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शिवाजी विद्यापीठ, कोल्हापूर ४१६ ००४, महाराष्ट्र
दूरध्वनी - इपीबीएक्स - २०६०९०००, अभ्यासमंडळे विभाग : ०२३१- २६०९०९४, २६०९४८७
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Estd. 1962
"A++" Accredited by NAAC (2021)
With CGPA 3.52

SU/BOS/Sci & Tech/ 315 **Date: 16/05/2025**

To,

The Principal / Director,
All Concerned Affiliated Colleges / Institutions,
Shivaji University, Kolhapur.

Subject: Regarding revised syllabus of **B. Tech. Part - II (Sem– III - IV)** degree **Programme (Affiliated College)** under the Faculty of Science and Technology as per NEP 2020.

Sir/Madam,

With reference to the subject mentioned above, I am directed to inform you that the university authorities have accepted and granted approval to the revised syllabi, Nature of Question paper and equivalence of B. Tech. Part - II (Sem - III & IV) under the Faculty of Science & Technology as per NEP 2020.

No.	Course Syllabus
1	Civil Engineering
2	Mechanical Engineering
3	Mechanical and Mechatronic Engineering (Additive Manufacturing)
4	Electrical Engineering and Technology
5	Electrical and Computer Engineering
6	Electronics and Telecommunication Engineering
7	Electronics & Computer Science Engineering
8	Computer Science and Engineering
9	Artificial Intelligence & Machine Learning (AIML)
10	Data Science (DS)
11	Artificial Intelligence & Data Science (AIDS)

This Syllabus, shall be implemented from the academic year **2025-26** onwards. A soft copy containing the syllabus is attached herewith and it is available on university website **www.unishivaji.ac.in NEP-2020@suk (Online Syllabus)**

The question papers on the pre-revised syllabi of above-mentioned course will be set for the examinations to be held in October/ November 2025 & March / April 2026. These chances are available for repeater students, if any

You are, therefore, requested to bring this to the notice of all students and teachers concerned.

Thanking you,

Yours faithfully,

Dr. S. M. Kubal
Dy. Registrar

Copy to: for Information and necessary action

1	The I/c Dean, Faculty of Science & Technology	6	Appointment Section A & B
2	Director, Board of Examinations & Evaluation	7	Affiliation Section (T.1) (T.2)
3	The Chairpersan, Respective Board of Studies	8	P.G.Admission Section, /P.G Seminar Section
4	OE 4 Exam Section,	9	Computer Centre,/IT Cell
5	Eligibility Section,	10	Internal Quality Assorance Cell (IQAC)

Shivaji University
Kolhapur

Revised Syllabus
as per
National Education Policy-2020
(NEP-2.0)

S. Y. B. Tech.
Mechanical Engineering

To be Implemented from
Academic Year 2025-26

First Year Exit: Teaching Methodology, Assessment and Evaluation

[I] As per R. R. B. Tech. 12.1 Rule: Award of Degree

If a student passes all the courses of first year and earns the requisite number of credits, the student will become entitled to Undergraduate Certificate (One year or two semesters) in the programme of his/her major subject. If he/she wants to exit, can exit the programme with UG Certificate. However, for the award of one year UG Certificate in Major with 44 credits, an additional 8 credits are required to earn.

[II] First Year Exit Course:

Methodology 1:

1. The students should complete two online certification courses (NPTEL) related to their programme, each of 3 credits. In addition to this, they will also need to complete 2 credits worth of two Virtual Lab work related to online certification courses. These additional 8 credits earn by students shall be based upon skill based vocational courses or internship/Apprenticeship.
2. The NPTEL courses are likely to be available online and can be completed at the student's own pace. The content will be specific to the student's field of study or programme. The skill based vocational courses shall be analogous to the Baskets/Areas provided by the concerned BoS.
3. The student must complete two virtual lab work that adds 2 credits to simulate practical or experimental learning experiences in a controlled virtual environment.

4. **Examination scheme:** The marks gained from the two NPTEL Courses (3 credits each) are converted to a total of 100 marks. The report for the two Virtual Lab work of 2 credits will be evaluated for 25 marks. The report should include a detailed write-up and analysis of the virtual lab experiments conducted, encompassing the methodology, results, and conclusions.
5. There may be uncertainty in availability of the NPTEL courses offered by concerned BoS as there is continuous updatation of the NPTEL courses. The students can choose equivalent NPTEL course of the required duration with prior permission from the concerned institute. The concerned institute should communicate to Concerned BoS for their permission. For NPTEL course registration, the students are required to visit to website https://swayam.gov.in and create their account. Log in the account and join the required course and follow the instructions to compete the course. Similarly, for Virual Lab, the students are required to visit to website https://www.vlab.co.in and create their account. Log in the account and join the required lab and follow the instructions to compete the course (need to perform all listed experiments under that Lab). To fulfill the requirement of 06 credits, students can go for two courses each of 12 weeks.

Methodology 2:

1. The students should complete two online certification courses (NPTEL) related to their programme, each carrying 2 credits. In addition to this, they will also need to complete 4 credits worth of two physical internship/Apprenticeship (each of 40 hrs) work from relevant

industry. These additional 8 credits earned by the students shall be based upon skill based vocational courses or internship/Apprenticeship.

2. The NPTEL courses are likely to be available online and can be completed at the student's own pace. The content will be specific to the student's field of study/programme. The skill-based vocational courses shall be analogous with the list provided by the concerned BoS.
3. The student should complete two physical internship/Apprenticeship (each of 40 hrs) work from relevant industrial practices that adds 4 credits to simulate practical or experimental learning experiences in a controlled virtual environment.
4. **Examination scheme:** The marks gained from the two NPTEL Courses (2 credits each) are converted to a total of 100 marks. The report for the performed two physical internship/Apprenticeship (each of 40 hrs) work from relevant industrial practices of 4 credits will be evaluated for 25 marks. The report should include a detailed write-up and analysis of two physical internship/Apprenticeship (each of 40 hrs) work along with certificate of internship/Apprenticeship from relevant industrial practices conducted, encompassing the methodology, results, and conclusions.
5. There may be uncertainty in availability of the NPTEL courses offered by concerned BoS as there is continuous updatation of the NPTEL courses. The students can choose equivalent NPTEL course of the required duration with prior permission from the concerned institute.

The concerned institute should communicate to Concerned BoS for their permission. For NPTEL course registration, the students are required to visit to website https://swayam.gov.in and create their account. Log in the account and join the required course and follow the instructions to compete the course.

Direct Second Year Entry: Teaching Methodology, Assessment and Evaluation

[I] For the students admitted directly into the second year of a programme (at the entry level) from a different programme, earning of an additional 2 credits is mandatory.

[II] As per R. R. B. Tech. 13.3 Rule, For direct second year admitted students (at entry level) to concern programme, the earning of additional 2 credits is mandatory. It is required to conduct examination and evaluation for same at institute level at the time of third semester ESE examination. The evaluation report must be submitted to The Director, Board of Examination and Evaluation, Shivaji University, Kolhapur.

[III] Examination scheme:

Students admitted directly into the second year of a programme from another programme are required to complete a 2-credit entry-level course as per the prescribed curriculum. This course should be completed at their own pace to ensure alignment with the programme foundational requirements. End Semester Examination (ESE) of 100 marks will be conducted at the institute level. It is mandatory to organize the examination and evaluate the performance of such students at the institute level during the third semester ESE. The evaluation report must be submitted to The Director, Board of Examination and Evaluation, Shivaji University, Kolhapur.

Open Elective Courses: Teaching Methodology, Assessment and Evaluation

Open Elective (OE) courses other than faculty of Science and Technology through Massive Open Online Courses (MOOCs) allowing students to engage with a broad spectrum of ideas and knowledge areas. The OE courses are likely to be available online and can be completed at the student's own pace within a set timeframe. For OE course, students are required to visit to the website https://swayam.gov.in for registration and create an account. Afterward, students should Login the account and join the course assigned by the course coordinator and follow the instructions to compete the course. Minimum 25 students can register for one OE course in the concerned institute. There will be only one course coordinator for one OE course.

1. **For Semester-III,** OE theory course of 3 credits consists of Mid Semester Examination (MSE) of 30 Marks, In Semester Evaluation/Continuous Assessment (ISE/CA) of 10 Marks and End Semester Examination (ESE) of 60 Marks.
2. **For Semester-III,** OE practical lab course of 1 credit consists of In Semester Evaluation/Continuous Assessment (ISE/CA) of 25 Marks and End Semester Examination-Practical Oral Examination (ESE-POE) of 25 Marks. Course Coordinator assigned by Institute should complete the selected course practical through expert of that course.
3. **For Semester-IV,** OE theory course of 2 credits consists of Mid Semester Examination (MSE) of 30 Marks, In Semester

Evaluation/Continuous Assessment (ISE/CA) of 10 Marks and End Semester Examination (ESE) of 60 Marks.

4. The Mid Semester Examination (MSE) of 30 Marks based on selected OE Course will be conducted by Concerned Departmental Course Coordinator. The course expert of concerned faculty should set question paper of MSE and evaluate the same.
5. Online submitted assignments by students using SWAYAM platform for concerned OE course will be used for In Semester Evaluation/Continuous Assessment (ISE/CA) of 10 Marks by Concerned Departmental Course Coordinator appointed for particular course by Principal of the Institute. Assignments may be of varied in nature for OE course.
6. The setting of ESE question paper of Concerned OE Course should be done through course expert of concerned faculty as per University rules and is responsibility of Institute/ Departmental Course Coordinator.
7. Student may get failure in the said OE course or the examination may get delayed by SWAYAM, in either cases, ESE of the said course will be conducted as per the University rules.

Note: One OE course is to be floated by the institute for 60 intake.

Second Year Exit: Teaching Methodology, Assessment and Evaluation

[I] As per R. R. B. Tech. 12.2 Rule: Award of Degree

If a student passes all the courses of first year, second year and earns the requisite number of credits, the student will become entitled to Undergraduate Diploma (Two years or four semesters) in the programme of his/her major subject. If he/she wants to exit, can exit the programme with UG Diploma certificate. However, for the award of two years UG Diploma Certificate in Major with 88 credits, an additional 8 credits from Exit Courses are required to earn.

[II] Second Year Exit Course:

Methodology 1:

1. The students should complete two online certification courses (NPTEL) related to their programme, each of 3 credits. In addition to this, they will also need to complete 2 credits worth of two Virtual Lab work related to online certification courses. These additional 8 credits earn by students shall be based upon skill based vocational courses or internship/Apprenticeship.
2. The NPTEL courses are likely to be available online and can be completed at the student's own pace. The content will be specific to the student's field of study or programme. The skill based vocational courses shall be analogous to the Baskets/Areas provided by the concerned BoS.

3. The student must complete two virtual lab work that adds 2 credits to simulate practical or experimental learning experiences in a controlled virtual environment.
4. **Examination scheme:** The marks gained from the two NPTEL Courses (3 credits each) are converted to a total of 100 marks. The report for the two Virtual Lab work of 2 credits will be evaluated for 25 marks. The report should include a detailed write-up and analysis of the virtual lab experiments conducted, encompassing the methodology, results, and conclusions.
5. There may be uncertainty in availability of the NPTEL courses offered by concerned BoS as there is continuous updatation of the NPTEL courses. The students can choose equivalent NPTEL course of the required duration with prior permission from the concerned institute. The concerned institute should communicate to Concerned BoS for their permission. For NPTEL course registration, the students are required to visit to website https://swayam.gov.in and create their account. Log in the account and join the required course and follow the instructions to compete the course. Similarly, for Virual Lab, the students are required to visit to website https://www.vlab.co.in and create their account. Log in the account and join the required lab and follow the instructions to compete the course (need to perform all listed experiments under that Lab). To fulfill the requirement of 06 credits, students can go for two courses each of 12 weeks.

Methodology 2:

1. The students should complete two online certification courses (NPTEL) related to their programme, each carrying 2 credits. In addition to this, they will also need to complete 4 credits worth of two physical internship/Apprenticeship (each of 40 hrs) work from relevant industry. These additional 8 credits earned by the students shall be based upon skill based vocational courses or internship/Apprenticeship.
2. The NPTEL courses are likely to be available online and can be completed at the student's own pace. The content will be specific to the student's field of study/programme. The skill-based vocational courses shall be analogous with the list provided by the concerned BoS.
3. The student should complete two physical internship/Apprenticeship (each of 40 hrs) work from relevant industrial practices that adds 4 credits to simulate practical or experimental learning experiences in a controlled virtual environment.
4. **Examination scheme:** The marks gained from the two NPTEL Courses (2 credits each) are converted to a total of 100 marks. The report for the performed two physical internship/Apprenticeship (each of 40 hrs) work from relevant industrial practices of 4 credits will be evaluated for 25 marks. The report should include a detailed write-up and analysis of two physical internship/Apprenticeship (each of 40 hrs) work along with certificate of internship/Apprenticeship from

relevant industrial practices conducted, encompassing the methodology, results, and conclusions.

5. There may be uncertainty in availability of the NPTEL courses offered by concerned BoS as there is continuous updatation of the NPTEL courses. The students can choose equivalent NPTEL course of the required duration with prior permission from the concerned institute. The concerned institute should communicate to Concerned BoS for their permission. For NPTEL course registration, the students are required to visit to website https://swayam.gov.in and create their account. Log in the account and join the required course and follow the instructions to compete the course.

Exit Course for Mechanical Engineering after 1st Year

<table>
<tr><th colspan="5">Exit option : Award of UG Certificate in Major with 44 credits and an additional 8 credits from following Exit Courses</th></tr>
<tr><th>Sr. No</th><th>Course Code</th><th>Course Title</th><th>Mode</th><th>Credits</th></tr>
<tr><td>1</td><td>ME-EC-0201</td><td>Certificate Course in Machine Maintenance</td><td rowspan="3">Online NPTEL,MOOCS
To earn 8 credits, the student must complete two NPTEL courses and two virtual labs related to Machine Maintenance or Vehicle Maintenance.</td><td>8</td></tr>
<tr><td colspan="3">OR</td><td>OR</td></tr>
<tr><td>2</td><td>ME-EC-0202</td><td>Certificate Course in Vehicle Maintenance</td><td>8</td></tr>
</table>

F.Y. Exit Course

To earn 8 credits, the student must complete two NPTEL courses and two virtual labs related to Machine Maintenance or Vehicle Maintenance

1. Certificate Course in Machine Maintenance (8)

NPTEL Courses Like

1. Maintenance Engineering and Asset Management (3)
2. Industrial Maintenance (3)
3. Machinery Fault Diagnosis (3)
4. Advanced Manufacturing Processes (3)
5. Advanced Maintenance Techniques (3)

Virtual Labs Like

1. IIT Kharagpur – Model-Based Fault Detection Lab (1)
2. NITK Surathkal – Mechanics of Machines Lab (1)
3 .IIT Delhi – Virtual Lab on Machine Tool Maintenance (1)
4. IIT Kanpur – Virtual Lab on Manufacturing Systems and Maintenance (1)
5. IIT Kharagpur – Virtual Lab on Preventive Maintenance of Machines (1)

2. Certificate Course in Vehicle Maintenance (8)

NPTEL Courses Like

1. Vehicle Maintenance and Repair (3)
2. Automotive Electrical Systems (3)
3. Engine Components and Maintenance (3)
4. Vehicle Dynamics and Suspension Systems (3)
5. Electric and Hybrid Vehicles: Maintenance and Diagnostics (3)

Virtual labs Like

1. IIT Kharagpur – Virtual Lab on Automotive Systems and Maintenance (1)
2. IIT Madras – Virtual Lab on Automotive Electronics (1)
3. IIT Bombay – Virtual Lab on Vehicle Dynamics and Maintenance (1)
4. IIT Roorkee – Virtual Lab on Vehicle Performance and Maintenance (1)
5. IIT Delhi – Virtual Lab on Diagnostics and Repair of Vehicles (1)

Earning of additional 2 mandatory credits for direct second year admitted students to Mechanical Engineering branch.

Sr. No.	Semester	Subject	Credits
1	III	Basics of Mechanical Engineering	2

Shivaji University, Kolhapur

Second Year Entry Syllabus

Basics of Mechanical Engineering

Teaching Scheme			Examination Scheme	
Total Credits	02		**ESE**	100 Marks

Note-For Direct second year admitted students (at entry level) to concern programme, the earning of additional 02 credits are mandatory. It is required to conduct examination and evaluation for same at institute level at the time of third semester ESE examination and need to submit report to Director, Board of Examination and Evaluation, Shivaji University, Kolhapur.

	Course Contents	Hours
Unit 1	**Introduction to Thermodynamics and I. C .Engine** **A:** Introduction to Thermodynamics, Laws of thermodynamics, **B:** Introduction to IC Engines, Construction and Working of C.I. and S.I. Engines.	**04**
Unit 2	**Energy Sources and power plants** **A;** Introduction and applications of Energy sources like Fossil fuels, Nuclear fuels, Hydro, Solar, Wind, and Bio-fuels **B:** Environmental issues like Global warming and Ozone depletion	**04**
Unit 3	**Mechanical Power Transmission and Energy conversion devices A**: Type of Belt and belt drives, chain drive, Types of gears and gear Trains **B:** Introduction to Pumps, Compressors and Turbines	**04**
Unit 4	**Introduction to Mechanism and Mobility System** **A:** Introduction to Links, kinematic pair, Kinematic chain, Mechanism, inversion. **B:** Introduction to Automobile, Introduction to Electric and hybrid vehicles	**04**
Unit 5	**Manufacturing Processes** **A:**Introduction to manufacturing processes - Casting Process, Metal removing processes ,Metal Joining Processes – Arc welding, soldering and brazing and their applications **B:** Introduction to Advanced Manufacturing Systems, Introduction and components of CNC, advantages and applications of CNC, 3D printing.	**04**
Unit 6	**Introduction to Mechatronics and Robotics** **A:** Introduction to Mechatronics, Mechatronics systems, Sensor and its types and its applications **B:** Introduction to Robotics, Joints &links, Robot anatomy, Applications of Robots in material handling, processing and assembly and inspection.	**04**

Text Books

1.	Solar Energy by Dr.S.P. Sukathame, Tata Mc- Graw Hill Publication
2.	Non-Conventional Sources of Energy by G.D. Rai, Khanna Publication
3.	Engineering Thermodynamics by R.Joel, The English Language Book Society
4.	Automobile Engineering by Dr. Kripal Singh, standard publish distributors

5.	Thermal Engineering by R.K. Rajput, Laxmi Publication, Delhi.
Reference Books	
1.	Elements of Heat Engine Vol. I, II,III by Patel and Karamchandani, Acharya Book Depot.
2.	Power Plant Engineering by Arora and Domkunwar, Dhanpat Rai and Sons.
3.	Manufacturing Technology Volume I and II by P. N. Rao, Tata Mc-Graw Hill Publication
4.	Elements of Workshop Technology, Vol.I and II by HajaraChoudhari, Media Promoters
5.	Basic Mechanical Engineering by Basant Agrawal & C. M. Agrwal, Wiley India Pvt.Ltd.
6.	Energy Technology by S. Rao and Dr.B.B. Parulekar, Khanna Publication. Mechatronics – W. Bolton, Pearson education
7.	"Robotics for Engineers", Koren, Yoram, Tata McGraw Hill.,(2003)
8.	"Theory of Machines", Ratan S.S, Tata McGraw Hill New Delhi, 2nd Edition.

SCHEME OF INSTRUCTION & SYLLABI

Name of Programme: Mechanical Engineering

Scheme of Instructions: Second Year B. Tech. Mechanical Engineering

Semester – III

Sr. No.	Course Category	Course Code	Course Title	L	T	P	Contact Hrs/Week	Course Credits	EXAM SCHEME			
									MSE	ISE/CA	ESE	TOTAL
1	PCC	ME0231	Mathematics for Mechanical Engineering	3	1	--	4	4	30	10	60	100
2	PCC	ME0232	Applied Thermodynamics	3	--	--	3	3	30	10	60	100
3	PCC	ME0233	Metallurgy	3	--	--	3	3	30	10	60	100
4	PCC	ME0234	Applied Thermodynamics Lab	--	--	2	2	1	--	50	25	75
5	MDM	ME0235	Multi-disciplinary Minor – 01	2	--	--	2	2	30	10	60	100
6	OE	ME0236	Open Elective -01	3	--	--	3	3	30	10	60	100
7	HSSM	ME0237	Universal Human Values	2	--	--	2	2	--	50	--	50
8	**FP**	ME0238	Machine Drawing & Computer Aided Drafting Lab	--	--	2	2	1	--	50	25	75
9	HSSM	ME0239	Economics for Engineers	2	--	--	2	2	--	50	--	50
10	OE	ME02310	Open Elective -01 Lab	--	--	2	2	1	--	25	25	50
			Total	**18**	**1**	**6**	**25**	**22**	**150**	**275**	**375**	**800**

L-Lecture T-Tutorial P-Practical

MSE-Mid Semester Examination ISE/CA-In Semester Evaluation/Continuous Assessment ESE-End Semester Examination (For Laboratory End Semester performance)

Course Category	Basic Science Courses (BSC)	Engineering Science Courses (ESC)	Programme Core Course (PCC)	Programme Elective Course (PEC)	Open Elective other than particular Programme (OE/MDM)	Vocational and Skill Enhancement Course (VSEC)	Humanities Social Science and Management (HSSM)	Experiential Learning (EL)	Co-curricular And Extracurricular Activities (CCA)
Last Sem. Cumulative Sum	**16**	**16**	--	--	--	**06**	**04**	--	**02**
Semester Credits	--	--	**11**	--	**06**	--	**04**	**01**	--
Cumulative Sum	**16**	**16**	**11**	--	**06**	**06**	**08**	**01**	**02**

PROGRESSIVE TOTAL CREDITS : 44+22 = 66

SCHEME OF INSTRUCTION & SYLLABI

Name of Programme: Mechanical Engineering

Scheme of Instructions: Second Year B. Tech. Mechanical Engineering

Semester– IV

Sr. No.	Course Category	Course Code	Course Title	L	T	P	Contact Hrs/Week	Course Credits	EXAM SCHEME			
									MSE	ISE/CA	ESE	TOTAL
1	PCC	ME0241	Analysis of Mechanical Elements	3	--	--	3	3	30	10	60	100
2	PCC	ME0242	Kinematics and Theory of machines	3	--	--	3	3	30	10	60	100
3	PCC	ME0243	Machine Tools and Processes	3	--	--	3	3	30	10	60	100
4	MDM	ME0244	Multi-disciplinary Minor- 02	2	--	--	2	2	30	10	60	100
5	OE	ME0245	Open Elective -02	2	--	--	2	2	30	10	60	100
6	HSSM	ME0246	Strategic Management	2	--	--	2	2	--	50	--	50
7	HSSM	ME0247	Professional Ethics	2	--	--	2	2	--	25	--	25
8	VEC	ME0248	Humanity Science	--	--	2	2	1	--	50	25	75
9	PCC	ME0249	Kinematics and Theory of machines Lab	--	--	2	2	1	--	25	25	50
10	PCC	ME02410	Testing and Measurement Lab	--	--	2	2	1	--	25	25	50
11	BSC	ME02411	Environmental Science	2	--	--	2	Audit	30	10	60	100
12	VSEC	ME02412	Mechanical Workshop	--	--	4	4	2		50	--	50
			Total	**19**	**--**	**10**	**29**	**22**	**180**	**285**	**435**	**800+100(Audit)**

L-Lecture T-Tutorial P-Practical

MSE-Mid Semester Examination ISE/CA-In Semester Evaluation/Continuous Assessment ESE-End Semester Examination (For Laboratory End Semester performance)

Course Category	Basic Science Courses (BSC)	Engineering Science Courses (ESC)	Programme Core Course (PCC)	Programme Elective Course (PEC)	Open Elective other than Particular Programme (OE/MDM)	Vocational and Skill Enhancement Course (VSEC)	Humanities Social Science and Management (HSSM)	Experiential Learning (EL)	Co-curricular And Extracurricular Activities (CCA)
Last Sem. Cumulative Sum	**16**	**16**	**11**	**--**	**06**	**06**	**08**	**01**	**02**
Semester Credits	**--**	**--**	**11**	**--**	**04**	**02**	**05**	**--**	**--**
Cumulative Sum	**16**	**16**	**22**	**--**	**10**	**08**	**13**	**01**	**02**

PROGRESSIVE TOTAL CREDITS : 66 + 22 = 88

SECOND YEAR (B. Tech) SEM. III

Shivaji University, Kolhapur

Second Year (Sem – III) B. Tech. Mechanical Engineering

ME0231: Mathematics for Mechanical Engineering

Teaching Scheme			Examination Scheme	
Lectures	03 Hrs /week		**MSE**	30 Marks
Tutorials	01 Hr /week		**ISE**	10 Marks
Total Credits	04		**ESE**	60 Marks
			Duration of ESE	02 Hrs 30 Min

Prerequisite : Basics of Matrices, Complex Algebra, Derivative and its properties, Integration and its properties

Course Outcomes (CO): After the successful completion of this course the student will be able

CO1	Solve Linear Differential Equations with constant coefficients.
CO2	Apply Laplace transform and inverse Laplace transform in solving linear differential equation with initial conditions arising in engineering problems
CO3	Develop Fourier Series expansion of a function over the given interval.
CO4	Apply knowledge of vector differentiation to find directional derivatives, curl and divergence of vector fields
CO5	Describe the statistical data numerically by using Lines of regression and Curve fittings.
CO6	Make use of Partial Differential Equation to solve the Mechanical Engineering problems

	Course Contents	CO	Hours
Unit 1	**Linear Differential Equations (LDE)** 1.1 Linear Differential equations with constant coefficients. 1.2 Rules to find complementary function. 1.3 Methods to find particular Integral (e^{ax}, sinax or cosax,x^m, $e^{ax}x^m$, $e^{ax}sinax$ or$e^{ax}cosax$) 1.4 Cauchy's homogeneous linear differential equations.	**CO1**	**08**
Unit 2	**Laplace Transform and Inverse Laplace Transform** 2.1 Laplace transform of elementary functions. 2.2 Properties of Laplace transforms(First Shifting , Change of scale property , Multiplication & Division by t). 2.3 Laplace transforms of derivatives and integral. 2.4 Inverse Laplace transforms by partial fractions 2.5 Application of Laplace Transform	**CO2**	**07**
Unit 3	**Fourier Series:** 3.1 Introduction : Definition, Euler's Formula 3.2 Dirichlet's Conditions. 3.3 Change of Interval. 3.4 Expansions of odd and even functions. 3.5 Half range series.	**CO3**	**07**
Unit 4	**Vector Differential Calculus** 4.1 Gradient of scalar point function. 4.2 Directional derivative. 4.3 Divergence of vector point function. 4.4 Curl of a vector point function. 4.5 Irrotational, Solenoidal and Scalar potential function of a vector field	**CO4**	**07**
Unit 5	**Correlation, Regression & Curve Fitting:** 5.1 Introduction. 5.2 Karl Pearson's Coefficient of Correlation. 5.3 Lines of regression of bivariate data. 5.4 Fitting of Curves by method of Least-squares: 5.4.1 Fitting of Straight lines. 5.4.2 Fitting of exponential curves. 5.4.3 Fitting of second degree Parabolic curves.	**CO5**	**07**
Unit 6	**Partial Differential Equations and Applications** 6.1 Method of separation of variables. 6.2 Wave Equation and its solution 6.3 Solutions of Laplace equations by the Gauss – Seidel iterative method	**CO6**	**06**

Text Books

1.	A Textbook of Applied Mathematics Vol. II and Vol. III, J.N. and P.N. Wartikar, Vidyarthi Grah Prakashan , Pune.
2.	Applied Mathematics by Navneet D. Sangle (Cengage Publication)
3.	Engineering Mathematics by V. Sundaram (Vikas Publication.)

Reference Books	
1.	Advanced Engineering Mathematics, by H. K. Das (S. Chand Publication.)
2.	Advanced Engineering Mathematics by Erwin Kreyszig (Wiley India.)
3.	Higher Engineering Mathematics, by B. V. Ramana (Tata McGraw-Hill)
4.	Mathematical Methods of Science and Engineering, by Kanti B. Dana (Cengage Learning.)
5.	Advanced Engineering Mathematics, 3e, by Jack Goldberg (Oxford University Press.)

Shivaji University, Kolhapur

Second Year (Sem – III) B. Tech. Mechanical Engineering

ME0232 : Applied Thermodynamics

Teaching Scheme			Examination Scheme	
Lectures	03 Hrs /week		**MSE**	30 Marks
Tutorials	--		**ISE**	10 Marks
Total Credits	03		**ESE**	60 Marks
			Duration of ESE	02 Hrs 30 Min

Prerequisite : Applied Physics

Course Outcomes (CO): After the successful completion of this course the student will be able

CO1	Remember the fundamental laws of thermodynamics
CO2	Understand and Solve the introductory problems on Rankine cycle.
CO3	Classify steam generators and condensers and Steam turbines.
CO4	Design the steam nozzle.
CO5	Understand and Solve problems on Steam turbines.
CO6	Understand the property of lubricants and selection of lubricants.

	Course Contents	CO	Hours
Unit 1	**Review of Laws of Thermodynamics:** Zeroth law, first law and Second law of thermodynamics, Statement of third law of thermodynamics. Corollaries of Second Law, Equivalence of Second law Simple Numerical treatment second law of Thermodynamics (Heat engine, Refrigerator and Heat Pump), Entropy, Clausis theorem, Clausis inequality, Entropy as a property of system, Entropy change in a reversible and irreversible processes, Increase of entropy principle, Calculation of entropy changes of gases,(numerical treatment should be based on single Thermodynamic process),Introduction to Availability Definition-Available Energy, Unavailable Energy, Dead State)	**CO1**	**08**
Unit 2	**Properties of Pure Substances and Vapour Power Cycles:** Properties of steam, Use of steam table and Mollier chart, Temperature Entropy Diagram Carnot cycle using steam, Limitations of Carnot cycle Rankine cycle, Representation on P-v, T-s and h-s planes, Thermal efficiency, Specific steam consumption. Work ratio, Effect of steam supply pressure and temperature, Condenser pressure on the performance. (Numerical Treatment), Reheat and regenerative steam power cycles	**CO2**	**07**
Unit 3	**Steam Condensers:** 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, Edward Air Extraction Pump Estimation of cooling water required (Numerical Treatment on Steam Condensers)	**CO3**	**06**
Unit 4	**Steam Nozzles:** Functions, Shapes, Critical pressure ratio, Maximum discharge condition, Effect of faction, 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 on nozzle without friction)	**CO4**	**06**
Unit 5	**Impulse Turbines:** Principles of operation, Classification, Impulse and reaction steam turbine, compounding of steam turbines. Flow through impulse turbine blades, Velocity diagrams, Work done, Efficiencies, End thrust, Blade friction, condition curve and reheat factors.(Numerical Treatment on Single stage impulse turbine)	**CO5**	**06**
Unit 6	**Reaction Turbines:** Comparison between impulse and reaction, Flow through impulse reaction blades, turbine Velocity diagram, and degree of reaction, Parson's reaction turbine, Governing of steam turbines. Losses in steam turbines, Performance of steam turbines. Function of diaphragm, Glands, Turbine troubles like Erosion, Corrosion, Vibration, Fouling etc. (Numerical Treatment on Single stage impulse reaction turbine)	**CO6**	**06**

Text Books

1.	"Thermal Engineering", Kumar and Vasandani, D. S . Publisher Metropolitan Book Co, Delhi, 3rd Edition.
2.	"Thermal Engineering", Mathur and Mehta, Jain Bros. Publishers,Delhi,3rd Edition.
3.	"Thermal Engineering", Ballaney P.L, Khanna Publishers, New Delhi, 27th Edition.
4.	"Engineering Thermodynamics", P.K. Nag., Tata McGraw Hill, New Delhi, 4th Edition.
5.	"Engineering Thermodynamics", D.P. Mishra, Cengage learning, 1st Edition
6.	"Principles of Engineering Thermodynamics", Moran, Shapiro, Boetnner, Wiley, 8th Edition
7.	"Engineering Thermodynamics", Gupta and Prakash , Nemichand and Sons, 2nd edition.
8.	"Thermal Engineering" ,R. K. Rajput, Laxmi Publications, 3rd Edition
9.	"Steam and Gas Turbines", R. Yadav, CPH Allahabad, 2nd Edition , 2005
10.	"Thermal Engineering", M.M Rathod, Tata McGraw Hill Education Pvt. Ltd, 1st Edition , 2010

Reference Books	
1.	“Fundamentals of Thermodynamics”, Claus Borgnakke, Sonntag R. E., John Wiley and Sons.
2.	“Thermodynamics” ,Holman, , McGraw Hill, London
3.	“Principles of Engineering Thermodynamics”, Moran, Shapiro, Boetnner, Wiley, 8th Edition.
4.	“Thermodynamics: an Engineering Approach”,Cengel and Boles, Tata McGraw-Hill, New Delhi ,3rd Edition,.
5.	“Applied Thermodynamics”, Estop Mcconkey ,Pearson Education, 5th Edition
6.	“Engineering Thermodynamics” G. Rogers Yon Mayhew, Pearson Education, 4th Edition.
7.	“Fundamentals of Thermodynamics”, R.E. Sonntag, C. Borgnakke , V. Wylen, Wiely India Pvt. Ltd, 6th Edition

Shivaji University, Kolhapur

Second Year (Sem – III) B. Tech. Mechanical Engineering

ME0233 : Metallurgy

Teaching Scheme			**Examination Scheme**	
Lectures	03 Hrs /week		**MSE**	30 Marks
Tutorials	--		**ISE**	10 Marks
Credit	03		**ESE**	60 Marks
			Duration of ESE	02 Hrs 30 Min

Pre-requisites: Applied Physics, Applied Chemistry.

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

CO1	Understand basic concept of metal structure.
CO2	Understand fundamental knowledge of Ferrous and Non Ferrous Metal.
CO3	Selection of Metals and Alloys for different application.
CO4	Understand need of Heat treatment and various heat treatment processes**.**
CO5	Understand of Mechanical Testing and Powder Metallurgy
CO6	Understand of Advance Materials

	Course Contents	**CO**	**Hours**
Unit 1	**Introduction to Materials and Phase Diagram** Metallic and Non-metallic materials and its classification (metals/alloys, polymers and composites), Crystal systems, a) Types of Dislocations; Slip Systems; Plastic Deformation by Slip b) Solid solutions and intermediate phases ,Gibbs phase rule c) Alloy formation by crystallization, Nucleation and growth, Cooling curves, Construction of equilibrium diagrams from cooling curves, Isomorphs system, Eutectic, Partial solubility, Lever arm principles.	**CO1**	**08**
Unit 2	**Engineering Materials Ferrous materials** Introduction to Fe-Fe3C equilibrium diagram, Steel, Plain carbons steel , Alloy steel a) Free cutting steels, HSLA high carbon low alloy steels, Maraging steels, Creep resisting steels, Stainless steels-different types. Tool steels- types, HSS b) Specifications based on -IS, BS, SAE, AISI Cast Irons-Classification, properties and production process	**CO2**	**06**
Unit 3	**Non-ferrous materials** a) Copper based alloys brasses Cu-Zn, Bronzes Cu-Sn, Cu-Be, and Cu-Ni. b) Aluminium based alloys Al-Cu (Duralumin)Al-Si (Modification). c) Pb-Sn (Solders and fusible alloys) d) Sn-Sb alloys (Babbits) e) Ti (Ti-6Al-4V)	**CO2**	**06**
Unit 4	**Principles of heat treatment** Transformation of austenite into Pearlite, Bainite and Martensite on cooling. TTT – Diagram and CCT -Diagrams -significance, Effect of alloying elements on TTT diagram. a) Heat treatment of steels I. Annealing –Types-Full, Partial and Sub critical annealing II. Normalizing-Purposes, Hardening and Tempering Types, III. Surface hardening -Flame and Induction IV. Chemical heat treatments for case hardening -Carburizing, Nitriding, Cyaniding, Carbonitriding, b) Heat treatment of Non-ferrous Alloys I. Annealing-Stress relief, Recrystallization and Process annealing II. Precipitation hardening -Basic requirements, Stages, Common alloys	**CO4**	**07**
Unit 5	**Principles of Mechanical Testing and Powder Metallurgy:** a) Destructive Testing methods: Tensile, Compressive, Impact, Fatigue, Creep, Hardness (Rockwell, Brinell and Vickers) b) Non- Destructive Testing: Dye Penetrant, Magnetic, Ultrasonic, Radiography, Eddy Current testing. c) Advantages, Limitations and Applications of Powder Metallurgy d) Powder manufacturing types- Mechanical, Physical, Chemical and Electro Chemical e) Mixing/ Blending. f) Compaction- types- Conventional, Isostatic, HERF, Powder rolling and extrusion g) Sintering- Types liquid stage and solid stage sintering h) Finishing operations: Sizing, Machining, Infiltration and Impregnation	**CO5**	**07**

Unit 6	**Advance Materials** Ceramics: - Ceramics, Types and applications of ceramics Polymers:- Introduction to Polymers, Classification of Polymers, Thermoplasts, Thermosets, Elastomers Composite material:-Introduction to Composite, Classification of composites, Mechanical properties of composites Bio- Materials:-Classes of materials used in medicine, and Application of materials in medicine	**CO3**	**06**

Text Books

1.	"Introduction to physical metallurgy", S.H. Avner, Mcgraw Hill Book Company Inc, Edition, 2nd, 1974.
2.	"Physical metallurgy", Vijendra Singh, Standard Publishers Delhi
3.	"Material science and engineering", W.D Callister, Wiley India Pvt. Ltd., 5th Edition.
4.	"Material science and metallurgy for engineers", V. D. Kodgire, Everest Publishers Pune, 12th Edition.
5.	"Heat Treatments Principles and Practices", T.V. Rajan / C.P. Sharma, Prentice Hall of India Pvt. Ltd, New Delhi,
6.	"Material Science and Engineering", V Raghwan., Prentice Hall of India Pvt. Ltd., New Delhi, 3rd Edition, 1995.

Reference Books

1.	"Engineering Metallurgy", R.A. Higgins, Viva Books Pvt. Ltd., New Delhi, 1st Edition1998
2.	"Engineering Metallurgy", R.A. Higgins, Viva Books Pvt. Ltd., New Delhi, 1st Edition1998
3.	"Physical Metallurgy for Engineers ", D.S. Clark, W. R. Varney, AN East West Press Pvt. Ltd. , New Delhi, 2nd Edition,1962
4.	"Heat Treatment of Metals", J L Smith and SC Bhatia , CBS Publishers and Distributors New Delhi, 1st edition, 2008.

Shivaji University, Kolhapur

Second Year (Sem –III) B. Tech. Mechanical Engineering

ME0234 : Applied Thermodynamics Lab

Laboratory Scheme:			**Examination Scheme:**	
Practical	02 Hrs/week		**ISE**	50 Marks
Total Credits	01		**ESE**	25 Marks

Pre-Requisite: Applied Physics

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

CO1	Understand working of boiler, mountings and accessories, boiler efficiency and condensers
CO2	Explain and evaluate steam generation, turbine and its compounding.
CO3	Understanding Fuel Properties
CO4	Determine properties of lubricant.

	Course Contents	**CO**
Experiment 1	Study and Demonstration of water tube and fire tube boilers.	**CO1**
Experiment 2	Study and Demonstration of boiler mountings, Accessories and steam calorimeters	**CO1**
Experiment 3	Study and Demonstration of condenser and study of cooling towers	**CO1,2**
Experiment 4	Significance and relevance of lubrication properties and systems	**CO4**
Experiment 5	Test on Grease penetrometer and dropping point apparatus	**CO4**
Experiment 6	Test on Carbon residue, Cloud and Pour point apparatus.	**CO3**
Experiment 7	Test on Red wood viscometer and Aniline point apparatus	**CO3**
Experiment 8	Determination of flash and fire point of a lubricating oil	**CO4**
Experiment 9	Study / Trial on steam power plant	**CO2**
Experiment 10	Report on industrial visit to a steam power plant	**CO2**

List of Submission:

Minimum number of Experiments :10

Shivaji University, Kolhapur

Second Year (Sem –III) B. Tech. Mechanical Engineering

ME0235 : Thermodynamics (Multi-Disciplinary Minor-01)

Teaching Scheme			Examination Scheme	
Lectures	02 Hrs/week		**MSE**	60 Marks
Tutorials	--		**ISE**	10 Marks
Total Credits	02		**ESE**	30 Marks

Prerequisite : Applied Physics

Course Outcomes (CO): After the successful completion of this course the student will be able

CO1	Remember the fundamental laws of thermodynamics
CO2	Understand and Solve the introductory problems on Rankine cycle.
CO3	Classify steam generators and condensers.
CO4	Explain the fundamental concepts, classifications, and working principles of boilers
CO5	Design the steam nozzle.
CO6	Understand and Solve problems on Steam turbines.

	Course Contents	CO	Hrs
Unit 1	**Review of Laws of Thermodynamics:** Zeroth law, first law and Second law of thermodynamics, Statement of third law of thermodynamics. Corollaries of Second Law, Equivalence of Second law Simple Numerical treatment second law of Thermodynamics (Heat engine, Refrigerator and Heat Pump) , (Numerical Treatment).	**CO1**	**05**
Unit 2	**Properties of Pure Substances and Vapour Power Cycles:** Properties of steam, Use of steam table and Mollier chart, Temperature Entropy Diagram Carnot cycle using steam, Limitations of Carnot cycle Rankine cycle, Representation on P-v, T-s and h-s planes, Thermal efficiency, Specific steam consumption.	**CO2**	**05**
Unit 3	**Steam Condensers:** 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,	**CO3**	**04**
Unit 4	**Boilers, Mountings and Accessories** Introduction to Boilers, Definition and classification of boilers, Basic concepts and working principles, Comparison of fire-tube(Cochran Boiler, Lancashire Boiler) and water-tube boilers(Babcock and Wilcox Boiler, LaMont Boiler), Advantages and disadvantages of different types of boilers, Applications of boilers in industries, Boiler Mountings, Boiler Accessories	**CO4**	**05**
Unit 5	**Steam Nozzles:** Functions, Shapes, Critical pressure ratio, Maximum discharge condition, Effect of faction, Nozzle efficiency, Velocity coefficient, Coefficient of discharge, Supersaturated flow	**CO5**	**04**
Unit 6	**Steam Turbines:** Principles of operation, Classification, Impulse and reaction steam turbine, compounding of steam turbines. Flow through impulse turbine blades, Velocity diagrams, Work done, Efficiencies, Comparison between impulse and reaction	**CO6**	**05**

Text Books

1.	"Thermal Engineering", Kumar and Vasandani, D. S . Publisher Metropolitan Book Co, Delhi, 3rd Edition.
2.	"Thermal Engineering", Mathur and Mehta, Jain Bros. Publishers, Delhi,3rd Edition.
3.	"Thermal Engineering", Ballaney P.L, Khanna Publishers, New Delhi, 27th Edition.
4.	"Engineering Thermodynamics" ,P. K. Nag., Tata McGraw Hill, New Delhi, 4th Edition.
5.	"Engineering Thermodynamics", D. P. Mishra, Cengage learning, 1st Edition
6.	"Principles of Engineering Thermodynamics", Moran, Shapiro, Boetnner, Wiley, 8th Edition
7.	"Engineering Thermodynamics", Gupta and Prakash, Nemichand and Sons, 2nd edition.
8.	"Thermal Engineering", R. K. Rajput, Laxmi Publications, 3rd Edition
9.	"Steam and Gas Turbines" ,R. Yadav, CPH Allahabad, 2nd Edition , 2005
10.	"Thermal Engineering", M.M. Rathod, Tata McGraw Hill Education Pvt. Ltd, 1st Edition , 2010

Reference Books

01.	"Fundamentals of Thermodynamics", Claus Borgnakke, Sonntag R. E., John Wiley and Sons.
02.	"Thermodynamics", Holman, , McGraw Hill, London
03.	"Principles of Engineering Thermodynamics", Moran, Shapiro, Boetnner, Wiley, 8th Edition.
04.	"Thermodynamics: an Engineering Approach",Cengel and Boles, Tata McGraw-Hill, New Delhi ,3rd Edition,.
05.	"Applied Themodynamics", Estop Mcconkey ,Pearson Education, 5th Edition
06.	"Engineering Thermodynamics" G. Rogers Yon Mayhew, Pearson Education, 4th Edition.
07.	"Fundamentals of Thermodynamics", R. E. Sonntag,C. Borgnakke, V. Wylen, Wiely India Pvt. Ltd, 6th Edition

Shivaji University, Kolhapur

Second Year (Sem –III) B. Tech. Mechanical Engineering

ME0236 : Marketing Management (Open Elective -01)

Teaching Scheme			Examination Scheme	
Lectures	03 Hrs/week		**MSE**	60 Marks
Tutorials	--		**ISE**	10 Marks
Total Credits	03		**ESE**	30 Marks

Prerequisite : Business Communication

Course Outcomes (CO): After the successful completion of this course the student will be able

CO1	Understand the fundamental concepts of marketing and its role in business.
CO2	Analyze consumer behavior and market segmentation techniques.
CO3	Apply marketing mix strategies effectively in various business scenarios.
CO4	Explore digital marketing trends and their impact on business.
CO5	Understand emerging trends and ethical considerations in marketing.
CO6	Analyze market trends and decision-making processes in marketing management.

	Course Contents	CO	Hours
Unit 1	**Introduction to Marketing** Definition, Scope, and Importance of Marketing, Evolution of Marketing: Production, Product, Selling, Marketing & Societal Concepts, Difference Between Marketing & Selling, Role of Marketing in Business & Society, Recent Trends in Marketing: Digital Marketing, Green Marketing, Relationship Marketing.	**CO1**	**07**
Unit 2	**Marketing Environment & Market Segmentation** Internal & External Marketing Environment, PESTLE Analysis (Political, Economic, Social, Technological, Legal, and Environmental Factors), Market Segmentation: Meaning, Bases (Demographic, Geographic, Psychographic, Behavioral), Target Market Selection & Positioning Strategies.	**CO2**	**07**
Unit 3	**Consumer Behavior & Buying Decision Process** Introduction to Consumer Behavior & Its Importance, Factors Influencing Consumer Behavior (Cultural, Social, Personal & Psychological), Buying Decision Process, Need Recognition, Information Search, Evaluation of Alternatives, Purchase Decision, Post-Purchase Behavior, Organizational vs. Individual Consumer Behavior.	**CO3**	**06**
Unit 4	**Marketing Mix – 4Ps & Extended 7Ps** Product, Product Classification & Levels, Product Life Cycle (PLC) & Strategies, Branding, Packaging & Labeling, Price, Pricing Objectives & Factors Affecting Pricing, Pricing Strategies (Penetration, Skimming, Value-based, Competition-based), Place (Distribution), Types of Distribution Channels (Direct & Indirect),Channel Management & Selection, Retailing & Wholesaling Trends, Promotion-Elements of Promotion Mix (Advertising, Personal Selling, Sales Promotion, PR, Direct Marketing),Integrated Marketing Communication (IMC), Extended 7Ps (for Services Marketing),People, Process, and Physical Evidence	**CO4**	**08**
Unit 5	**Digital & Social Media Marketing** Overview of Digital Marketing, Components: SEO, SEM, PPC, Social Media Marketing (Facebook, Instagram, LinkedIn, Twitter),Email & Content Marketing, Online Consumer Behavior & Customer Engagement Strategies, Ethical Considerations in Digital Marketing.	**CO5**	**07**
Unit 6	**Emerging Trends in Marketing** Green Marketing & Sustainable Marketing Practices**,** Artificial Intelligence (AI) in Marketing**,** Customer Relationship Management (CRM) & Personalization**,** Rural & Global Marketing Strategies**,** Omni-channel Marketing & E-commerce Trends	**CO6**	**06**

Text Books

1.	"Marketing Management" – Philip Kotler & Kevin Lane Keller
2.	V.S. Ramaswamy & S. Namakumari – Marketing Management (McGraw Hill)

Reference Books

1.	V.S. Ramaswamy & S. Namakumari – Marketing Management (McGraw Hill)
2.	Philip Kotler & Gary Armstrong – Principles of Marketing (Pearson)
3.	Michael J. Etzel, Bruce J. Walker, William J. Stanton – Marketing (McGraw Hill)
4.	Leon G. Schiffman, Leslie Lazar Kanuk, S. Ramesh Kumar – Consumer Behavior (Pearson)
5.	David L. Mothersbaugh & Del I. Hawkins – Consumer Behavior: Building Marketing Strategy (McGraw Hill)
6.	E. Jerome McCarthy – Basic Marketing: A Managerial Approach (McGraw Hill)
7.	Dave Chaffey & Fiona Ellis-Chadwick – Digital Marketing: Strategy, Implementation, and Practice (Pearson)
8.	Damian Ryan – Understanding Digital Marketing (Kogan Page)

Shivaji University, Kolhapur

Second Year (Sem –III) B. Tech. Mechanical Engineering

ME0237 : Universal Human Values

Teaching Scheme			Examination Scheme	
Lectures	02 Hrs/week		**MSE**	--
Tutorials	--		**ISE**	50 Marks
Total Credits	02		**ESE**	--

Prerequisite: Yoga, Professional Communication, Indian Knowledge System.

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

CO1	Describe the concept of value education and its significance in shaping personal and professional life.
CO2	Analyze the relationship between fundamental human aspirations such as happiness and prosperity and their influence on personal development.
CO3	Evaluate practices that promote harmony between the self and the body for holistic well-being.
CO4	Demonstrate ethical values and effective communication in interpersonal and professional relationships.
CO5	Assess the interconnection between individuals, society, universal order, and nature to promote sustainable living.
CO6	Develop ethical decision-making frameworks for a smooth transition from academic to professional life.

	Course Contents	CO	Hours
Unit 1	**Introduction to Value Education:** Right understanding, relationship, and physical facility (holistic development and the role of education), understanding value education, self-exploration as the process for value Education.	**CO1**	**03**
Unit 2	**Fundamental Human Aspirations:** Continuous happiness and prosperity – the basic human aspirations, happiness and prosperity – current scenario, method to fulfill the basic human aspirations.	**CO2**	**05**
Unit 3	**Harmony between Self and Body:** Understanding human being as the co-existence of the self and the body. Distinguishing between the needs of the self and the body, the body as an instrument of the self, Understanding harmony in the self, harmony of the self with the body.	**CO3**	**05**
Unit 4	**Values in Human Interaction:** Harmony in the Family – the Basic Unit of Human Interaction, 'Trust' – the Foundational Value in Relationship, 'Respect' – as the Right Evaluation, Other Feelings, Justice in Human-to-Human Relationship	**CO4**	**05**
Unit 5	**Society, Universal Order, and Nature:** Understanding Harmony in the Society, Vision for the Universal Human Order and Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfillment among the Four Orders of Nature, Realizing Existence as Co-existence at all levels.	**CO5**	**04**
Unit 6	**Ethical Conduct and Professional Transition:** Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics, Holistic Technologies, Production Systems and Management Models.	**CO6**	**04**

Text Books

1.	R. R. Gaur, R. Asthana, G. P. Bagaria, "The Textbook A Foundation Course in Human Values and Professional Ethics", 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034- 47-1
2.	R. R. Gaur, R. Asthana, G. P. Bagaria, "The Teacher's Manual Teachers: Manual for A Foundation Course in Human Values and Professional Ethics", 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2.

Reference Books

1.	D R Kiran , "Professional ethics and human values", McGraw Hill Education (India) Private Limited P-24, 2nd edition, 2014, Green Park Extension, New Delhi 110 016
2.	V. Jayakumar, "Professional ethics and Human values in Engineering"
3.	R.S. Naagarazan, "A Textbook on Professional Ethics and Human Values", New Age International Pvt. Ltd Publishers, Year: 2007 ISBN: 8122419380,9788122419382,9788122423013
4.	Rudolf Steiner, "Human Values in Education (The Foundations of Waldorf Education, 20)", Anthroposophic Press, Year: 2004, ISBN: 0880105445,9780880105446

Shivaji University, Kolhapur

Second Year (Sem –III) B. Tech. Mechanical Engineering

ME0238:Machine Drawing & Computer Aided Drafting Lab

Laboratory Scheme:			**Examination Scheme:**	
Practical	02 Hrs/week		**ISE**	50 Marks
Total Credits	01		**ESE**	25 Marks
			TOTAL:	**75** Marks

Pre-Requisite: Engineering Graphics

Course Outcomes (CO): After the successful completion of this course the student will be able

CO1	Use BIS conventions in part drawings and assembly machine drawing
CO2	Understand & Draw function of permanent & temporary joints and various machine components
CO3	Interpret given production drawings having surface roughness and tolerances
CO4	Draw assembly drawing from given detail drawing and vice versa with tolerances and fits
CO5	Understand & can draw the simple machine parts by using software.

Course Contents		**CO**
Experiment 1	Study and draw BIS conventions.	**CO1**
Experiment 2	Study and draw temporary joints.	**CO2**
Experiment 3	Study and draw permanent joints.	**CO2**
Experiment 4	Study and draw sketching of various machine components (e.g.-keys, couplings).	**CO2**
Experiment 5	Study and draw sheet based on limits, fits and tolerances & surface roughness symbols.	**CO3**
Experiment 6	Study and draw sheet on Production drawing.	**CO3**
Experiment 7	Study and draw assembly drawing from given details drawing 1	**CO4**
Experiment 8	Study and draw assembly drawing from given details drawing 2	**CO4**
Experiment 9	Study and draw assembly drawing from given details drawing 3	**CO4**
Experiment 10	Introduction to drawing software , basic sketching commands and Navigational commands.	**CO5**
Experiment 11	Starting a new drawing sheet. Sheet sizes. Naming a drawing, Drawing units, grid and snap.	**CO5**

List of Submission:

Minimum number of Experiments :08

Shivaji University, Kolhapur

Second Year (Sem – III) B. Tech. Mechanical Engineering

ME0239 : Economics for Engineers

Teaching Scheme			Examination Scheme	
Lectures	02 Hrs./week		**MSE**	-
Tutorials	00 Hrs. /week		**ISE**	50 Marks
Total Credits	02		**ESE**	-

Prerequisite : Basic knowledge of Mathematics and Economics

Course Outcomes (CO): After the successful completion of this course the student will be able

CO1	Explain the role of information systems in business management and decision-making processes.
CO2	Illustrate key economic concepts such as demand, supply, scarcity, and opportunity cost with real-life examples.
CO3	Differentiate between microeconomic and macroeconomic principles and analyze their impact on business and society.
CO4	Evaluate the influence of market structures, industrial policies, and competition on industrial growth and performance.
CO5	Construct and interpret cash flow statements to assess financial health and business performance.
CO6	Develop effective personal financial management strategies, including budgeting, saving, and investment planning.

	Course Contents	CO	Hours
Unit 1	**Basic of Information system and management:** Role of Information Systems in Organizations, The Information System Manager and his challenges, Concepts of Information Systems, Information Systems and Management Strategy Case Studies - Information Systems in the Indian Railways, Information Systems in an ecommerce Organization.	**CO1**	**05**
Unit 2	**Basic Concepts of Economics:** Definitions, Overview of Micro and Macro Economics, Explanation of theories of demand, supply and market equilibrium and Economics Basics – Cost, efficiency and scarcity, Opportunity Cost	**CO2**	**05**
Unit 3	**Micro and Macro Economics:** Micro economics: Differences and Comparison, Theories of Utility and Consumers Choice, Competition and Market Structures, Macro Economics: Aggregate Demand and Supply, Economic Growth and Business Cycles, The role of the Nation in economic activity	**CO3**	**05**
Unit 4	**Industrial Economics:** Behavior of firms: Strategies with regard to entry, pricing, advertising, and R & D and innovation. The development of Firms and Market and Industrial Structure: Stochastic models of firm growth, and market structure.	**CO4**	**05**
Unit 5	**Cash Flow:** Accounting for Depreciation and Income Taxes, Project Cash-Flow Analysis, Understanding Financial Statements, Case Studies - cash flow analysis done in start-up Companies.	**CO5**	**04**
Unit 6	**Personal Economics:** Compound Interest and Credit, Financial Markets, Human Capital and Insurance, Money Management/ Budgeting, Risk and Return, Saving and Investing, Role of IT in financial market, IT economics and data mining in stock market.	**CO6**	**04**

Text Books

1.	Rahul De, "MIS: Management Information Systems in Business, Government and Society", Wiley India, ISBN: 13: 978-81-265-2019-0.
2.	Baumol, William J., "Economic Theory and Operations Analysis", Prentice Hall India Ltd.,4th Edition, 1985.
3.	Varian, Hal, "Intermediate Microeconomics: A Modern Approach", Norton, 5th Edition, 1999.
4.	Hay, Donald A., Derek J. Morris, "Industrial Economics and Organization: Theory and Evidence", 2nd Edition (Oxford: Oxford University Press), 1991.
5.	Panneer Selvam, R, "Engineering Economics", Prentice Hall of India Ltd, New Delhi, 2001.
6.	Rachel Siegel, Carol Yacht, "Personal finance", Publisher Saylor Foundation ISBN 13: 9780982361863,2009.

Reference Books

1.	C. Laudon Kenneth and P. Laudon Jane Management Information System 15 Th Edition 2016.
2.	R.J. Gordon, "Macroeconomics", Little Brown& Co. Boston, 4th Edition, 1987.
3.	Donald G. Newman, Jerome P. Lavelle, "Engineering Economics and analysis" Engg. Press, Texas, 2010.

Shivaji University, Kolhapur

Second Year (Sem III) B. Tech. Mechanical Engineering

ME02310 : Marketing Management (Practical Open Elective -01)

Laboratory Scheme:			**Examination Scheme:**	
Practical	2 Hrs/week		**ISE**	25 Marks
Total Credits	1		**ESE**	25 Marks

Pre-Requisite: Business Communication

Course Outcomes (CO): After the successful completion of this course the student will be able

CO1	Analyze various market segmentation strategies and identify the most effective targeting approaches for different consumer groups
CO2	Evaluate the stages of the product life cycle and develop strategic recommendations for optimizing marketing efforts at each stage
CO3	Conduct a SWOT analysis to assess a brand's strengths, weaknesses, opportunities, and threats, leading to informed marketing decisions.
CO4	Design and implement a marketing survey, analyze the collected data, and derive actionable insights for decision-making.
CO5	Develop a comprehensive marketing mix strategy incorporating product, price, place, and promotion for a new product launch.
CO6	Design and evaluate a digital marketing campaign utilizing online channels to enhance brand awareness and customer engagement.

	Course Contents	**CO**
Experiment 1	Market Segmentation and Targeting	**CO1**
Experiment 2	Product Life Cycle and Strategy Analysis	**CO2**
Experiment 3	SWOT Analysis for a Brand	**CO3**
Experiment 4	Marketing Research - Survey Design and Data Analysis	**CO4**
Experiment 5	Marketing Mix (4Ps) Strategy for a New Product	**CO5**
Experiment 6	Digital Marketing Campaign Design	**CO6**
Experiment 7	Advertising Effectiveness Analysis	**CO4**
Experiment 8	Digital Marketing and SEO Experiment	**CO6**
Experiment 9	Consumer Behavior Analysis	**CO1**
Experiment 10	Brand Positioning Strategy	**CO5**
Experiment 11	**Social Media Marketing Strategy**	**CO5**
Experiment 12	Sales Promotion Techniques	**CO5**

List of Submission: Minimum 10 Experiments should be completed

Text Books

1.	"Marketing Management" – Philip Kotler & Kevin Lane Keller
2.	V.S. Ramaswamy & S. Namakumari – Marketing Management (McGraw Hill)

Reference Books

1.	V.S. Ramaswamy & S. Namakumari – Marketing Management (McGraw Hill)
2.	Philip Kotler & Gary Armstrong – Principles of Marketing (Pearson)
3.	Michael J. Etzel, Bruce J. Walker, William J. Stanton – Marketing (McGraw Hill)
4.	Leon G. Schiffman, Leslie Lazar Kanuk, S. Ramesh Kumar – Consumer Behavior (Pearson)
5.	David L. Mothersbaugh & Del I. Hawkins – Consumer Behavior: Building Marketing Strategy (McGraw Hill)
6.	E. Jerome McCarthy – Basic Marketing: A Managerial Approach (McGraw Hill)
7.	Dave Chaffey & Fiona Ellis-Chadwick – Digital Marketing: Strategy, Implementation, and Practice (Pearson)
8.	Damian Ryan – Understanding Digital Marketing (Kogan Page)

SECOND YEAR (B. Tech) SEM. IV

Shivaji University, Kolhapur

Second Year (Sem. – IV) B. Tech. Mechanical Engineering

ME0241: Analysis of Mechanical Elements

Teaching Scheme			Examination Scheme	
Lectures	3 Hrs /week		**MSE**	30 Marks
Tutorials	-		**ISE**	10 Marks
Total Credits	3		**ESE**	60 Marks

Prerequisite : Applied Mechanics

Course Outcomes (CO): After the successful completion of this course the student will be able

CO1	Apply concepts of analysis of mechanical elements to obtain solution to various types of loading
CO2	Compute plane stress, principal stress .maximum shear stress and their orientations using Analytical method and Mohr's circle.
CO3	Draw shear force and bending moment diagrams for simple beams subjected to various loads and support conditions
CO4	Compute and analyze bending and shear stresses in mechanical components
CO5	Analyze the effect of deflection in beams
CO6	Analyze shafts for torsion & evaluate buckling in beams subject to various types of loading

	Course Contents	CO	Hours
Unit 1	**Simple Stresses and Strains** Concept of stress - tension, compression and shear stresses, Factor of safety, Working stress, Hooke's law, Poisson's ratio, elastic constants and their relations. Strain- linear, volumetric, and shear strains. Thermal Stresses	**CO1**	**06**
Unit 2	**Principal Stresses and Strains** Introduction, state of stress at a point, General two dimensional stress system, Principal stresses and principal planes. Mohr's circle of stresses. Theories of failure (Maximum Principle stress, Maximum shear stress and Maximum Distortion Energy)	**CO2**	**08**
Unit 3	**Shear Force and Bending Moment in Beams** Beams and types, Concept and definition of shear force and bending moment in determinate beams (Simply supported, cantilever and overhanging) due to concentrated, UDL, UVL and Couple.	**CO3**	**06**
Unit 4	**Stresses in Beams** Bending of beams, bending stress distribution and neutral axis, Design of various commonly used sections such rectangular and circular sections, L, I and T sections. Shear stress distribution.	**CO4**	**06**
Unit 5	**Deflection of Beams** Definition of slope, Deflection and curvature, Derivation of moment- curvature equation. Double integration method and Macaulay's method: Slope and deflection for standard loading cases and for determinate prismatic beams subjected to point loads, UDL, UVL and couple.	**CO5**	**06**
Unit 6	**Torsion of shaft and Columns** **Torsion:** Introduction to Torsion, Basic assumptions, Torsion formula, Stresses and deformation in circular and hollow shafts, **Column:** Euler's formula for different end connections, Concept of equivalent length, Eccentric loading, Rankine formula.	**CO6**	**08**

Text Books

1.	Strength of Materials (Mechanics Of Solids)- R.K. Rajput- 4th edition- S. Chand
2.	Strength of Materials- S.S. Bhavikatti- 4th edition - Vikas Pub.
3.	Strength of Materials- S.S. Rattan- 3rd edition - McGraw Hill Education
4.	Strength of Materials- U. C. Jindal- Pearson
5.	Mechanics Of Materials- Barry J. Goodno, James M. Gere.- 7th edition- Cengage

Reference Books

01.	Strength of Materials- S. Ramamrutham- Dhanpat Rai Publication.
02.	Mechanics Of Materials- Beer, Johnston, DeWolf, and Mazurek's – 6th edition- McGraw Hill
03.	Mechanics Of Materials- R. C. Hibbeler- 7th edition- Pearson
04.	Advanced Mechanics of Materials- Boresi & Schmidt- 6th edition- Wiley

Shivaji University, Kolhapur

Second Year (Sem – IV) B. Tech. Mechanical Engineering

ME0242: Kinematics and Theory of Machines

Teaching Scheme			Examination Scheme	
Lectures	3 Hrs/week		**MSE**	30 Marks
Tutorials	--		**ISE**	10 Marks
Total Credits	3		**ESE**	60 Marks

Prerequisite: Applied Physics, Engineering Mechanics

Course Outcomes (CO): After the successful completion of this course the student will be able

CO1	Identify the nature of kinematic pair, chains and Mechanism.
CO2	Analyze kinematic theories of mechanism.
CO3	Design cam with follower for different applications
CO4	Identify the various types of gears.
CO5	Select a gear drive for practical purpose**.**
CO6	Understand the importance of balancing and implications of computed results in dynamics

	Course Contents	CO	Hours
Unit 1	**Basic Concept of Mechanisms** Links, kinematic pair (lower and higher), Kinematic chain, Mechanism, inversion, Types of constraints, Grubbler's criterion, Inversions of slider crank chain, Double slider crank chain, Four bar, Steering gear mechanisms, Hooke's joint (only theoretical treatment).	**CO1**	**04**
Unit 2	**Velocity and Acceleration in Mechanisms** 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.	**CO2**	**09**
Unit 3	**Cams and follower** Types of cams and followers, Profiles of cams for specified motion of different followers, Spring load on the follower, Jumping of follower.	**CO3**	**07**
Unit 4	**Toothed Gearing** Geometry of motion, Gear geometry, Types of gear profile- Involute & cycloidal, Theory of Spur gear, Interference in Involute tooth gears and methods for its prevention, Path of contact, Contact ratio.	**CO4**	**06**
Unit 5	**Gear Trains** Types of Gear trains - Simple, Compound, Reverted, Epicyclic gear train, Tabular method for finding the speeds of elements in Epicyclic gear train, Torque in Epicyclic gear train, Differential gear box.	**CO5**	**07**
Unit 6	**Balancing** Static and Dynamic balancing of rotary masses. Number of masses rotating in single plane and different planes.	**CO6**	**07**

Text Books

1.	Theory of Machines by Rattan S.S. (Tata McGraw Hill)
2.	Theory of Machines by Sadhu Singh ((Pearson, Edition 3rd)
3.	Mechanism and Machine Theory by A.G. Ambekar-PHI
4.	Theory of Machines by Dr. V.P. Singh, Dhanpat Rai Publications
5.	"Theory of Machines and Mechanism", G.S. Rao and R.V. Dukipatti, "New Age Int. Publications Ltd., New Delhi.

Reference Books

1.	Theory of Machines & Mechanisms by Shigley (Tata McGraw Hill)
2.	Theory of machines by Thomas Beven (Pearson, Edition 3rd)
3.	Machines & Mechanisms: Applied Kinematic Analysis by David H. Myszka Pearson; 4th edition
4.	Kinematics, Dynamics and Design of Machinery by Waldron, Wiley India Publi.

Shivaji University, Kolhapur

Second Year (Sem – IV) B. Tech. Mechanical Engineering

ME0243: Machine Tools and Processes

Teaching Scheme			Examination Scheme	
Lectures	03 Hrs/week		**MSE**	30 Marks
Tutorials	--		**ISE**	10 Marks
Total Credits	03		**ESE**	60 Marks
			Duration of ESE	02 Hrs 30 Min

Prerequisite : Basic Mechanical Engineering

Course Outcomes (CO): After the successful completion of this course the student will be able

CO1	Identify various kinds of manufacturing processes.
CO2	Describe construction and working of basic machine tools.
CO3	Demonstrate their understanding of plastic processing, injection moulding, extrusion and thermoforming.
CO4	Analyze the concept, mechanism of material removal with respect different processes
CO5	In position to appreciate the merits of non-traditional machining and its applications in industries.

	Course Contents	CO	Hours
Unit 1	**Casting Processes** Importance of casting as manufacturing process, advantages and limitations of casting processes, casting defects, Components of gating system, functions and importance of runners and risers, Introduction to permanent mould casting process such as continuous casting, Gravity die casting, pressure die casting, centrifugal casting, Moulding types such as Green sand moulding, Shell moulding,CO2moulding, investment casting	**CO1**	**07**
Unit 2	**Forming Processes:** Rolling: Introduction, Hot and cold rolling, Rolling Mill Classification, Defects in rolling Forging: Introduction, Forging Machines ,Open and Closed die Forging, Extrusion: Introduction, Direct, Indirect, Tube, Impact and Hydraulic Extrusion Drawing: Introduction and Types of Wire, rod and pipe drawing	**CO1**	**07**
Unit 3	**Plastic Shaping** Thermosetting and thermoplastic materials, their properties and applications, Introduction to blow moulding, injection moulding, extrusion, calendaring and thermo forming.	**CO3**	**06**
Unit 4	**Machine Tools for Metal Cutting I:** Introduction, Working principle, types, specifications, principle parts, accessories, attachments, and various lathe operations, Turret indexing mechanism, bar feeding mechanism, Comparison with center lathe. Construction and working of radial drilling machine, Introduction to boring machines, Types of boring machine	**CO2, CO4**	**07**
Unit 5	**Machine Tools for Metal Cutting II:** Construction & working of shaper and Planer machine, Comparison between planer and shaper machine. Types- Horizontal, Vertical milling machines, Gear finishing processes ,Gear shaping, Gear Hobbing,	**CO2, CO4**	**06**
Unit 6	**Nonconventional Machining** Introduction to Abrasive Jet Machining, Electrical Discharge machining, Electro- Chemical machining, Laser beam machining, Ultrasonic machining, Water jet machining.	**CO5**	**06**

Text Books

1.	"Manufacturing Technology- Foundry, Forming and Welding, Vol. I", P. N. Rao, Tata McGraw-Hill, New Delhi,3rd edition, 2009.
2.	"Principles of Foundry Technology", P.L. Jain, Tata McGraw-Hill, NewDelhi, 2nd Edition
3.	"A Textbook of Production Technology (Manufacturing Processes)", P.C. Sharma, S.Chand and Company Pvt. Ltd, New Delhi.7thEdition,2010.
4.	"Foundry technology", O. P. Khanna, Dhanapat Rai Publications Pvt.Ltd, New Delhi.17th Edition, 2013.
5.	"Workshop Technology vol. II", B.S. Raghuvanshi, Dhanapat Rai Publications Pvt.Ltd, New Delhi.10th Edition, 2000
6.	"Workshop Technology vol. II", W. A. J. Chapman, Viva Books Pvt.Ltd,NewDelhi,1stEdition,2001
7.	"Elements of Workshop Technology vol. II", S.K.Hajra Choudhury and A.K. Hajra Choudhury , Media promoters and Publishers Pvt.Ltd,NewDelhi,13thEdition,2012.
8.	"Production technology", R. K. Jain, Khanna Publishers, Delhi, 15th Edition,2000
9.	"A Textbook of Manufacturing Technology (Manufacturing Processes)", R.K. Rajput, Laxmi Publications Pvt.Ltd, New Delhi. Edition,2007

Reference Books

1.	"Principles of metal casting", Haineand Rosenthal, Tata McGraw-Hill Book, Company. New Delhi.
2.	ASTM Volumes on Welding, casting, forming and material selection
3.	ASM Handbook," Volume- 15, 1988, Casting.
4.	"Workshop Technology", W.A.J.Chapman, CBS Publishing and Distributors, N.DelhiVol.I [ISBN-13:9788123904016]2001, Vol.II [9788123904115] 2007 and Vol. II [9788123904122] 1995
5.	"Machine Tools and Manufacturing Technology" , Steve F. Krar, Mario Rapisarda,Albert F. Check.

Shivaji University, Kolhapur

Second Year (Sem – IV) B. Tech. Mechanical Engineering

MD0244 : Theory of Machines (Multi-Disciplinary Minor-02)

Teaching Scheme			Examination Scheme	
Lectures	02 Hrs/week		**MSE**	60 Marks
Tutorials	--		**ISE**	10 Marks
Total Credits	02		**ESE**	30 Marks

Prerequisite : Applied Physics, Engineering Mechanics

Course Outcomes (CO): After the successful completion of this course the student will be able

CO1	Understand the basic principles of mechanisms and the classification of different types of machines
CO2	Analyze the kinematics of planar mechanisms including displacement, velocity, and acceleration analysis.
CO3	Apply the principles of force analysis to determine forces in machines using graphical and analytical methods
CO4	Understand the dynamics of machines and the impact of vibrations on the performance of machines
CO5	Study and analyze cam profiles, gears, and gear trains in different mechanical systems.
CO6	Design and analyze basic mechanical linkages and systems using principles of mechanism and motion analysis.

	Course Contents	CO	Hours
Unit 1	**Introduction to Mechanisms and Machines** Definition of mechanism, machine, and structure. Classification of machines (based on the number of degrees of freedom), Classification of linkages (single, double, and multi-degree freedom)., Kinematic chain and its applications.	**CO1**	05
Unit 2	**Kinematics of Mechanisms** Types of motion in mechanisms, Kinematic analysis of planar mechanisms, Velocity and acceleration analysis (Graphical methods, Instantaneous center of rotation)., Application of Kutzbach's criterion and Gruebler's criterion.	**CO2**	**05**
Unit 3	**Friction:** Introduction to friction, Friction in pivot bearings, Inclined plane theory, Friction in screws	**CO3**	**04**
Unit 4	**Cams:** Types of cams and followers, Profiles of cams for specified motion of different followers, Spring load on the follower, Jumping of follower.	**CO4**	**05**
Unit 5	**Gear Mechanisms and Gear Trains** Introduction to gears and gear trains. Types of gears: Spur, Helical, Bevel, and Worm gears. Gear ratio and velocity ratio. Simple and compound gear trains. Applications of gear mechanisms in machines.	**CO5**	**05**
Unit 6	**Introduction to Vibrations** Introduction to mechanical vibrations, Types Of Vibrations, Free and forced vibrations of single degree systems. Damped and Undamped Vibration	**CO6**	**04**

Text Books

1.	"Theory of Machines", Ratan S.S, Tata McGraw Hill New Delhi, 2nd Edition.
2.	"Fundamentals of Thermodynamics", Claus Borgnakke, Sonntag R. E., John Wiley and Sons.
3.	"Theory of Machines", P.L. Ballany, Khanna Publication, New Delhi, 2nd Edition.
4.	"Theory of Machines", V.P. Singh, DhanpatRai and Sons.
5.	"Theory of Machines", Dr. R.K. Bansal, Laxmi Publication.
6.	"Theory of Machines", Thomas Bevan, CBS Publishers, New Delhi.
7.	"Theory of Machines", Shah and Jadhawani, Dhanpat Raiand Sons

Reference Books

1.	"Theory of Machines and Mechanism", Shigley, McGraw Hill, New York
2.	"Theory of Machines", Abdullah Shariff, McGraw Hill, New Delhi.

Shivaji University, Kolhapur

Second Year (Sem – IV) B. Tech. Mechanical Engineering

ME0245 : Entrepreneurship Development (Open Elective-02)

Teaching Scheme			Examination Scheme	
Lectures	02 Hrs/week		**MSE**	60 Marks
Tutorials	--		**ISE**	10 Marks
Total Credits	02		**ESE**	30 Marks

Prerequisite : Marketing Management , Business Communication

Course Outcomes (CO): After the successful completion of this course the student will be able

CO1	Understand the nature, importance, and evolution of entrepreneurship, along with key theories and types of entrepreneurs.
CO2	Analyze the role of entrepreneurship in economic development and assess the challenges and risks faced by entrepreneurs
CO3	Conduct market research, generate innovative business ideas, and perform feasibility studies for potential ventures.
CO4	Develop a comprehensive business plan incorporating financial, operational, and marketing strategies.
CO5	Evaluate financial sources, analyze financial statements, and apply forecasting techniques to assess business viability.
CO6	Implement branding, digital marketing, and scaling-up strategies while examining leadership and exit strategies for startups.

	Course Contents	CO	Hours
Unit 1	**Introduction to Entrepreneurship** Definition, Nature, and Importance of Entrepreneurship, Evolution and Theories of Entrepreneurship, Characteristics and Skills of an Entrepreneur, Types of Entrepreneurs (Innovative, Imitative, Social, Women Entrepreneurs, etc.),Role of Entrepreneurship in Economic Development, Challenges and Risks in Entrepreneurship.	**CO1**	04
Unit 2	**Entrepreneurial Ecosystem & Business Opportunities** The Entrepreneurial Ecosystem: Stakeholders and Institutional Support**,** Identifying Business Opportunities and Market Research**,** Idea Generation and Feasibility Study**,** Innovation and Creativity in Entrepreneurship**,** Role of Incubators, Accelerators, and Networking**,** Case Studies of Successful Entrepreneurs	**CO2**	**04**
Unit 3	**Business Planning and Project Management** Concept and Importance of a Business Plan**,** Elements of a Business Plan (Executive Summary, Market Analysis, Product/Service Description, Operations Plan, Financial Plan)**,**Business Model Canvas (BMC)**,**Project Identification, Selection, and Appraisal**,** Risk Analysis and Mitigation Strategies**,** Pitching to Investors	**CO3**	**05**
Unit 4	**Financial Management & Funding Sources** Financial Planning for Startup, Sources of Finance for Entrepreneurs (Angel Investors, Venture Capital, Bank Loans, Government Grants)**,**Working Capital and Cash Flow Management**,** Revenue Models and Cost Structures**,** Basics of Financial Statements (Balance Sheet, Income Statement, Cash Flow Statement)**,**Financial Forecasting and Break-even Analysis	**CO4**	**04**
Unit 5	**Startup Management & Growth Strategies** Legal Framework for Startups (Company Registration, Taxation, Intellectual Property Rights), Marketing Strategies for Startups (Branding, Digital Marketing, Customer Engagement), Scaling Up: Growth Strategies and Expansion Planning, Leadership and Team Management in Startups, Exit Strategies (Mergers & Acquisitions, IPOs, Family Succession),	**CO5**	**04**
Unit 6	**Government Policies & Emerging Trends in Entrepreneurship** Government Schemes and Support for Entrepreneurs (Startup India, MSME Schemes, SIDBI, NABARD), Social Entrepreneurship and Sustainable Business Models, Women and Rural Entrepreneurship Development, Role of Technology and AI in Entrepreneurship, Future Trends: Gig Economy, E-commerce, Green & Sustainable Entrepreneurship.	**CO6**	**05**

Text Books

1.	"Entrepreneurship Development" – S.S. Khanka
2.	"Entrepreneurial Development" – Vasant Desai

Reference Books

1.	Hisrich, R. D., Peters, M. P., & Shepherd, D. A. – Entrepreneurship (McGraw Hill)
2.	Kurakto, D. F. – Entrepreneurship: Theory, Process, and Practice (Cengage Learning)
3.	Timmons, J. A., & Spinelli, S. – New Venture Creation: Entrepreneurship for the 21st Century (McGraw Hill)

4.	Vasant Desai – Entrepreneurship Development and Management (Himalaya Publishing)
5.	Barringer, B. R., & Ireland, R. D. – Entrepreneurship: Successfully Launching New Ventures (Pearson)
6.	Nandini Vaidyanathan – Entrepedia: A Step-by-Step Guide to Becoming an Entrepreneur (Random House)
7.	Steven Rogers – Entrepreneurial Finance: Finance and Business Strategies for the Serious Entrepreneur (McGraw Hill)

Shivaji University, Kolhapur

Second Year (Sem – IV) B. Tech. Mechanical Engineering

ME3407 : Strategic Management

Teaching Scheme			Examination Scheme	
Lectures	02 Hrs/week		**MSE**	-
Tutorials	--		**ISE**	25 Marks
Total Credits	02		**ESE**	-

Prerequisite : Marketing Management , Business Communication

Course Outcomes (CO): After the successful completion of this course the student will be able

CO1	Apply strategic analysis tools such as SWOT, PESTEL, and Porter's Five Forces to assess business scenarios.
CO2	Analyze the external environment of a firm to identify opportunities and threats that influence strategic decisions.
CO3	Assess a firm's internal resources and capabilities to determine its competitive advantage.
CO4	Develop cost leadership strategies to enhance operational efficiency and maintain competitive pricing.
CO5	Design strategies for product differentiation to create unique market offerings and customer value.
CO6	Evaluate the advantages and risks of vertical integration and corporate diversification for business growth and sustainability.

	Course Contents	CO	Hours
Unit 1	**The Tools of Strategic Analysis:** Strategy and the Strategic Management Process, What Is Competitive Advantage, The Strategic Management Process, Measuring Competitive Advantage, Emergent Versus Intended Strategies**.**	**CO1**	**04**
Unit 2	**Evaluating a Firm's External Environment:** Understanding a Firm's General Environment, The Structure-Conduct-Performance Model of Firm, Performance, A Model of Environmental Threats. Industry Structure and Environmental Opportunities.	**CO2**	**04**
Unit 3	**Evaluating a Firm's Internal Capabilities :** The Resource-Based View of the Firm, The VRIO Framework, Applying the VRIO Framework, Imitation and Competitive Dynamics in an Industry, Implications of the Resource-Based View.	**CO3**	**05**
Unit 4	**Cost Leadership:** Business-Level Strategy, Cost Leadership, The Value of Cost Leadership, Cost Leadership and Sustained Competitive Advantage , Organizing to Implement Cost Leadership.	**CO4**	**04**
Unit 5	**Product Differentiation:** Product Differentiation, The Value of Product Differentiation, product differentiation and Sustained Competitive Advantage, Organizing to Implement Product Differentiation.	**CO5**	**05**
Unit 6	**Vertical Integration & Corporate Diversification:** Corporate Strategy, Vertical Integration, Vertical Integration and Sustained Competitive Advantage, Organizing to Implement Vertical Integration, Corporate Diversification, Organizational Structure and Implementing Corporate, Diversification, (**Self Study**: Management Controls and Implementing Corporate).	**CO6**	**06**

Text Books

1.	Jay B. Barney and William S. Hesterly, "Strategic Management and Competitive Advantage Concepts", 5th edition, Pearson Education Limited 2015 (Unit : 1,2,3,4,5,6)
2.	Mason Carpenter Gerry Sanders, "Strategic Management Concepts and Cases", 2nd Edition Pearson EducationLimited 2014.

Reference Books

1.	Frank Rothaer, "Strategic Management Concepts", McGraw-Hill Irwin, 2014.
2.	Michael A. Hitt, R. Duane Ireland, Robert E. Hoskisson, "Strategic Management Concepts and Cases", 7th edition,South Western College Pub, 2006
3.	Michael A. Hitt, R. Duane Ireland, Robert E. Hoskisson, "Strategic Management Concepts Competitiveness and Globalization", South Western College Pub, 2010

Shivaji University, Kolhapur

Second Year (Sem –IV) B. Tech. Mechanical Engineering

ME0247 : Professional Ethics

Teaching Scheme			Examination Scheme	
Lectures	02 Hrs/week		**Lectures**	02 Hrs/week
Tutorials	--		**Tutorials**	--
Total Credits	02		**Total Credits**	02

Prerequisite : Marketing Management , Business Communication

Course Outcomes (CO): After the successful completion of this course the student will be able

CO1	Explain the principles of individual and professional ethics and their relevance in personal and professional life.
CO2	Analyze ethical dilemmas in business scenarios and propose solutions that uphold ethical standards.
CO3	Demonstrate ethical behavior in workplace interactions and decision-making processes.
CO4	Valuate various psychological approaches to enhance time-management and develop effective goal-setting strategies.
CO5	Identify workplace safety standards and assess the responsibilities and rights of employees and employers.
CO6	Assess the ethical responsibilities towards ecological sustainability and formulate strategies for environmentally responsible practices.

	Course Contents	CO	Hours
Unit 1	**Introduction: Individual and Professional Ethics** Introduction to Professional Ethics, Morals, Values and Ethics – Personal and Professional- Sense of Engineering Ethics – Code of Ethics by NSPE - Making decisions with ethical dimensions – definition – roadmap to ethical decision making – common standards – internal obstacles – bias – empathy	**CO1**	04
Unit 2	**Business Ethics** Philosophical approaches to Business Ethics – ethical reasoning – ethical issues in business - Social Responsibility of Business conflict of interest – cultural relativism - Ethical leadership - Resisting un-ethical authority and domination - Global Business Ethics.	**CO2**	**04**
Unit 3	**Workplace Ethics** Ethics in changing domains of Research – academic integrity – intellectual honesty - Role of Engineers and Managers - Ethical issues in Diverse workplace – competition – free will - Confidentiality – employee rights – Intellectual property rights – discrimination	**CO3**	**05**
Unit 4	**Psychological Approaches** Ethical Theories - Psychological and Philosophical approaches - Myths about Morality - conflict of interest in psychological perspective - Courage-Integrity – ethical dilemma – Emotional Intelligence.	**CO4**	**04**
Unit 5	**Time-management, and goal setting, skills:** The Tyranny of the Urgent, Setting Personal Goals, short term goals, long term goals, Schedule the Plan, Avoid Procrastination, Memory Skills	**CO5**	**04**
Unit 6	**Safety, Responsibilities and Rights Ecology** Engineering, Economy - Risk benefit analysis and reducing risk SDGs – Corporate social responsibility and Corporate Sustainability - CSR in India - Sustainability Case Studies	**CO6**	**05**

Text Books

1.	David Strelecky, Ferguson, “Professional Ethics and Etiquette”, 2nd Edition, An imprint of Facts On File, Inc
2.	R. Subramanian, “Professional Ethics”, Oxford University Press, 2015.
3.	Caroline Whitbeck, “Ethics in Engineering Practice & Research”, 2nd Edition, Cambridge University Press 2015.

Reference Books

1.	Charles E Harris Jr., Michael S Pritchard, Michael J Rabins “Engineering Ethics, Concepts Cases”, 4th edition, Cengage learning, 2015.
2.	Charles B. Fleddermann, “Engineering Ethics”, Pearson Prentice Hall, New Jersey, 2004.
3.	John R Boatright, “Ethics and the Conduct of Business”, Pearson Education, New Delhi, 2003
4.	Edmund G Seebauer and Robert L Barry, “Fundamentals of Ethics for Scientists and Engineers”, Oxford University Press, Oxford, 2001.
5.	Laura P. Hartman and Joe Desjardins, “Business Ethics: Decision Making for Personal Integrity and SocialResponsibility”, Mc Graw Hill education, India Pvt. Ltd., New Delhi, 2013.
6.	Erode, “World Community Service Centre Value Education”, Vethathiri publications, 2011

Shivaji University, Kolhapur

Second Year (Sem –IV) B. Tech. Mechanical Engineering

ME0248 : Humanity Science

Teaching Scheme			Examination Scheme	
Practical	02 Hrs/week		**MSE**	-
Tutorial	--		**ISE**	50 Marks
Total Credits	01		**ESE**	-

Prerequisite : Psychology, Philosophy or Ethics, Business Communication

Course Outcomes (CO): After the successful completion of this course the student will be able

CO1	Explain the concept of value education and its significance in personal and professional life.
CO2	Analyze the relationship between fundamental human aspirations and the pursuit of happiness and prosperity.
CO3	Evaluate methods to achieve harmony between self and body for holistic well-being.
CO4	Demonstrate ethical values and principles in interpersonal relationships and social interactions.
CO5	Assess the role of individuals in maintaining harmony with society, the universal order, and nature.
CO6	Formulate strategies for ethical decision-making and responsible professional conduct during the transition from student to professional life.

	Course Contents	CO	Hours
Unit 1	**Introduction to Value Education** Right understanding, relationship, and physical facility (holistic development and the role of education), understanding value education, self-exploration as the process for value education.	**CO1**	**05**
Unit 2	**Fundamental Human Aspirations** Continuous happiness and prosperity – the basic human aspirations, happiness and prosperity – current scenario, method to fulfill the basic human aspirations.	**CO2**	**05**
Unit 3	**Harmony between Self and Body** Understanding human being as the co-existence of the self and the body. Distinguishing between the needs of the self and the body, the body as an instrument of the self, Understanding harmony in the self, harmony of the self with the body, programme to ensure self-regulation and health.	**CO3**	**05**
Unit 4	**Values in Human Interaction** Harmony in the Family – the Basic Unit of Human Interaction, 'Trust' – the Foundational Value in Relationship, 'Respect' – as the Right Evaluation, Other Feelings, Justice in Human-to-Human Relationship.	**CO4**	**05**
Unit 5	**Society, Universal Order, and Nature** Understanding Harmony in the Society, Vision for the Universal Human Order, Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfillment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels. (**Self-Study**: The Holistic Perception of Harmony in Existence.)	**CO5**	**04**
Unit 6	**Ethical Conduct and Professional Transition** Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics, Holistic Technologies, Production Systems and Management Models-Typical Case Studies, (**Self Study**: Strategies for Transition towards Value-based Life and Profession)	**CO6**	**04**

Text Books

1.	R. R. Gaur, R. Asthana, G. P. Bagaria, "The Textbook A Foundation Course in Human Values and Professional Ethics", 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034- 47-1 (Unit: 1,2,3,4,5,6)
2.	R. R. Gaur, R. Asthana, G. P. Bagaria, "The Teacher"s Manual Teachers: Manual for A Foundation Course in Human Values and Professional Ethics", 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2.(Unit: 1,2,3,4,5,6)

Reference Books

1.	D R Kiran , "Professional ethics and human values", McGraw Hill Education (India) Private Limited P-24, 2nd edition, 2014, Green Park Extension, New Delhi 110 016
2.	V. Jayakumar, "Professional ethics and Human values in Engineering"
3.	Rudolf Steiner, "Human Values in Education (The Foundations of Waldorf Education, 20)", Anthroposophic Press, Year: 2004, ISBN: 0880105445,9780880105446
4.	R.S. Naagarazan, "A Textbook on Professional Ethics and Human Values", New Age International Pvt Ltd Publishers, Year: 2007 ISBN: 8122419380,9788122419382,9788122423013

Shivaji University, Kolhapur

Second Year (Sem IV) B. Tech. Mechanical Engineering

ME0249 : Kinematics and Theory of Machines Lab

Laboratory Scheme:			**Examination Scheme:**	
Practical	2 Hrs/week		**ISE**	25 Marks
Total Credits	1		**ESE**	25 Marks

Pre-Requisite: Applied Physics , Engineering Mechanics

Course Outcomes (CO): After the successful completion of this course the student will be able

CO1	Understand and verify the relationship between the angular velocities of shafts connected by a Hooke's joint.
CO2	Understand the use of various measuring devices in dynamic testing.
CO3	Develop problem-solving skills to identify unbalanced conditions and propose efficient solutions for minimizing their effects.
CO4	Develop proficiency in using computer-aided design (CAD) and simulation software for force analysis in mechanical systems.

Course Contents		**CO**
Experiment 1	Verification of ratio of angular velocities of shafts connected by Hooks joint	**CO1**
Experiment 2	Experiment on Governor characteristics for Porter or Hartnell governor.	**CO2**
Experiment 3	Experiment on Cam Profile	**CO2**
Experiment 4	Experiment on belt drives.	**CO2**
Experiment 5	Experiment on Dynamometer	**CO2**
Experiment 6	Generation of involute profile using rack cutter method.	**CO2**
Experiment 7	Experiment on Torque Measurement in epicyclical Gear Train.	**CO2**
Experiment 8	Experiment on Gyroscope.	**CO2**
Experiment 9	Experiment on Balancing of rotary masses (Static and Dynamic).	**CO3**
Experiment 10	Computer aided force analysis of any one of following a. Slider crank mechanism b. Four bar mechanism	**CO4**

List of Submission:

Minimum number of Experiments :08

Shivaji University, Kolhapur

Second Year (Sem.–IV) B. Tech. Mechanical Engineering

ME02410:Testing and Measurement Lab.

Laboratory Scheme:			**Examination Scheme:**	
Practical	2 Hrs. / Week		**ISE**	25 Marks
Total Credits	1		**ESE**	25 Marks

Pre-Requisite: Applied Thermodynamics, Fluid Mechanics, Physics

Course Outcomes (CO): After the successful completion of this course the student will be able

CO1	Understand basic construction and working of angular Speed, force/load and temperature measuring instruments.
CO2	Understand basic construction and working of flow, Vibrations, linear displacement measuring instruments.
CO3	Understand testing and calibration of pressure gauge.

Course Contents		**CO**
Experiment 1	Study of generalized measurement system and characteristics of instruments.	**CO4**
Experiment 2	Study of sensing elements and transducers.	**CO4**
Experiment 3	Testing of mechanical pressure gauge by using dead weight pressure gauge tester	**CO3**
Experiment 4	Study and Measurement of fluid flow by using Rota meter/ Anemometer/ Turbine meter/ Target Meter.	**CO2**
Experiment 5	Study and Measurement of Angular speed by using Magnetic Pickup and Photoelectric Pickup/ Stroboscope	**CO1**
Experiment 6	Study and Measurement of Temperature by using Thermocouple, RTD, Thermistor/ Pyrometer.	**CO1**
Experiment 7	Study and Measurement of Displacement by using LVDT.	**CO2**
Experiment 8	Study and Measurement of Force and Torque by using Strain Gauges.	**CO1**
Experiment 9	Study of Vibrations testing by using Vibrometer	**CO2**

List of Submission:

Minimum number of Experiments : 5 (Performance)

Shivaji University, Kolhapur

Second Year (Sem –IV) B. Tech. Mechanical Engineering

ME02411 : Environmental Science (Common to all Branches of Engineering)

Teaching Scheme			Examination Scheme	
Practical	02 Hrs/week		**MSE**	30 Marks
Tutorial	--		**ISE**	10 Marks
Total Credits	01		**ESE**	60 Marks

Prerequisite : Applied Chemistry

Course Outcomes (CO): After the successful completion of this course the student will be able

CO1	Understand the importance of Environmental Studies and recognize significance of ecosystem.
CO2	Classify the values of natural resources with associated problems for sustainable lifestyles.
CO3	Describe the social and global environmental issues
CO4	Make aware of Pollution issues with its mitigation measures.
CO5	Familiarize the basics of Biodiversity and concerned issues in the context of Western Ghats.
CO6	Define the role of environmental laws and regulations in conservation efforts.

	Course Contents	CO	Hours
Unit 1	**Nature of Environmental Studies and Importance of ecosystems** Definition, scope and importance, Multidisciplinary nature of environmental studies, Need for public awareness. **Ecosystem** -Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers, Food chains, food webs and ecological pyramids Introduction, types, characteristics features, structure and function of the following ecosystem-Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) Degradation of the ecosystems and it's impacts.	**CO1**	**06**
Unit 2	**Natural Resources and Associated Problems** Forest resources: Use and over-exploitation, deforestation, dams and their effects on forests and tribal people. Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. Mineral resources: Usage and exploitation. Environmental effects of extracting and using mineral resources. Food resources: World food problem, changes caused by agriculture, effect of modern agriculture, fertilizer-pesticide problems. Energy resources: Growing energy needs, renewable and non- renewable energy resources, use of alternate energy sources. Solar energy, Biomass energy. Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.	**CO2**	**06**
Unit 3	**Social Issues and the Environment** Human population growth and impact on environment. Environmental ethics: Role of Indian religious traditions and culture in conservation of the environment. Environmental movements- Chipko Movement, Appiko Movement, Silent Valley Movement. Resettlement and rehabilitation of people; its problems and concerns. Water conservation, rain water harvesting. Disaster management: floods, earthquake, cyclone, tsunami and landslides, Case studies.	**CO3**	**04**
Unit 4	**Environmental Pollution** Definition: Causes, effects and control measures of: Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Global warming, acid rain, ozone layer depletion. Solid waste Management: Causes, effects and control measures of urban and industrial wastes. Solid waste management, control & rules, Role of an individual in prevention of pollution	**CO4**	**04**
Unit 5	**Biodiversity and its conservation** Introduction- Definition: genetic, species and ecosystem diversity. Bio-geographical classification of India. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. India as a mega- diversity nation. Western Ghat as a biodiversity region. Hot-spots of biodiversity. Threats to biodiversity: habitat loss, poaching of wildlife, man- wildlife conflicts, Conservation of biodiversity: In-situ and Ex- situ conservation of biodiversity.	**CO5**	**04**
Unit 6	**Environmental Protection-Policies and practices** Environment Protection Act, Air (Prevention and Control of Pollution) Act, Water (Prevention and control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act, National and International Conventions and agreements on environment.	**CO6**	**04**

	Field work: (Field work is equal to 4 lectures) **Note - The ISE is carried out through the Field work and Report writing.** Visit to a local area to document environmental assets river/ forest/grassland/hill/mountain Visit to a local polluted site-Urban/Rural/Industrial/Agricultural Study of common plants, insects, birds. Study of simple ecosystems-pond, river, hill slopes, etc.	**10 Marks**

Text Books

1.	Raut P.D., Environmental Studies, Shivaji University Press, 2021
2.	Gleick, H.,1993, Water in crisis, Pacific Institute for studies in Dev., Environment & Security. Stockholm Env. Institute. Oxford Univ. Press 473p
3.	Hawkins R. e., Encyclopedia of Indian Natural History, Bombay Natural History Society, Bombay (R)

Reference Books

1.	Heywood, V.H.& Watson, R.T.1995, Global Biodiversity Assessment, Cambridge Univ. Press 1140p.
2.	Jadhav, H.& Bhosale, V.M.1995, Environmental Protection and Laws, Himalaya Pub. House, Delhi 284p.
3.	McKinney, M.L.& School. R.M.1196, Environmental Science Systems & Solutions, Web enhanced edition.
4.	Mhaskar A.K., Master Hazardous, Techno-Science Publications (TB)

Shivaji University, Kolhapur

Second Year (Sem –IV) B. Tech. Mechanical Engineering

ME02412 : Mechanical Workshop

Laboratory Scheme:			**Examination Scheme:**	
Practical	04 Hrs /week		**ISE**	50 Marks
Total Credits	02		**ESE**	--

Pre-Requisite: Machine Tools and Processes

Course Outcomes (CO): After the successful completion of this course the student will be able

CO1	Demonstrate proficiency in basic lathe operations
CO2	Demonstrate the ability to perform milling machine operations
CO3	Analyze and report industrial machining processes

Course Contents		**CO**
Experiment 1	Job preparation on lathe having operations like straight, step, taper turning, Boring, knurling.	**01**
Experiment 2	Job preparation on milling machine having operations like plain milling, side milling, etc.	**02**
Experiment 3	Job preparation by using operations such as Shaping / Planing , Grinding, Tapping, die threading, slotting.	**03**
Experiment 4	Hands on machine maintenance and overhauling	**03**
Experiment 5	A visit report based on the industrial visit to study at – least two of the following machining Processes. I) CNC Turning / Milling, ii.) Honing, iii.) Thread Rolling	**03**

List of Submission:

Minimum number of Experiments : 04

Equivalence of Subjects between CBCS and NEP for

S.Y. B. Tech (Sem-III & IV)

Class: S. Y. B. Tech (Mechanical) **Semester- III**

Sr. No	Name of Subject in existing CBCS 2018 onwards pattern	Name of Equivalent Subject in NEP pattern	Reason	Remark
1	Engineering Mathematics - III	Mathematics for Mechanical Engineering	80 % Syllabus is equivalent.	Equivalence
2	Electrical Technology	-	This Subject is currently not available in NEP Pattern	-
3	Applied Thermodynamics	Applied Thermodynamics	80 % Syllabus is equivalent	Equivalence
4	Metallurgy	Metallurgy	75 % Syllabus is equivalent	Equivalence
5	Fluid Mechanics	-	This subject is clubbed with other subject	-

Class: S. Y. B. Tech (Mechanical) **Semester- IV**

Sr. No	Name of Subjects in existing CBCS 2018 onwards pattern	Name of Subjects in NEP pattern	Reason	Remark
1	Applied Numerical Methods	-	This Subject is currently not available in NEP Pattern	-
2	Analysis of Mechanical Elements	Analysis of Mechanical Elements	80 % Syllabus is equivalent	Equivalence
3	Fluid and Turbo Machinery	-	This subject is clubbed with other subject	-
4	Theory of Machines – I	-	This subject is clubbed with other subject	-
5	Machine Tools and Processes	Machine Tools and Processes	80 % Syllabus is equivalent	Equivalence

Exit Course for Mechanical Engineering after 2nd Year

<table>
<tr><th colspan="5">Exit option : Award of UG Certificate in Major with 44 credits and an additional 8 credits from following Exit Courses</th></tr>
<tr><th>Sr. No</th><th>Course Code</th><th>Course Title</th><th>Mode</th><th>Credits</th></tr>
<tr><td>1</td><td>ME-EC-0203</td><td>Certificate Course in CNC Operations</td><td rowspan="4">Online NPTEL,MOOCS
To earn 8 credits, the student must complete two NPTEL courses and two virtual labs related to CNC Operations or Computer Aided Drafting.</td><td>8</td></tr>
<tr><td colspan="3">OR</td><td>OR</td></tr>
<tr><td>2</td><td>ME-EC-0204</td><td>Certificate Course in Computer Aided Drafting</td><td>8</td></tr>
</table>

S.Y. Exit Course

To earn 8 credits, the student must complete two NPTEL courses and two virtual labs related to CNC Operations or Computer Aided Drafting

1. Certificate Course in CNC Operations (8)

NPTEL Courses Like

1. An Overview of CNC Machines (3)
2. CNC Machine Tools and Operations (3)
3. CNC of Machine tools and Processes (3)
4. Elements of metal cutting, Machine tools, gear cutting and CNC machining (3)
5. CNC Programming and Operation (3)

Virtual Labs Like

1. Virtual Lab on CNC Machining (IIT Roorkee) (1)
2. Manufacturing Process Virtual Lab (IIT Kanpur) (1)
3. Machine Tools Virtual Lab (IIT Roorkee) (1)
4. Manufacturing Processes –II Virtual Lab (IIT Kanpur) (1)

2. Certificate Course in Computer Aided Drafting (8)

NPTEL Courses Like

1. Engineering Graphics and Design with CAD Tools (3)
2. Computer Aided Design (3)
3. Computer Aided Engineering: Design, Analysis and Manufacturing (3)
4. CAD and Product Design (3)
5. Computer Integrated Manufacturing (3)

Virtual labs Like

1. Engineering Drawing and Computer Graphics (IIT Kharagpur) (1)
2. Engineering Graphics and Design (IIT Delhi) (1)
3. Computer Aided Design and Manufacturing (IIT Delhi) (1)
4. Computer Aided Engineering Design (IIT Kanpur) (1)