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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 and Mechatronics 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.

F.Y. B. Tech Mechanical and Mechatronics Engineering

Exit Course

(as per NEP-2020)

Mechanical and Mechatronics Engineering

(Draft Copy)

Exit Course for Mechanical & Mechatronics Engineering After First Year

Exit option : Award of UG Certificate in Major with 44 credits and an additional 8 credits from followingExit Courses				
Sr. No	**Course Code**	**Course Title**	**Mode**	**Credits**
NPTEL				
1	MME-EC-0201	Design of Mechanical Transmission System Fundamental of Welding Science and Technology Inspection & Quality Control in Manufacturing Manufacturing Process & Technology I & II	Online/offline certification Course or project of total 6 credits Each Course 3 Credits	3
VIRTUAL LAB				
2	MME-EC-0202	3D Printing Basic Electrical Lab Metal Forming & Virtual Simulating Material Response & Microstructure	offline certification Course total 2 Credits 1 Credit each	2

Note: **Select any 2 Courses from NPTEL &Virtual Lab list**

Earning of Additional 2 mandatory Credits for direct Second year admitted students to Mechanical & Mechatronics Engineering branch

Sr.No	Semester	Subject	Credit
1	III	Basics Of Mechanical & Mechatronics Engineering	2

S.Y. B. Tech Mechanical and Mechatronics Engineering

Entry Course

(as per NEP-2020)

Mechanical and Mechatronics Engineering

(Draft Copy)

Year and Semester	Second Year B. Tech - Semester III Mechanical Mechatronics Engineering				
Course Category	Second Year Entry Course				
Title of Course	**Basic Mechanical and Mechatronics Engg.**			Contact Hrs./Week	Credits
Teaching Scheme	L	T	P		
	02	--	--	02	02
Examination Scheme	MSE	ISE/CA	ESE	Total	
	30	10	60	100	

Course Objectives: The objectives of the course is to

1. Understand and apply core concepts in basic mathematics required for analyzing engineering systems.
2. Gain knowledge of fundamental electrical and electronic principles relevant to automation and mechatronics.
3. Learn the basics of thermodynamics and fluid mechanics essential for mechanical systems.
4. Understand mechanical power transmission components and their functions in real-world machines.
5. Analyze the dynamics of practical motion including forces, vibrations, and balancing.
6. Get hands-on familiarity with workshop practices, measurement tools, welding, and casting techniques.

Course Outcomes:

COs	**At the end of successful completion of the course, the student will be able to**	**Blooms Taxonomy**
CO1	Apply basic mathematics including vector algebra, probability, and differential equations in solving engineering problems.	II
CO2	Demonstrate an understanding of electrical/electronic components and their role in automation and control systems.	IV
CO3	Explain fundamental laws of thermodynamics and fluid mechanics in context with mechanical systems.	III
CO4	Identify and explain various mechanical power transmission elements and calculate power, torque, and motion relations.	V
CO5	Analyze practical motion dynamics such as vibration, inertia, gyroscopic effects, and balancing of rotating systems.	VI
CO6	Use basic measuring instruments and understand casting, pattern making, and welding techniques used in workshops.	III

SYLLABUS

Unit No	Content	Hours
Unit 1	**Basic Mathematics**	
	• Linear algebra ; vector algebra • Linear Differential equation • Probability theory • Application of differential equations.	**05 Hrs**
Unit 2	**Basic Electrical Engg. & Electronics Engg.**	

	• **Fundamentals of Electrical Circuits**
	  o Ohm's Law, Kirchhoff's Laws, AC/DC sources, power and energy calculations.
	• **Electrical Machines and Applications**
	  o Basic working of transformers, DC motors, and induction motors with relevance to mechanical systems.
	• **Electronic Devices**
	  o PN junction diode, Zener diode, BJT – working and applications in switching and amplification.
		05 Hrs

Unit 3	**Thermodynamics and Fluid Mechanics**	

	• Basic concepts of Thermodynamics (Laws of Thermodynamics, Properties of Steam, Boilers)
	• Heat and Energy laws of Thermodynamics
	• Basic principles of Refrigeration and Air Conditioning
	• Fundamentals of Fluid Mechanics:
	  o Properties of fluids (Viscosity, Density, Pressure)
	  o Pascal's law and Bernoulli's theorem
	• Flow through pipes and hydraulic machines (Turbines, Pumps)
		04 Hrs

Unit 4	**Mechanical power transmission**	

	• **Introduction to Power Transmission Systems**
	  • Types: Mechanical, Electrical, Hydraulic
	  • Applications in machines and automation
	• **Belt, Chain, and Rope Drives**
	  • Types, construction, and working
	  • Velocity ratio, slip, tension, and power transmission
	• **Gear Drives**
	  • Types of gears: spur, helical, bevel, worm
	  • Gear trains and gear ratio calculations
	• **Clutches, Brakes, and Couplings**
	  • Types and functions
	  • Applications in mechanical and mechatronic systems
		06 Hrs

Unit 5	**Dynamics of practical motion**	
	• **Introduction to Dynamics** Difference between statics and dynamics, Types of motion: Rectilinear and curvilinear • **Kinematics of Particles** Displacement, velocity, acceleration, Equations of motion (constant acceleration),Graphical representation of motion, Relative motion • **Kinetics of Particles** Newton's Second Law of Motion, Equations of motion using force and mass, D'Alembert's principle, Application to linear motion problems • **Work-Energy Principle** Work done by a force, Kinetic energy of a particle, Work-Energy equation, Principle of conservation of energy	**06 Hrs**
Unit 6	**Workshop Technology**	
	• Measuring instruments- Steel rule, Caliper, Varnier caliper, Micrometer surface plate, Dial Gauge error in measuring instruments. • Study of pattern- Types, Material used , Pattern allowances, construction & colour code. • Study of core boxes – Types allowances • Welding and its types.	**04 Hrs**

Note - The ISE/CA is carried out through any five Assignments from the following: [10 Marks]

1. Assignment on Application of Differential Equations and Probability in Engineering.
2. Assignment on Study of Electrical Machines and Drives.
3. Assignment on Thermodynamics and Fluid Mechanics Concepts
4. Assignment on Power Transmission Systems
5. Assignment on Dynamics of Motion
6. Assignment on Workshop Practice and Metrology

References:

Reference Books and Text Books	
1	"Electrical Machines" by B.L. Theraja & A.K. Theraja, Publication: S. Chand & Co., 2014 ISBN: 978-8121902534
2	**"Basic Electrical and Electronics Engineering"** by M.S. Sukhija & T.K. Nagsarkar **Publication:** Oxford University Press, 2012 **ISBN:** 978-0198070894
3	**"Engineering Thermodynamics"** by P.K. Nag **Publication:** McGraw Hill Education, 2017 **ISBN:** 978-9352606429
4	**"Fluid Mechanics and Hydraulic Machines"** by R.K. Bansal **Publication:** Laxmi Publications, 2012 **ISBN:** 978-8131808153
5	**"Theory of Machines"** by R.S. Khurmi & J.K. Gupta **Publication:** S. Chand & Co., 2011 **ISBN:** 978-8121925243
6	**"Workshop Technology Part 1"** by W.A.J. Chapman **Publication:** CBS Publishers & Distributors, 2005 **ISBN:** 978-8123904017
7	**"Engineering Mathematics"** by B.S. Grewal **Publication:** Khanna Publishers, 2018 **ISBN:** 978-9382609052
8	**"A Textbook of Fluid Mechanics and Hydraulic Machines"** by Dr. D.S. Kumar **Publication:** S.K. Kataria & Sons, 2013 **ISBN:** 978-9350142814

S.Y. B. Tech Mechanical and Mechatronics Engineering

Second Year Structure

(as per NEP-2020)

Mechanical and Mechatronics Engineering

(Draft Copy)

SCHEME OF INSTRUCTION & SYLLABI

Programme Mechanical Engineering

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

Semester – III

Sr. No.	Course Category	Course Code	Course Title	L	T	P	Contact Hrs/Wk	Course Credits	EXAM SCHEME			
									MSE	ISE/CA	ESE	TOTAL
1	PCC	MME0231	Analysis of Mechanical Elements	3	1	--	4	4	30	10	60	100
2	PCC	MME0232	Thermal & Fluid Engineering	3	--	--	3	3	30	10	60	100
3	PCC	MME0233	Electrical Machines	3	--	--	3	3	30	10	60	100
4	PCC	MME0234	Computational Methods in Engineering with C++	-	--	2	2	1	--	50	25	75
5	MDM	MME0235	Multi-disciplinary Minor-01	2	--	--	2	2	30	10	60	100
6	OE	MME0236	Open Elective-01	3	--	--	3	3	30	10	60	100
7	HSSM	MME0238	Universal Human Values	2	--	--	2	2	--	50	--	50
8	PCC	MME0239	Electrical Machines Lab	--	--	2	2	1	--	50	25	75
9	HSSM	MME0240	Economics for Engineers	2	--	--	2	2	--	50	--	50
10	OE	MME02310	Open Elective-01 lab	--	--	2	2	1	--	25	25	50
			Total	**18**	**01**	**6**	**25**	**22**	**150**	**275**	**375**	**800**

L- Lecture T-Tutorial P-Practical

MSE- Mid Semester Examination ISE/CA- In Semester Evaluation/Continuous AssessmentESE-

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 (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**	**18**	**--**	**-**	**-**	**04**	**04**	**--**	**02**
Semester Credits	**--**	**-**	**12**	**-**	**06**	**-**	**04**	**-**	**-**
Cumulative Sum	**16**	**18**	**12**	**-**	**06**	**04**	**08**	**-**	**02**

PROGRESSIVE TOTAL CREDITS: 44+22 =66

SCHEME OF INSTRUCTION & SYLLABI

Programme Mechanical Engineering

Scheme of Instructions: Second Year B. Tech. in Mechanical & Mechatronics Engineering

Semester – IV

Sr. No.	Course Category	Course Code	Course Title	L	T	P	Contact Hrs/Wk	Course Credits	EXAM SCHEME			
									MSE	ISE/CA	ESE	TOTAL
1	PCC	MME0241	Theory of Machines	3	--	--	3	3	30	10	60	100
2	PCC	MME0242	Signals Processing	3	--	--	3	3	30	10	60	100
3	PCC	MME0243	Material & Manufacturing Processes	3	--	--	3	3	30	10	60	100
4	MDM	MME0244	Multi-disciplinary Minor-02	2	--	--	2	2	30	10	60	100
5	OE	MME0245	Open Elective-02	2	--	--	2	2	30	10	60	100
6	HSSM	MME0246	Strategic Management	2	--	--	2	2	-	50	-	50
7	HSSM	MME0247	Professional Ethics	2	--	--	2	2	-	25	-	25
8	PCC	MME0248	Theory of Machines Lab	--	--	2	2	1	--	50	25	75
9	PCC	MME0249	Signal Processing Lab	--	--	2	2	1	-	25	25	50
10	PCC	MME02410	Machine Drawing & CAD Lab	2	--	--	2	2	-	25	25	50
11	BSC	MME02411	Environmental Science	2	--	--	2	Audit	30	10	60	100
12	VSEC	MME02412	Workshop Practice	--	--	2	2	1	--	50	--	50
			Total	**21**	**--**	**6**	**27**	**22**	**180**	**285**	**435**	**800+100**(Audit

L- Lecture T-Tutorial P-Practical

MSE- Mid Semester Examination ISE/CA- In Semester Evaluation/Continuous AssessmentESE- 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 program (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**	**18**	**12**	**-**	**06**	**04**	**08**	**-**	**02**
Semester Credits	**-**	**-**	**13**	**-**	**04**	**01**	**04**	**-**	**-**
Cumulative Sum	**16**	**18**	**25**	**-**	**10**	**05**	**12**	**-**	**02**

PROGRESSIVE TOTAL CREDITS: 66+22 =88

Shivaji University,Kolhapur

S. Y. B. Tech Syllabus (as per NEP-2020)

Mechanical and mechatronics Engineering

(2025-26)

Semester III

(Draft Copy)

Year and Semester	Second Year B. Tech - Semester III (Mechanical Mechatronics Engineering)				
Course Category	Programme Core Course (PCC)				
Title of Course	Analysis of Mechanical Elements			Contact Hrs/Week	Credits
Teaching Scheme	L	T	P		
	03	01	--	04	04
Examination Scheme	MSE	ISE/CA	ESE	Total	
	30	10	60	100	

Course Objectives: The objectives of the course is to

1. To gain knowledge of different types of stresses, strains and deformation induced in mechanical components due to external loads.
2. To study shear force and bending moment distribution for different types of loads and support conditions.
3. To study the distribution of various stresses and deformation in mechanical elements.
4. To study the analytical and graphical method to solve the problems in principal planes and stresses.
5. To study the effect of component dimensions and shape on stresses and deformations.
6. To study the buckling, and strain energy effect in mechanical elements.

Course Outcomes:

COs	At the end of successful completion of the course, the student will be able to	Blooms Taxonomy
CO1	Apply concepts of analysis of mechanical elements to obtain solution to various types of loading and stresses induced in real time engineering problems.	II
CO2	Draw shear force and bending moment diagrams for simple beams subjected to various loads and support conditions.	II
CO3	Compute and analyze bending and shear stresses in mechanical components.	II
CO4	Determine plane stress, principal stress .maximum shear stress and their orientations using analytical method and Mohr's circle.	II
CO5	Analyze the effect of deflection in beams.	IV
CO6	Evaluate buckling and strain energy in beams subject to various types of loading.	V

SYLLABUS

Unit No	Content	Hours
Unit 1	**Stresses and Strains:**	
	• Concept of Stress and Strain, (Linear, Lateral, Shear and Volumetric), Hooke's Law, Poisson's ratio, Modulus of Elasticity, Modulus of Rigidity, Stress-strain diagram for ductile and brittle material, Factor of safety, Working stress. Normal and shear stresses, Thermal Stresses, Bulk Modulus, Inter-relationship between elastic constants..	**06**
Unit 2	**Torsion, Shear Force and Bending Moment:**	
	• **Torsion**: Introduction to Torsion, Basic assumptions, Torsion formula, Hollow and solid circular shafts ,Angular deflection. • **Shear Force and Bending Moment** : Concept and definition of shear force and bending moment in determinate beams (Simply supported, cantilever and overhanging) due to concentrated, UDL, UVL and Couple.	**08**
Unit 3	**Stresses in Beams:**	**08**
	• Bending Stresses: Symmetric pure bending of beams, Flexure formula, moment of resistance of cross-sections, Simple built-up section, Design of rectangular and circular(solid and hollow) sections; L, I and T sections • Shear Stresses: Distribution of shear stresses in beams of various commonly used sections such as circular. I, T, and angles.	
Unit 4	**Principal Stresses and Strains**:	**08**
	• Normal and shear stresses on any oblique planes, Concept of Principal planes, Derivation of expression for Principal stresses and maximum shear stress, Positions of principal planes and planes of maximum shear, Graphical solutions using Mohr's circle of stresses, Combined effect of shear and bending in Beam.	
Unit 5	**Deflection of Beams:**	**06**
	• Strain curvature and moment curvature relation, Solution of beam deflection problem by Double integration method, Macaulay's method and Area moment method. (Simply Supported Beam and Cantilever.)	
Unit 6	**Columns, Energy Methods:**	**06**
	• A. Columns: Euler's formula for different end connections, Concept of equivalent length, Eccentric loading, Rankine formula. B. Energy Methods: Concept of strain energy, Resilience, Proof resilience, Modulus of resilience, derivation for deformation of axially loaded members under gradual, sudden and impact loads (including Numerical).	

EXPERIMENTS: (Experiments is equal to 4 lectures) 10 marks

Note - The ISE/CA is carried out through the report on the assignments given below

- Stresses and strains.
- Torsion (Problems based on industrial applications)
- Shear force diagram & bending moment diagram.
- Bending stresses and shear stresses in beams.

References:

Reference Books	
1	"Strength of Materials", Beer and Johnson, CBS Publication.
2	"Strength of Materials", G.H. Rider,Mac Millan India Ltd.
3	"Strength of Materials", Nag and Chanda, Willey India Publication.
4	"Advanced Mechanics of Materials", Boresi, Willey India Publication.
5	"Strength of Materials", Den Hartong, McGraw Hill Publication.
6	"Mechanical analysis and design", H. Burr and John Cheatam, PHI, New Delhi

TEXTBOOKS:

Textbook Books	
1	"Strength of Materials", S. Ramamruthum, DhanpatRai and Sons, New Delhi.
2	"Strength of Materials", R. K. Bansal, Laxmi Publication, 4th Edition.
3	"Strength of Materials", Khurmi Gupta, S. Chand Publication.
4	"Strength of Materials", R.K. Rajput, S. Chad Publication.
5	"Mechanics of structure", S.BJunnerkar,Charotar Publication House
6	"Strength of Materials", S. S. Bhavikatti, Vikas Publication House.
7	"Strength of Materials", Timoshenko and Young, CBS Publication.
8	"Mechanics of Materials", S. S. Ratan, Tata McGraw Hill Publication, 2009.
9	"Strength of Materials",B. K. Sarkar, McGraw Hill Publication, 2003
10	"Strength of Materials", L. S. Negi, McGraw Hill Publication, 2008.

Year and Semester	Second Year B. Tech - Semester III Mechanical Mechatronics Engineering)				
Course Category	Programme Core Course (PCC)				
Title of Course	**Thermal & Fluid Engineering**			Contact Hrs/Week	Credits
Teaching Scheme	L	T	P		
	03	--	--	03	03
Examination Scheme	MSE	ISE/CA	ESE	Total	
	30	10	60	100	

Course Objectives: The objectives of the course is to

1. To provide a strong understanding of the fundamental principles of thermodynamics and fluid mechanics.
2. To develop problem-solving skills for analyzing energy systems and fluid flow behavior in engineering applications.
3. To introduce students to the design and analysis of thermodynamic and fluid systems in real-world engineering contexts.
4. To integrate theoretical knowledge with practical applications in thermodynamics and fluid mechanics for engineering solutions.

Course Outcomes:

COs	At the end of successful completion of the course, the student understand	Blooms Taxonomy
CO1	Thermodynamic concepts, including system types, state functions, equilibrium, and the use of properties and diagrams for analysis.	II
CO2	The First Law of Thermodynamics to analyze energy, work, and heat interactions in various thermodynamic processes and systems.	II
CO3	The Second Law of Thermodynamics, including entropy, thermodynamic cycles, and energy, and apply them to analyze efficiency and irreversibility in engineering systems.	III
CO4	Fluid properties, fluid statics, and hydrostatic forces, and apply these concepts to analyze fluid behavior, pressure, buoyancy, and stability in engineering systems.	II
CO5	Fluid flow types, continuity, Bernoulli's equation, and momentum equation, applying them to analyze mass conservation, energy, and forces in fluid systems.	II
CO6	Advanced fluid mechanics concepts to analyze flow in pipes, dimensional analysis, boundary layers, and hydraulic machines.	I

SYLLABUS

Unit No	Content	Hours
Unit 1	**Introduction to Thermodynamics**	
	• Definition of Thermodynamics and its importance • Types of systems: open, closed, and isolated • State and path functions • Thermodynamic equilibrium and the Zeroth Law of Thermodynamics • Concept of temperature • Phases of matter (solid, liquid, and gas) • Ideal and real gases • Thermodynamic properties of substances • P-V, T-S, and P-H diagrams	**07 Hrs**
Unit 2	**First Law of Thermodynamics**	
	• Internal energy and enthalpy • Work and heat interactions in thermodynamic processes • Types of processes: isochoric, isobaric, isothermal, and adiabatic • Specific heat at constant pressure and volume • First law for closed and open systems • Applications to non-flow and flow processes • Heat engines, refrigerators, and heat pumps • Application to turbines, compressors, nozzles, and diffusers	**07 Hrs**
Unit 3	**Second Law of Thermodynamics**	
	• The Second Law of Thermodynamics • Clausius and Kelvin-Planck statements • Entropy changes in reversible and irreversible processes • Calculation of entropy change for different processes • Carnot cycle, efficiency, and its significance • Rankine cycle (steam power plants) • Otto and Diesel cycles (internal combustion engines) • Brayton cycle (gas turbines) • Concept of exergy and availability • Second law analysis of thermodynamic cycles • Introduction to irreversibility in practical systems	**08 Hrs**

Unit 4	**Fluid Mechanics – Fluid Properties and Fluid Statics**	
	• Density, viscosity, surface tension, and compressibility • Types of fluids: Newtonian and non-Newtonian • Bulk modulus, kinematic viscosity, and their importance • Pressure variation with depth (Pascal's law) • Hydrostatic equilibrium • Forces on submerged bodies: Buoyancy and stability of floating bodies • Manometers and pressure measurement devices • Force on submerged planes and curved surfaces • Centre of pressure • Stability of floating and submerged bodies	**06 Hrs**
Unit 5	**Fluid Dynamics – Basic Principles and Flow**	
	• Types of fluid flow: Steady vs. unsteady, laminar vs. turbulent • Continuity equation and its significance in mass conservation • Velocity and acceleration fields in fluid flow • Derivation of Bernoulli's equation • Applications of Bernoulli's equation (Venturi meter, Pitot tube, orifice meter) • Energy analysis in fluid flow systems • Application of the momentum equation in fluid flow • Control volume analysis and force balance in control volumes	**07 Hrs**
	Advanced Topics in Fluid Mechanics	
Unit 6	• Darcy-Weisbach equation for head loss due to friction • Laminar and turbulent flow in pipes • Moody chart and Reynolds number • Flow through fittings and valves • Flow in open channels: flow rate calculations and channel classification • Importance of dimensional analysis • Buckingham π-theorem and its applications • Model testing and similitude in fluid flow • Concept of the boundary layer and its formation • Laminar and turbulent boundary layers • Boundary layer separation and its effects on drag • Methods for controlling boundary layer separation • Introduction to hydraulic turbines and pumps	**07 Hrs**

	• Types of turbines and pumps (centrifugal, reciprocating)	

Lab/Practical: (Lab/Practical is equal to 4 lectures) **10 marks**

Note - The ISE/CA is carried out through the Lab/Practical and Experiment writing.

- Study of heat engines, refrigeration, and heat pump systems
- Measurement of specific heat, work, and heat in various processes
- Flow measurement using Venturi meters, orifice meters, and Pitot tubes
- Study of laminar and turbulent flow in pipes
- Hydraulic experiments on pumps, turbines, and flow through open channels

References:

Reference Books	
1	**Cengel, Y.A., & Boles, M.A.**, 2014, *Thermodynamics: An Engineering Approach*, 8th Edition, McGraw-Hill Education, New York.
2	**Sonntag, R.E., & Borgnakke, C.**, 2018, *Fundamentals of Thermodynamics*, 9th Edition, Wiley, Hoboken.
3	**Moran, M.J., & Shapiro, H.N.**, 2006, *Fundamentals of Engineering Thermodynamics*, 6th Edition, Wiley, Hoboken.
4	**White, F.M.**, 2016, *Fluid Mechanics*, 8th Edition, McGraw-Hill Education, New York.
5	**Bansal, R.K.**, 2015, *Fluid Mechanics and Hydraulic Machines*, 9th Edition, Laxmi Publications, New Delhi.
6	**Young, D.F., Munson, B.R., & Okiishi, T.H.**, 2011, *A Brief Introduction to Fluid Mechanics*, 6th Edition, Wiley, Hoboken. enhanced edition, 639p
7	**Rajput, R.K.**, 2014, *Problems in Thermodynamics and Heat Engines*, 5th Edition, Laxmi Publications, New Delhi.

Year and Semester	Second Year B. Tech - Semester III Mechanical Mechatronics Engineering				
Course Category	Programme Core Course (PCC)				
Title of Course	**Electrical Machines (EMC)**			Contact Hrs./Week	Credits
Teaching Scheme	L	T	P		
	03	--	--	03	03
Examination Scheme	MSE	ISE/CA	ESE	Total	
	30	10	60	100	

Course Objectives: The objectives of the course is to

1. To understand the principles of electrical machines and their operating characteristics.
2. To analyze the performance of different types of electrical machines under various loading conditions.
3. To learn the methods of control and protection of electrical machines.
4. To understand the construction, working principles, and application of electric motors, generators, and transformers.
5. To develop a solid foundation for further study in power systems and electrical drives.

Course Outcomes:

COs	**At the end of successful completion of the course, the student will be able to**	**Blooms Taxonomy**
CO1	Describe the working principle, construction and characteristics of various electrical machines.	II
CO2	Analyze the performance of transformers, synchronous and induction machines under different operating conditions.	IV
CO3	Apply mathematical models and circuits for machine analysis.	III
CO4	Evaluate the efficiency and power factor of electrical machines.	V
CO5	Design and analyze basic control systems for electrical machines.	VI
CO6	Use relevant standards and methods for the protection and control of electrical machines.	III

SYLLABUS

Unit No	Content	Hours
Unit 1	**Introduction to Electrical Machines**	
	• Types of Electrical Machines (DC Machines, AC Machines: Synchronous and Induction). • Basic principles of operation of electrical machines. • Construction and classification of electrical machines. • Electromagnetic laws applied to electrical machines.	**06 Hrs**
Unit 2	**DC Machines (Motors and Generators)**	
	• Construction, types and working of DC Machines. • Operation of DC Generators (Shunt, Series, and Compound). • DC Motors: Torque-speed characteristics, applications. • Testing and efficiency of DC machines.	**06 Hrs**
Unit 3	**Transformers**	
	• Principle of operation of Transformers. • Construction of Single-phase and Three-phase Transformers. • Efficiency, regulation and testing of transformers. • Auto-transformers and their applications. • Testing of transformers : Polarity of windings, OC and SC test, separation of losses, determination of equivalent circuit parameters. Regulation, efficiency, • Single phase auto-transformers, principle of operation, phasor diagram. • Comparison of weight, copper loss equivalent reactance with 2-winding transformer..	**08 Hrs**
Unit 4	**Synchronous Machines (Generators and Motors)**	
	• Construction and working of Synchronous Generators and Motors. • Synchronous speed, operation, and power factor control. • V and Inverted V curves. • Synchronization of alternators. • Performance and efficiency of synchronous machines • Operation of Synchronous motor as Synchronous Condenser, • Application of three phase synchronous motor.	**08 Hrs**

Unit 5	**Induction Motors**	
	• Construction and principle of operation of Induction Motors (Single-phase and Three-phase). • Double field revolving theory • Torque-speed characteristics and starting methods. • Slip and frequency relationships. • Performance analysis and testing of induction motors. Applications of induction motors.	**07 Hrs**
	Special Machines and Control of Electrical Machines	
Unit 6	• Stepper motors and their working principle. • Permanent Magnet Synchronous Motor (PMSM). • Reluctance motors. • Control methods for electrical machines: V/f control, vector control, and DTC (Direct Torque Control). • Protection schemes for electrical machines.	**07 Hrs**

Note - The ISE/CA is carried out through any five Assignments from the following: [10 Marks]

1. Assignment on Introduction to Electrical Machines.
2. Assignment on DC Machines.
3. Assignment on Construction of Single-phase and Three-phase Transformers.
4. Assignment on Synchronous Machines
5. Assignment on Induction Motors
6. Assignment on Special Machines and Control of Electrical Machines

References:

Reference Books and Text Books	
1	"Electrical Machines" by B.L. Theraja & A.K. Theraja, Publication: S. Chand & Co., 2014 ISBN: 978-8121902534
2	"Electrical Machines: DC Machines" by Nagrath & Kothari
3	"Principles of Electrical Machines" by V.K. Mehta. Publication: S. Chand & Co., 2014 ISBN: 978-8121901582
4	"Synchronous Machines" by S.K. Bhattacharya, Publication: Oxford University Press, 2017 ISBN: 978-0198094066
5	"Special Electrical Machines" by K. Vijaya Kumar, Publication: PHI Learning, 2011 ISBN: 978-8120337765

Year and Semester	Second Year B. Tech - Semester IV Mechanical Mechatronics Engineering)				
Course Category	Programme Core Course (PCC)				
Title of Course	**Computational Methods in Engineering with C++**			Contact Hrs/Week	Credits
Teaching Scheme	L	T	P		
	00	--	02	02	2
Examination Scheme	MSE	ISE/CA	ESE	Total	
	--	50	25	75	

Course Objectives: The objectives of the course is to

1. To understand how C++ improves C with object-oriented features.
2. To introduce an object oriented programming language.
3. After the students have successfully completed the course, they shall have sufficient knowledge of the basic computer operations and various programming techniques especially in C++.
4. To transform various methods into computer programs.

Course Outcomes:

COs	**At the end of successful completion of the course, the student will be able to**	**Blooms Taxonomy**
CO1	Write, compiler and Error programs in C++ language.	I
CO2	Design programs involving decision control roots of equation statement.	II
CO3	Develop algorithms for solving problems using Linear algebraic Method	III
CO4	Apply their knowledge and programming skills to solve various computing problems in the field of Mechanical Engineering.	IV
CO5	Apply their knowledge to numerical differentiation and integration	V
CO6	Design a programs for ordinary differential equation	VI

Unit No	Content	Hours
Unit 1	**Evolution of Programming methodologies**	
	Introduction to Error, Types of Errors, Rules for estimate errors, Error propagation and function.	**05 Hrs**
Unit 2	**Data types, Roots and Equation, Bracketing method**	
	bisection method, false position method and Open method multiple root, iteration method, roots and polynomial.	**05 Hrs**
Unit 3	**Linear Algebraic equation**	
	gauss elimination method, gauss-seidel iteration method, gauss jocobi method.	**04 Hrs**
Unit 4	**Operand function**	
	LU decomposition function, langranges interpolating polynomial, trapezoidal rule, triangle law, power function	**05 Hrs**
Unit 5	**Operator Overloading in C++,**	
	Simpson's rules , mathematical operator and operand, logical operator, modulus method, parallelogram law	**05 Hrs**
Unit 6	**Inheritance in C++,**	
	Euler's method, Runge – kutta method and finite method.	**04 Hrs**

Term Work:

Sr. No	TITLE OF EXPERIMENTS
01	Object-Oriented programming: Introduction, Basic concepts, Benefits, Object-oriented languages, Applications.
02	Program on Data types, Expression and control statements Iteration statements in C++, Introduction to Arrays, Multidimensional Arrays, Strings and String related Library Functions.
03	Program on Functions, Passing Data to Functions, Scope and Visibility of variables in Functions, Structures in C++
04	Program on Creating classes and Abstraction: Classes objects, data members, member functions, this Pointer, Friends, Friend Functions, Friend Classes, Friend Scope, and Static Functions. Constructors and Destructors, Static variables and Functions in class
05	Program on Operator Overloading in C++, Simpson's rules, trapezoidal method.
06	Program on Inheritance in C++, Euler's method, Runge – kutta method and finite method.

NOTE:

1) Assessment of Journal based on above Term Work and Programmer conduction.

TEXT BOOKS:

TEXT BOOKS:	
1	"Object Oriented Programming", E. Balguruswami, Tata McGraw Hill Publication.
2	"Numerical Method", Dr .B. S. Grewal, Khanna Publication
3	"Applied Numerical Method",steven .c .chopra, tuff university
4	"C language and Numerical Method ", c Xavier, international publisher
5	"Numerical Method ", Dr.A. Singaravelu", meenakshi publication
6	"Numerical Method ", s.chand

Year and Semester	Second Year B. Tech - Semester III Mechanical Mechatronics Engineering				
Course Category	Multi-disciplinary Minor (MDM)				
Title of Course	**Computer Aided Design (CAD)**			Contact Hrs./Week	Credits
Teaching Scheme	L	T	P		
	02	--	--	02	02
Examination Scheme	MSE	ISE/CA	ESE	Total	
	30	10	60	100	

Course Objectives: The objectives of the course is to

1. To understand the role and evolution of CAD in engineering.
2. To develop skills in creating and annotating 2D engineering drawings.
3. To create 3D parts and assemble them virtually.
4. To understand and apply geometric transformations in modeling.
5. To understand interoperability and visualization tools.
6. To learn the application of CAD in real-world design and manufacturing.

Course Outcomes:

COs	**At the end of successful completion of the course, the student will be able to**	**Blooms Taxonomy**
CO1	Understand the role and evolution of CAD in engineering.	II
CO2	Create detailed 2D engineering drawings using CAD software and apply correct dimensioning and labeling.	IV
CO3	Create 3D models and simulate assembly operations.	III
CO4	Perform transformations on 2D/3D geometry and apply curve/surface modeling techniques in CAD.	V
CO5	Use standard file formats for data exchange and visualize CAD models effectively.	VI
CO6	Apply CAD for basic design analysis.	III

SYLLABUS

Unit No	Content	Hours
Unit 1	**Introduction to CAD Systems** • History of CAD • Benefits and limitations • CAD hardware and software components • Overview of CAD workstations	04 Hrs
Unit 2	**2D Drafting and Annotation** • Drawing tools, layers, blocks, dimensions • Orthographic projections, sectional views • Standard conventions	04 Hrs
Unit 3	**3D Modeling and Assemblies** • Wireframe, surface, and solid modeling • Boolean operations • Assembly constraints	04 Hrs
Unit 4	**Geometric Transformations and Modeling Techniques** • Translation, rotation, scaling, reflection • Parametric vs non-parametric modeling • Curve and surface modeling (Bezier, B-Spline)	06 Hrs
Unit 5	**CAD Data Exchange and Visualization** • CAD file formats: IGES, STEP, STL • Visualization techniques: rendering, sectioning • Introduction to PLM and PDM	06 Hrs
Unit 6	**CAD in Product Design and Analysis** • Design optimization using CAD • CAD-FEA Integration basics • Introduction to CAD-CAM integration	04 Hrs

Note - The ISE/CA is carried out through the Assignments on each unit. [10 Marks]

References:

Reference Books	
1	CAD/CAM: Principles and Applications by P.N. Rao, McGraw Hill
2	Computer Aided Design and Manufacturing by Mikell P. Groover & Emory Zimmers, Pearson Education
3	Computer Aided Design: Software and Analytical Tools by S. C. Sharma, S.K. Kataria & Sons
4	Mastering CAD/CAM by Ibrahim Zeid, McGraw Hill

Year and Semester	Second Year B. Tech - Semester III Mechanical Mechatronics Engineering				
Course Category	Open Elective (OE)				
Title of Course	**Auto CAD**			Contact Hrs./Week	Credits
Teaching Scheme	L	T	P		
	03	--	--	03	03
Examination Scheme	MSE	ISE/CA	ESE	Total	
	30	10	60	100	

Course Objectives: The objectives of the course is to

1. To impart hands-on skills in using AutoCAD for 2D and basic 3D modeling.
2. To teach standard engineering drawing practices and annotations.
3. To familiarize students with dimensioning, layering, and sheet layout.
4. To build foundational knowledge for future design courses and CAD/CAM applications.

Course Outcomes:

COs	**At the end of successful completion of the course, the student will be able to**	**Blooms Taxonomy**
CO1	Understand the workspace, file types and startup configuration.	II
CO2	Create accurate 2D sketches using basic drawing tools.	IV
CO3	Modify geometry using standard editing tools and manage drawings with layers.	III
CO4	Apply appropriate dimensions and annotations to technical drawings.	V
CO5	Convert orthographic views into isometric and vice versa using AutoCAD tools.	VI
CO6	Construct simple 3D models and apply visualization tools in AutoCAD.	III

Unit No	Content	Hours
Unit 1	**Introduction to AutoCAD and Interface**	
	• History and application of AutoCAD • AutoCAD workspace and user interface • File management and drawing setup • Units, limits, grid, snap, and object selection methods	**06 Hrs**
Unit 2	**Basic 2D Drawing Tools**	
	• Drawing commands: LINE, CIRCLE, ARC, POLYGON, RECTANGLE, ELLIPSE • Editing commands: ERASE, MOVE, COPY, OFFSET, MIRROR, TRIM, EXTEND, FILLET, CHAMFER	**08 Hrs**
Unit 3	**Editing Tools and Layers**	
	• Modify commands (move, copy, rotate, mirror, trim, extend, offset) • Object grouping • Layer properties and management • Text annotation: single-line and multiline • Dimensioning: linear, aligned, angular, radius, diameter • Hatching and gradients	**06 Hrs**
Unit 4	**Dimensioning and Text**	
	• Types of dimensions • Tolerancing • Leader lines, text styles	**06 Hrs**
Unit 5	**Isometric and Orthographic Drawing**	
	• First angle and third angle projections • Orthographic views (front, top, side) • Sectional views: full, half, offset • Isometric settings and snap • Isometric drawing techniques • Introduction to 3D modeling • 3D commands: EXTRUDE, REVOLVE, UNION, SUBTRACT, INTERSECT	**10 Hrs**

Unit 6	**Introduction to 3D Drawing**	
	• Extrude, revolve, sweep • Viewports and rendering • 3D navigation and UCS	**06 Hrs**

SYLLABUS

Note - The ISE/CA is carried out through the Assignments on each unit. [10 Marks]

References:

Reference Books	
1	AutoCAD for Engineers by Nighat Mir, Pearson Education
2	Engineering Drawing with AutoCAD T. Jeyapoovan, Vikas Publishing
3	Engineering Drawing and Graphics Using AutoCAD by K. Venugopal, New Age Int'l

Year and Semester	Second Year B. Tech - Semester III (Mechanical Mechatronics Engineering)				
Course Category	Humanities Social Science and Management (HSSM)				
Title of Course	Universal Human Values			Contact Hrs/Week	Credits
Teaching Scheme	L	T	P		
	02	-	--	02	02
Examination Scheme	MSE	ISE/CA	ESE	Total	
	-	50	-	50	

Course Objectives: The objectives of the course is to

1. To help students understand the meaning, importance, and application of human values in daily life.
2. To develop an understanding of self and body, inner happiness, and mindfulness.
3. To help students understand trust, respect, and responsibility in relationships and social coexistence.
4. To create awareness about the interconnection between humans and nature for sustainable living.
5. To develop ethical decision-making skills and moral responsibility in professional life.
6. To enable students to apply human values in personal and social life for conflict resolution and ethical decision-making.

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Course Outcomes:

COs	At the end of successful completion of the course, the student will be able to	Blooms Taxonomy
CO1	Students will be able to explain the significance of human values and identify ways to achieve happiness and prosperity.	II, III
CO2	Students will be able to differentiate between physical needs and inner happiness and apply mindfulness for inner peace.	II, III
CO3	Students will be able to identify key values in family and social relationships and apply them for peaceful coexistence.	II, III
CO4	Students will be able to recognize the role of nature in human life and apply eco-friendly practices.	II, III
CO5	Students will be able to explain workplace ethics and apply ethical values in professional decision-making.	II, III
CO6	Students will be able to identify ethical approaches to challenges and apply value-based decision-making.	II, III

SYLLABUS

Unit No	Content	Hours
Unit 1	**Introduction to Universal Human Values:**	
	• Meaning and Importance of Human Value • Right Understanding • Relationship & Physical facility • Understanding Value Education • Continuous Happiness & prosperity- The basic human aspirations, method to fulfil the human values.	**[05]**
Unit 2	**Harmony in Human being:**	
	• Understanding Human being as the Co-existence of the self & Body. • **Needs of Self vs. Body** – Physical needs vs. inner happiness. • Understanding harmony in the self. • Developing Inner Peace and Self-Awareness. • **Achieving Inner Peace** – Self-awareness and mindfulness	**[05]**
Unit 3	**Harmony in Family & Society:**	**[05]**
	• **Harmony in Family** – Trust, respect, and responsibility in relationships • **Family as a Support System** – Role of love and care • Justice in Human-to-Human Relationship. • Understanding Harmony in the society • Living in Coexistence- **Respect for Diversity** – Accepting different cultures, beliefs, and perspectives without discrimination.	
Unit 4	**Nature and Coexistence**:	**[04]**
	• Understanding Nature and Its Role in Human Life • Interconnection between Humans and the Environment • Sustainable Living Practices • Responsibility towards Nature and Future Generations	
Unit 5	**Professional Ethics & Holistic Development:**	**[04]**
	• Ethical Decision-Making in Professional Life • Workplace Ethics and Moral Responsibility • Leadership with Integrity and Values • Developing a Holistic Perspective in Life. •	

Unit 6	**Universal Human Values in Daily Life:** • Application of Human Values in Personal and Social Life • Conflict Resolution through Values • Overcoming Challenges with Ethical Approaches • Case Studies on Value-Based Decision-Making	**[05]**

Note - The ISE/CA is carried out through the report on the assignments given below

- Define human values and explain their role in achieving happiness and prosperity.
- Compare the needs of the self and body and explain the role of mindfulness in achieving inner peace.
- Explain the importance of trust and respect in family and how they contribute to social harmony.
- Describe sustainable living practices and discuss their importance for future generations.
- Discuss the importance of integrity in leadership and how it impacts professional ethics.
- Analyze a real-life case study where ethical decision-making led to a positive outcome.

References:

Reference Books	
1	**"Universal Human Values: A Global Perspective on Shared Principles and Ethics"** by Dr. Narayan R. Chandak and Adv. Jyotsna N. Chandak, Notion Press, Chennai.
2	**"Human Values and Professional Ethics (AP Univ)"** by Dr. Madhukar Behara, Dr. N. Sambasiva Rao, and Prof. Abdul Noorbasha, Himalaya Publishing House, Mumbai
3	**"The Invention of Good and Evil: A World History of Morality"**, Hanno Sauer, Published in *The New Yorker*
4	**"Human Values"**, A. Tripathi, New Age International Publishers, New Delhi.
5	**"Values and Ethics in Profession"**, Prof. Mazumdar, Everest Publishing House, Pune
6	**"Human Values and Professional Ethics"**, Jayshree Suresh and B.S. Raghavan, S Chand Publishing, New Delhi

TEXTBOOKS:

Textbook Books	
1	**"Universal Human Values"** by Dr. C.S.G. Krishnamacharyulu and Dr. Lalitha Ramakrishnan, Himalaya Publishing House, Mumbai.
2	**"Universal Human Values: Navigating Ethics and the Environment with Case Studies Approach"** by Debidutta Acharya and Amitabh Nanda, S Chand Publishing, New Delhi.
3	**"A Foundation Course in Human Values and Professional Ethics"** by R.R. Gaur, R. Asthana, and G.P. Bagaria, UHV Publications, Delhi.
4	**"Human Values and Beliefs: A Cross-Cultural Sourcebook"**, Ronald F. Inglehart, Miguel Basanez, and Alejandro Moreno, University of Michigan Press, Ann Arbor
5	**"Universal Human Values for GTU 24 Course (I/II- COMMON -)"**, Technical Publications, Nashik
6	**"Universal Human Values and Professional Ethics"**, Dr. Ritu Soryan, Neelkamal Publications, New Delhi.
7	**"Human Rights and Global Diversity"**, Robert Paul Churchill, Prentice Hall, Upper Saddle River, NJ.

Year and Semester	Second Year B. Tech - Semester III Mechanical Mechatronics Engineering				
Course Category	Programme Core Course (PCC)				
Title of Course	**Electrical Machines (EMC) Lab**			Contact Hrs./Week	Credits
Teaching Scheme	L	T	P		
	--	--	02	02	01
Examination Scheme	MSE	ISE/CA	ESE	Total	
	--	50	25	75	

Course Objectives: The objectives of the course is to

1. Understand the fundamental principles and working of electrical machines, including DC motors, DC generators, transformers, induction motors and synchronous machines.
2. Analyze the performance characteristics of electrical machines through experimental testing and evaluation of efficiency, voltage regulation and torque-speed characteristics.
3. Develop skills in conducting and interpreting various electrical tests, such as open-circuit, short-circuits, no-load, blocked rotor and load tests for different machines.
4. Apply modern control techniques, such as V/f control and stepper motor control, to improve the efficiency and performance of electrical machines in industrial applications.

Course Outcomes:

COs	**At the end of successful completion of the course, the student will be able to**	**Blooms Taxonomy**
CO1	Explain the construction, working principles and types of electrical machines,	II
CO2	Conduct standard performance tests to determine efficiency, voltage regulation, slip and other key parameters of electrical machines.	IV
CO3	Analyze and interpret experimental data to evaluate the characteristics of DC generators, DC motors, induction motors, and transformers.	III
CO4	Demonstrate synchronization of alternators with the grid and study the impact of excitation on power factor through V and Inverted V curve analysis.	V
CO5	Implement and assess modern motor control techniques, such as V/f control on induction motors and stepper motor control, to enhance machine performance.	VI
CO6	Apply the knowledge of electrical machines in industrial applications, ensuring proper selection, testing, and maintenance of motors and transformers for efficient operation.	III

Unit No.	Content	Hours
1	**Study and Testing of DC Machines:** Construction, working principle and characteristics of DC motors and generators. Perform open-circuit and load tests on a DC machine to analyze voltage, current and efficiency.	2
2	**Performance Testing of DC Generators:** Construction, working principle, and voltage-current characteristics of DC shunt, series, and compound generators. Conduct open-circuit and load tests on different types of DC generators to determine their voltage regulation and efficiency.	3
3	**Open-Circuit and Short-Circuit Tests on a Single-Phase Transformer:** Equivalent circuit parameters, efficiency, and voltage regulation of a single-phase transformer. Conduct OC (no-load) and SC (short-circuit) tests to evaluate the transformer's performance characteristics.	2
4	**Load Test on a Three-Phase Transformer:** Efficiency and voltage regulation of a three-phase transformer under different load conditions. Perform a load test on a three-phase transformer, record voltage, current and power readings, and calculate efficiency.	2
5	**V and Inverted V Curve Analysis of a Synchronous Motor:** Effect of excitation on the power factor and performance of a synchronous motor. Conduct a no-load and load test on a synchronous motor, plot V and inverted V curves and study power factor variation.	3
6	**Study and Performance Analysis of a Stepper Motor:** Working principle, step angle and control techniques of a stepper motor. Perform step angle calculations, run the motor in different step modes (full-step, half-step, micro-stepping) and analyze its response.	2

NOTE:

1) For ISE/ CA- Assessment of Journal based on above six experiments. [50 Marks]

2) For ESE- Practical Examination on above six experiments. [25 Marks]

References:

Reference Books	
1	"Electrical Machines" by B.L. Theraja & A.K. Theraja, Publication: S. Chand & Co., 2014 ISBN: 978-8121902534
2	"Electrical Machines: DC Machines" by Nagrath & Kothari
3	"Principles of Electrical Machines" by V.K. Mehta. Publication: S. Chand & Co., 2014 ISBN: 978-8121901582
4	"Synchronous Machines" by S.K. Bhattacharya, Publication: Oxford University Press, 2017 ISBN: 978-0198094066
5	"Special Electrical Machines" by K. Vijaya Kumar, Publication: PHI Learning, 2011 ISBN: 978-8120337765

Year and Semester	Second Year B. Tech - Semester III (Mechanical Mechatronics Engineering)				
Course Category	Humanities Social Science and Management (HSSM)				
Title of Course	Economics for Engineers			Contact Hrs/Week	Credits
Teaching Scheme	L	T	P		
	02	-	--	02	02
Examination Scheme	MSE	ISE/CA	ESE	Total	
	-	50	-	50	

Course Objectives: The objectives of the course is to

1. To help engineering students understand basic economic principles so they can explain resource allocation, cost-benefit analysis, and project evaluation under scarcity.
2. To help students understand the concepts of demand, supply, and market equilibrium, and explain how elasticity affects pricing decisions in engineering.
3. To help students understand cost concepts, production functions, and break-even analysis, enabling them to explain their applications in engineering.
4. To help students understand different market structures, pricing strategies, and the impact of technology on markets, with applications in engineering.
5. To help students understand key macroeconomic concepts like GDP, inflation, and business cycles, and explain their impact on engineering and infrastructure projects.
6. To help students understand project evaluation techniques, including time value of money, NPV, IRR, cost-benefit analysis, and risk assessment in engineering projects.

Course Outcomes:

COs	At the end of successful completion of the course, the student will be able to	Blooms Taxonomy
CO1	Upon completion of this course, students will be able to explain economic principles related to engineering decision-making, describe the concept of opportunity cost, and summarize different economic systems.	II
CO2	Upon completion of this course, students will be able to describe the relationship between demand and supply, explain market equilibrium, and apply elasticity concepts in engineering pricing decisions	III
CO3	Upon completion of this course, students will be able to describe different types of costs, explain production functions, and apply break-even analysis in engineering projects	III
CO4	Upon completion of this course, students will be able to describe various market structures, explain pricing strategies, and apply these concepts to engineering products and firms	III

CO5	Upon completion of this course, students will be able to describe macroeconomic indicators, explain monetary and fiscal policies, and apply these concepts to engineering and infrastructure projects	III
CO6	Upon completion of this course, students will be able to explain the time value of money, describe project evaluation methods, and apply cost-benefit analysis and risk assessment in engineering decision-making.	III

SYLLABUS

Unit No	Content	Hours
Unit 1	**Introduction to Economics for Engineers:**	
	• **Definition of Economics**-Economics as a study of choice under scarcity, Application of economic principles to engineering decisions. • Microeconomics vs. Macroeconomics • **Scarcity**-Limited resources vs unlimited wants **Choice-** Decision making under resource constraints **Opportunity Cost**-The value of the next best alternative foregone • **Role of Economics in Engineering Decision-Making**-Resource allocation in engineering projects • Economic Systems (Capitalism, Socialism, Mixed Economy).	**[05]**
Unit 2	**Demand, Supply, and Market Equilibrium:**	
	• Law of Demand and Supply **Demand**- Relationship between price & quantity demanded **Supply**- Cost of production, technology. • Factors Affecting Demand and Supply. • Market Equilibrium and Price Determination- Equilibrium price & quantity. • Elasticity of Demand and Supply- Applications of elasticity in engineering (e.g., pricing strategies)	**[05]**
Unit 3	**Cost Analysis and Production Functions:**	**[04]**
	• Types of costs- Fixed, variable, marginal & average costs. • Production function- Input-output relationship. • Break- Even Analysis- Calculation of break-even point, Applications in engineering projects. • Applications in Engineering- Cost optimization in manufacturing.	
Unit 4	**Market Structures and Pricing Strategies:**	**[05]**
	• **Market structures-** Perfect competition, monopoly, monopolistic competition. • **Pricing strategies-** Cost & value-based pricing. • **Role of Innovation & Technology-**Impact of technology on market structures. • **Applications in Engineering-** Pricing strategies for engineering products, Impact of market structure on engineering firms.	

Unit 5	**Macroeconomic Concepts for Engineers:** • **GDP, Inflation & Unemployment-** Measurement & significance. • **Monetary & Fiscal Policy-** Role of central banks & government in economic stability. • **Business Cycles-** Phases of business cycles (boom, recession, recovery). **Applications in Engineering-** Impact of macroeconomic indicators on infrastructure projects	**[04]**
Unit 6	**Project Evaluation and Economic Decision-Making:** • **Time value of money-** Present value, future value & discounting**.** • **Net Present Value (NPV) & Internal Rate of Return (IRR)-** Calculation & interpretation. • **Cost-Benefit Analysis-** Steps & Applications in engineering projects**.** • **Risk Analysis-** Identifying & mitigating risks in engineering projects.	**[05]**

Note - The ISE/CA is carried out through the report on the assignments given below

- Define economics and explain how it helps in decision-making under scarcity.
- Define the law of demand and supply with examples & explain the factors affecting demand and supply.
- Describe the steps to calculate the break-even point & solve a simple numerical problem on break-even analysis.
- Describe pricing strategies used for engineering product.
- Define GDP, inflation, and unemployment, and explain their significance & describe the role of central banks and government in economic stability.
- Describe NPV and IRR with their significance in project evaluation & explain the steps of cost-benefit analysis in engineering projects

References:

Reference Books	
1	"Principles of Economics" by N. Gregory Mankiw, Cengage Learning, Boston.
2	"Microeconomics" by Robert S. Pindyck and Daniel L. Rubinfeld, Pearson Education, London.
3	"Macroeconomics" by Olivier Blanchard, Pearson Education, London.
4	"Economics for Engineers" by James L. Riggs, David D. Bedworth, and Sabah U. Randhawa, Pearson Education, London.
5	"The Economics of Engineering Projects: Planning and Control" by Schuyler Totten, CRC Press, Boca Raton.
6	"Engineering Decision Making and Risk Management" by Jeffrey W. Herrmann, Wiley, Hoboken.
7	"Economic Decision Analysis" by Frank A. Tillman and Deandra T. Cassone, CRC Press, Boca Raton.

TEXTBOOKS:

Textbook Books	
1	"Principles of Engineering Economics with Applications" by Zahid A. Khan, Arshad N. Siddiquee, Brajesh Kumar, and Mustufa H. Abidi, Cambridge University Press, New Delhi.
2	"Engineering Economy and Management" by Pravin Kumar, Wiley India, New Delhi.
3	"Engineering Economy" by Leland Blank and Anthony Tarquin, McGraw-Hill Education, New York
4	"Fundamentals of Engineering Economics" by Chan S. Park, Pearson Education, London.
5	"Contemporary Engineering Economics" by Chan S. Park, Pearson Education, London.
6	"Engineering Economic Analysis" by Donald G. Newnan, Ted G. Eschenbach, and Jerome P. Lavelle, Oxford University Press, Oxford.
7	"Economic Analysis for Engineering and Managerial Decision Making" by Norman N. Barish and Seymour Kaplan, McGraw-Hill Education, New York.

Year and Semester	Second Year B. Tech - Semester III Mechanical Mechatronics Engineering				
Course Category	Open Elective (OE)				
Title of Course	**Auto CAD Lab**			Contact Hrs./Week	Credits
Teaching Scheme	L	T	P		
	--	--	02	02	01
Examination Scheme	MSE	ISE/CA	ESE	Total	
	--	25	25	50	

Course Objectives: The objectives of the course is to

1. To familiarize students with 2D drafting using AutoCAD.
2. To develop engineering visualization skills using digital tools.
3. To enable students to create orthographic, isometric, and sectional views.
4. To train students in industrial drawing standards using layers, dimensioning and symbols.

Course Outcomes:

Cos	**At the end of successful completion of the course, the student will be able to**	**Blooms Taxonomy**
CO1	Navigate AutoCAD interface and set up drawings efficiently.	II
CO2	Create 2D shapes using standard commands and snapping tools.	IV
CO3	Use modified tools and layers for drafting clarity and organization.	III
CO4	Apply industrial dimensioning and text standards.	V
CO5	Convert 3D models into orthographic projections.	VI
CO6	Build isometric and basic 3D visualizations using solid modeling.	III

Syllabus

Unit No.	Content	Hours
1	**Introduction to AutoCAD:** GUI, coordinates, units, basic commands	2
2	**Basic 2D Sketching:** Line, Circle, Arc, Rectangle, Polygon, Ellipse	2
3	**Modify Commands & Layers:** Move, Copy, Mirror, Offset, Trim, Extend, Layers	3
4	**Dimensioning & Text Annotation:** Linear, Angular, Radial dimensions, text styles	2
5	**Orthographic Projections:** Front, Top, Side views of simple machine parts	2
6	**Isometric Drawing & 3D Introduction:** Isometric grids, 3D View Setup, Extrude	3

NOTE:

1) For ISE/ CA- Assessment of Journal based on above six experiments. [25 Marks]

2) For ESE- Practical Examination on above six experiments. [25 Marks]

References:

Reference Books	
1	Engineering Drawing with AutoCAD by T. Jeyapoovan, Vikas Publishing
2	AutoCAD Workbook for Engineers by Nighat Mir, Pearson
3	Engineering Drawing and Graphics Using AutoCAD by K. Venugopal, New Age

Shivaji University, Kolhapur S. Y. B. Tech Syllabus

(as per NEP-2020)

Mechanical and Mechatronics Engineering

(2025-26)

Semester IV

Year and Semester	Second Year B. Tech - Semester IV (Mechanical Mechatronics Engineering)				
Course Category	Programme Core Course (PCC)				
Title of Course	Theory of machines			Contact Hrs/Week	Credits
Teaching Scheme	L	T	P		
	03	00	--	03	03
Examination Scheme	MSE	ISE/CA	ESE	Total	
	30	10	60	100	

Course Objectives: The objectives of the course is to

1. To represent kinematic behaviour of different machine elements and mechanisms.
2. To select various Power transmitting devices.
3. To compare types of Governing mechanisms.
4. understand the basic theory on gears, analyze the various types of gear trains used for transmission of motion and power.
5. study and analyze the problems on balancing of rotary masses study the force analysis of simple mechanisms
6. study turning moment diagram.

Course Outcomes:

COs	At the end of successful completion of the course, the student will be able to	Blooms Taxonomy
CO1	Understand different types of mechanisms and their applications	II
CO2	Analyze kinematic theories of mechanism,	IV
CO3	Select different power transmitting elements & governing mechanisms according to application	II
CO4	Identify the various types of gears & Select a gear drive for practical purpose.	II
CO5	Do force analysis of mechanisms & Solve a balancing problem	IV
CO6	Understand turning moment diagram	II

SYLLABUS

Unit No	Content	Hours
Unit 1	**Basic Concept of Mechanisms:** • Links, kinematic pair (lower and higher), Kinematic chain, Mechanism, inversion, Types of constraints, Grubblers criterion, Inversions of slider crank chain, Double slider crank chain, Four bar, Steering gear mechanisms, Hooke's joint (only theoretical treatment).	**[07]**
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.	**[08]**
Unit 3	**Belts & Governors** • **Belts** Types of belt drives, Calculation of power transmitted, Belt tension ratio, Actual tension in a running belt, Centrifugal and initial tension in belt, Slip and creep of belt • **Governors** Types of governors, Porter and Hartnell governor, Controlling force and stability of governor, Hunting, Sensitivity, Isochronism, Governor effort and power, Insensitiveness of governors.	**[08]**
Unit 4	**Toothed Gearing & Gear Trains** • **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. • **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.	**[08]**
Unit 5	**Static and dynamic Force analysis of Mechanisms Balancing** • **Static and dynamic Force analysis of Mechanisms** Velocity and acceleration of slider crank mechanism by analytical method, Inertia force and torque, D'Alembert's principle, Dynamically equivalent system, force analysis of reciprocating engine mechanism and four bar chain mechanism. • **Balancing** Static and Dynamic balancing of rotary masses. Number of masses rotating in single plane and different planes	**[09]**
Unit 6	**Flywheel** • Turning moment diagrams, Fluctuation of energy, Coefficient of fluctuation of speed, Rimmed flywheel	**[05]**

EXPERIMENTS: (Assignment is equal to 5 lectures) 10 marks

Note - The ISE/CA is carried out through the report on the assignments given below

1. Study of basic mechanisms. (Demonstration of models, Actual mechanisms, etc.)
2. Computer aided force analysis of any one of following
a. Slider crank mechanism
b. Four bar mechanism
3. Assignment on Flywheel
4. One A3 size sheet of Velocity problems by relative velocity method. (Minimum 4 problems)

5. One A3 size sheet of Velocity problems by Klien's construction and Instantaneous center method. (Minimum 4 problems)

References:

Reference Books	
1	"Theory of Machines and Mechanism", Shigley, McGraw Hill, New York
2	"Theory of Machines", Abdullah Shariff, McGraw Hill, New Delhi.
3	Theory of machines by Thomas Beven (Pearson, Edition 3rd)
4	Mechanisms and Dynamics of machines by J.Srinivas (SciTech Publications)
5	Theory of Machines by Jagdishlal, Metropolitan Publication

TEXTBOOKS:

Textbook Books	
1	"Theory of Machines", Dr. R.K.Bansal, Laxmi Publication
2	"Theory of Machines", RatanS.S, Tata McGraw Hill New Delhi, 2nd Edition.
3	"Theory of Machines", P.L.Ballany, Khanna Publication, New Delhi, 2nd Edition
4	"Theory of Machines", V.P. Singh, DhanpatRai and Sons.
5	Mechanism and Machine Theory by Rao, Dukkipati, New Age International.

Year and Semester	Second Year B. Tech - Semester IV Mechanical Mechatronics Engineering)				
Course Category	Programme Core Course (PCC)				
Title of Course	**Signals Processing**			Contact Hrs/Week	Credits
Teaching Scheme	L	T	P		
	03	--	--	03	3
Examination Scheme	MSE	ISE/CA	ESE	Total	
	30	10	60	100	

Course Objectives: The objectives of the course is to

1. Learn the importance of signal processing in mechanical and mechatronic systems.
2. Learn how to capture and prepare signals for analysis.
3. Analyze signals in the time domain for key characteristics and behaviors.
4. Convert and analyze signals in the frequency domain using mathematical tools.
5. Learn how to remove noise and extract meaningful data from signals.
6. Apply signal processing techniques to real-world systems and automation.

Course Outcomes:

COs	At the end of successful completion of the course, the student will be able to	Blooms Taxonomy
CO1	**Identify and classify different types of signals and systems** relevant to mechanical and mechatronic applications.	II
CO2	**Acquire and condition signals** using appropriate sensors and data acquisition systems to ensure accurate analysis.	III
CO3	**Analyze signals in the time domain** to extract meaningful characteristics such as amplitude, RMS value, and response behavior.	III
CO4	**Apply frequency domain techniques** like FFT and spectral analysis to interpret mechanical vibrations and system responses.	II
CO5	**Design and implement basic digital filters** to process signals and remove noise using tools like MATLAB.	III
CO6	**Integrate signal processing techniques** into real-world mechanical and mechatronic systems for monitoring, control, and diagnostics.	III

SYLLABUS

Unit No	Content	Hours
Unit 1	**Introduction to Signal Processing**	
	• Definition and types of signals (analog, digital, periodic, aperiodic). • Continuous vs discrete signals. • Real-world signals in mechanical/mechatronics (vibration, temperature, pressure, motor feedback, etc.) • Linear Time-Invariant (LTI) systems • Applications of signal processing in fault diagnosis, automation, control.	**08 Hrs**
Unit 2	**Signal Acquisition and Conditioning**	
	• Sensors and transducers used in mechanical/mechatronics (accelerometers, strain gauges, encoders, etc.) • Signal acquisition: sampling, quantization. • Aliasing and Nyquist theorem. • Signal conditioning: amplification, filtering, isolation. • DAQ systems and interfacing.	**06 Hrs**
Unit 3	**Time Domain Signal Analysis**	
	• Time-domain parameters: amplitude, RMS, mean, peak-to-peak, rise time. • Signal averaging and smoothing. • Correlation and convolution. • Time response of mechanical systems (step, impulse, ramp). • Use of tools like MATLAB/Simulink for time-domain analysis.	**08 Hrs**
Unit 4	**Frequency Domain Analysis**	
	• Fourier Series and Fourier Transform (basic concepts and interpretation). • Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT). • Frequency response of mechanical systems. • Spectral analysis of vibration signals. • Practical case: FFT analysis of motor noise or structural vibrations.	**06 Hrs**
Unit 5	**Filtering and Signal Processing Techniques**	
	• Types of filters: Low-pass, High-pass, Band-pass, Band-stop. • FIR vs IIR filters. • Digital filter design basics. • Real-time signal processing for control and diagnostics. • Signal denoising techniques. • Use of Python/MATLAB for filter implementation.	**08 Hrs**
Unit 6	**Applications in Mechanical and Mechatronic Systems**	
	• Vibration monitoring and analysis of rotating machines. • Condition monitoring and predictive maintenance. • Signal processing in feedback control systems (PID tuning using signals). • Sound and noise analysis in automotive/industrial systems. • Data acquisition and signal processing for robotics and automation. • Case studies: smart manufacturing, digital twin, mechatronic subsystems	**06 Hrs**

Assignment (10 Marks):

1. Explain the difference between continuous and discrete signals with suitable examples from mechanical or mechatronic systems. Discuss how these signals are used in automation or control applications.
2. Select any one sensor (e.g., accelerometer or strain gauge) used in mechanical systems and explain how the signal from this sensor is acquired, conditioned, and digitized. Include the importance of sampling rate and Nyquist theorem in your explanation.
3. A step input is given to a first-order mechanical system (e.g., mass-damper system). Simulate the time response using MATLAB or Simulink and analyze the signal in terms of RMS, peak-to-peak, and rise time. Attach plots and comment on the system's behavior.
4. Perform a Fast Fourier Transform (FFT) on a vibration signal (real or simulated) of a rotating machine using MATLAB or Python. Identify dominant frequency components and explain what they indicate about the machine's condition.
5. Design a digital low-pass FIR filter to remove high-frequency noise from a motor speed signal using MATLAB or Python. Provide code, filtered vs. unfiltered plots, and explain how the filter improves signal quality.
6. Choose one application (e.g., condition monitoring of a gearbox or noise analysis in an automotive system). Describe how signal processing is applied in this context, including sensors used, type of signal analysis performed, and benefits for predictive maintenance or control.

References:

Reference Books	
1	**"Signals and Systems" by Alan V. Oppenheim, Alan S. Willsky, and S. Hamid Nawab Publication Year: 1997 (2nd Edition) ISBN: 978-0138147570**
2	**"Signal Processing and Linear Systems"** by B. P. Lathi **Publication Year**: 2004 **ISBN**: 978-0195158335
3	**"Digital Signal Processing: Principles, Algorithms and Applications"** by John G. Proakis and Dimitris K. Manolakis **Publication Year**: 2006 (4th Edition) **ISBN**: 978-0131873742
4	**"Applied Signal Processing: A MATLAB-Based Proof of Concept"** by Thierry Dutoit and Benoît Macq **Publication Year**: 2009 **ISBN**: 978-0387799767
5	**"Mechanical Vibrations: Theory and Applications"** by Kelly S. G. **Publication Year**: 2011 **ISBN**: 978-1133706571
6	**"Introduction to Mechatronics and Measurement Systems"** by David G. Alciatore and Michael B. Histand **Publication Year**: 2011 (4th Edition) **ISBN**: 978-0073380230

Text Books	
1	**"Signals and Systems" by Alan V. Oppenheim, Alan S. Willsky, and S. Hamid Nawab Publication Year: 1997 (2nd Edition) ISBN: 978-0138147570**
2	**"Digital Signal Processing: Principles, Algorithms and Applications"** by John G. Proakis and Dimitris K. Manolakis **Publication Year**: 2006 (4th Edition) **ISBN**: 978-0131873742

3	**"Signal Processing and Linear Systems"** by B. P. Lathi **Publication Year**: 2004 **ISBN**: 978-0195158335
4	**"Fundamentals of Signals and Systems Using the Web and MATLAB"** by Edward W. Kamen and Bonnie S. Heck **Publication Year**: 2006 (3rd Edition) **ISBN**: 978-013168737

Year and Semester	Second Year B. Tech - Semester IV Mechanical Mechatronics Engineering)				
Course Category	**Programme Core Course (PCC)**				
Title of Course	**Material & Manufacturing Processes**			Contact Hrs/Week	Credits
Teaching Scheme	L	T	P		
	03	--	--	03	3
Examination Scheme	MSE	ISE/CA	ESE	Total	
	30	10	60	100	

Course Objectives: The objectives of the course is to

1. **Material Knowledge**: To impart knowledge of the various engineering materials (metals, polymers, ceramics, and composites) and their properties.
2. **Manufacturing Techniques**: To introduce students to fundamental manufacturing processes, including casting, forming, machining, and welding.
3. **Process Selection**: To enable students to select appropriate manufacturing processes based on material properties, design requirements, and economic factors.
4. **Process Optimization**: To develop an understanding of process parameters and their influence on quality and productivity.
5. **Manufacturing Automation**: To expose students to advanced manufacturing technologies, including automation, rapid prototyping, and computer-aided manufacturing.
6. **Safety and Environmental Considerations**: To highlight safety aspects and the environmental impact of manufacturing processes

Course Outcomes:

COs	**At the end of successful completion of the course, the student will be able to**	**Blooms Taxonomy**
CO1	Understand the mechanical, thermal, and chemical properties of various engineering materials and their role in manufacturing.	II
CO2	Analyze and compare different manufacturing processes (casting, forming, machining, etc.) based on material, design, and cost.	IV
CO3	Develop the ability to select suitable materials and manufacturing processes for given engineering applications.	VI
CO4	Apply the knowledge of material processing techniques to real-world engineering problems.	III
CO5	Demonstrate proficiency in process planning, material selection, and cost analysis for product manufacturing.	I

CO6	Understand the implications of environmental and safety regulations in manufacturing processes.	II

SYLLABUS

Unit No	Content	Hours
Unit 1	**Engineering Materials**	
	Introduction to Materials: Classification of engineering materials (Metals, Polymers, Ceramics, and Composites). **Material Properties**: Mechanical properties (strength, hardness, ductility, toughness, etc.), thermal properties, electrical properties, and magnetic properties. **Material Selection**: Criteria for selecting materials based on properties and applications. **Phase Diagrams**: Types of phase diagrams (binary and ternary), and phase transformations. **Heat Treatment**: Annealing, normalizing, hardening, tempering, and surface hardening processes.	**08 Hrs**
Unit 2	**Manufacturing Processes - Casting**	
	Introduction to Casting: Types of casting processes (Sand casting, Die casting, Investment casting, Shell casting). **Casting Defects**: Causes and remedies for common casting defects (shrinkage, cracks, and porosity). **Moulding Materials**: Properties of moulding sand, core making, and gating systems. **Solidification and Cooling**: Principles of solidification, cooling rates, and effect on the quality of castings	**06 Hrs**
Unit 3	**Forming Processes**	
	Introduction to Forming Processes: Overview of forming processes such as forging, rolling, extrusion, drawing, and sheet metal operations. **Metal Forming**: Basics of plastic deformation, strain hardening, and recovery. **Forging**: Types of forging processes (open-die, closed-die, and upset forging). **Rolling and Extrusion**: Hot and cold rolling, and extrusion processes (solid and hollow). **Sheet Metal Processes**: Cutting, bending, deep drawing, punching, and stamping.	**08 Hrs**
Unit 4	**Machining Processes**	
	Introduction to Machining: Overview of machining processes (turning, milling, drilling, grinding, and shaping). **Cutting Tools**: Types of cutting tools, tool geometry, and tool wear. **Machining Parameters**: Speed, feed, depth of cut, and their effects on machining.	**06 Hrs**

	Non-traditional Machining: Electrical Discharge Machining (EDM), Laser Beam Machining (LBM), Water Jet Cutting (WJC). **Surface Finish and Tolerances**: Measuring surface finish, quality control, and tolerance standards.	
Unit 5	**Joining Processes**	
	Welding Processes: Arc welding, MIG welding, TIG welding, resistance welding, and laser welding. **Brazing and Soldering**: Process characteristics and differences between welding, brazing, and soldering. **Welding Defects**: Causes, effects, and methods of detecting welding defects (cracks, porosity, and undercut). **Non-Destructive Testing (NDT)**: Methods like ultrasonic testing, X-ray inspection, dye penetrant testing.	**08 Hrs**
	Advanced Manufacturing Techniques	
Unit 6	**Rapid Prototyping**: Technologies such as 3D printing, stereolithography (SLA), and selective laser sintering (SLS). **Computer Numerical Control (CNC)**: Introduction to CNC machining, G-code, and automated manufacturing. **Automation in Manufacturing**: Types of automation (fixed, programmable, and flexible), industrial robots, and automated production lines. **Lean Manufacturing**: Principles of lean manufacturing, value stream mapping, and continuous improvement.	**06 Hrs**

Field work: (Term work is equal to 2 hours per week) **10 marks**

Note - The ISE/CA is carried out through the Term work.

1) Demonstration of N.D.T. (Minimum two of different NDT tests)
2) Observation of various industrial heat treatments processes during industrial visits.
3) One assignment on each unit .

References:

Reference Books	
1	**"Materials and Processes in Manufacturing"** by **E. Paul DeGarmo**, **J.T. Black**, and **R.A. Kohser** **Publication Year**: 2011 (10th Edition) **ISBN**: 978-0135063340
2	**"Manufacturing Processes for Engineering Materials"** by **Serope Kalpakjian** and **Steven R. Schmid** **Publication Year**: 2014 (7th Edition) **ISBN**: 978-0133128741
3	**"Fundamentals of Modern Manufacturing"** by **Mikell P. Groover Publication Year**: 2016 (5th Edition) **ISBN**: 978-1118474201
4	**"Mechanical Metallurgy"** by **George E. Dieter Publication Year**: 2013 (4th Edition) **ISBN**: 978-0070168930
Text Books	
1	**"Manufacturing Engineering and Technology"** by **Serope Kalpakjian** and **Steven R. Schmid Publication Year**: 2019 (7th Edition) **ISBN**: 978-0134733196
2	**"Fundamentals of Modern Manufacturing"** by **Mikell P. Groover Publication Year**: 2016 (5th Edition) **ISBN**: 978-1118474201

Year and Semester	Second Year B. Tech - Semester IV (Mechanical Mechatronics Engineering)				
Course Category	Multidisciplinary minor (MDD)				
Title of Course	Product Design & Development			Contact Hrs/Week	Credits
Teaching Scheme	L	T	P		
	02	--	--	02	02
Examination Scheme	MSE	ISE/CA	ESE	Total	
	30	10	60	100	

Course Objectives: The objectives of the course is

1. To provide students with a foundational understanding of product design, including product classification, life cycle, product mix, and the modern product development process.
2. To introduce students to the foundational principles of conceptual design, including concept generation, selection, embodiment, industrial design processes, robust design methodologies such as Taguchi Designs and Design of Experiments (DOE), and design optimization techniques.
3. To provide students with an understanding of design principles that enhance manufacturability and assembly, emphasizing maintainability, environmental considerations, product costing, legal factors, social issues, and engineering ethics.
4. To introduce students to the principles and methodologies of Value Engineering and Value Analysis, including their definitions, methodologies, case studies, and economic analysis techniques.
5. To introduce students to the principles of ergonomics and aesthetics in product design, focusing on human factors, man-machine interaction, and creative techniques.
6. To introduce students to the principles and practices of concurrent engineering, including rapid prototyping, product design tools, computer-aided manufacturing (CAM) interfaces, and an overview of patents and intellectual property (IP) acts.

Course Outcomes:

COs	At the end of successful completion of the course, the student will be able to	Blooms Taxonomy
CO1	Explain the classification and specifications of products, the stages of the product life cycle, the concept of product mix, and the modern product development process.	II
CO2	Apply robust design principles, including Taguchi methods and Design of Experiments (DOE), to optimize product designs	III

CO3	Explain the methods of designing for manufacturing and assembly, including considerations for maintainability and environmental impact.	II
CO4	Define the concepts of Value Engineering and Value Analysis, and describe their methodologies.	I
CO5	Explain the concepts of gross human anatomy, man-machine interaction, and the elements of aesthetics such as size, texture, color, and comfort criteria.	II
CO6	Explain the concepts of concurrent engineering and rapid prototyping, and describe the use of drafting/modeling software and CAM interfaces in product design.	II

SYLLABUS

Unit No	Content	Hours
Unit 1	**Introduction:** • Classification/ Specifications of Products. • Product life cycle. Product mix. • Introduction to product design. • Modern product development process. • Innovative thinking.	[05]
Unit 2	**Conceptual Design:** • Generation, selection & embodiment of concept. • Product architecture. • Industrial design: process, need. • Robust Design: Taguchi Designs & DOE. • Design Optimization	[04]
Unit 3	**Design for Mfg. & Assembly:** • Methods of designing for Mfg. & Assy. • Designs for Maintainability. • Designs for Environment. • Product costing. • Legal factors and social issues. Engineering ethics and issues of society related to design of products.	[05]

Unit 4	**Value Engineering / Value Analysis**:	**[04]**
	• Definition. Methodology. • Case studies. • Economic analysis: Qualitative & Quantitative.	
Unit 5	**Ergonomics / Aesthetics:**	**[05]**
	• Gross human autonomy. • Man-Machine interaction. • Concepts of size and texture, colour, Comfort criteria. • Psychological & Physiological considerations. • Creativity Techniques: Creative thinking, conceptualization, brain storming, primary design, drawing.	
Unit 6	**Concurrent Engineering:**	**[05]**
	• Rapid prototyping. • Tools for product design – Drafting / Modeling software. • CAM Interface. • Patents & IP Acts. Overview, Disclosure preparation.	

Note - The ISE/CA is simple, practical and engaging assignments unit-wise. These assignments are short, case-based to ensure students grasp the key concepts without being overwhelmed.

Unit-1

- What are the main types of products based on their classification?
- Why are product specifications important in product development?
- Define the product life cycle and briefly describe its stages.
- What is meant by a product mix? Give a real-world example.
- Explain the term “product design” and its significance.
- What are the main stages of the modern product development process?
- What is innovative thinking, and how does it help in product design?

Unit-2

- Generate two different design concepts for the product (add simple sketches if possible).
- Select the better concept using a simple comparison or selection method (e.g., pros and cons).
- Break the product into main components/functions (write as a list or simple block diagram).
- Mention one industrial design improvement (e.g., better grip, appearance).
- Suggest one robustness improvement (e.g., better material, tolerance) using simple logic.
- Identify one parameter to optimize (e.g., weight, cost) and explain why.

Unit-3

- Describe at least two methods or strategies used in DFMA.
- Explain the key principles of designing products for manufacturing and assembly (DFMA).
- How do these strategies help in reducing product cost and improving quality?
- Explain how design choices impact product maintenance.
- Give an example of a product that is easy to maintain and explain why.
- How does designing for the environment benefit both society and industry?
- Describe any one method used in DFE (e.g., material selection, recyclability).

Unit-4

- Define the following terms: a) Value Engineering, b) Value Analysis
- What are the main objectives of Value Engineering?
- List at least three goals of applying VE in product design or manufacturing
- List and briefly explain the key steps involved in the Value Engineering / Value Analysis methodology. Use a flowchart if possible.

Unit-5

- Explain 'Gross Human Autonomy' and its importance in product design.
- What do you understand by 'Man-Machine Interaction'?
- Give an example of a product where user interaction plays a key role in the design.
- Discuss the role of size, texture, colour, and comfort in aesthetics.
- Briefly differentiate between psychological and physiological considerations in ergonomics.
- List and explain any two creativity techniques used in the design process.

Unit-6

- What is Rapid Prototyping and how does it support concurrent engineering?
- Give one example of a product that benefits from rapid prototyping.
- Name any two drafting or modeling software used in product design.
- Briefly explain how such software helps designers work collaboratively and efficiently.
- What is the CAM (Computer-Aided Manufacturing) Interface?
- Explain how it connects design and manufacturing in the product development cycle.
- What are Patents and Intellectual Property (IP) Acts? Why are they important in product design?
- What is a Disclosure Document in the context of patents?
- What basic information does it contain?

References:

Reference Books	
1	"Product Design and Development" – Karl T. Ulrich, Steven D. Eppinger, Tata McGraw-Hill, New Delhi, 2003.
2	"Product Design: Fundamentals and Methods" – N. J. M. Roozenburg, J. Eekels, N. F. M. Roozenburg, John Wiley & Sons, 1995.
3	"Product Design: Techniques in Reverse Engineering and New Product Development" – Kevin Otto, Kristin Wood, Pearson Education, New Delhi, 2004.
4	"Value Engineering" – L. D. Miles, McGraw-Hill.
5	"Successful Product Design" – B. Hollins, S. Pugh, Butterworths, London.

TEXTBOOKS:

Textbook Books	
1	“Product Design and Value Engineering”, Dr. H. R. Thakkar, Dr. M. A. Bulsara, Charotar Publishing House Pvt. Ltd., 2015.
2	“Value Engineering: A Plan for Invention”, Richard Park, CRC Press, 1999.
3	“Product Design for Manufacture and Assembly”, Geoffrey Boothroyd, Peter Dewhurst, Winston A. Knight, CRC Press, 2010.
4	“Concurrent Engineering: Tools and Technologies for Mechanical System Design”, Edward J. Haug, Springer-Verlag, 1993.
5	“Concurrent Engineering in Construction Projects”, Chimay Anumba, John M. Kamara, Anne-Francoise Cutting-Decelle, Routledge, 2007.

Year and Semester	Second Year B. Tech - Semester IV Mechanical Mechatronics Engineering				
Course Category	Open Elective- 02				
Title of Course	**Design and Technology**			Contact Hrs./Week	Credits
Teaching Scheme	L	T	P		
	02	00	--	02	02
Examination Scheme	MSE	ISE/CA	ESE	Total	
	30	10	60	100	

Course Objectives: The objectives of the course is to

1. To introduce students to the fundamentals of design thinking and the engineering design process.
2. To equip students with essential tools and communication techniques.
3. To develop awareness of material selection, manufacturability, sustainability, and cost-efficiency.
4. To encourage innovation, teamwork, and project-based learning.

Course Outcomes:

COs	**At the end of successful completion of the course, the student will be able to**	**Blooms Taxonomy**
CO1	Understand and explain the principles of design thinking and the engineering design process used to solve real-world problems.	II
CO2	Apply suitable tools such as sketches, flowcharts, and CAD models to communicate design ideas effectively	III
CO3	Analyze user needs, design constraints, and trade-offs to develop feasible and efficient design solutions.	IV
CO4	Evaluate different materials, manufacturing methods, and sustainability aspects to select optimal design options.	V
CO5	Create innovative design solutions using prototyping methods and iterative development techniques.	VI
CO6	Work collaboratively in teams to plan, execute, and present a mini design project aligned with industry or societal needs.	VI

SYLLABUS

Unit No	Content	Hours
Unit 1	**Introduction to Design Thinking**	
	• Definition, need, and importance of design in engineering • Design thinking process: Empathize, Define, Ideate, Prototype, Test • Case studies of innovative designs in various fields • Mind-mapping, brainstorming techniques • Role of creativity and user-centric approach	**05 Hrs**
Unit 2	**Engineering Design Process**	
	• Difference between scientific method and engineering design • Problem identification and requirement gathering • Concept development and functional decomposition • Design constraints, criteria, trade-offs • Ethical and environmental considerations in design	**05 Hrs**
Unit 3	**Design Tools and Communication**	
	• Sketching and basic drawing techniques • Introduction to CAD (2D & 3D tools overview—not branch specific) • Flowcharts, block diagrams, and design documentation • Technical presentations and visual communication • Collaborative tools and team dynamics in design	**05 Hrs**
Unit 4	**Materials and Manufacturing Considerations**	
	• Overview of materials used in product design (metals, polymers, ceramics, composites) • Design for manufacturability (DFM) and design for assembly (DFA) • Sustainable and eco-friendly materials • Introduction to prototyping methods (manual, digital, 3D printing) • Cost vs. quality vs. performance trade-offs	**05 Hrs**
Unit 5	**Innovation and Product Development**	
	• What is innovation? Incremental vs. disruptive innovation • Product life cycle: From concept to market • Market research and identifying user needs • Intellectual Property Rights (IPR): Patents, copyrights, trademarks • Case studies on product development journeys	**05 Hrs**
Unit 6	**Design Projects and Industry Practices**	
	• Mini project planning and execution methodology • Agile and iterative design methods (SCRUM basics) • Design validation and testing methods • Industry 4.0 and emerging technologies in design • Industry case studies: Automotive, IT, Civil, and IoT examples	**05 Hrs**

Note - The ISE/CA is carried out through any five Assignments from the following: [10 Marks]

1. Assignment on Introduction to Design Thinking.
2. Assignment on Engineering Design Process.
3. Assignment on Design Tools and Communication.
4. Assignment on Materials and Manufacturing Considerations.
5. Assignment on Innovation and Product Development.
6. Assignment on Design Projects and Industry Practices.

References:

Reference Books and Text Books	
1	"Engineering Design" by M.S. Mahajan, Dhanpat Rai & Co.
2	"Product Design and Development" by A.K. Chitale & R.C. Gupta, McGraw Hill Education (India)
3	"Design of Machine Elements" by V.B. Bhandari, Tata McGraw Hill
4	"Innovation and Entrepreneurship: Practice and Principles" by Dr. S.S. Khanka, S. Chand Publishing.
5	"Engineering Graphics and Design" by P.S. Gill, Kataria & Sons

Year and Semester	Second Year B. Tech - Semester III (Mechanical Mechatronics Engineering)				
Course Category	**Humanities SocialScience and Management** (HSSM)				
Title of Course	Strategic Management			Contact Hrs/Week	Credits
Teaching Scheme	L	T	P		
	02	--	--	02	02
Examination Scheme	MSE	ISE/CA	ESE	Total	
	--	50	--	50	

Course Objectives: The objectives of the course is to

1. To understand the fundamental concepts of strategic management, its scope, and the role of top management in decision-making..
2. To explore the process of strategy formulation and its impact on business growth.
3. To analyze business environments using environmental scanning techniques and SWOT analysis.
4. To study various competitive strategies and business models adopted by organizations.
5. To understand the implementation and evaluation of strategies using various performance measurement tools.
6. To explore the impact of emerging trends like AI, digital transformation, and globalization on business strategies.

Course Outcomes:

COs	**At the end of successful completion of the course, the student will be able to**	**Blooms Taxonomy**
CO1	Learners will be able to explain strategic management concepts and differentiate between strategic planning and strategic management.	III
CO2	Learners will be able to describe corporate, business, and functional strategies and their significance.	II
CO3	Learners will be able to conduct SWOT and PESTLE analysis for a given business scenario.	III
CO4	Learners will be able to compare and apply different competitive strategies in real-world cases.	III
CO5	Learners will be able to use the Balanced Scorecard and KPIs to evaluate business performance	III
CO6	Learners will be able to explain how digital transformation and sustainability influence strategic decision-making	II

SYLLABUS

Unit No	Content	Hours
Unit 1	**Introduction to Strategic Management:** • Definition, scope, and importance of strategic management • Strategic decision-making process • Levels of strategy: Corporate, Business, and Functional • Role of top management in strategy formulation • Difference between strategic planning and strategic management	[05]
Unit 2	**Strategy Formulation:** • Meaning and importance of strategy formulation • Types of strategies: Corporate, Business, and Functional strategies • Vision, Mission, and Objectives of an organization • Strategy formulation process • Case study on real-world strategy formulation	[04]
Unit 3	**Environmental Analysis and SWOT Analysis:** • Understanding business environment: Internal and External • Environmental scanning techniques • PESTLE analysis (Political, Economic, Social, Technological, Legal, Environmental) • SWOT analysis: Strengths, Weaknesses, Opportunities, Threats • Industry analysis: Porter's Five Forces Model	[05]
Unit 4	**Competitive Strategies and Business Models**: • Competitive strategies: Cost Leadership, Differentiation, and Focus strategies • Generic strategies by Michael Porter • Business models: Traditional vs. Digital models • Case studies on competitive strategies adopted by leading companies • Role of innovation in business strategy	[05]
Unit 5	**Strategy Implementation and Evaluation:** • Concept and process of strategy implementation • Challenges in strategy execution • Resource allocation and budgeting • Balanced Scorecard approach	[04]
	• Strategy evaluation techniques: Key Performance Indicators (KPIs) and Performance metrics	

Unit 6	**Emerging Trends in Strategic Management:** • Digital transformation and its impact on strategic management • Sustainability and Green Business Strategies • Globalization and its effect on strategy formulation • Impact of Artificial Intelligence (AI) and Big Data on strategic decision-making • Future trends in strategic management	**[05]**

Note - The ISE/CA is simple, practical and engaging assignments unit-wise. These assignments are short, case-based to ensure students grasp the key concepts without being overwhelmed. Each assignment carries 4-5 marks can be submitted as short reports, case studies, or presentations.

- Write a short note on the importance of strategic management in an organization. Provide one real-life example of a company using strategic management successfully.
- Identify a well-known company (e.g., Apple, Tata, Reliance, etc.) and describe its corporate, business, and functional strategies in a tabular format.
- Conduct a SWOT and PESTLE analysis for any one of the following industries:
  Automobile Industry
  E-commerce Industry
  Banking Sector
  Use a simple table format for clarity.
- Compare the competitive strategies of two rival companies (e.g., Coca-Cola vs. Pepsi, Jio vs. Airtel, Amazon vs. Flipkart) and explain which strategy you think is more successful.
- Choose a multinational company and analyze how it implements its strategies. Focus on:
  Leadership role
  Budget allocation
  Key Performance Indicators (KPIs) used to measure success.
- Write a short report on how digital transformation is changing business strategies. Give one example of a company that successfully adopted digital transformation.

References:

Reference Books	
1	"Strategic Management: Concepts and Cases" – Fred R. David & Forest R. David, Pearson Education.
2	"Strategic Management: A Competitive Advantage Approach" – Thomas L. Wheelen & J. David Hunger, Pearson.
3	"Crafting and Executing Strategy: The Quest for Competitive Advantage" – Arthur A. Thompson, A.J. Strickland & John E. Gamble, McGraw-Hill.
4	"Strategic Management and Business Policy" – Azhar Kazmi, McGraw-Hill.
5	"Exploring Corporate Strategy" – Gerry Johnson, Kevan Scholes & Richard Whittington, Pearson Education.
6	"Strategic Management: Theory and Practice" – John A. Parnell, Sage Publications.
7.	"Strategic Management: Planning for Domestic & Global Competition" – John A. Pearce & Richard B. Robinson, McGraw-Hill.
8.	"Competitive Strategy: Techniques for Analyzing Industries and Competitors" – Michael E. Porter, Free Press.

TEXTBOOKS:

Textbook Books	
1	"Strategic Management: Concepts and Cases", Fred R. David & Forest R. David, Pearson Education..
2	"Strategic Management: A Competitive Advantage Approach", Thomas L. Wheelen & J. David Hunger, Pearson.
3	"Crafting and Executing Strategy: The Quest for Competitive Advantage", Arthur A. Thompson, A.J. Strickland & John E. Gamble, McGraw-Hill.
4	"Strategic Management and Business Policy", Azhar Kazmi, McGraw-Hill.
5	"Exploring Corporate Strategy", Gerry Johnson, Kevan Scholes & Richard Whittington, Pearson Education.
6	"Strategic Management: Theory and Practice", John A. Parnell, Sage Publications
7	"Strategic Management: Planning for Domestic & Global Competition", John A. Pearce & Richard B. Robinson, McGraw-Hill.
8	"Competitive Strategy: Techniques for Analyzing Industries and Competitors", Michael E. Porter, Free Press.

Year and Semester	Second Year B. Tech - Semester IV (Mechanical Mechatronics Engineering)				
Course Category	**Humanities SocialScience and Management** (HSSM)				
Title of Course	Professional Ethics			Contact Hrs/Week	Credits
Teaching Scheme	L	T	P		
	02	--	--	02	02
Examination Scheme	MSE	ISE/CA	ESE	Total	
	--	25	--	25	

Course Objectives: The objectives of the course is to

1. To understand the fundamental concepts of ethics and professionalism in a workplace.
2. To study ethical theories and their application in professional decision-making.
3. To explore the principles of corporate governance and ethical leadership in organizations.
4. To understand workplace ethics and responsibilities of professionals.
5. To examine the ethical challenges posed by technology and digital transformation.
6. To study the ethical aspects of environmental sustainability and global corporate ethics.

Course Outcomes:

COs	At the end of successful completion of the course, the student will be able to	Blooms Taxonomy
CO1	Learners will be able to explain the significance of ethics and ethical dilemmas in professional life.	II
CO2	•Learners will be able to describe different ethical theories and their relevance in business ethics.	II
CO3	•Learners will be able to apply corporate governance principles to analyze ethical leadership.	III
CO4	•Learners will be able to apply ethical principles to workplace scenarios and professional responsibilities.	III
CO5	•Learners will be able to describe the ethical issues related to technology and privacy	II
CO6	•Learners will be able to apply ethical frameworks in sustainability and global business ethics.	III

SYLLABUS

Unit No	Content	Hours
Unit 1	**Introduction to Ethics and Professionalism:** • Meaning, scope, and importance of ethics • Difference between ethics, morals, and values • Professional ethics vs. personal ethics • Role of ethics in decision-making • Ethical dilemmas in the workplace	[05]
Unit 2	**Ethical Theories and Decision-Making Models:** • Utilitarianism, Deontology, and Virtue Ethics • Ethical decision-making frameworks • Corporate social responsibility (CSR) and its importance • Application of ethical theories in business	[04]
Unit 3	**Corporate Governance and Ethical Leadership:** • Principles of corporate governance • Ethical leadership and corporate culture • Role of board of directors in governance • Case studies on corporate frauds (e.g., Enron, Satyam)	[05]
Unit 4	**Workplace Ethics and Professional Responsibilities**: • Ethical behavior in the workplace • Rights and responsibilities of employees and employers • Workplace discrimination and harassment • Code of conduct and professional responsibility	[05]
Unit 5	**Technology and Ethics:** • Ethical issues in AI, automation, and data privacy • Cyber security ethics • Intellectual property rights and plagiarism • Ethical considerations in social media usage	[04]
Unit 6	**Environmental and Global Ethics:** • Business ethics in environmental sustainability • Ethical trade and globalization issues • Ethical consumerism and fair trade • Sustainable development goals (SDGs)	[05]

Note - The ISE/CA is simple, practical and engaging assignments unit-wise. These assignments are short, case-based to ensure students grasp the key concepts without being overwhelmed. Each assignment carries 4-5 marks can be submitted as short reports, case studies, or presentations.

- Case Study Analysis: Identify an ethical dilemma in a real-life professional setting and discuss its resolution.
- Compare and Contrast: Write a report comparing Utilitarianism and Deontology with real-world examples.
- Case Study Review: Analyze a corporate fraud case and suggest governance improvements.
- Scenario-Based Questions: Solve workplace ethical dilemma scenarios with appropriate justifications.
- Research Report: Discuss ethical concerns in AI and suggest responsible AI practices.
- Presentation: Propose an ethical business model that promotes sustainability and corporate responsibility.

References:

Reference Books	
1	"Professional Ethics and Human Values" – R. S. Naagarazan, New Age International Publishers.
2	"Ethics in Engineering" – Mike W. Martin & Roland Schinzinger, McGraw-Hill Education.
3	"Professional Ethics and Corporate Governance" – A. C. Fernando, Pearson Education.
4	"Business Ethics: Concepts and Cases" – Manuel G. Velasquez, Pearson Education.
5	"Engineering Ethics" – Charles B. Fleddermann, Pearson Education.
6	"Ethics and the Conduct of Business" – John R. Boatright, Pearson Education.
7.	"Corporate Ethics, Governance, and Social Responsibility" – S. K. Bhatia, Deep & Deep Publications.

TEXTBOOKS:

Textbook Books	
1	"Professional Ethics and Human Values", R. S. Naagarazan, New Age International Publishers.
2	"Ethics in Engineering", Mike W. Martin & Roland Schinzinger, McGraw-Hill Education.
3	"Professional Ethics and Corporate Governance", A. C. Fernando, Pearson Education.
4	"Business Ethics: Concepts and Cases", Manuel G. Velasquez, Pearson Education.
5	"Engineering Ethics", Charles B. Fleddermann, Pearson Education.
6	"Ethics and the Conduct of Business", John R. Boatright, Pearson Education.
7	"Corporate Ethics, Governance, and Social Responsibility", S. K. Bhatia, Deep & Deep Publications.

Year and Semester	Second Year B. Tech - Semester IV Mechanical Mechatronics Engineering)				
Course Category	Programme Core Course (PCC)				
Title of Course	Theory of machines Lab			Contact Hrs/Week	Credits
Teaching Scheme	L	T	P		
	--	--	02	02	1
Examination Scheme	MSE	ISE/CA	ESE	Total	
	--	50	25	75	

Course Objectives: The objectives of the course is to

1. To represent kinematic behaviour of different machine elements and mechanisms.
2. To select various Power transmitting devices.
3. To compare types of Governing mechanisms.
4. understand the basic theory on gears, analyze the various types of gear trains used for transmission of motion and power.
5. study and analyze the problems on balancing of rotary masses study the force analysis of simple mechanisms
6. study turning moment diagram.

Course Outcomes:

COs	**At the end of successful completion of the course, the student will be able to**	**Blooms Taxonomy**
CO1	Understand different types of mechanisms and their applications	II
CO2	Analyze kinematic theories of mechanism,	IV
CO3	Select different power transmitting elements & governing mechanisms according to application	II
CO4	Identify the various types of gears & Select a gear drive for practical purpose.	II
CO5	Do force analysis of mechanisms & Solve a balancing problem	IV
CO6	Understand turning moment diagram	II

Unit No.	Content	Hours
1	Explanation for M.I. using bifilar suspension system, M.I. using Trifilar Suspension system.	4
2	Types of governors, Porter and Hartnell governor, Controlling force and stability of governor,	2
3	Types of cams and followers, Profiles of cams for specified motion of different followers, Spring load on the follower,	2
4	Gyroscopic couple, spinning and Precessional Motion, Gyroscopic couple and its effect on i) Four-Wheeler ii) Two –Wheeler.	2
5	Static and Dynamic balancing of rotary masses	2
6	Types of Gear trains - Simple, Compound, Reverted, Epicyclic gear train, Tabular method for finding the speeds of elements in epicyclic gear train	2

Sr. No	TITLE OF EXPERIMENTS
01	Determination of M.I. using bifilar suspension system, M.I. using Trifilar Suspension system.
02	Experiment on Governor characteristics for Porter or Hartnell governor
03	Experiment on Cam Profile
04	Experiment on Gyroscope
05	Experiment on Balancing of rotary masses (Static and Dynamic).
06	Experiment on Torque Measurement in epicyclical Gear Train.

References:

Reference Books	
1	"Theory of Machines and Mechanism", Shigley, McGraw Hill, New York
2	"Theory of Machines", Abdullah Shariff, McGraw Hill, New Delhi.
3	Theory of machines by Thomas Beven (Pearson, Edition 3rd)
4	Mechanisms and Dynamics of machines by J.Srinivas (SciTech Publications)
5	Theory of Machines by Jagdishlal, Metropolitan Publication

TEXTBOOKS:

Textbook Books	
1	"Theory of Machines", Dr. R.K.Bansal, Laxmi Publication
2	"Theory of Machines", RatanS.S, Tata McGraw Hill New Delhi, 2nd Edition.
3	"Theory of Machines", P.L.Ballany, Khanna Publication, New Delhi, 2nd Edition
4	"Theory of Machines", V.P. Singh, DhanpatRai and Sons.
5	Mechanism and Machine Theory by Rao, Dukkipati, New Age International.

Year and Semester	Second Year B. Tech - Semester IV Mechanical Mechatronics Engineering)				
Course Category	**ProgrammeCore Course (PCC)**				
Title of Course	**Signals processing Lab**			Contact Hrs/Week	Credits
Teaching Scheme	L	T	P		
	--	--	02	02	01
Examination Scheme	MSE	ISE/CA	ESE	Total	
	00	25	25	50	

Course Objectives: The objectives of the course is to

1. Acquire analog signals using sensors (e.g., vibration or temperature).
2. Analyze waveform in time domain.
3. Convert time signal to frequency domain.
4. Create low-pass or high-pass filter.
5. Simulate a second-order system.
6. Monitor machine health via vibration.

Course Outcomes:

COs	At the end of successful completion of the course, the student will be able to	Blooms Taxonomy
CO1	Identify and classify different types of signals and systems relevant to mechanical and mechatronic applications.	II
CO2	Acquire and condition signals using appropriate sensors and data acquisition systems for accurate signal analysis.	III
CO3	Analyze signals in the time domain to extract characteristics like mean, RMS, and peak values.	V
CO4	Apply Fourier Transform and FFT techniques to convert signals into the frequency domain and interpret the results.	III
CO5	Design and implement digital filters to process real-world signals using suitable software.	VI

S.No.	Experiments	Hr
1	• **Signal Acquisition and Sampling using DAQ or Arduino** To acquire real-time analog signals (e.g., from a temperature or vibration sensor) and perform sampling using a DAQ system or Arduino.	03
2	• **Time-Domain Signal Analysis** To analyze the characteristics of a given signal (mean, RMS, peak, frequency, etc.) in the time domain.	02
3	• **Frequency Analysis using FFT** To perform Fast Fourier Transform (FFT) on a vibration or audio signal and analyze its frequency components.	02
4	• **Digital Filtering (Low-Pass and High-Pass)** To design and apply FIR and IIR filters to remove noise from a given signal.	03
5	• **Simulation of a Mechanical System Response** To simulate the step and impulse response of a mechanical system modeled as a second-order system.	02
6	• **Vibration Signal Analysis for Condition Monitoring** To analyze machine vibration signals for potential faults using time and frequency domain techniques.	02

NOTE:

1) Assessment of Journal based on above Term Work.

2) ISE will consist of (25) Marks, Journal Assessment (10) Marks along with internal oral (15) marks.

4) Practical Examination is on basis of Experiment conduction (25 Marks)

Text Books	
1	**"Signals and Systems" by Alan V. Oppenheim, Alan S. Willsky, and S. Hamid Nawab Publication Year: 1997 (2nd Edition) ISBN: 978-0138147570**
2	**"Digital Signal Processing: Principles, Algorithms and Applications"** by John G. Proakis and Dimitris K. Manolakis **Publication Year**: 2006 (4th Edition) **ISBN**: 978-0131873742
3	**"Signal Processing and Linear Systems"** by B. P. Lathi **Publication Year**: 2004 **ISBN**: 978-0195158335
4	**"Fundamentals of Signals and Systems Using the Web and MATLAB"** by Edward W. Kamen and Bonnie S. Heck **Publication Year**: 2006 (3rd Edition) **ISBN**: 978-013168737

Year and Semester	Second Year B. Tech - Semester IV (Mechanical Mechatronics Engineering)				
Course Category	**ProgrammeCore Course (PCC)**				
Title of Course	Machine Drawing & Computer Aided Drafting Lab			Contact Hrs/Week	Credits
Teaching Scheme	L	T	P		
	02	--	--	02	02
Examination Scheme	MSE	ISE/CA	ESE	Total	
	--	25	25	50	

Course Objectives: The objectives of the course is to

1. To study BIS conventions used in machine drawing.
2. To find the line/curve of intersection between two solids.
3. To study the function of various machine components
4. To study the use of production drawings.
5. To study assembly and detail drawings.

Course Outcomes:

COs	**At the end of successful completion of the course, the student will be able to**	**Blooms Taxonomy**
CO1	Use BIS conventions in machine drawings.	II
CO2	Find line/curve of intersection between two solids.	II
CO3	Sketch the various machine components.	III
CO4	Read and interpret the given production drawings.	II
CO5	Understand significance of assembly and detail drawings.	II

SYLLABUS

Unit No	Content	Hours
Unit 1	**Study of B.I.S. (Bureau of Indian Standards) Conventions:**	
	Significance and importance of BIS Conventions, Drawings sheet sizes and layout recommended by BIS. Conventional representation of engineering materials, BIS conventions for sectioning, Types of threads profiles, Internal and external threads, Types of springs, Types gears and gearings, Conventional representation of common features (Splined shaft, Serrated shaft, Knurling, Bearings etc.). BIS methods of Linear-and angular dimensioning. Symbolic representation of welds as per BIS for representation of above conventions.	**04 Hrs**
Unit 2	**Interpenetration of Solids:**	
	Introduction, interpenetration of Prism with Prism, Prism with cylinder, Prism with cone, prism with pyramid. (Prisms and Pyramids limited up to Rectangular base), Cylinder with Cylinder, Cone with Cylinder.	**04 Hrs**
Unit 3	**Sketching of Machine Component:**	
	Importance of sketching and entering proportionate dimensions on sketches. Sketches of nut, Bolts square and Hexagonal Flanged nuts, Lock nuts, Dome nut, Capstan nut, Wing nut, Castle nut, Split pin, Square headed bolt, Cup headed bolt, T-headed bolt, Types of foundation bolts, Stud, Washer, Set screws, Cap screws. Various types of rivets and riveted joints, Various types of keys, Socket and spigot (Cotter joint) , Knuckle (pin) joint, Muff coupling, Protected and unprotected Flanged, Coupling, Universal coupling, solid and bush bearing. Plummer block (pedestal bearing), Foot step bearing. Flat and V-belt pulleys, Fast and loose pulleys, speed cone pulleys, Pipe joint for C.I. Flanged, socket and spigot type pipe joint. Union pipe joint and standard pipe-fittings. Students should know the applications of above machine components.	**06 Hrs**
Unit 4	**Auxiliary Projection:**	
	Projection on auxiliary vertical and horizontal plane, Auxiliary and projection of simple machine components.	**04 Hrs**
Unit 5	**Limits, Fits and Tolerances:**	
	Significance of system of limits and fits. Definitions, Types, Recommendations and selections, Tolerances of form and position, surface finish symbols as per BIS, Selection and entering of all these symbols with reference to details and assembly drawings, Tolerance an individual dimensions of details drawing.	**05 Hrs**
Unit 6	**Details and Assembly Drawing:**	
	To prepare detail drawings from given assembly drawing. To prepare assembly drawing from given drawing of details. The number of parts is limited to ten to twelve. Preparation of detail and assembly drawing from the following details such	**05 Hrs**

	as: - Machine tool parts: Tool post, Tailstock, Machine vice, Chucks etc.- Engine parts: Stuffing box, Crosshead assembly, Piston and connecting rod, etc. - Miscellaneous parts: Valve assembly, Screw jack, Jigs and fixtures, Pipe vice etc. Assembly selected should include different types of sections.	

Term work: **[25 marks]**

1. Draw a sheet on conventional representation of various materials.
2. Draw a free hand sheet of given object.
3. Draw a sheet on various assembly of component.
4. Draw a sheet on screw jack coupling.
5. Draw a sheet on washer using auxiliary view.

References:

Text Books	
1	P.S. Gill, Machine Drawing. S. K. Kataria and Sons, Delhi, 7th Edition, 2008
2	N. D. Bhatt, Machine Drawing. Charotor Publication House, Bombay, 42th Edition, 2007
3	N. Sidheshwar . P. Kannaiah and V.V. S. Sastry. Machine Drawing, Tata McGraw Hill, New Delhi.
4	R.K. Dhavan, MachineDrawing, S. Chand and Company, 1st Edition, 1996.
5	"Production Drawing", Narayana, Kannaiah and Venkata Reddv, New Age International. 2nd Edition, 2002.

Referance Books	
1	IS: SP46-Engineering Drawing Practice for Schools and Colleges, B.I.S. Publications.
2	IS: 696-Code of Practice for General Engineering Drawings B.I.S. Publications.
3	IS: 2709-Guide for Selection of Fits, B.I.S. Publications
4	IS: 919-Recommendation for Limits and Fits for Engineering, B.I.S. Publications
5	IS: 8000-Part I, II. III. TV, Geometrical Tolerencing of Technical Drawings --B.I.S. Publications.

Year and Semester	Second Year B. Tech - Semester IV (Common to all branches of Engineering)				
Course Category	Basic Science Courses (BSC)				
Title of Course	**Environmental Science**			Contact Hrs/Week	Credits
Teaching Scheme	L	T	P		
	02	--	--	02	Audit
Examination Scheme	MSE	ISE/CA	ESE	Total	
	30	10	60	100	

Course Objectives: The objectives of the course is to

1. Understand the scope & multidisciplinary nature of Environmental Studies.
2. Get acquainted with the problems associated with natural resources and their conservation.
3. Familiarize the environmental & social problems with global concern.
4. Recognize the importance of Biodiversity with respect to Western Ghats.

Course Outcomes:

COs	At the end of successful completion of the course, the student will be able to	Blooms Taxonomy
CO1	Understand the importance of Environmental Studies and recognize significance of ecosystem.	II
CO2	Classify the values of natural resources with associated problems for sustainable lifestyles.	II
CO3	Describe the social and global environmental issues	II
CO4	Make aware of Pollution issues with its mitigation measures.	II
CO5	Familiarize the basics of Biodiversity and concerned issues in the context of Western Ghats.	II
CO6	Acquaint with the role of environmental laws and regulations in conservation efforts.	I

SYLLABUS

Unit No	Content	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 a) Forest ecosystem, b) Grassland ecosystem, c) Desert ecosystem, d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) • Degradation of the ecosystems and it's impacts.	**06 Hrs**
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. • Role of individuals in conservation of natural resources. Equitable use of resources for sustainable lifestyles.	**06 Hrs**

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.	**04 Hrs**
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	**04 Hrs**
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.	**04 Hrs**
	Environmental Protection-Policies and practices	
Unit 6	• 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.	**04 Hrs**

Field work: (Field work is equal to 4 lectures) **10 marks**

Note - The ISE/CA 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.

References:

Reference 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)
4	Heywood, V.H. & Watson, R.T.1995, Global Biodiversity Assessment, Cambridge Univ. Press 1140p.
5	Jadhav, H. & Bhosale, V.M.1995, Environmental Protection and Laws, Himalaya Pub. House, Delhi 284p.
6	McKinney, M.L. & School. R.M.1196, Environmental Science Systems & Solutions, Web enhanced edition, 639p
7	Mhaskar A.K., Master Hazardous, Techno-Science Publications (TB)

Question Paper Format (S.Y. B. Tech) NEP2020

Environmental Science

End Semester Examination

Marks – 60 Marks

All Questions are compulsory – Q1 to Q4		
Q.1	**Attempt Any Three Questions**	**15 Marks**
A	Unit 1	5
B	Unit 2	5
C	Unit 3	5
D	Unit 1 to 3 (Any one)	5
Q.2	**Attempt Any Three Questions**	**15 Marks**
A	Unit 4	5
B	Unit 4	5
C	Unit 4	5
D	Unit 4	5
Q.3	**Attempt Any Three Questions**	**15 Marks**
A	Unit 5	5
B	Unit 5	5
C	Unit 5	5
D	Unit 5	5
Q.4	**Attempt Any Three Questions**	**15 Marks**
A	Unit 6	5
B	Unit 6	5
C	Unit 6	5
D	Unit 6	5

Year and Semester	Second Year B. Tech - Semester IV Mechanical Mechatronics Engineering)				
Course Category	Vocational and Skill Enhancement Course (VSEC)				
Title of Course	**Workshop Practice**			Contact Hrs/Week	Credits
Teaching Scheme	L	T	P		
	--	--	02	02	1
Examination Scheme	MSE	ISE/CA	ESE	Total	
	--	50	--	50	

Course Objectives: The objectives of the course is to
1) To study Machine layout, installation of Machine Tools, selection of Tools 2) To study Lathe Machine, Drilling Machine, Milling Machine. 3) To study machining operations and prepare Job with its process sheet on Lathe machine. 4) To study basics of CNC and VMC Machine

Course Outcomes:

COs	**At the end of successful completion of the course, the student will be able to**	**Blooms Taxonomy**
CO1	Understand Machine layout, method of Machine Tool installation, selection of Tools for various machining operation.	I
CO2	Understand Construction, Mechanism and Application of Lathe Machine, Drilling Machine, and Milling Machine.	I
CO3	Understand machining operations and prepare Job with plain turning, taper turning, external threading and knurling operation along with its process sheet	I
CO4	Understand basics of CNC and VMC Machine	I

Term Work:

Sr. No	TITLE OF EXPERIMENTS	Hr
01	Machine layout, existing machine specifications, Installation procedure of Machine Tools	**2**
02	Selection of tools for metal cutting based on work piece materials.	**2**
03	Study of Construction, Mechanism and Application of following machines (any two) a. Lathe Machine b. Drilling Machine c. Milling Machine	**3**
04	One Job of MS material; plain turning, taper turning, external threading and knurling operation with its process sheet.	**3**
05	Introduction to CNC and VMC Machine (Construction working theoretical treatment only)	**2**
06	Industrial visit to study Plastic Shaping, Forming, Conventional Machine Shop and gear manufacturing processes.	**2**

NOTE:

1) Assessment of Journal based on above Term Work and Industrial Visit Report.

3) Term work will consist of Job Carrying 25 Marks, Journal Assessment along with internal oral 25 marks.

4) Practical Examination is on basis of Job done (25 Marks)

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

REFERANCE 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 andVol.III [9788123904122] 1995.

5. “Machine Tools and Manufacturing Technology” , Steve F. Krar, Mario Rapisarda,Albert F. Check.

S.Y. B. Tech Mechanical and Mechatronics Engineering

Exit Course

(as per NEP-2020)

Mechanical and Mechatronics Engineering

(Draft Copy)

Exit option : Award of UG Certificate in Major with 44 credits and an additional 8 credits from followingExit Courses				
Sr. No	**Course Code**	**Course Title**	**Mode**	**Credits**
NPTEL				
1	MME-EC-0203	Design of Mechanical Transmission System Oil Hydraulic & pneumatics Mechatronics	Online/offline certification Course or project of total 6 credits Each Course 3 Credits	6
VIRTUAL LAB				
2	MME-EC-0204	Mechanisms & Robotics Lab Fab Lab Dynamics of Machine Lab	offline certification Course total 2 Credits 1 Credit each	2

Note: **Select any 2 Courses from NPTEL &Virtual Lab list**