata McGraw Hill, New Delhi, 4th Edition.
4	"Thermal Engineering", R. K. Rajput, Laxmi Publications, 3rd Edition.
5	"Steam and Gas Turbines", R. Yadav, CPH Allahabad, 2nd Edition, 2005.
6	"Principles of Engineering Thermodynamics", Moran, Shapiro, Boetnner, Wiley, 8th Edition.

Reference Books

1	Y.A. Cengel & M.A. Boles, Thermodynamics: An Engineering Approach, 8th Ed., McGraw Hill Education (India) Pvt. Ltd., New Delhi,2016.
2	R.E. Sonntag, C. Borgnakke & G.J. Van Wylen, Fundamentals of Thermodynamics, 6th Ed., John Wiley, 2003. 3. T.D. Eastop& A.
3	McConkey, Applied Thermodynamics, 5th Ed., Pearson Education Ltd., New Delhi, 2014.

CO-PO Mapping:

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	PSO 3
CO1	3	--	--	--	--	--	--	---	--	--	--	--	--	3	--
CO2	3	--	--	--	--	--	--	---	--	--	--	--	--	3	--
CO3	3	--	--	--	--	--	--	---	--	--	--	--	--	3	--
CO4	3	--	--	--	--	--	--	---	--	--	--	--	--	3	--
CO5	3	--	--	--	--	--	--	---	--	--	--	--	--	3	--
CO6	3	3	3	--	--	--	--	---	--	--	--	--	--	3	--

Tatyasaheb Kore Institute of Engineering and Technology, Warananagar Second Year B. Tech. Department of Mechanical Engineering				
Course Code: 2501UMEHPCC303P Course Name: Fluid Mechanics Lab.				
Teaching Scheme		**Credit**	**Evaluation Scheme**	
Practicals:	02 Hours/Week	01	**ISA:**	25 Marks
			POE:	25 Marks

Prerequisites, if any:

1. Fundamentals of Fluid Mechanics and fluid properties.
2. Pressure, head, velocity, discharge, and flow rate.
3. Basic mathematical calculations and graphical interpretation.
4. Familiarity with laboratory instruments, measurement procedures, and safety practices.

Course Objectives: The objective of the course is to

1)	Familiarize students with various pressure and flow measuring devices used in fluid systems.
2)	Develop practical understanding of laminar and turbulent flow and flow visualization.
3)	Enable students to experimentally verify Bernoulli's equation.
4)	Develop skills for calibration of discharge-measuring devices such as venturimeter, orificemeter, and notches.
5)	Enable students to determine major and minor losses in pipe systems.
6)	Develop experimental skills in observation, measurement, data recording, calculations, analysis, and interpretation of fluid-flow phenomena

Course Outcomes: At the end of successful completion of the course, the student will be able to

		Bloom's Level
CO1	Identify and use different pressure measuring devices used fluid system.	Knowledge Understand
CO2	Understand different types of fluid flow and determine laminar or turbulent fluid flow.	Understand
CO3	Verify Bernoulli's Theorem.	Apply Analyze
CO4	Calibrate the different discharge measuring devices to determine coefficient of discharge.	Apply Analyze
CO5	Determine the major and minor losses in pipe system.	Apply

Course Description:

Fluid Mechanics Lab provides hands-on experience in the experimental study of fluid-flow principles and measurement techniques. The laboratory introduces students to pressure-measuring devices and flow visualization techniques and enables them to investigate laminar and turbulent flow through the Reynolds experiment. Students experimentally verify Bernoulli's equation and calibrate various discharge-measuring devices, including venturi meter, orifice meter, and notches. The course also covers determination of minor losses in pipe fittings and coefficients of friction for pipes of different materials. These experiments strengthen students' ability to apply theoretical fluid-mechanics concepts to practical engineering systems.

Course Content

Sr. No.	**Topic of Practical / Experiment / Tutorial**	**Hours**

1	Assignment on Study and demonstration of Pressure Measuring Devices.	2
2	Flow visualization by plotting of streamlines (Heleshaw's apparatus).	2
3	Reynold's experiment.	2
4	Verification of Bernoulli's equation.	2
5	Calibration of Venturi meter	2
6	Calibration of Orifice meter	2
7	Calibration of Notches	2
8	Calibration of orifice under steady and unsteady flow condition.	2
9	Determination of minor losses in pips-fittings.	2
10	Determination of coefficient of friction in pipes of different materials.	2

Learning Resources:

Text Books

1	R. K. Rajput, *A Textbook of Fluid Mechanics and Hydraulic Machines*, S. Chand.
2	R. K. Bansal, *Fluid Mechanics and Hydraulic Machines*, Laxmi Publications.
3	Modi & Seth, *Hydraulics and Fluid Mechanics including Hydraulic Machines*, Standard Book House.

Reference Books

1	Frank M. White, *Fluid Mechanics*, McGraw-Hill.
2	P. N. Modi and S. M. Seth, *Hydraulics and Fluid Mechanics*, Standard Book House.
3	Yunus A. Çengel and John M. Cimbala, *Fluid Mechanics: Fundamentals and Applications*, McGraw-Hill.

CO-PO Mapping:

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	PSO 3
CO1	3	2	1	2	2	1	0	1	1	1	0	2	3	0	3
CO2	3	3	1	3	2	1	1	0	1	1	1	2	3	0	3
CO3	3	3	2	3	2	1	1	0	1	1	1	1	3	0	3
CO4	3	3	2	3	3	1	1	0	1	1	1	2	3	0	3
CO5	3	3	2	3	2	2	1	1	1	1	1	2	0	0	3

Tatyasaheb Kore Institute of Engineering and Technology, Warananagar Second Year B. Tech. Department of Mechanical Engineering				
Course Code: 2501UMEHPCC304TP Course Name: Material Science and Metallurgy Lab.				
Teaching Scheme		**Credit**	**Evaluation Scheme**	
Practicals:	02 Hours/Week	01	**ISA:**	25 Marks
			POE:	25 Marks

Prerequisites, if any:

1. Classification and properties of engineering materials.
2. Basic concepts of mechanical properties such as strength, hardness, toughness and ductility.
3. Fundamentals of ferrous and non-ferrous materials.
4. Basic knowledge of heat treatment and microstructure of metals.
5. Basic laboratory safety and measurement practices.

Course Objectives: The objective of the course is to

1)	To familiarize the students with the use equipment to determine mechanical properties of materials to acquire the knowledge in Destructive Material Testing
2)	To familiarize the students with various heat treatment processes

Course Outcomes: At the end of successful completion of the course the student will be able to

		Bloom's Level
CO1	Determine different properties like strength, elongation, toughness, hardness by doing tests like Tensile test, Impact test, and Hardness test.	Knowledge, Apply
CO2	Choose different NDT techniques for determining surface and sub surface Cracks.	Analyze
CO3	Explain various heat treatment processes and their microstructural changes.	Analyze
CO4	Explain the concept of hardenability and estimate the hardenability.	Understand, Analyze

Course Description:

Material Science and Metallurgy Lab is a practical course designed to provide hands-on experience in evaluating the mechanical properties, microstructure, and metallurgical characteristics of engineering materials. The course familiarizes students with destructive and non-destructive material testing techniques, including tensile, hardness, impact, dye penetrant and magnetic particle testing. Students also study the preparation and examination of metallic microstructures, macroscopic examination through spark testing, and the microstructure of steels, cast irons and non-ferrous alloys. The course further introduces heat treatment processes and hardenability, including the Jominy end-quench test. An industrial visit is included to expose students to practical heat-treatment practices.

Course Content

Sr. No.	Topic of Practical / Experiment / Tutorial	Hours
1	Tensile testing on mild steel specimen by using a universal testing machine.	2
2	Brinell Hardness testing.	2
3	Impact testing (Izod and Charpy) on mild steel specimen.	2

4	Non-Destructive testing – Dye penetrant and magnetic particle testing.	2
5	Macroscopic Examinations – Spark Test.	2
6	Preparation of specimen for microstructure analysis	2
7	Study of microstructure of steels and Cast Irons	2
8	Study of microstructure of non-ferrous alloys	2
9	Jominyend quench test for hardenability	2
10	Industrial visit should be conducted to observe industrial heat treatment practices	2

Learning Resources:

Text Books

1	S. H. Avner, "Introduction to physical metallurgy", McgrawHill Book Company Inc, Edition, 2nd, 1974.
2	Vijendrasingh, "Physical metallurgy", Standard Publishers Delhi
3	Materials Science and – An Introduction by William D. Callister Jr. and David G. Rethwisch, Wiley, Tenth Edition, 2010.
4	V. D. Kodgire, "Material science and metallurgy for engineers", Everest Publishers Pune,12th Edition.
5	T. V. Rajan /C. P. Sharma, "Heat Treatments Principles and Practices", Prentice Hall of India Pvt Ltd, New Delhi.
6	V Raghwan, "Material ScienceandEngineering", Prentice Hall of India Pvt. Ltd., New Delhi, 3rd Edition, 1995.

Reference Books

1	V. Raghvan, "Materials Science & Engineering", PHI 5th Edition, Prentice-Hall of India(P) Ltd.
2	W. Callister, "Materials Science& Engineering", John Wiley & sons
3	R. A. Higgins, "Engineering Metallurgy", Viva Books Pvt. Ltd., New Delhi,1st Edition
4	Foundations of Materials Science and Engineering by William F. Smith, Mc Graw Hill, Third Edition, 2004.
5	Elements of Materials Science and Engineering by H. Van Vlack, Addison – Wesley, Fifth Edition, 2006.
6	Introduction to Materials Science for Engineers by James F. Shackelford, Pearson, Eighth Edition, 2015.
7	Characterization of Materials by P. K. Mitra, PHI Learning, 2014.
8	Mechanical Metallurgy by George E. Dieter, Tata McGraw Hill, 3rd edition, 2013.

CO-PO Mapping:

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	PSO 3
CO1	2	1	--	--	--	--	--	---	--	--	---	--	2	---	--
CO2	2	1	--	--	--	--	--	---	--	--	---	--	2	---	--
CO3	--	2	--	--	--	--	--	---	--	--	---	--	--	---	--
CO4	--	2	--	--	--	--	--	---	--	--	---	--	--	---	--

Tatyasaheb Kore Institute of Engineering and Technology, Warananagar Second Year B. Tech. Department of Mechanical Engineering				
Course Code: 2501UMEHPCC309T Course Name: Machine Drawing & Geometric Modelling Lab				
Teaching Scheme		**Credit**	**Evaluation Scheme**	
Practicals:	02 Hours/Week	01	**ISA:**	25 Marks
Prerequisites, if any:				
Course Objectives: The objective of the course is to				
1)	To study and identify BIS conventions used in machine drawing.			
2)	To develop an ability to create constrained 2-D Sketches and 3-D modelling.			
3)	To create solid models of machine components.			
Course Outcomes: At the end of successful completion of the course the student will be able to				
				Bloom's Level
CO1	Understanding BIS conventions and Standard machine components			Understanding
CO2	Draw 2D drawings and 3D models of simple components.			Applying
CO3	Creating the skills for drawing assembly from details and details from assembly drawing by using CATIA software			Creating
CO4	Analyze production Drawing and Understand use of limit fits and tolerances on production drawing.			Analysis
Course Description:				
The Machine Drawing & Geometric Modeling includes study of AutoCAD & CATIA modeling software to make 2D and 3D object. This study is beneficial for students to enhance their basic and fundamental knowledge of machine drawing to make 2D and 3D models effectively. This is required skills of Mechanical Engineer will be achieved by this subject.				
Course Content				
Unit 1	**Study of B.I.S. Conventions & Sketching of Machine Component**			**4 hrs**
Importance of BIS Conventions, BIS Conventional representation of engineering materials, BIS conventions for sectioning, Types of threads profiles, Internal and external threads, Types of springs, Types of gears BIS Conventional representation of Splined shaft, Serrated shaft, Free- hand Sketches of nut, bolts square and Hexagonal Flanged nuts, Lock nuts, Dome nut, Capstan nut, Wing nut, Castle nut, Split pin, Square headed bolt, Cup headed bolt, T-headed bolt, Types of foundation bolts, Stud, Washer, set screws, Cap screws. Muff coupling, Protected and unprotected Flanged, Coupling, Universal coupling, solid and bush bearing. Plummer block (pedestal bearing), Foot step bearing. Flat and V-belt pulleys, Fast and loose pulleys, speed cone pulleys etc. (Drawing Sheet on AutoCAD in A3 size printout)				
Unit 2	**Solid Modelling with Drafting**			**4 hrs**
Drawing of solid Modelling of four simple mechanical components with its drafting in CATIA				

(Drawing Sheet in CATIA in A4 size printout)

Unit 3	Details and Assembly Drawings	6 hrs

Preparing detail and assembly drawings in 3D & 2D. Preparing Bill of Material (BOM). Maximum number of parts to be limited. Entering limits, fits, Tolerances and surface finish symbols on detail and assembly drawings.

Preparation of detail and assembly drawing from the following examples such as Machine tool parts: Tool post, Tailstock, Machine vice, Chucks etc. Engine parts: Stuffing box, Crosshead assembly, Piston and connecting rod, etc. Miscellaneous parts: Valve assembly, Screw jack, Jigs and fixtures, Pipe vice etc.

(Drawing Sheet in CATIA in A3 size printout of two detail and assembly of mechanical components)

Unit 4	Production Drawing	6 hrs

Production drawing including removed cross section, detailed views, Cross sectional views, dimensions and tolerances etc.

Applying various tolerance symbols like Straightness, Flatness, Perpendicularity, Angularity, Roundness, Concentricity, Cylindricity, Run out, Profile, Parallelism etc. Entering limits, fits, tolerances surface finish symbols and Machining Symbols on drawings

Significance of limits and fits and tolerances, Definitions, Types, Recommendations and selections in relation with limits fits and tolerance system, Tolerances of form and position, surface finish symbols as per BIS conventions, Selection and entering of all these symbols with reference to details and assembly drawings, Tolerancing an individual dimensions of details drawing.

(Drawing Sheet in CATIA in A3 size printout)

Unit 5	Surface Modelling	4 hrs

Drawing of Surface Modeling of two simple mechanical components in CATIA

(Drawing Sheet in CATIA in A4 size printout)

Learning Resources:

Text Books

1	P.S. Gill, Machine Drawing. S. K. Kataria and Sons, Delhi, 7th Edition, 2008
2	N. D. Bhatt, Machine Drawing. Charotor Publication House, Bombay, 42th Edition, 2007
3	CAD/CAM- Principals and Applications", P.N. Rao, Tata McGraw Hill, 2nd Edition.
4	CAD/CAM/CAE, N. K. Chougule, SciTech Publication, Revised Edition.

Reference Books

1	IS: SP46-Engineering Drawing Practice for Schools and Colleges, B.I.S. Publications.
2	IS: 696-Code of Practice for General Engineering Drawings B.I.S. Publications.
3	CAD/CAM by M. P. Grover. and E. W. Zimmer, Prentice Hall of India Pvt. Ltd.
4	CATIA V5R20 for Engineers and Designers, Prof. Shyam Tickoo and Deepak Maini, Dream Tech Press

CO-PO Mapping:

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	PSO 3
CO1	1	1	--	--	1	--	--	--	--	2	--	--	2	--	--
CO2	1	1	--	--	3	--	--	--	--	3	--	1	2	--	--

CO3	2	1	--	--	3	--	--	--	--	3	--	1	2	--	--
CO4	2	1	--	--	3	--	--	--	--	3	--	1	2	--	--

Tatyasaheb Kore Institute of Engineering and Technology, Warananagar Second Year B. Tech. Department of Mechanical Engineering				
Course Code: 2501UMEHPCC401 Course Name: Analysis of Mechanical Elements				
Teaching Scheme		**Credit**	**Evaluation Scheme**	
Lectures:	03 Hours/Week	02	**ISE:**	40 Marks
			ESE:	60 Marks
Prerequisites, if any:				
Course Objectives: The objective of the course is to				
1)	1. To develop understanding of the basic concepts related to tensile, compressive and shear stresses in engineering components and basic knowledge of principal stresses and strains.			
2)	2. To discuss the basic principles of torsion in shafts, shear force and bending moment in beams, deflection in beams, buckling in mechanical elements.			
3)	3. To enable the students to calculate distribution of bending stresses and shear stresses in mechanical components of various cross sections.			
Course Outcomes: At the end of successful completion of the course the student will be able to				
				Bloom's Level
CO1	Define different types of stresses and strains induced in any machine component due to various loading conditions.			Remember
CO2	Interpret the nature of internal stresses that will develop within the mechanical components for different types of loading.			Understand
CO3	Utilize mathematics and basic engineering principle to evaluate stress, strain, torque, buckling load, slope and deflection.			Apply
CO4	Examine the effect of different loading conditions in various machine elements such as simple machine components, beams, shafts, columns.			Analyze
CO5	Determine the mechanical design parameters of structural member under different loadings.			Evaluate
CO6	Apply and construct graphical solutions for given loading conditions of structure.			Apply Create
Course Description:				
Analysis of Mechanical Elements is a fundamental subject needed primarily for the students of Mechanical sciences. The course provides an introductory study on stresses and strains on deformable solids. It focuses on the analysis of members subjected to axial, bending, and torsional loads. The course discusses in detail, the shear force and bending moments on beams. It introduces the concept of principal stresses in the analysis of structural members. In a nutshell, the course aims at developing the skill to solve design problems on Analysis of Mechanical Elements which is basic need of mechanical engineering.				
Course Content				
Unit 1	**Stresses and Strains**			**06Hrs**
Concept of Stress and Strain, (Linear, Lateral, Shear and Volumetric), Hooke's Law, Poisson's ratio, Stress-strain diagram for ductile and brittle material, Factor of safety, Elastic constants and Inter-relationship between elastic constants, Stresses, stains and deformation in composite bars, Complementary shear stresses, Thermal Stresses.				
Unit 2	**Principal Stresses and Strains**			**06 Hrs**

Normal and shear stresses on any oblique planes, Concept of Principal planes, Derivation of expression for Principal stresses and maximum shear stress, Positions of principal planes and planes of maximum shear, Graphical solutions using Mohr's circle of stresses.

Unit 3	**Shear Force and Bending Moment Diagram**	**08 Hrs**

Concept and definition of shear force and bending moment in determinate beams (Simply supported, cantilever and overhanging) due to concentrated load, UDL, UVL.

Unit 4	**Bending Stresses in Beams**	**08 Hrs**

Symmetric pure bending of beams, flexure formula, moment of resistance of cross-sections, Design of rectangular, circular(solid and hollow) sections, I and T sections.
Shear Stresses in Beams
Distribution of shear stresses in beams of various commonly used sections such as rectangular, circular, I and T.(Only numerical)

Unit 5	**Slope and Deflection of Beams**	**06Hrs**

Slope and deflection of beam using double integration method for simply supported beam and cantilever beam due to concentrated load and UDL.

Unit 6	**Torsion**	**06 Hrs**

Introduction to Torsion, Basic assumptions, Torsion equation, Stresses in hollow and solid circular shafts, power transmitted by shaft.
Columns
Euler's formula & assumptions, Euler's formula for different end connections, Concept of equivalent length, limitations of Euler's formula.

Learning Resources:

Text Books

1	"Strength of Materials", S. Ramamruthum, DhanpatRai and Sons, New Delhi.
2	"Strength of Materials", R. K. Bansal, Laxmi Publication, 4th Edition.
3	"Strength of Materials", Khurmi Gupta, S. Chand Publication.
4	"Strength of Materials", R.K. Rajput, S. Chad Publication.
5	"Mechanics of structure", S.BJunnerkar,Charotar Publication House.
6	"Strength of Materials", S. S. Bhavikatti, Vikas Publication House.

Reference Books

1	"Strength of Materials", Beer and Johnson, CBS Publication.
2	"Strength of Materials", G.H. Rider,Mac Millan India Ltd.
3	"Strength of Materials", Nag and Chanda, Willey India Publication.
4	"Advanced Mechanics of Materials", Boresi, Willey India Publication.
5	"Strength of Materials", Den Hartong, McGraw Hill Publication.

CO-PO Mapping:

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	PSO 3
CO1	3	3	3	2	--	--	--	--	--	--	--	--	2	--	--
CO2	3	3	3	2	--	--	--	--	--	--	--	--	2	--	--
CO3	3	3	3	2	--	--	--	--	--	--	--	--	2	--	--

CO4	3	3	3	2	--	--	--	--	--	--	--	--	2	--	--
CO5	3	3	3	2	--	--	--	--	--	--	--	--	2	--	--
CO6	3	3	3	2	--	--	--	--	--	--	--	--	2	--	--

Tatyasaheb Kore Institute of Engineering and Technology, Warananagar Second Year B. Tech. Department of Mechanical Engineering				
Course Code: 2501UMEHPCC402 Course Name: Theory of Machines-I				
Teaching Scheme		**Credit**	**Evaluation Scheme**	
Lectures:	03 Hours/Week	02	**ISE:**	40 Marks
			ESE:	60 Marks
Prerequisites, if any:				
Course Objectives: The objective of the course is to				
1)				
2)				
3)				
4)				

Course Outcomes: At the end of successful completion of the course, the student will be able to		
		Bloom's Level
CO1	List different types of mechanisms and their applications in mechanical engineering.	Remember
CO2	Describe and apply kinematic theories of mechanism to plot velocity and acceleration diagrams of links used in machines.	Understand
CO3	Apply knowledge of cam to draw the cam profile with follower for different applications.	Apply
CO4	Compare power transmitting elements used in different machines and select the appropriate as per requirement.	Analyze
CO5	Evaluate suitability of given governing mechanisms based on speed control parameter analysis.	Evaluate
CO6	Select and design an appropriate mechanism for given proposed machine by considering various parameters like friction, power transmitting capacity and other parameters.	Create

Course Description:

The effectiveness of mechanical machines depends upon mechanism used for transmission of motion in different components. Engineer can deal with these machines only if he has fundamental knowledge of mechanisms. Theory of Machine subject is introduced in syllabus to get the students acquainted with mechanism which is used in machine to transmit power from a source to its various parts as well as to transform motion from one form in to another form. It includes kinematics and kinetics of mechanism, design of cam and follower, theory of governor etc.

Course Content

Unit 1	**Basic Concept of Mechanisms:**	**[8]**

Links, kinematic pair (lower and higher), Kinematic chain, Mechanism, inversion, Types of constraints, Grubblers criterion, Inversions of slider crank chain, Double slider crank chain, Four bar, Steering gear mechanisms, Hooke's joint (only theoretical treatment).
Cams:

Cams Types of cams and followers, Profiles of cams for specified motion of different followers, Spring load on the follower, Jumping of follower.

Unit 2	**Velocity and Acceleration in Mechanisms:**	**[6]**

Graphical analysis of Velocity and acceleration for different mechanisms using relative velocity and acceleration method, Klein's construction for slider crank mechanism, Velocity analysis by Instantaneous center method.
Belts:
Types of belt drives, Calculation of power transmitted, Belt tension ratio, Actual tension in a running belt, Centrifugal and initial tension in belt, Slip and creep of belt.

Unit 3	**Friction:**	**[6]**

Introduction to friction, Friction in pivot bearings, Inclined plane theory, Friction in screws
Governors:
Types of governors, Porter and Hartnell governor, Controlling force and stability of governor, Hunting, Sensitivity, Isochronisms, Governor effort and power, Insensitiveness of governors.

Learning Resources:

Text Books

1	"Theory of Machines", Ratan S.S, Tata McGraw Hill New Delhi, 2nd Edition..
2	"Theory of Machines", P.L.Ballany, Khanna Publication, New Delhi, 2nd Edition
3	"Theory of Machines", V.P. Singh, DhanpatRai and Sons.

Reference Books

1	"Theory of Machines and Mechanism", Shigley, McGraw Hill, New York
2	"Theory of Machines", Abdullah Shariff, McGraw Hill, New Delhi.
3	"Theory of Machines", Thomas Bevan, CBS Publishe

CO-PO Mapping:

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	PSO 3
CO1	3	2	2	--	--	--	--	--	--	--	--	--	2	--	--
CO2	2	2	3	--	--	--	--	--	--	--	--	--	2	--	--
CO3	2	2	3	3	--	--	--	--	--	--	--	--	2	--	--
CO4	2	2	2	--	--	--	--	--	--	--	--	--	2	--	--
CO5	2	2	2	2	--	--	--	--	--	--	--	--	2	--	--
CO6	3	3	2	2	--	--	--	--	--	--	--	--	3	--	--

Tatyasaheb Kore Institute of Engineering and Technology, Warananagar Second Year B. Tech. Department of Mechanical Engineering				
Course Code: 2501UMEHPCC403 Course Name: Manufacturing Processes & Machine Tools				
Teaching Scheme		**Credit**	**Evaluation Scheme**	
Lectures:	03 Hours/Week	02	**ISE:**	40 Marks
			ESE:	60 Marks
Prerequisites, if any:				
Course Objectives: The objective of the course is				
1)	To understand different methods of Molding and Casting.			
2)	To study different types of forming processes			
3)	To learn various plastic shaping processes and welding processes.			
4)	To understand theories of lathe, drilling and boring machine, shaping, milling and gear manufacturing process & Non-conventional Machining.			

Course Outcomes: At the end of successful completion of the course, the student will be able to:

		Bloom's Level
CO1	Explain the construction & working of various machine tools used in Manufacturing processes.	Understand
CO2	Describe various metal casting, metal cutting, metal forming & metal joining processes.	Understand,
CO3	Discuss various plastic processing and tools includes thermoforming, extrusion etc.	Understand
CO4	Apply the fundamental theory of machining processes to calculate Machining time and Metal removal rate.	Apply, Analysis
CO5	Summarize various Gear manufacturing processes and select the appropriate process as per the requirement.	Evaluation
CO6	Illustrate the principles and applications of Non-traditional machining (NTM) processes	Understand, Apply

Course Description:

Manufacturing processes used in industry for converting raw materials into finished products. This course contains basic knowledge of different types of manufacturing process and its advantages, applications. Machining and machine tools is an important subject with application in several industries. Traditional machining is the broad term used to describe removal of material from a work piece. This course has six units namely i) Casting Process ii) Metal Forming Process iii) Plastic Shaping Process and Welding Process iv) Metal Cutting Processes-I v) Metal Cutting Processes-II and vi) Non-Traditional Machining

Course Content

Unit 1	**Casting Processes:**	**08 Hrs**

Importance of casting as manufacturing process, advantages and limitations of casting processes, introduction and types of patterns and core boxes, materials used and selection criteria for patterns, pattern allowances, Types of sands used in moulding and core making, their properties. Sand moulding types such as Green sand Moulding, shell Moulding, CO2 Moulding, Investment casting, Components of gating system, functions and importance of runners and risers, solidification control devices: chills, ceramics.

Introduction to permanent mould casting processes such as Continuous casting, Gravity die casting, pressure die-casting, Centrifugal casting, Cupola furnace, Induction and Arc Furnace, casting defects		
Unit 2	**Forming Processes:**	**08 Hrs**
Introduction - Hot, cold and worm working, Classification of various metal Forming processes. a) Rolling: Introduction, Hot and cold rolling, Rolling Mill Classification, Defects in rolling. b) Forging: Introduction, Forging Machines (board Hammer, Air and Steam, Hydraulic Hammer), Open and Closed die Forging, Defects in forging. c) Extrusion: Introduction, Direct, Indirect, Tube, Impact and Hydraulic Extrusion, Defects in extrusion.		
Unit 3	**Plastic Shaping and welding process**	**04 Hrs**
Thermosetting and thermoplastic materials, their properties and applications, Introduction to blow moulding, injection moulding, extrusion, calendaring and thermo forming. Definition of welding, classification of welding, construction and working of Metal inert gas (MIG), Tungsten inert gas (TIG)		
Unit 4	**Machine Tools for Metal Cutting I:**	**07 Hrs**
Lathe: Introduction, Working principle, types, specifications, principle parts, accessories, attachments, and various lathe operations. b) Drilling Machines: Classification of drilling machines, Construction and working of radial drilling machine, various accessories and various operations and C) Boring Machines: Introduction to boring machines, Types of boring machine, different operations.		
Unit 5	**Machine Tools for Metal Cutting II:**	**07 Hrs**
a) Milling Machine: Types- Horizontal, Vertical milling machines, milling cutters, construction and working of column and knee type, milling operations, simple and compound indexing. b) Shaping & Planning Machine: Construction & working of shaper and Planer machine, Comparison between planer and shaper machine c) Gear Manufacturing processes: Study of various processes like gear shaping, gear hobbing, Gear finishing processes –Gear shaving, Gear burnishing and gear rolling.		
Unit 6	**Nonconventional Machining:**	**06Hrs**
Fundamental principle, machining unit, tool material, advantages, limitations and applications of Abrasive Jet Machining, Electrical Discharge machining, Electro- Chemical machining, Laser beam machining, Ultrasonic machining, Water jet machining		
Learning Resources:		
Text Books		
1	"Manufacturing Technology- Foundry, Forming and Welding, Vol. I", P. N. Rao, Tata McGraw-Hill, New Delhi,3rd edition, 2009.	
2	"A Textbook of Production Technology (Manufacturing Processes)", P.C. Sharma, S. Chand and Company Pvt.Ltd, New Delhi.7thEdition,2010.	
3	"Workshop Technology vol. II", B.S. Raghuvanshi, Dhanapat Rai Publications Pvt.Ltd, New Delhi.10th Edition, 2000.	
4	"Workshop Technology vol. II", B.S. Raghuvanshi, Dhanapat Rai Publications Pvt.Ltd Viva Books Pvt.Ltd,NewDelhi,1stEdition,2001.	
5	"Elements of Workshop Technology vol. II", S.K.Hajra Choudhury and A.K. Hajra Choudhury , Media promoters and Publishers Pvt.Ltd,NewDelhi,13thEdition,2012.	
6	"Production technology", R. K. Jain, Khanna Publishers, Delhi, 15th Edition,2000.	
Reference Books		
1	"Principles of metal casting", Haineand Rosenthal, Tata McGraw-Hill Book, Company. New Delhi.	

2	"Workshop Technology", W.A.J.Chapman, CBS Publishing and Distributors, N.DelhiVol.I [ISBN-13:9788123904016]2001, Vol.II [9788123904115] 2007 andVol.III [9788123904122] 1995.
3	"Machine Tools and Manufacturing Technology", Steve F. Krar, Mario Rapisarda,Albert F. Check.

CO-PO Mapping:

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	PSO 3
CO1	2	2	--	--	2	--	--	--	--	--	--	--	--	--	
CO2	2	2	--	--	3	--	--	--	--	--	--	--	--	--	2
CO3	2	2	--	--	3	--	--	--	--	--	--	--	--	--	2
CO4	3	2	--	--	--	--	--	--	--	--	--	--	--	--	3
CO5	3	3	--	--	2	--	--	--	--	--	--	--	--	--	2
CO6	3	2	1	--	3	1	1	--	--	--	1	--	--	--	2

Tatyasaheb Kore Institute of Engineering and Technology, Warananagar Second Year B. Tech. Department of Mechanical Engineering				
Course Code: 2501UMEHEEC4041 Course Name: Industrial Management and Operation Research				
Teaching Scheme		**Credit**	**Evaluation Scheme**	
Lectures:	03 Hours/Week	02	**ISE:**	40 Marks
			ESE:	60 Marks
Prerequisites, if any:				
Course Objectives: The objective of the course is to				
1)	1. State various functions of management.			
2)	2. Know Production and marketing functional area of management.			
Course Outcomes: At the end of successful completion of the course, the student will be able to				
				Bloom's Level
CO1	Apply the concepts of Industrial management and operations research approaches. Know various functional areas of management.			Knowledge Understand
CO2	They will analyses issues in Managing operations and projects and various approaches to resolve those issues.			Understand
CO3	They will Study MIS, Entrepreneurship Development			Understand
CO4	Formulate and solve a wide variety of applications and problems that can be addressed using Operations Research techniques as Linear programming problems.			Understand Apply
CO5	Formulate and solve a wide variety of applications and problems that can be addressed using Operations Research techniques as Transportation and Assignment problems.			Apply Evaluate
CO6	Apply the various techniques of Project Management such as Network Model and Sequencing Model.			Apply
Course Description:				
Industrial Management and Operation Research course is offered as the basic management course. This course contains Mathematical methods and techniques that are used to solve complex Mechanical engineering problems. This course has six units namely i) Functions of Management ii) Functional areas of Management iii) Entrepreneurship Development, iv) Introduction to Operations Research and Linear Programming Problems, v) Assignment Model and transportation model and vi) Network model and sequencing				
Course Content				
Unit 1	**Functions of Management**			**7 Hrs**
Definition of Management, Planning –Objectives, Steps in Planning, elements of planning, Organizing – Process of Organizing importance and principle of organizing, departmentation, Span of control. Staffing – Nature, Purpose, Scope, Human resource management, Policies, Recruitment procedure, training and development, appraisal methods. Leading – Leadership style, Communication process, Barriers, remedies, Motivation, importance				

Herzberg's theory, Maslow's theory, McGregor's theory . Controlling–Process, Requirement for control management.		
Unit 2	**Functional areas of Management**	**6 Hrs**
Production Management-Product mix, line balancing, break even analysis, Material Handling Equipments, TPM, Problem solving Techniques. Marketing Management –Principles & Functions, Types of Market, Market Research, Market Segmentation, Marketing Mix, Advertisement, Channel Of Distribution.		
Unit 3	**Entrepreneurship Development**	**7 Hrs**
Types of small scale industries (SSI), stages in starting SSI, Qualities required to be Entrepreneur, Government policies for SSI, Problems of SSI, Feasibility Report writing, Industrial Safety, Management Information System.		
Unit 4	**Introduction to Operations Research and Linear Programming Problems**	**7 Hrs**
History and development of OR, Applications, OR models and their Applications, Formulation of LPP problem, Graphical solution of LPP, Simplex procedure for maximization, Simplex procedure for minimization, Duality concept.		
Unit 5	**Assignment Model and transportation model**	**6 Hrs**
Assignment Model- Mathematical statement, Methods to solve balanced assignment problems, Unbalanced assignment problems, Maximization problems, Assignment with restrictions. Transportation model- Mathematical formulation, methods to obtain initial basic feasible solution (IBFS)-NWCR, LCM and VAM, Conditions for testing optimality, MODI method for testing optimality of solution of balanced problems and unbalanced problems		
Unit 6	**Network model and sequencing**	**7 Hrs**
CPM-Construction of network, Critical path, forward and backward Path, Floats and their significance. PERT- construction of networks, Time estimates, Probability of completing project by given date. Sequencing-Sequencing of n jobs & 2 machines, Sequencing of n jobs & 3 machines		
Learning Resources:		
Text Books		
1	"Industrial Engineering and Management", Vishwanath ,Scitech Publication,1st Edition.	
2	"Industrial Management and Operation Research", Nandkumar Hukeri, Electrotech Publication.	
3	"Operations Research", J. K. Sharma, McMillan India Publication New Delhi,5th Edition	
4	"Operations Research", Hira and Gupta, S.Chand and Co. New Delhi.	
5	"Operation Research an Introduction", Hamdy A. Taha, Pearson,10 th Edition	
Reference Books		
1	"Management, Today – Principles and Practice", Gene Burton and Manab Thakur, Tata McGraw Hill Publishing Company, New Delhi.	
2	"Essentials of Management", Koontz and H.Weinrich, Tata McGraw Hill Publication, 12th Edition.	
3	"Business Management", J.P.Bose, S. Talukdar, New Central Agencies (P) Ltd.,	
4	"Production and Operation Management", Tripathy, Scitech Publication, 2nd Edition.	
5	"Management", James A.F. Stoner, R. Edward Freeman, Prentice Hall of India New Delhi.	
6	"Introduction to Operation Research", Paneer-Selvam, Prentice Hall of India publication, 2nd Edition.	
7	"Operation Research", Pradeep J. Jha, Tata McGraw Hill Publication.	

8	“Operation Research”, Mariappan, Pearson Education.
9	“Operation Research – Principle and Applications”, G. Shriniwasan, Prentice Hall of India Publication, 3rd Edition.

CO-PO Mapping:

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	PSO 3
CO1	2	1	--	--	--	--	--	---	--	--	--	--	--	--	--
CO2	2	1	--	--	--	--	--	--	--	--	--	--	--	--	--
CO3	2	1	--	--	--	--	--	--	--	--	--	--	--	--	--
CO4	2	1	--	--	--	--	--	--	--	--	--	--	--	--	--
CO5	2	2	1	--	--	--	--	--	--	--	--	--	--	--	--
CO6	2	1	--	--	--	--	--	--	--	--	--	--	--	--	--

Tatyasaheb Kore Institute of Engineering and Technology, Warananagar Second Year B. Tech. Department of Mechanical Engineering				
Course Code: 2501UMEHEECC4042 Course Name: Intellectual Property Rights and Patents				
Teaching Scheme		**Credit**	**Evaluation Scheme**	
Lectures:	03 Hours/Week	02	**ISE:**	40 Marks
			ESE:	60 Marks
Prerequisites, if any:				
Course Objectives: The objective of the course is to				
1)	To familiarize students with the essentials of intellectual property rights, since they will be heavily i nvolved in the creation and oversight of creative initiatives in the business world.			
2)	To spread information about patents, the Indian and international patent systems, and the issues of r egistration.			
3)	To propagate awareness of copyrights, the rights associated with them, and the registration process.			
4)	To be updated on IPR developments and government initiatives to promote IPR.			
Course Outcomes: At the end of successful completion of the course, the student will be able to				
				Bloom's Level
CO1	Students will receive sufficient training in patent and copyright for their creative research works after completing their academic assignments.			Knowledge
CO2	Information from patent filings offers valuable insight about the uniquenes s of their idea,based on cutting edge researches.This offers an additional a venue for refining their concepts to improvements.			Understand
CO3	The process of conducting a literature review and professional reading			Knowledge Understand
CO4	To summarize, the effects of patent law and drafting procedure.			Knowledge
CO5	Recognizing copyright rules and topics related to designs and copyrights			Understand Apply
CO6	Understanding the benchmark principles of design rights			Knowledge Apply Evaluate
Course Description:				
The course provides an in-depth exploration of intellectual properties and rights, focusing on the research, development, and application of rights in personal and professional contexts. Students will engage with various design and copyrights theories, reflect on their own values and learn to navigate complex moral dilemmas.				
Course Content				
Unit I	**INTRODUCTION:**			**06**
Concept of property, Intellectual Property (IP) and Intellectual Property Rights (IPR), Importance of IP, Types of IP, IP Acts in India, Value creation through IP, Advantages of IP protection				
Unit II	**PATENTS AND COPYRIGHTS:**			**09**

Objectives, Rights, Patent Acts 1970 and its amendments. Procedure of obtaining patents, working of patent, Infringement, Industrial Application: Non-Patentable Subject Matter, Registration Procedure, Rights and duties of Patentees. Introduction, works protected under copyright law, Rights, Transfer of Copyrights, Infringement, Remedies and Penalties.		
Unit III	**Trademark & Infringement**	**06**
Types of trademarks, Brands and logos, Criteria for Registration of Trademarks, Trademark Registration process, Well-Known Trademarks, Trademark classification, Trademark filing, Trademark Infringement and case studies, Madrid convention		
Unit IV	**Protection of traditional knowledge**	**06**
Objectives, Concept of traditional knowledge, Holders, Issues concerning, Bio-Prospecting and Bio-Piracy, Alternative ways, Protectability. Traditional Knowledge Digital Library.		
Unit V	**Industrial Design**	**06**
Industrial design, Requirements, Article- Not registrable as Designs, Term of designs, Design registration, examples of Industrial Designs, Design infringement, Industrial Designs vs Trademarks, Industrial Designs vs Patents.		
Unit VI	**Geographical Indications and Protection of Plant**	**03**
Option for protection, UPOV, Protection system in India, Implementation of the PPV&FR Act, Biodiversity act. What are Trade Secrets, How trade secrets are maintained in trade and business, examples of Trade Secrets		

Learning Resources:

Text Books

1	Nithyananda, K.V. 2019. Intellectual Property Rights: Protection and Management. India, In: Cengage Learning India Private Limited.
2	Ahuja, V.K. 2017. Law relating to Intellectual Property Rights. India, In: Lexis Nexis.
3	Intellectual Property Rights by N.K.Acharya Asia Law House 6th Edition. ISBN: 978-93-81849-30-9
4	Neeraj, P. and Khusdeep, D. 2014. Intellectual Property Rights. India, In: PHI learning Private Limited.

Reference Books

1	Intellectual Property Rights by N.K.Acharya Asia Law House 6th Edition. ISBN: 978-93-81849-30-9
2	Intellectual Property A Primer for Academia by Prof. RupinderTewari Ms. MamtaBhardwa
3	Law of Intellectual Property, Asian Law House, Dr.S.R. Myneni.

CO-PO Mapping:

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	PSO 3
CO1	-	-	-	-	-	-	-	1	-	1	-	-	-	-	-
CO2	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-
CO3	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-
CO4	-	-	-	-	-	1	-	-	-	-	-	1	-	-	-
CO5	-	-	-	1	-	-	-	-	-	2	-	-	-	-	-
CO6	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-

Tatyasaheb Kore Institute of Engineering and Technology, Warananagar Second Year B. Tech. Department of Mechanical Engineering				
Course Code: 2501UMEHEEC4043 Course Name: Start up Management				
Teaching Scheme		**Credit**	**Evaluation Scheme**	
Lectures:	03 Hours/Week	02	**ISE:**	40 Marks
			ESE:	60 Marks
Prerequisites, if any:				
Course Objectives: The objective of the course is to				
1)	To introduce the students to the concept of Startups and Entrepreneurship..			
2)	To provide the knowledge of becoming an entrepreneur by identifying business opportunities and developing business plans			
Course Outcomes: After successful completion of the course, student will be able to				
CO1	Relate basic concepts of economics to Projects.			
CO2	Utilize the concepts of time value of money and equivalence in economic decision making			
CO3	Analyze basic concepts of economics to Projects			
CO4	Developing of the project's project economic investment viability and resolution of outstanding economic issues			
CO5	Identify appropriate method to evaluate an engineering project.			
CO6	Make use of replacement study considering inflation to make decisions			
Course Description:				
The subject aims to provide a detailed coverage of fundamental concepts and important issues associated with Start Up Management. It highlights on the essential skill set a successful entrepreneur should possess as well as the essential elements of an entrepreneurial ecosystem. The subject focuses on the discussion of important procedures to convert innovative ideas into result-oriented actions and emphasizes use of critical and innovative thinking to add value. It also discusses important aspects of scaling up process and application of risk management strategies to avoid failure.				
Course Content				
Unit 1	**Importance of Entrepreneurship**			**7 hrs**
Introduction: Meaning and importance of Entrepreneurship, Evolution of the term entrepreneurship, Factors influencing entrepreneurship, characteristics of entrepreneurship, types of entrepreneurship, objectives of entrepreneurship development, Startups- Definition, Types.				
Unit 2	**Types of business- Manufacturing – Services**			**6 hrs**
Types of business- Manufacturing – Services- Merchandise – Hybrid, Forms of Organisation Sole proprietorship- Partnership- Corporation- Limited Liability Company (LLC)- 19 Cooperatives, Choice of form of Organisations. Management and Society- Ecological environment, Ethics and Social responsibility.				
Unit 3	**Entrepreneurship Development Skills:**			**7 hrs**
Types of entrepreneurial skills - team work and leadership skill, analytical and problem solving skills, critical thinking skills, branding, marketing and networking skills. Role of entrepreneurship				

development programmes (EDP)

Unit 4	Entrepreneurship Development	7 hrs

Types of small scale industries (SSI), stages in starting SSI, Qualities required to be Entrepreneur, Government policies for SSI, Problems of SSI, Feasibility Report writing, Industrial Safety, Management Information System.

Learning Resources:

Text Books

1	Kathleen R Allen, Launching New Ventures, An Entrepreneurial Approach, Cengage Learning
2	Anjan Raichaudhuri, Managing New Ventures Concepts and Cases, Prentice Hall International.

Reference Books

1	S. R. Bhowmik & M. Bhowmik, Entrepreneurship, New Age International
2	Steven Fisher, Ja-nae' Duane, The Startup Equation -A Visual Guidebook for Building Your Startup, Indian Edition, Mc Graw Hill Education India Pvt. Ltd.
3	Byrd Megginson, Small Business Management an Entrepreneur's Guidebook, 7th ed, McGrawHill
4	A Fayolle Entrepreneurship and new value creation, Cambridge, Cambridge University Press

CO-PO Mapping:

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	PSO 3
CO1	2	2	1	--	--	--	--	---	--	--	--	1	--	--	--
CO2	2	2	1	--	--	--	--	--	--	--	--	1	--	--	--
CO3	2	1	1	--	--	--	--	--	--	--	--	1	--	--	--
CO4	2	1	1	--	--	--	--	--	--	--	--	1	--	--	--
CO5	2	2	1	--	--	--	--	--	--	--	--	2	--	--	--
CO6	2	1	1	--	--	--	--	--	--	--	--	1	--	--	--

Tatyasaheb Kore Institute of Engineering and Technology, Warananagar Second Year B. Tech. Department of Mechanical Engineering				
Course Code: 2501UMEHOE14052 Course Name: Open Elective-I Renewable Energy Systems				
Teaching Scheme		**Credit**	**Evaluation Scheme**	
Lectures:	03 Hours/Week	03	**ISE:**	40 Marks
			ESE:	60 Marks

Prerequisites, if any:

1. Environmental Science
2. Basic Mechanical Engineering

Course Objectives: The objective of the course is to

1)	To learn about renewable energy scenario, energy sources and understand the potential of various renewable energy sources and their utilization.
2)	To understand society's present needs and future energy demands and also explore the future potential sources of energy.
3)	To Study the principles of renewable energy conversion systems.

Course Outcomes: At the end of successful completion of the course, the student will be able to

		Bloom's Level
CO1	Understand the importance of renewable energy sources, their potential and utilization in the present world energy scenario along with their limitations and applications.	Knowledge Understand
CO2	Understand Solar radiation measurement, illustrate its conversion and analyze different solar collectors.	Understand Apply
CO3	Understand the principles of wind energy conversion and the factors influencing site selection.	Understand
CO4	Understand biomass conversion technologies and the process of biogas production and Identify factors affecting biogas generation and the types of biofuels.	Understand Analyze
CO5	Understand the principles of harnessing tidal energy and Ocean Thermal Energy	Understand
CO6	Understand energy conversion from hydrogen and application of fuel cell for electric vehicles	Understand

Course Description:

Renewable energy (RE) is the key element of sustainable, environmentally friendly, and cost-effective electricity generation. Nowadays, more sustainable energy technologies are required to replace conventional electricity generation resources such as fossil fuel, due to the worldwide demands especially in developed and developing countries. Fossil fuel-based energy sources are causing detrimental environmental issues such as global warming and climate change. The greenhouse gas emission into the atmosphere from power generation has increased exponentially in the past few decades. Therefore, RE technologies such as solar, wind, hydro, biomass and hydrogen energies have been introduced to generate electricity to overcome current environmental crisis. Due to their environmentally friendly characteristics and ability to generate power with zero or almost nil emission of air pollutants, RE is getting more and more attention, due to the increasing awareness of clean environment among the society. RE not only helps in sustainability but also has economic importance. It benefits the economy by reducing the cost of

electricity generation, as it generates energy using natural, renewable resources.		
Course Content		
Unit 1	**Introduction to Renewable energy**	**05 Hrs**
Introduction to renewable energy sources and their potential, Global and Indian renewable energy scenario. Brief descriptions on solar energy, wind energy, tidal energy, wave energy, ocean thermal energy, biomass energy, geothermal energy, oilshale. Introduction to Internet of energy (IOE).		
Unit 2	**Solar Energy**	**08 Hrs**
Introduction to Solar Radiation, Estimation of solar radiation on horizontal and inclined surfaces, Solar radiation Measurements- Pyrheliometers, Pyrometer, Sunshine Recorder, application of solar energy. Solar Photovoltaic: Solar PV system stand alone and grid connected, Photo cell materials, Maximum power point tracking system. Solar energy collector: Classification, evacuated tube collector, Concentrating collector and comparison between them.		
Unit 3	**Wind Energy**	**07 Hrs**
Wind Energy: Introduction, availability of wind energy in India, Wind parameters and wind data, principle of working, Site selection, Basic components of wind energy conversion system (WECS), Classification, working of WECS- Horizontal axis- single, double and multiblade system. Vertical axis- Savonius and Darrieus types.		
Unit 4	**Biomass and Bio gas Energy**	**07Hrs**
Introduction to Biomass Energy, Biomass Resources, energy plantation, Biomass conversion technologies, bio gas production from organic wastes by anaerobic fermentation, factors affecting bio- gas generation, advantages, disadvantages and applications of Bio-gas. Bio fuels its types and applications., urban waste to energy conversion,		
Unit 5	**Tidal and Ocean Energy**	**07Hrs**
Tidal Power: Tides and waves as energy source and their mechanics; fundamental characteristics of tidal power, harnessing tidal energy, advantages and limitations. Ocean Thermal Energy Conversion: Principle of working, classification, working, OTEC power stations in the world, problems associated with OTEC.		
Unit 6	**Fuel Cell and Hydrogen energy**	**06Hrs**
Fuel cell: Introduction, Principle of operation, classification, applications advantages and disadvantages. Introduction to fuel cell electric vehicles (FCEV'S). Hydrogen Energy: Properties of Hydrogen with respect to its utilization as a renewable form of energy, hydrogen production technologies (electrolysis method only), hydrogen energy storage, applications of hydrogen energy, problem associated with hydrogen energy.		
Learning Resources:		
Text Books		
1	Nonconventional Energy sources, G D Rai, Khanna Publication, Fourth Edition,	
2	Energy Technology, S.Rao and Dr. B.B. Parulekar, Khanna Publication.Solarenergy, SubhasP Sukhatme, TataMcGraw-Hill,	
Reference Books		
1	Principles of Energy conversion, A. W. Culp Jr.,, McGraw Hill	
2	Non-Convention EnergyResources, ShobhNath Singh, Pearson, 2018	
CO-PO Mapping:		

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	PSO 3
CO1	3	3	2	--	--	--	3	--	--	--	--	3	--	3	--
CO2	3	3	3	--	--	--	3	--	--	--	--	3	--	3	--
CO3	3	3	3	--	--	--	3	--	--	--	--	3	--	2	--
CO4	3	3	3	--	--	--	3	--	--	--	--	3	--	3	--
CO5	3	3	3	--	--	--	3	--	--	--	--	3	--	3	--
CO6	3	3	3	--	--	--	3	--	--	--	--	3	--	3	--

Tatyasaheb Kore Institute of Engineering and Technology, Warananagar Second Year B. Tech. Department of Mechanical Engineering				
Course Code: 2501UMEHMDM2406T Course Name: Multidisciplinary Minor-2 Materials and Applications				
Teaching Scheme		**Credit**	**Evaluation Scheme**	
Lectures:	02 Hours/Week	02	**ISA:**	50 Marks
Prerequisites, if any:				
Course Objectives: The objective of the course is to				
1)	Understand the relationship between the structure of materials at atomic or molecular scales and their macroscopic properties.			
2)	Develop the ability to select appropriate materials for various engineering applications.			

Course Outcomes: At the end of successful completion of the course, the student will be able to		
		Bloom's Level
CO1	Understanding Metals and Metallic Bonds, Crystal Structures and Imperfections	Understanding
CO2	Relate the composition of materials to their mechanical properties.	Apply
CO3	Describe the role of material specifications and standards in engineering design and manufacturing.	Apply
CO4	Explain Properties and applications of Smart Materials	Understanding
CO5	Explain Properties and applications of Magnetic Materials	Understanding
CO6	Discuss the various stages of techniques used in manufacturing of Powder Metallurgy components.	Understand

Course Description:

This course introduces the fundamental concepts of materials science and engineering. Topics include the structure of materials, their properties, and how they can be manipulated and used in engineering applications.

Course Content

Unit 1	**Introduction to Metals and alloys systems**	**05Hrs**
Crystal structure (SC, BCC, FCC, HCP), Imperfections in crystals, Alloy formation by crystallization, Nucleation and growth, Cooling curves, Dendritic structure and coring. Solid solutions and intermediate phases, Phases and Gibbs phase rule Construction of equilibrium diagrams from cooling curves,		
Unit 2	**Ferrous Alloys**	**05 Hrs**
Fe-Fe3C Diagram, Plain carbon steels, Steel Specifications based on -IS, BS, SAE, AISI Alloy steels-Free cutting steels, HSLA high carbon low alloy steels, maraging steels. creep resisting steels, Stainless steels- different types of cast iron		
Unit 3	**Introduction to Non-Ferrous metals**	**03 Hrs**
Alloys of Copper, Aluminium, other alloys of lead, zinc, Bearing alloys		
Unit 4	**Smart Materials**	**05 Hrs**

Introduction to Smart Materials, Classification of Smart Materials, Properties of Smart Materials, Applications of Smart Materials		
Unit 5	**Introduction to Magnetic Materials**	**05 Hrs**
Classification of Magnetic Materials, Properties of Magnetic Materials, Applications of Magnetic Materials		
Unit 6	**Powder Metallurgy**	**05 Hrs**

Learning Resources:

Text Books

1	S.H.Avner,"Introductiontophysicalmetallurgy", McgrawHillBookCompanyInc,Edition, 2nd, 1974.
2	Vijendrasingh,"Physicalmetallurgy",StandardPublishersDelhi
3	Materials Science and – An Introduction by William D. Callister Jr. and David G.Rethwisch, Wiley, Tenth Edition, 2010.

CO-PO Mapping:

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	PSO 3
CO1	3	--	--	--	--	--	1	--	--	--	--	--	--	--	--
CO2	3	2	--	--	--	--	--	--	--	--	--	--	--	--	--
CO3	3	2	--	--	--	--	--	--	--	--	--	--	--	--	--
CO4	2	2	--	--	--	--	--	--	--	--	--	--	--	--	--

Tatyasaheb Kore Institute of Engineering and Technology, Warananagar Second Year B. Tech. Department of Mechanical Engineering				
Course Code: 2501UMEHSEC407T Course Name: C++ Programming Lab				
Teaching Scheme		**Credit**	**Evaluation Scheme**	
Practicals:	02 Hours/Week	01	**ISA:**	50 Marks
Prerequisites, if any:				
Course Objectives: The objective of the course is to				
1)	To understand how C++ improves C with object-oriented features.			
2)	After the students have successfully completed the course, they shall have sufficient			
3)	knowledge of the basic computer operations and various programming techniques			
4)	To develop and enhance the programming skills amongst the students in general as well as application of it in the field of Mechanical Engineering.			
Course Outcomes: At the end of successful completion of the course, the student will be able to				
				Bloom's Level
CO1	Explain the evolution of programming methodologies from procedural to object-oriented programming, identifying key features and advantages of Object-Oriented Programming (OOP).			Knowledge
CO2	Demonstrate understanding by categorizing different data types in C++, explaining their usage, and identifying appropriate scenarios for using arrays, multidimensional arrays, and strings.			Comprehension
CO3	Apply their knowledge by writing C++ functions to manipulate data, passing arguments by value and reference, and implementing functions with appropriate scope and visibility of variables.			Application
CO4	Analyze and compare the concepts of classes and structures in C++, evaluating when to use classes versus structures based on their design requirements.			Analysis
CO5	Synthesize their understanding by designing and implementing C++ classes that overload unary and binary operators, demonstrating creativity in enhancing class functionality.			Synthesis
CO6	Evaluate the advantages and potential pitfalls of multiple inheritance in C++, critically assessing scenarios where virtual functions and polymorphism provide solutions to common programming challenges.			Evaluation
Course Description:				
In the modern age, computers play a pivotal role across all engineering sectors, necessitating a foundational understanding of essential programming languages like C++. C++ is widely recognized for its extensive applications, including games, GUI-based applications, database software, operating systems, web browsers, advanced computational tasks, graphics rendering, and banking applications. This course aims to introduce C++ to mechanical engineering students, equipping them with practical skills applicable across various domains.				
Course Content				
Unit 1	**Evolution of Programming Methodologies**			**04 Hrs**

Introduction to OOP and its basic features, Basic components of a C++, Program and program structure, Compiling and Executing C++ Program. Selection control statements in C++.		
Unit 2	**Data Types, Expression and Control Statements**	**04 Hrs**
Iteration statements in C++, Introduction to Arrays, Multidimensional Arrays, Strings and String related Library Functions.		
Unit 3	**Functions**	**04 Hrs**
Passing Data to Functions, Scope and Visibility of variables in Functions		
Unit 4	**Creating Classes and Abstraction**	**06 Hrs**
Classes objects, data members, member functions, this Pointer, Friends, Friend Functions, Friend Classes, Friend Scope, and Static Functions. Structures in C++. Constructors and Destructors, Static variables and Functions in class.		
Unit 5	**Operator Overloading**	**02 Hrs**
Overloading Unary Operators, Overloading binary operators.		
Unit 6	**Inheritance in C++**	**04 Hrs**
Types of Inheritance, Pointers, Objects and Pointers, Multiple Inheritances. Virtual Functions, Polymorphism, Abstract classes.		

Learning Resources:

Text Books

1	Object Oriented Programming, E. Balagurusamy, Tata McGraw Hill Publication.
2	Let us C++, Yashwant Kanitkar, BPB Publication, New Delhi
3	C++ Programming, AlstevanswielyIndia,7th Edition.
4	Object oriented Programming with C++, Sourav Sahay, Oxford University Press.
5	Object-Oriented Programming in C++, Rajesh K Shukla, Wiley India

Reference Books

1	The C++ Programming Language, Brian W. Kernighan, Dennis M. Ritchie, Prentice Hall
2	C++: The Complete Reference, Scheldt H., Tata McGraw Hill.

Important Links

1	http://vlabs.iitb.ac.in/vlabs-dev/labs/oops/labs/index.php

CO-PO Mapping:

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	PSO 3
CO1	3	3	2	-	2	-	-	-	-	3	-	2	2	-	-
CO2	3	3	2	-	2	-	-	-	-	2	-	2	2	-	-
CO3	3	2	2	2	2	-	-	-	-	3	-	2	2	-	-
CO4	3	2	2	-	2	-	-	-	-	2	-	2	2	-	-
CO5	3	3	2	-	2	-	-	-	-	2	-	2	2	-	-
CO6	3	3	2	-	2	-	-	-	-	2	-	2	2	-	-

Tatyasaheb Kore Institute of Engineering and Technology, Warananagar Second Year B. Tech. Department of Mechanical Engineering				
Course Code: 2501UMEHAEC4081T Course Name: Modern Indian Language Kannada				
Teaching Scheme		**Credit**	**Evaluation Scheme**	
Lectures:	02 Hours/Week	02	**ISA:**	25 Marks

Prerequisites, if any:

1. Fundamentals of Language
2. Basic terms and rules in Grammar

Course Objectives: The objective of the course is to

1)	To understand the necessity of learning of other regional language.
2)	To Listen and understand the Kannada language.
3)	To speak, read and write Kannada language as per requirement.
4)	To communicate in Kannada in their daily life with Kannada speakers.

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

		Bloom's Level
1	To understand the necessity of learning of other regional language.	
2	To speak, read and write Kannada language as per requirement.	
3	To communicate in Kannada in their daily life with Kannada speakers.	
4	To listen and understand the Kannada language.	

Course Description:

KannadalanguagehasbeenofferedunderAbilityEnhancementCoursesforEngineeringstudentswithanobjectiveof enabling them to learn and use other regional Indian languages. As the technical education is delivered in English, a gap has arisen between an Indian student and his regional language. To narrow this distance is another objective of this course. The Course syllabus has been divided into four Units, namely Introduction to Kannada Alphabets & Numerals, Basic Grammar of Kannada, Sentence formation in Kannada and Conversations.

ಇತರಪ್ರಾದೇಶಿಕಭಾರತೀಯಭಾಷೆಯನ್ನುಕಲಿಯಲುಮತ್ತುಬಳಸಲುಅನುವುಮಾಡಿಕೊಡುವಉದ್ದೇಶದಿಂದ ಇಂಜಿನಿಯರಿಂಗ್ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆಕೌಶಲ್ಯವರ್ಧನೆಯಕೋರ್ಸಗಳಅಡಿಯಲ್ಲಿಕನ್ನಡಭಾಷೆಯನ್ನುನೀಡಲಾಗಿದೆ. ತಾಂತ್ರಿಕಶಿಕ್ಷಣವನ್ನುಇಂಗ್ಲೀಷನಲ್ಲಿನೀಡುವುದರಿಂದಭಾರತೀಯವಿದ್ಯಾರ್ಥಿಗಳುಮತ್ತುಅವರಪ್ರಾದೇಶಿಕಭಾಷೆ ನಡುವೆಅಂತರಉಂಟಾಗಿದೆ. ಈಅಂತರಕಡಿಮೆಮಾಡುವುದುಈಕೋರ್ಸಿನಮತ್ತೊಂದುಉದ್ದೇಶವಾಗಿದೆ. ಕೋರ್ಸಪಠ್ಯಕ್ರಮವನ್ನುನಾಲ್ಕುಘಟಕಗಳಾಗಿವಿಂಗಡಿಸಲಾಗಿದೆ: ಕನ್ನಡಅಕ್ಷರಮಾಲೆಮತ್ತುಅಂಕಿಗಳಪರಿಚಯ, ಕನ್ನಡದಮೂಲವ್ಯಾಕರಣ, ಕನ್ನಡದಲ್ಲಿವಾಕ್ಯರಚನೆಹಾಗುಸಂಭಾಷಣೆಗಳು.

Course Content

Unit 1	**Introduction to Kannada Alphabets (Varnamale) and Numerals**	**5 Hrs.**

Kannada Alphabets, Kannada Numerals and Ordinals, Conjunctive letters, Writing Words. (Category-wise) Fruits, Colours, Vegetables, Vehicles, Relations, Things, Human Body parts, Natural things like Hill, River etc.
Seasons, Grains, Cereals, Milk products, Groceries etc.

Unit 2	Fundamental Grammar	5 Hrs.
Nouns(Roodhanama,Ankitanaam,Anvarthnaam), Pronouns(Nanu,Naavu,Neenu,Neevu,Avanu,Avalu,avaru, Adu, Idu), Forms of Verbs, Adjectives (gunavachak, sankhyavachak, bhaavavachak), Adverbs, Singular Plural, Genders, Proverbs		
Unit 3	**Tenses**	**5 Hrs.**
Simple Present, Simple Past and Simple Future tense. Formation of Sentences using tenses.		
Unit 4	**Conversation**	**5 Hrs.**
Activities like Self- introduction, Information, Story-telling, Newspaper reading etc.		

Learning Resources:

Reference Books

1	Balake Kannada by Dr. L. Thimmesh
2	Kannada Kali by Lingadevaru Halemane, Kannada University Press, Hampi
3	Spoken Kannada by Kannada Sahitya Parishat, Bengaluru

CO-PO Mapping:

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

Tatyasaheb Kore Institute of Engineering and Technology, Warananagar Second Year B. Tech. Department of Mechanical Engineering				
Course Code: 2501UMEHAEC4082T Course Name: Modern Indian Language Marathi				
Teaching Scheme		**Credit**	**Evaluation Scheme**	
Lectures:	2 Hours/Week	02	ISA:	25

Prerequisites, if any:

1. भाषेची मूलतत्त्वे
2. व्याकरणातील मूलभूत संज्ञा आणि नियम

Course Objectives (उद्दिष्टे): The objective of the course is to

1. विद्यार्थ्यांच्यात मराठी भाषा आणि साहित्याविषयी जिज्ञासा निर्माण करणे.
2. मराठी भाषेतील प्रतिभावंत साहित्यिकांच्या कृतींचा अभ्यास करणे.
3. राठी साहित्याच्या वाचनाची आवड निर्माण करणे.
4. मराठी भाषेच्या प्रचार-प्रसारासाठी विविध उपक्रम राबवणे.
5. यांत्रिक अभियांत्रिकीतील संकल्पना मराठी भाषेतून विशद करणे.

Course Outcomes (विधेये): After successful completion of the course, student will be able to

CO1	मराठीतील विख्यात साहित्याचा आणि साहित्यिकांचा धांडोळा घेईल.
CO2	अभ्यासक्रमाव्यतिरिक्त इतर साहित्यिकांच्या साहित्याचा आस्वाद घेईल.
CO3	विद्यार्थ्यांच्यात अवांतर वाचनाची गोडी लागेल.
CO4	सभाधीटपणा, नाट्य, संभाषण, वक्तृत्व अश्या विविध कला अवगत होतील.

Course Description (विवरण):

"मराठी भाषेतील विशेष साहित्यकृतींचा अभ्यास" या विषयाचा ***क्षमता वृद्धिंगत अभ्यासक्रमांतर्गत*** समावेश करणेत आलेला आहे. यांत्रिक अभियांत्रिकीतील संकल्पना मातृभाषेतून स्पष्ट केल्यास, विद्यार्थ्यांना त्या संकल्पना प्रभावीरीत्या समजण्यास मदत होते. अभियांत्रिकीच्या इंग्रजीतील शिक्षणामुळे विद्यार्थी आपल्या मातृभाषेपासून आणि पर्यायाने त्यातील साहित्यापासून दूर जाऊ शकतो. हा दुरावा कमी करणे, हा या विषयाचा मूळ उद्देश आहे. या विषयांतर्गत, **मराठी भाषा :उत्पत्ती आणि विकास, विशेष साहित्य कृतींचा अभ्यास – गद्य, विशेष साहित्य कृतींचा अभ्यास – पद्य, मराठी रंगभूमी - एक सांस्कृतिक वारसा आणि उपक्रम** असे एकूण पाच घटक समाविष्ट करण्यात आलेले आहेत.

Course Content

घटक १	**मराठी भाषा :उत्पत्ती आणि विकास**	**4 hrs**
प्राचीन काल, मध्ययुग, मध्ययुगीन काल, साहित्य आणि सांस्कृतिक विकास, मराठा साम्राज्यातील मराठी साहित्य, २०व्या शतकातील मराठी भाषेची उत्क्रान्ती, मराठी भाषेची सद्यस्थिती		
घटक २	**विशेष साहित्य कृतींचा अभ्यास - गद्य**	**4 hrs**
मराठी साहित्यातील ख्यातनाम साहित्यिकांची ओळख आणि त्यांच्या साहित्यकृती – आचार्य प्र. के. अत्रे , पु. ल. देशपांडे, रणजीत देसाई, विश्वास पाटील इत्यादी		
घटक ३	**विशेष साहित्य कृतींचा अभ्यास - पद्य**	**4 hrs**
मराठी साहित्यातील ख्यातनाम कवी आणि कवयित्रींची ओळख व त्यांच्या पद्यकृती –		

बहिणाबाई चौधरी, मंगेश पाडगावकर, इंदिरा संत, बा. भ. बोरकर, सुरेश भट इत्यादी		
घटक ४	**मराठी रंगभूमी - एक सांस्कृतिक वारसा**	**4 hrs**
मराठी रंगभूमीची ओळख, मराठी नाट्यप्रकार, विख्यात मराठी नाटककार – गोविंद बल्लाळ देवल, आचार्य प्र. के. अत्रे, पु. ल. देशपांडे, शंकरराव किर्लोस्कर इत्यादी		
घटक ५	**उपक्रम**	**4 hrs**
वरील साहित्यकृतींचे सादरीकरण, हिप-हॉप शो, नाटिका, काव्यवाचन, कवितेचे रसग्रहण, अभिवाचन यांत्रिक अभियांत्रिकीतील एखाद्या संकल्पनेचे मराठी भाषेत अधिव्याख्यान, इत्यादी		

Learning Resources:

1	**अमृतसिद्धी: १ व २**, मंगला गोडबोले व स. ह. देशपांडे, *मौज प्रकाशन गृह*
2	**व्यक्ती आणि वल्ली**, पु. ल. देशपांडे, *मौज प्रकाशन गृह*
3	**मी कसा झालो?,** प्र. के. अत्रे, *परचुरे प्रकाशन*
4	**स्वामी**, रणजीत देसाई, *मेहता पब्लिशिंग हाउस*
5	**झाडाझडती**, विश्वास पाटील, *राजहंस प्रकाशन*
6	**बहिणाबाईंची गाणी**, बहिणाबाई चौधरी, *सुचित्रा प्रकाशन*
7	**बोलगाणी**, मंगेश पाडगांवकर, *मौज प्रकाशन गृह*
8	**बोरकरांची समग्र कविता, खंड १ व २**, बा. भ. बोरकर, *देशमुख आणि कंपनी*
9	**मृद्गंध**, इंदिरा संत, *मेहता पब्लिशिंग हाउस*
10	**रंग माझा वेगळा**, सुरेश भट, *मौज प्रकाशन गृह,*

CO-PO Mapping:

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

Tatyasaheb Kore Institute of Engineering and Technology, Warananagar Second Year B. Tech. Department of Mechanical Engineering				
Course Code: 2501UMEHAEC4083T Course Name: Modern Indian Language Hindi				
Teaching Scheme		**Credit**	**Evaluation Scheme**	
Lectures:	2 Hours/Week	02	ISA:	25

Prerequisites, if any:

3. भाषा के मूल तत्व
4. व्याकरण के बुनियादी शब्द और नियम

Course Objectives (उद्देश्य): The objective of the course is to

1. हिंदी के व्यावहारिक पक्ष से परिचित कराना
2. वाणिज्यिक व्यवहार में हिंदी भाषा को प्रज्वलित कराना
3. हिंदी में कार्य करने की रुचि विकसित कराना
4. राष्ट्रभाषा के प्रति रूचि उत्पन्न कराना
5. कार्यालय और व्यवसाय में हिंदी प्रयोग का कौशल विकसित कराना.

Course Outcomes (परिणाम): After successful completion of the course, student will be able to

CO1	हिंदी के व्यावहारिक और वाणिज्यिक पहलू से परिचित होगा.
CO2	अपने व्यावहारिक काम हिंदी में करने की क्षमता रखेगा
CO3	किसी भी अंग्रेजी लेख का प्रभावी हिंदी में अनुवाद कर सकेगा
CO4	राष्ट्रभाषा के प्रयोग को वरीयता दे पायेगा

Course Description (विवरण):

"प्रयोजनमूलक हिंदी" इस विषय को क्षमता निर्माण पाठ्यक्रम के अंतर्गत शामिल किया गया है। मैकेनिकल इंजीनियरिंग अवधारणाओं को राष्ट्रभाषा में समझाने से छात्रों को अवधारणाओं को प्रभावी ढंग से समझने में मदद मिलती है। अंग्रेजी में इंजीनियरिंग शिक्षा एक छात्र को उसकी राष्ट्रभाषा से दूर ले जा सकती है। इस अंतर को पाटना ही इस विषय का मुख्य उद्देश्य है। इस विषय के अंतर्गत, कार्यालयीन पत्राचार, अनुवाद, वृत्तांत लेखन और वाणिज्य पत्राचार इन इकाइयों को शामिल किया गया है |

Course Content

इकाई-1	**कार्यालयीन पत्राचार**	**4 hrs**
नौकरी के लिए आवेदन पत्र, पदाधिकारियोंके नाम पत्र, छुट्टी के लिए प्रार्थना पत्र, परिपत्र		
इकाई-2	**अनुवाद**	**4 hrs**
अनुवाद की परिभाषा, अनुवाद का स्वरुप, अनुवाद की उपयोगिता, अनुवादक के गुण		
इकाई-3	**वृत्तांत लेखन**	**4 hrs**
महाविद्यालयीन समारोह का वृत्तान्त लेखन, सामाजिक समारोह का वृत्तान्त लेखन, प्राकृतिक आपदाओंका वृत्तान्त लेखन, दुर्घटनाओंका वृत्तान्त लेखन		
इकाई-4.	**वाणिज्य पत्राचार**	**4 hrs**
पूछताछ के पत्र, क्रयादेश के पत्र, सन्दर्भ के पत्र, शिकायत के पत्र		

Learning Resources:

1	हिंदी और उसका व्यवहार- डॉ. व्ही. के. मोरे, फड़के प्रकाशन, कोल्हापूर.
2	अनुवादचिन्तन- डॉ. अर्जुन चव्हाण, अमन प्रकाशन, कानपुर.
3	प्रयोजनमूलक हिंदी व्याकरण एवं पत्रलेखन- डॉ. बापूराव देसाई, विनय प्रकाशन, कानपुर
4	रोजगारोन्मुख हिंदी- डॉ. गणेश ठाकुर, विजय प्रकाशन, कानपुर

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

Tatyasaheb Kore Institute of Engineering and Technology, Warananagar Second Year B. Tech. Department of Mechanical Engineering				
Course Code: 2501UMEHVEC409T Course Name: Sustainability Engineering in Mechanical System				
Teaching Scheme		**Credit**	**Evaluation Scheme**	
Lectures:	01 Hours/Week	02	**ISA:**	50 Marks
Prerequisites, if any:				
Course Objectives: The objective of the course is to				
1)				
2)				
3)				
Course Outcomes: At the end of successful completion of the course, the student will be able to				
				Bloom's Level
CO1	Define sustainability and its environmental, social, and economic aspects, and identify key global environmental challenges such as climate change, resource depletion, and pollution.			Remember
CO2	Explain the principles of sustainable manufacturing processes, such as additive manufacturing, lean manufacturing, and green machining, and summarize their benefits in reducing energy consumption and material waste.			Understand
CO3	Apply the methodology of Life Cycle Assessment (LCA) to demonstrate how to evaluate the environmental impact of mechanical engineering products			Apply
CO4	Explain the significance of renewable energy sources, such as solar, wind, and hydro, in mechanical systems, and discuss their importance in promoting sustainable energy solutions in mechanical engineering.			Understand
CO5	Discuss the principles of sustainable design in mechanical systems and outline the strategies for integrating renewable materials and energy-efficient tools.			Understand
CO6	List real-world applications of renewable energy systems in mechanical engineering and describe their implementation in energy-efficient system designs			Remember
Course Description:				
This course explores sustainability in mechanical engineering, covering its environmental, social, and economic aspects. Topics include sustainable manufacturing, Life Cycle Assessment (LCA), renewable energy systems, energy-efficient design, and the use of sustainable materials. Real-world applications and case studies emphasize the role of sustainability in engineering practices.				
Course Content				
Unit 1	**Introduction to Sustainability**			**3**
Definition of sustainability: Environmental, Social, and Economic aspects, Global environmental challenges: Climate change, resource depletion, pollution, Importance of sustainability in engineering, Role of sustainability in modern technologies and industrial practices				

Unit 2	Sustainability in Mechanical Engineering	2
Sustainable manufacturing processes, Explore various sustainable manufacturing processes, such as:Additive manufacturing (3D printing), Lean manufacturing&Green machining, Discuss their benefits in reducing energy consumption, material waste, and environmental impact		
Unit 3	**Life Cycle Assessment (LCA) Overview**	**2**
Study the Life Cycle Assessment (LCA) methodology, its stages (from raw material extraction to disposal), and its application in evaluating the environmental impact of products.		
Unit 4	**Renewable Energy in Mechanical Systems**	**3**
Introduction to renewable energy sources: Solar (Thermal and photovoltaic cell), Wind, Hydro, Mechanical applications of renewable energy systems, Importance of sustainable energy solutions in mechanical engineering		
Unit 5	**Sustainable Design**	**2**
Key principles of sustainable design in mechanical systems, Energy-efficient design strategies, Use of renewable materials in mechanical design, Introduction of tools for sustainable design.		
Unit 6	**Energy-Efficient Systems**	**2**
Renewable energy applications in mechanical engineering, Design and implementation of energy-efficient systems		

Learning Resources:

Text Books

1	“Environmental Studies" K. R. Nambiar
2	“Renewable Energy Engineering" by G. D. Rai
3	“Toyota Production System” Ravi Phadke, Nilesh Kate
4	“Product design and Manufacturing” A.K.Chitale

Reference Books

1	Sustainable Energy by Jeffersons W. Tester, Elisabeth M. Drake
2	Sustainable Design and Manufacturing" by A. J. A. Barron and B. D. Sheppard
3	Mechanical Engineering Design" by J. E. Shigley

CO-PO Mapping:

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	PSO 3
CO1	3	--	--	--	--	--	3	--	--	--	--	--	--	1	--
CO2	2	2	--	--	--	--	2	--	--	--	--	--	--	2	--
CO3	2	2	--	--	--	--	2	--	--	--	--	--	--	1	--
CO4	1	1	--	--	--	--	3	--	--	--	--	--	--	3	--
CO5	1	1	--	--	--	--	1	--	--	--	--	--	--	1	--
CO6	1	--	--	--	--	--	1	--	--	--	--	--	--	1	--

Tatyasaheb Kore Institute of Engineering and Technology, Warananagar Second Year B. Tech. Department of Mechanical Engineering				
Course Code: 2501UMEHPCC401T Course Name: Analysis of Mechanical Elements Lab				
Teaching Scheme		**Credit**	**Evaluation Scheme**	
Practicals:	01 Hours/Week	01	**ISA:**	25 Marks
Prerequisites, if any:				
Course Objectives: The objective of the course is to				
1)	apply the basic concepts related to tensile, compressive and shear stresses in engineering components and evaluate the stress- strain			
2)	Calculate force and bending moment in beams, deflection in beams, buckling in columns using fundamental equations.			
3)	Estimate distribution of bending stresses and shear stresses			

Course Outcomes: At the end of successful completion of the course the student will be able to		
		Bloom's Level
CO1	Understand the concept of stresses and strains.	Understand
CO2	Draw shear force and bending moment diagram under different loading conditions.	Create
CO3	Determine torque, bending stresses, shear stresses and principle stresses in beams.	Evaluate
CO4	Evaluate deflection in beams and buckling load in column due to application of different loading.	Evaluate

Course Description:

Analysis of Mechanical Elements is a fundamental subject needed primarily for the students of Mechanical sciences. As the engineering design of different components, structures etc. used in practice are done using different kinds of materials, it is essential to understand the basic behavior of such materials. Analysis of Mechanical Elements, also known as mechanics of materials, is focused on analyzing stresses and deflections in materials under load.

Course Content

Sr. No.	Topic of Practical / Experiment / Tutorial	Hours
1	Assignment on stresses and strains.	**2**
2	Assignment on principal stresses (both analytical and graphical).	**2**
3	Assignment on shear force diagram & bending moment diagram.	**2**
4	Assignment on bending stresses and shear stresses in beams.	**2**
5	Assignment on deflection of beams.	**2**
6	Assignment on torsion &Column	**2**

Learning Resources:

Text Books

1	“Strength of Materials”, S. Ramamruthum, DhanpatRai and Sons, New Delhi.
2	“Strength of Materials”, R. K. Bansal, Laxmi Publication, 4th Edition.
3	“Strength of Materials”, Khurmi Gupta, S. Chand Publication.
4	“Strength of Materials”, R.K. Rajput, S. Chad Publication.
5	“Mechanics of structure”, S.BJunnerkar,Charotar Publication House.
6	“Strength of Materials”, S. S. Bhavikatti, Vikas Publication House.
7	“Strength of Materials”, Timoshenko and Young, CBS Publication.
8	“Mechanics of Materials”, S. S. Ratan, Tata McGraw Hill Publication, 2009.
Reference Books	
1	“Strength of Materials”, Beer and Johnson, CBS Publication.
2	“Strength of Materials”, G.H. Rider,Mac Millan India Ltd.
3	“Strength of Materials”, Nag and Chanda, Willey India Publication.
4	“Advanced Mechanics of Materials”, Boresi, Willey India Publication.
5	“Strength of Materials”, Den Hartong, McGraw Hill Publication.
6	“Mechanical analysis and design”, H. Burr and John Cheatam, PHI, New Delhi.

CO-PO Mapping:

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	PSO 3
CO1	3	3	3	2	--	--	--	--	--	--	--	--	2	--	--
CO2	3	3	3	2	--	--	--	--	--	--	--	--	2	--	--
CO3	3	3	3	2	--	--	--	--	--	--	--	--	2	--	--
CO4	3	3	3	2	--	--	--	--	--	--	--	--	2	--	--

Tatyasaheb Kore Institute of Engineering and Technology, Warananagar Second Year B. Tech. Department of Mechanical Engineering				
Course Code: 2501UMEHPCC402TP Course Name: Theory of Machines-I Lab				
Teaching Scheme		**Credit**	**Evaluation Scheme**	
Practicals:	01 Hours/Week	02	**ISA:**	25 Marks
			POE:	25 Marks

Prerequisites, if any:	
1)	Basic Mechanical Engineering

Course Objectives: The objective of the course is to	
1)	Provide the students with basic knowledge of mechanism and its application in mechanical engineering through the experiments and table top working models.
2)	Know the significance of velocity and acceleration diagram in application of mechanism.
3)	Introduce the role of power transmission device (belt drive) in mechanism.
4)	Study the fundamental theory of friction and its analysis in different Mechanisms and machines.

Course Outcomes: At the end of successful completion of the course, the student will be able to

		Bloom's Level
CO1	Understand the concept of machines, mechanisms and related terminologies.	Understand
CO2	Analyse the power transmitting elements used in different machines and select the appropriate machines and mechanisms as per requirement.	Analyze
CO3	Analyse a mechanism for displacement, velocity and acceleration at any point in a moving link.	Analyze
CO4	Draw velocity and acceleration diagrams graphically and analytically.	Create

Course Description:

The effectiveness of mechanical machines depends upon mechanism used for transmission of motion in different components. Engineer can deal with these machines only if he has fundamental knowledge of mechanisms. Theory of Machine subject is introduced in syllabus to get the students acquainted with mechanism which is used in machine to transmit power from a source to its various parts as well as to transform motion from one form in to another form. It includes kinematics and kinetics of mechanism, design of cam and follower, theory of governor etc.

Course Content

Sr. No.	**Topic of Practical / Experiment / Tutorial**	**Hours**
1	Study of basic mechanisms. (Demonstration of models, Actual mechanisms, etc.)	2
2	One A3 size sheet of Velocity problems by relative velocity method. (Minimum 4 problems)	2
3	One A3 size sheet of Acceleration problems (including Coriollis component) by relative acceleration method. (Minimum 4 problems)	2
4	One A3 size sheet of Velocity problems by Klien's construction and Instantaneous center method. (Minimum 4 problems)	2
5	Verification of ratio of angular velocities of shafts connected by Hooks joint.	2

6	One A3 size sheet of Problems on cam profile. (Minimum 4 problems)	2
7	Experiment on Governor characteristics for Porter governor.	2
8	Experiment on belt drives	2
9	Experiment on Cam Profile	2
10	Experiment on Dynamometer	2

Learning Resources:

Text Books

1	"Theory of Machines", Ratan S.S, Tata McGraw Hill New Delhi, 2nd Edition.
2	"Theory of Machines", P.L.Ballany, Khanna Publication, New Delhi, 2nd Edition.
3	"Theory of Machines", V.P. Singh, DhanpatRai and Sons.

Reference Books

1	"Theory of Machines and Mechanism", Shigley, McGraw Hill, New York
2	"Theory of Machines", Abdullah Shariff, McGraw Hill, New Delhi.
3	"Theory of Machines", Thomas Bevan, CBS Publisher

CO-PO Mapping:

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	PSO 3
CO1	3	--	--	--	--	--	--	---	--	--	--	--	3	--	--
CO2	3	2	3	2	--	--	--	--	--	--	--	--	2	--	--
CO3	2	2	3	3	--	--	--	--	--	--	--	--	2	--	--
CO4	2	2	3	2	--	--	--	--	--	--	--	--	2	--	--

Tatyasaheb Kore Institute of Engineering and Technology, Warananagar Second Year B. Tech. Department of Mechanical Engineering				
Course Code: 2501UMEHPCC410TP Course Name: Manufacturing Process Lab				
Teaching Scheme		**Credit**	**Evaluation Scheme**	
Practicals:	01 Hours/Week	02	**ISA:**	25 Marks
			POE:	25 Marks

Prerequisites, if any:

Course Objectives: The objective of the course is to

1)	Acquire skills in basic sand casting process.
2)	Understand pattern making process.
3)	Perform Sand Testing.
4)	Study Lathe Machine, Drilling Machine, Milling Machine.
5)	Study and perform the various machining operations.

Course Outcomes: At the end of successful completion of the course, the student will be able to:

		Bloom's Level
CO1	Describe importance of casting processes in manufacturing.	Understand
CO2	Design and develop the pattern.	Apply Create
CO3	Evaluate the properties of molding sand.	Apply
CO4	Demonstrate the components and accessories of various Machine tools.	Understand
CO5	Perform various machining operations to prepare Job using plain turning, facing, taper, turning, threading, knurling, grooving, Centre drilling.	Apply Create

Course Description:

Most of mechanical manufacturing industries are dealing with casting processes. Student should have hands on experience related to this technology to make them skilled with industrial environment. To emphasize this objective, manufacturing lab is introduced to the mechanical engineering course which contains basic knowledge of casting process, sand testing and machine tools and operations.

Course Content

Sr. No.	**Topic of Practical / Experiment / Tutorial**	**Hours**
1	Study of Patterns–Types, Materials used, Pattern Allowances and preparation of pattern for solid casting.	4
2	Testing of Greensand To find Size and Grain fineness number of molding sand. To calculate Hardness (mould/core) and Green Compressive strength of molding sand to find Permeability, Moisture percentage and Clay content of given sand.	4
3	Demonstration of Lathe machine to understand constructional details, various mechanisms, accessories and attachments.	2

4	Reading the component Drawing, selecting and preparing operation sequence. Manufacturing of component on lathe Machine. This Job consists of operations such as turning, facing, grooving, Taper turning, Threading, Knurling, center drilling.	12
5	Visit to a Foundry to study patterns and different types of Machine tools. 2hrs Knowledge	2

Learning Resources:

Text Books

1	Manufacturing Technology - Foundry, Forming and Welding, Vol. I, P. N. Rao, Tata McGraw-Hill, New Delhi, 3rd edition, 2009.
2	A Text book of Production Technology (Manufacturing Processes) P. C. Sharma, S. Chand and Company Pvt. Ltd, New Delhi. 7th Edition, 2010.
3	Production technology, R. K. Jain, Khanna Publishers, Delhi, 15th Edition,2000.
4	P. L. Jain, Principles of Foundry Technology-II, Tata McGraw-Hill, New Delhi, 2nd Edition, 2006
5	Elements of Workshop Technology vol.-III, S. K. Hajra-Choudhury and A. K. Hajra Choudhury, Media promoters and Publishers Pvt. Ltd, New Delhi, 13th Edition, 2012

Reference Books

1	Principles of metal casting, Haine and Rosenthal, Tata McGraw-Hill Book, New Delhi.
2	Workshop Technology Vol. 1, W. A. J. Chapman, CBS Publishing and Distributors, New Delhi
3	O. P. Khanna, Foundry technology, Khanna Publishers, New Delhi
4	"Production Technology", P. C. Sharma, S. Chand Publication, 11thEdition.

CO-PO Mapping:

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	PSO 3
CO1	1	1	--	--	--	--	--	--	--	--	--	--	--	--	--
CO2	3	3	3	--	2	--	--	--	--	--	--	--	--	--	3
CO3	2	3	1	3	2	--	--	--	--	--	--	--	--	--	2
CO4	1	1	--	--	--	--	--	--	--	--	--	--	--	--	--
CO5	3	3	3	2	2	--	--	--	--	--	--	--	--	--	3

Tatyasaheb Kore Institute of Engineering and Technology, Warananagar Second Year B. Tech. Department of Mechanical Engineering				
Course Code: 2501UMEHA411A Course Name: Audit Course Environment Studies				
Teaching Scheme		**Credit**	**Evaluation Scheme**	
Lectures:	01 Hours/Week	02		
Prerequisites, if any:				
1)	Understanding of environmental sciences.			
Course Objectives: The objective of the course is				
1)	The syllabus of Environment ethics and sustainability provides an integrated, quantitative and interdisciplinary approach to the study of environmental systems. The students of Engineering undergoing this course would develop a better understanding of human relationships, perceptions and policies towards the environment and focus on design and technology for improving environmental quality. Their exposure to subjects like understanding of earth processes, evaluating alternative energy systems, pollution control and mitigation, natural resource management and the effects of global climate change, shall help the students to bring a systems approach to the analysis of environmental problems.			
Course Outcomes: At the end of successful completion of the course, the student will be able to:				
		Bloom's Level		
CO1	Acquire knowledge of fundamental environmental concepts including ecological concepts.	Understand		
CO2	Identify the environmental problems such as various pollutions, waste disposal and their solutions.	Understand		
CO3	Recognize the ethical responsibility of engineers towards environmental stewardship. .	Apply		
CO4	Realize various environmental changes like global warming, etc and its impact on society.	Apply		
Course Description:				
The Study of Environment is playing important and crucial role for sustainable development of society, particularly to address industrial pollution, living standards and climate change issues. This course covers essential theory of environment processes and infrastructure for the supply of water, the disposal of waste, and the control of pollution of all kinds.				
Course Content				
Sr. No.	**Topic of Practical / Experiment / Tutorial**	**Hours**		
1	Ecology: Ecosystem, Ecological Pyramids, Food chain, food web, Ecological succession. Natural Resources and Associated Problems: Forest resources, Water resources, Mineral resources, Food resources, Energy resources, Land resources Role of individuals in conservation of natural resources.	**4 Hrs**		
2	Pollution Water pollution: causes, effects, control, drinking water quality standards, Arsenic, lead, cadmium, chromium, fluoride contamination & its effects, water treatment, wastewater treatment. Air pollution: Causes, effects, control, Air pollution controlling equipments, Air quality standards, National air quality index, vehicular emission, alternative	**10 Hrs**		

	fuels, indoor air pollution, Thermal inversions, Photochemical Smog and Acid Precipitation Noise pollution: Causes, effects, control, noise standards recommended by CPCB, Environmental Protection Act: Air (Prevention and Control of Pollution) Act, Water (Prevention and control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act and International and National efforts for Environmental Protection.	
3	Waste management: Solid waste management, biomedical waste management, E waste, plastic waste management, Hazardous waste management, carbon footprint, Recycling of waste, Role of Central Pollution Control Board (CPCB), State Pollution Control Board, Role of NGO's	**4 Hrs**
4	Social Issues and Environment: Global Warming, Ozone layer depletion, urban problems related to energy, Alternative energy sources, Evolution of Sustainable development: timeline, Evolution of green movements in India, Disaster management: Flood, Earthquakes, Cyclones, Landslides, Draught, Tsunami etc., Swachh Bharat Mission, Role of Information technology in Environment and human health.	**6 Hrs**
5	Project Work: Visit to Local Polluted site –Urban/Rural/Industrial/Agricultural Or Study of simple Ecosystems –Ponds, River, Hill slopes Or Preparation of small models or device to resolve the environment problem/issue Project work shall be based on study / observation / analysis made on environmental issues and report should be submitted in hard copy. ---	

Learning Resources:

Text Books

1	Agarwal K.C. ,2001 "Environmental Biology", Nidi publication ltd., Bikaner
2	D. K. Asthana, Meera Asthana, A Textbook of Environmental Studies, S. Chand Publication Revised edition, 2006.
3	S. Deswal & A. Deswal, Basic course in environmental Studies, Dhanpat Rai & Co ltd., Delhi, Second revised edition, 2009.

Reference Books

1	Eldon D Enger, Bradley F. Smith, Environmental science – a study of inter- relationships Wm C Brown Publishers 1989
2	Francois Ramade Ecology of Natural resources, John wiley & Sons, 2009
3	Robert Leo Smith, Ecology and field biology, Harper Collins Publishers, 1998
4	Gilbert M. Masters, Introduction to Environmental Engineering & Science, Prentice Hall International Inc. Second Edition

CO-PO Mapping:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	--	--	--	--	2	1	--	--	--	--	1	--	--	--
CO2	--	2	--	--	--	2	1	--	--	--	--	1	--	--	--
CO3	--	--	3	--	--	3	1	3	1	--	--	1	--	--	--
CO4	--	--	3	--	--	3	2	--	1	--	--	1	--	--	--