Lokmanya Tilak Jankalyan Shikshan Santha's

Lokmanya Tilak College of Engineering

Sector 4, Vikas Nagar, Koparkhairane, Navi Mumbai 400709

An Autonomous Institute Affiliated to University of Mumbai

Department of Mechanical Engineering

CURRICULUM STRUCTURE

For

SECOND YEAR ENGINEERING

(BASED ON NEP 2020)

w.e.f. A.Y. 2025-26

Approved by Board of Studies on 07/04/2025

Approved by Academic Council on 15/04/2025

Department of Mechanical Engineering

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Preface

Lokmanya Tilak College of Engineering (LTCE) is founded by a Nagpur-based trust known as Lokmanya Tilak Jankalyan Shikshan Sanstha (LTJSS). The Sanstha was established in 1983, by Honourable Dr. Satish Chaturvedi. At present, there are 28 educational institutes run by the Sanstha in Nagpur. The Sanstha derives its philosophy from the magnanimous mathematician, educationist, social reformer Lokmanya Bal Gangadhar Tilak, who dedicated his life for the cause of Swaraj. Lokmanya Tilak College of Engineering was established in 1994, approved by the All-India Council for Technical Education, New Delhi, recognised by the Govt. of Maharashtra, accredited by NAAC with 'A' grade and is affiliated to the University of Mumbai. Within the span of 30 years of its inception, LTCE has grown leaps and bounds in terms of popular courses being offered at U.G., P.G. and Ph.D. level. Four of its branches viz., Computer, Mechanical, Electrical and Electronics and Telecommunications Engg. have been accredited by NBA. The Institute runs the Under-graduate Programmes in Mechanical Engineering, Computer Engineering, Electronics & Telecommunication Engineering, Electrical Engineering, Computer Science & Engineering (Data Science), Computer Science & Engineering (Artificial Intelligence & Machine Learning) and Computer Science & Engineering (IoT & Cyber Security Including Blockchain Technology). Institute also offers Doctoral Programmes in Mechanical Engineering and Computer Engineering. LTCE stands steadfast in its mission of continuing efforts for the betterment of its students and society.

The National Education Policy 2020, recently implemented by the Government of India, envisions providing quality education to all young people, with the primary goal of nurturing well-rounded, thoughtful, and creative individuals. NEP 2020 also emphasizes the importance of developing character, ethical values, constitutional principles, intellectual curiosity, scientific temper, creativity, and other related virtues. The Government of Maharashtra has instructed autonomous colleges to update their curriculum and begin implementing the National Education Policy (NEP) 2020. We are fully committed to ensuring the effective and meaningful adoption of NEP 2020 in its true essence. At "Lokmanya Tilak College of Engineering", the holistic development of learners has always been our top priority and central focus. LTCE embraced the NEP philosophy as early as 2022 wherein we have introduced the concept of Honors and Minors programs on emerging fields as per the guidelines of University of Mumbai and in 2024, we proudly graduated our first batch under this holistic curriculum. The autonomous curriculum for 2024-28 is structured in line with the recommendations of NEP 2020, AICTE, and UGC. It now includes courses in emerging technologies and multidisciplinary areas to ensure relevance to industry and practical applications. Greater focus has been placed on experiential learning to move away from rote memorization.

Sd/-	Sd/-	Sd/-
Dr. Jayesh J Dange	**Dr. Sheeba P. S.**	**Dr. Subhash K. Shinde**
BoS Chairman, Mechanical	**Dean, Academics & Research**	**Principal**

Illustrative Semester wise Credit distribution structure for Four Year UG Engineering Program – One Major, One Multidisciplinary Minor as per Maharashtra State Govt. Resolution:

Semester		I	II	III	IV	V	VI	VII	VIII	Total Credits
Courses										
Basic Science Course	BSC/ESC	6-8	8-10							14-18
Engineering Science Course		8-10	4-6							12-16
Programme Core Course (PCC)	Program Courses		2	8-10	8-10	10-12	8-10	4-6	4-6	44-56
Programme Elective Course (PEC)						4	8	2	6	20
Multidisciplinary Minor (MD M)	Multidisciplinary Courses			2	2	4	2	2	2	14
Open Elective (OE) Other than a particular program				4	2	2				8
Vocational and Skill Enhancement Course (VSEC)	Skill Courses	2	2		2		2			8
Ability Enhancement Course (AEC -01, AEC-02)	Humanities Social Science and Management (HSSM)	2			2					4
Entrepreneurship/Economics/ Management Courses				2	2					4
Indian Knowledge System (IKS)			2							2
Value Education Course (VEC)				2	2					4
Research Methodology	Experiential Learning Courses								4	4
Comm. Engg. Project (CEP)/Field Project (FP)				2						2
Project									4	4
Internship/ OJT								12		12
Co-curricular Courses (CC)	Liberal Learning Courses	2	2							4
Total Credits (Major)		**20-22**	**20-22**	**20-22**	**20-22**	**20-22**	**20-22**	**20-22**	**20-22**	**160-176**

Definition of Credit:

1 Hr. Lecture (L) per week	1 Credit
1 Hr. Tutorial (T) per week	1 Credit
2 Hr. Practical (P) per week	1 Credit
1 Hr. Practical (P) per week	0.5 Credit

Credit Requirements for Award of Degree:

a) A total of 167 credits are required for a student to be eligible for the award of an **Undergraduate Degree in Engineering**, including a Multi-Disciplinary Minor, in accordance with the Government of Maharashtra GR dated 04/06/2024.

b) A student shall be eligible for the award of an **Undergraduate Degree** with **Honours/Minor** in Emerging Areas upon earning an additional **18 credits**.

Multiple Exits:

Students will have the flexibility to enter a programme in odd semesters and exit a programme after the successful completion of even semesters as per their future career needs.

Distribution of Credits:

Level	Exit After Semester	Minimum Credits Required	LTCE Credits	Qualification Title	Additional Credit requirements
4.5	II (First Year)	40	44	One Year **UG Certificate** in relevant discipline	**8 credits** through Skill-based vocational courses (4 Credits) and Internship/ Apprenticeship/ Project (4 Credits).
5.0	IV (Second Year)	80	86	Two Years **UG Diploma** in relevant discipline	**8 credits** through Skill-based vocational courses (4 Credits) and Internship/ Apprenticeship/ Project (4 Credits).
5.5	VI (Third Year)	120	127	Three Years **B. Voc.** in the relevant Discipline	**8 credits** through Skill-based vocational courses (4 Credits) and Internship/ Apprenticeship/ Project (4 Credits).
6.0	VIII (Fourth Year)	160	167	**B.Tech**. in major discipline with multidisciplinary minor	-----
6.0	VIII (Fourth Year)	160+18= 178	167+18= 185	**B.Tech**. in major discipline with double minor (Multidisciplinary and Emerging minor)	--------

Type of Course	Course Code	No. of Credits as per Maharashtra Govt.	No. of credits as per LTCE
Basic Science Course	BSC	14-18	**16**
Engineering Science Course	ESC	12-16	**14**
Programme Core Course	PCC	44-56	**49**
Programme Elective Course	PEC	20	**19**
Multidisciplinary Minor	MDM	14	**14**
Open Elective (OE) Other than a particular program	OE	8	**08**

Vocational and Skill Enhancement Course	VSEC	8	**10**
Ability Enhancement Course (AEC -01, AEC-02)	AEC	4	**03**
Entrepreneurship/Economics/ Management Courses	EEMC	4	**04**
Indian Knowledge System (IKS)	IKS	2	**02**
Value Education Course (VEC)	VEC	4	**04**
Research Methodology	ELC	4	**03**
Comm. Engg. Project (CEP)/Field Project (FP)	ELC	2	**02**
Project	ELC	4	**04**
Internship/ OJT	ELC	12	**12**
Co-curricular Courses (CC)	CC	4	**03**
Total Credits (Major)		**160-176**	**167**
Total Credits (Major+ Honors/Minors)		**178-194**	**167+18=185**

Abbreviations:

AEC	Ability Enhancement Course
AEL	Ability Enhancement Laboratory
BSC	Basic Science Course
BSL	Basic Science Laboratory
CEP	Common Engineering Project
CC	Co-curricular courses
CIE	Continuous Internal Evaluation
ESC	Engineering Science Course
ESE	End Semester Exam
ESL	Engineering Science Laboratory
IKS	Indian Knowledge System
L	Lecture
MDM	Multidisciplinary Minor
MSE	Mid Semester Exam

OE	Open Elective
P	Practical
PCC	Programme Core Course
PCL	Programme Core Laboratory
PEC	Programme Elective Course
T	Tutorial
VEC	Value Education Course
VSEC	Vocational and Skill Enhancement Course

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Department of Mechanical Engineering

Second Year Engineering Scheme: Semester III (w.e.f. AY 2025-26)

Course Code	Course Name	Teaching Scheme		Credit Assigned		Total Credits	Examination Scheme					
							Internal Assessment		End Semester Exam		Oral &/ Practical	Total Marks
		L	P	L	P		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)	Marks	Duration (Hrs)		
MEESC301	Applied Maths -I for Mechanical Engineering	3	-	3	-	3	20	20	60	2		100
MEPCC301	Strength Of Material	3	-	3	-	3	20	20	60	2		100
MEPCC302	Applied Thermodynamics	3	-	3	-	3	20	20	60	2		100
OE301x	Open Elective	3	-	3	-	3	20	20	60	2		100
EEMC301	Entrepreneurship & Financial Management	2	-	2	-	2	20	20	60	2		100
VEC	Environment & Sustainability	2	-	2	-	2		50				50
MEVSEC301	CAD Modeling Lab	-	2*+2	-	2	2		25			25	50
MEPCL301	Material testing Lab	-	2	-	1	1		25			25	50
MEPCL302	Applied Thermodynamics Lab	-	2	-	1	1		25			25	50
Total		**16**	**08**	**16**	**4**	**20**	**100**	**225**	**300**	**10**	**75**	**700**

* Two hours of practical class to be conducted for full class as Theory Lecture.

OE301x: Open Elective Course	**OE3011**: Biology for Engineers	**OE3012**: Indian Constitution and Governance	**OE3013**: Human Psychology	**OE3014**: Disaster Management and Mitigation

Department of Mechanical Engineering

Second Year Engineering Scheme: Semester IV (w.e.f. AY 2025-26)

Course Code	Course Name	Teaching Scheme		Credit Assigned		Total Credits	Examination Scheme					
							Internal Assessment		End Semester Exam		Oral &/ Practical	Total
		L	P	L	P		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)	Marks	Duration (Hrs)		
MEPCC401	Applied Maths -II for Mechanical Engineering	3		3		3	20	20	60	2		100
MEPCC402	Manufacturing Technology	3		3		3	20	20	60	2		100
MEPCC403	Fluid Mechanics & Hydraulic Machinery	3		3		3	20	20	60	2		100
XXMDM401	Multidisciplinary Minor	3		3		3	20	20	60	2		100
OE401x	Open Elective	2		2		2	20	20	60	2		100
EEMC401	Digital Business Management	2		2		2		50				50
VEC401	Business Communication Skills		2*+2		2	2		25				25
MEPCL402	Fluid Mechanics & Hydraulic Machinery Lab		2		1	1		25			25	50
MEPCL403	Machine Shop		2		1	1		25			25	50
XXMDML401	Multidisciplinary Minor Lab		2		1	1		25				25
MECEP401	Mini Project 1		2		1	1		25			25	50
Total		**16**	**12**	**16**	**06**	**22**	**100**	**275**	**300**	**10**	**75**	**750**

* Two hours of practical class to be conducted for full class as Theory Lecture.

OE401x: Open Elective Course	**OE4011**: Human Resource Management	**OE4012**: Corporate and Cyber Laws	**OE4013**: Stock Market and Personal Finance	**OE4014**: Nutrition Literacy and Health

Multidisciplinary Minor (MDM) (14 Credits)

Semester	Computer Engineering (CE)	Electronics & Telecommunication Engineering (ET)	Artificial Intelligence & Robotics (AI&R)	Internet of Things (IT)	Mechanical Engineering (ME)	Electrical Engineering (EE)
IV	**CEMDM401:** Data Structure and Algorithms	**ETMDM401:** Microprocessor and Microcontroller	**ARMDM401:** Artificial Intelligence	**ITMDM401:** Internet of Things and Applications	**MEMDM401:** Basics of Mechanical Engineering	**EEMDM401:** Elements of Electrical System
	CEMDML401: Data Structure and Algorithms Lab	**ETMDML401:** Microprocessor and Microcontroller Lab	**ARMDML401:** AI Lab	**ITMDML401:** Internet of Things Lab	**MEMDML401:** Mechanical Engineering Lab	**EEMDML401:** Elements of Electrical System Lab
V	**CEMDM501:** Database Management System	**ETMDM501:** Digital Communication & Sensor Technology	**ARMDM501:** Robotics	**ITMDM501:** Sensors, Actuators and Transducers	**MEMDM501:** Conventional & Renewable Energy Sources	**EEMDM501:** Special Machines and Smart grid
	CEMDML501: Database Management System Lab	**ETMDML501:** Digital Communication & Sensor Technology Lab	**ARMDML501:** Robotics Lab	**ITMDML501:** Sensors, Actuators and Transducers Lab	**MEMDML501:** Renewable Energy Sources Lab	**EEMDML501:** Special Machines and Smart grid Lab
VI	**CEMDM601:** AI & Soft Computing	**ETMDM601:** Digital Image Processing	**ARMDM601:** Industrial Automation	**ITMDM601:** Microcontrollers and Application	**MEMDM601:** Automobile System	**EEMDM601:** Electric Vehicle Technology
	CEMDML601: AI & Soft Computing Lab	**ETMDML601:** Digital Image Processing Lab	**ARMDML601:** Automation Lab	**ITMDML601:** Microcontrollers Lab	**MEMDML601:** Automobile Lab	**EEMDML601:** Electric Vehicle Technology Lab
VII	**CEMDML701:** Web Design Lab	**ETMDML701:** Mobile Computing Lab	**ARMDML701:** Predictive Maintenance Lab	**ITMDML701:** PLC and SCADA Lab	**MEMDML701:** 3D Printing Lab	**EEMDML701:** Design Management Auditing of Electrical System Lab

Open Elective Courses (OE) (8 Credits)

Semester	Course Code	Course Name
III	OE3011	Biology for Engineers
	OE3012	Indian Constitution and Governance
	OE3013	Human Psychology
	OE3014	Disaster Management and Mitigation
IV	OE4011	Human Resource Management
	OE4012	Corporate and Cyber Laws
	OE4013	Stock Market and Personal Finance
	OE4014	Nutrition Literacy and Health
VIII	OE8011	Intellectual Property Rights (IPR) and Patents
	OE8012	Risk Management
	OE8013	Economics for Engineers
	OE8014	Innovation and Startups

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Second Year Engineering Curriculum: Semester III

Course Code	Course Name	Examination Scheme						Lecture
		Marks Distribution			Exam Duration (Hrs)		Total Marks	3 Hrs
		Internal Assessment		End Semester Exam (ESE)	MSE	ESE		Total Credits
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)					3
MEESC301	Applied Maths-I for Mechanical Engineering	20	20	60	1	2	100	

Prerequisite:Engineering Mathematics-I, Engineering Mathematics-II	
Course Objectives: The course aims to	
1	To familiarize with the Laplace Transform, Inverse Laplace Transform of various functions, its applications.
2	To acquaint with the concept of Fourier Series, its complex form and enhance the problem solving skills
3	To familiarize with the concept of complex variables, C-R equations with applications.
4	To study the application of the knowledge of matrices and numerical methods in complex engineering problems.
Course Outcomes: Learners will be able to	
1	Analyse the techniques of Laplace transform and apply it to determine the solutions of differential equations.
2	Analyse the techniques of inverse Laplace transform and apply it to determine the solutions of differential equations.
3	Analyse the periodic functions and expand it by using Fourier series to solve complex engineering problems
4	Solve Partial differential equations by applying numerical solution and analytical methods for one dimensional heat and wave equations
5	Apply the concept of complex variables to analyse the function is holomorphic or not and also determine orthogonal trajectory.
6	Apply Matrix algebra to solve the engineering problems.

Module	Detailed Contents	Hrs.	CO Mapping
01	**Laplace Transform** Definition of Laplace Transforms, Condition of existence of Laplace Transform, Laplace Transforms of standard functions: $sinat, cosat, sinhat, coshat, t^n$ $n > 0$. Properties of Laplace Transform: Linearity, First Shifting Theorem, Change of scale Property, Multiplication by t, Division by t. **Self Learning Topic:** Second Shifting Theorem, Laplace Transform of Periodic functions.	07	CO1

02	**Inverse Laplace Transform**	**07**	**CO2**
	Definition of Inverse Laplace Transform, Properties of Inverse Laplace Transform: Linearity, Shifting Theorem, Finding Inverse Laplace Transform using partial fraction, Solution of Differential equations-initial value problem and Boundary Value Problem.		
	Self Learning Topic: Inverse Laplace transform using Convolution theorem.		
03	**Fourier Series**	**08**	**CO3**
	Dirichlet's conditions,Definition Periodic function and graphical representation of periodic function: sine wave form, cosine waveform, square wave form, saw tooth waveform, Definition of Fourier series and Parseval's Identity (without proof) , Fourier series of periodic function with period 2π and $2l$, Fourier series of even and odd functions , Half range Sine and Cosine Series.		
	Self Learning Topic: Complex form of Fourier Series, orthogonal and orthonormal set of functions, Fourier Transform.		
04	**Numerical methods for Partial differential equations (PDE)**	**07**	**CO4**
	Introduction of Partial Differential equations, method of separation of variables, Vibrations of string, Analytical method for one dimensional heat and wave equations. (only problems) , Crank Nicholson method , Bender Schmidt method		
	Self Learning Topic: Analytical methods of solving two and three dimensional problems.		
05	**Complex Variables**	**06**	**CO5**
	Function f(z) of complex variable, limit, continuity and differentiability of f(z), Analytic function, necessary and sufficient conditions for f(z) to be analytic (without proof), Cauchy-Riemann equations in cartesian coordinates (without proof), Harmonic function, Harmonic conjugate and orthogonal trajectories.		
	Self Learning Topic: Conformal mapping, linear, bilinear mapping, cross ratio, fixed points and standard transformations.		
06	**Matrices**	**07**	**CO6**
	Characteristic equation, Eigenvalues and Eigenvectors, Properties of Eigenvalues and Eigenvectors. (No theorems/ proof) ,Cayley-Hamilton theorem (without proof): Application to find the inverse of the given square matrix and to determine the given higher degree polynomial matrix.Functions of square matrix, Similarity of matrices, Diagonalization of matrices.		
	Self Learning Topic: Verification of Cayley Hamilton theorem, Minimal polynomial and Derogatory matrix & Quadratic Forms.		

Text Books:

1.Higher Engineering Mathematics, Dr. B. S. Grewal, Khanna Publication.
2. Advanced engineering mathematics, H.K. Das, S. Chand, Publications.

References:

1.Advanced Engineering Mathematics, Erwin Kreyszig, Wiley Eastern Limited.
2. Complex Variables and Applications, Brown and Churchill, McGraw-Hill Education.
3. Higher Engineering Mathematics B.V. Ramana, McGraw Hill Education.
4. Laplace transforms, Murray R. Spiegel, Schaum's Outline Series.

Other Resources :

1. NPTEL Course: Laplace Transform, IMSc By Prof. Indrava Roy
   Web link- https://nptel.ac.in/courses/111/106/111106139/

Internal Assessment (40 Marks)

A. Mid Semester Exam (20 Marks)

Mid semester examination will be based on 40 % to 50% of the syllabus.

B. Continuous Internal Evaluation (20 Marks)

1. Assignment: 5 Marks
2. Quiz/Open book test/Presentation: 10 Marks
3. Regularity and attendance: 5 Marks

End Semester Examination (60 Marks)

End semester will be based on the syllabus coverage up to Mid Semester Examination (MSE) carrying 20% to 30% weightage and the syllabus covered from MSE to ESE carrying 70% to 80% weightage.

Course Code	Course Name	Examination Scheme						Lecture
		Marks Distribution			Exam Duration (Hrs)		Total Marks	3 Hrs
		Internal Assessment		End Semester Exam (ESE)	MSE	ESE		Total Credits
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)					3
MEPCC301	Strength Of Material	20	20	60	1	2	100	

Prerequisite: Engineering Mechanics (ESE101)	
Course Objectives: The course aims	
1	To understand the nature of stresses developed in simple geometries such as bars, cantilevers, beams, shafts, cylinders and spheres subjected to various types of simple loads.
2	To calculate the elastic deformation occurring in various simple geometries for different types of Loading.
3	To study distribution of various stresses in the mechanical elements under different types of loads
4	To understand analytical methods for determining the strength, stiffness and stability of various load carrying structural members and machine components.
Course Outcomes: Learners will be able to	
1	Predict and calculate various stresses induced under simple axial loading
2	Calculate shear force and bending moment and draw the SFD and BMD for different types of loads and support conditions.
3	Calculate the bending and shear stresses induced in beam.
4	Calculate the deflection in beams and stresses in shaft
5	Calculate the stresses and deflection in beams and Estimate the strain energy in mechanical elements
6	Calculate buckling phenomenon in columns.

Module	Detailed Contents	Hrs.	CO Mapping
01	**Simple Stress and strain** Simple stress and strain, axial stresses, shear stress and strain, Hooke's law, elastic limit, modulus of elasticity, yield stress, ultimate stress, modulus of rigidity, bulk modulus, Poisson's ratio, factor of safety, Volumetric strain for tri-axial loading. Deformation of stepped bars, tapering bars, deformation due to self-weight , Thermal stress and strain , Thermal stress in composite section Principal stresses and Principal planes- Mohr's circle Introduction to Area Moment of inertia , Calculation of Area Moment of Inertia of standard cross sections of beam **Self Learning Topic:** Location of centroidal axes of standard cross sections of beam by method of moment, Calculation of Area Moment of Inertia of Composite sections	**08**	**CO1**
02	**Shear Force and Bending Moment in Beams** Theory of types of beams, supports and loadings.Definition of bending moment and shear force, Sign conventions, relationship between load intensity, bending moment and shear force. Construction of Shear force and bending moment diagrams for statically determinate beams including beams with beams with internal Hinges subjected to points load, uniformly distributed loads, uniformly varying loads, couple and their combination**s.** **Self Learning Topic:** Determination of support reactions for beams with different types of load and different types of support	**08**	**CO2**
03	**Bending and Shear stresses in beam** Theory of bending of beams ,Equation of Bending (Flexural formula),Calculation of bending stress at different sections of beam Theory of shear stress, Calculation of shear stress at different sections of beam and plotting Shear stress distribution diagrams for point and distributed loads in simply supported, cantilevers and over hanging beams.	**06**	**CO3**
04	**Deflection of Beams and Torsion** **Deflection of Beams:** Differential equation of defection, assumptions, sign conventions, Double integration method, maximum deflection, Maxwell's reciprocal theorems for computation of slopes and deflection in beams for point and distributed loads. **Torsion :** Theory of pure torsion, Equation of torsion, Assumptions in pure torsion , Moment of resistance Polar modulus, method of section, Shear stress in solid and hollow shaft	**08**	**CO4**

05	**Thin Cylindrical and Spherical Shells, Strain Energy** **Thin Cylindrical and Spherical Shells:** Stresses and deformation in Thin Cylindrical and Spherical Shells subjected to internal pressure **Strain Energy:** Strain energy stored in the member due to gradual, sudden and impact loads, Resilience, Proof Resilience Strain energy due to bending and torsion	06	CO5
06	**Columns and Struts** Types of columns and Struts , crushing, buckling, Euler's theory ,Factor of safety, Buckling load, Effective length, Equivalent length Flexural rigidity and Rankine formula.	06	CO6

Text Books:

1. Strength of Materials by S. Ramamrutham, Dhanpat Rai Pvt. Ltd, 16th Edition
2. Mechanics of Structures by S. B. Junnarkar, Charotar Publication, 24th Edition, 2015
3. Mechanics of Materials by S. S. Ratan, Tata McGraw Hill Pvt. Ltd, Third Edition, 2017
4. Strength of Materials by R. K. Rajput, S Chand Publications, Revised Edition, 2018
5. A textbook of Strength of Materials by R. K. Bansal, Laxmi Publications, 2006

References:

1. Strength of Materials by Ryder, Macmillan.
2. Mechanics of Materials by James M. Gere and Barry J. Goodno, Cengage Learning, 6thEd, 2009.
3. Mechanics of Materials by Gere and Timoshenko, CBS 2nd Edition.
4. Elements of Strength of Materials by Timoshenko and Youngs, Affiliated East -West Press
5. Mechanics of Materials byBeer, Jhonston, DEwolf and Mazurek, TMHPvt Ltd., New Delhi
6. Introduction to Solid Mechanics by Shames, PHI
7. Strength of Materials by W.Nash, Schaum's Outline Series, McGraw Hill Publication, Special Indian Edition
8. Strength of Materials by R. Subramanian, Oxford University Press, Third Edition 2016

Links for online NPTEL/SWAYAM courses:

1. http://www.nptelvideos.in/2012/11/strength-of-materials-prof.html
2. https://swayam.gov.in/nd1_noc20_ce34

Internal Assessment (40 Marks)

A. Mid Semester Exam (20 Marks)

Mid semester examination will be based on 40 % to 50% of the syllabus.

B. Continuous Internal Evaluation (20 Marks)

1. Assignment: 5 Marks
2. Quiz/Open book test/Presentation: 10 Marks
3. Regularity and attendance: 5 Marks

End Semester Examination (60 Marks)

End semester will be based on the syllabus coverage up to Mid Semester Examination (MSE) carrying 20% to 30% weightage and the syllabus covered from MSE to ESE carrying 70% to 80% weightage.

Course Code	Course Name	Examination Scheme						Lecture
		Marks Distribution			Exam Duration (Hrs)		Total Marks	3 Hrs
		Internal Assessment		End Semester Exam (ESE)	MSE	ESE		Total Credits
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)					3
MEPCC302	Applied Thermodynamics	20	20	60	1	2	100	

Prerequisite:	
Course Objectives: The course aims to	
1	Explain: Fundamental concepts, laws of classical thermodynamics, principle of working and operation of thermodynamic cycles, scope and applications in research and advanced topics.
2	Explain and illustrate: Application of the fundamental principles and the laws of classical thermodynamics for non-flow systems, steady flow systems, and thermodynamic cycles.
3	Explain and illustrate: Thermodynamic analysis of non-flow and steady flow thermodynamic systems, thermodynamic cycles, advanced / emerging systems, scope and methods of modifications for performance improvements.
Course Outcomes: Learners will be able to	
1	Understand and explain the fundamental concepts of thermodynamics, its scope and applications in few emerging areas.
2	Understand and apply the First Law of Thermodynamics to analyze and solve basic thermodynamic problems in non-flow processes.
3	Apply the Second Law of Thermodynamics to analyze the direction of thermodynamic processes, evaluate entropy changes, and determine the efficiency of heat engines, refrigerators, and heat pumps.
4	Analyze the concepts of availability, irreversibility, and thermodynamic relations to evaluate the efficiency and performance of energy conversion systems.
5	Understand and analyze vapor power cycles, different types of boilers, and their mountings and accessories.
6	Aware of the working principles of blowers and compressors, analyze their performance.

Module	Detailed Contents	Hrs.	CO Mapping
01	**Fundamental Concepts:** Thermodynamic system, surrounding and universe, control volume, Thermodynamic State, Properties, Process and Cycle.Thermodynamic Equilibrium, Quasi-Static process,Work Transfer and Heat Transfer.Energy, Internal Energy, Enthalpy, Specific and Latent heat,Zeroth Law of Thermodynamics. **Self Learning Topic:** Macroscopic and Microscopic thermodynamics, Law of conservation of Energy	05	CO1
02	**First Law of Thermodynamics:** Non-flow System undergoing a Cycle and Thermodynamic Processes: Constant Pressure, Constant Volume, Isothermal, Isentropic and Polytropic Process, Representation on P-V and T-S Diagram, Calculation of Heat Transfer, Work Done, Change in Internal Energy and Enthalpy for these processes. Perpetual motion machine of first kind(PMM-I). Steady Flow Energy Equation (SFEE), and its applications to various devices such as boilers, nozzles, turbines, compressors and pumps, **Self Learning Topic:** Limitations of First Law of Thermodynamics ,Thermal Reservoirs , Sink & Source.	08	CO2
03	**Second Law of Thermodynamics and Entropy** Heat Engine, Refrigerator and Heat Pump, Carnot Cycle, Absolute Thermodynamic Temperature Scale,Second Law of thermodynamic Kelvin-Planck and Clausius Statements and their equivalence, Entropy - entropy is a Property of system, Entropy changes during process, Principle of Entropy. Perpetual motion machine of Second kind(PMM-II)	06	CO3
04	**Availability and thermodynamic relations** High grade and low-grade energy, Available and Unavailable energy, Dead State, Useful work, Irreversibility, Availability of closed system & steady flow process. Helmholtz and Gibbs function, Pours plug experiment, throttling process, Joules Thomson coefficient. Thermodynamic Relations: Maxwell relations, Clausius-Clapeyron Equation, Joule Thomson coefficient.	06	CO4
05	**Pure substance and Vapor Power Cycles** Properties of Pure Substances, p-v, Ts and h-s Diagrams,Ideal and actual Rankine Cycle, Reheat Cycle, Regenerative Cycle, Use of Steam Tables and Mollier Diagram, Evaluation of efficiency and performance parameters of vapor power cycles.Types of Boilers, Mountings and accessories, Balance sheet, Steam power plant.	08	CO5

06	**Blower and Compressor** Classification blower and compressor, Positive displacement and non-positive displacement compressor, types of reciprocating compressor . Single stage reciprocating compressor-neglecting clearance. Multistage of compressors. Minimum work, Free air delivered, volumetric efficiency, isothermal and adiabatic efficiency. Effect of clearance volume on F.A.D and volumetric efficiency. Work, power and efficiency calculations. Losses in Compressors: Choking, Surging and Stalling.	**09**	**CO6**

Text Books:

1. Cengel, Yunus A., and Boles, Michael A., Thermodynamics An Engineering Approach, McGraw Hill Education, New York
2. Holman, J.P., Thermodynamics, McGraw Hill, New York
3. Nag, P.K., Engineering Thermodynamics, McGraw Hill Education

References:

1. Achuthan, M., Engineering Thermodynamics, Prentice Hall India Pvt., Limited.
2. Saad, Michel A., Thermodynamics for Engineers- Principles and Practice.
3. Eastop, T. D., and A. McConkey, Applied Thermodynamics for EngineeringTechnologists.
4. Nag, P.K., Power Plant Engineering, McGraw Hill Edu. Private Ltd.
5. Barron Randall F., Cryogenic Systems, Oxford University Press, New York.
6. Sonntag, Richard Edwin, Claus Borgnakke, Gordon John Van Wylen, and Steve VanWyk.Fundamentals of Thermodynamics. Wiley, New York.

Recommended NPTEL/ IITBombayX Lectures / Courses:

1. Thermodynamics IITBombayX Course by Prof. U.N. Gaitonde, IIT Bombay https://www.iitbombayx.in/courses/thermodynamics-5
2. Thermodynamics Video Lectures by Prof. U.N. Gaitonde, IIT Bombay [Online]
3. Basic Thermodynamics NPTEL Course Lectures by Prof. S.K. Som, IIT Kharagpur https://nptel.ac.in/courses/112/105/112105123/

Internal Assessment (40 Marks)

A. Mid Semester Exam (20 Marks)

Mid semester examination will be based on 40 % to 50% of the syllabus.

B. Continuous Internal Evaluation (20 Marks)

1. Assignment: 5 Marks
2. Quiz/Open book test/Presentation: 10 Marks
3. Regularity and attendance: 5 Marks

End Semester Examination (60 Marks)

End semester will be based on the syllabus coverage up to Mid Semester Examination (MSE) carrying 20% to 30% weightage and the syllabus covered from MSE to ESE carrying 70% to 80% weightag.

Course Code	Course Name	Examination Scheme						Lecture
		Marks Distribution			Exam Duration (Hrs)		Total Marks	3 Hrs
		Internal Assessment		End Semester Exam (ESE)	MSE	ESE		Total Credits
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)					3
OE3011	**Biology for Engineers**	20	20	60	1	2	100	

Prerequisite: Basic concepts of core sciences like physics, chemistry, and mathematics	
Course Objectives: The course aims to	
1	To familiarize the students with the basic biological concepts and their engineering applications.
2	To enable the students with an understanding of biodesign principles to create novel devices and structures.
3	To provide the students an appreciation of how biological systems can be re-designed as substitute products for natural systems
4	To motivate the students to develop the interdisciplinary vision of biological engineering.
Course Outcomes: Learners will be able to	
1	Understand the biological concepts from an engineering perspective.
2	Understand the artificial systems mimicking human action and collaborate the concepts of biomimetics for specific requirements.
3	Elucidate the basic biological concepts via relevant industrial applications and case studies.
4	Think critically towards exploring innovative biobased solutions for socially relevant problems.
5	Evaluate the principles of design and development, for exploring novel bio-engineering projects.
6	Integrate biological principles for developing next generation technologies.

Module	Detailed Contents	Hrs.	CO Mapping
01	**Introduction of Cell and Biomolecules :** Structure and functions of a cell. Stem cells and their application. Biomolecules: Properties and functions of Carbohydrates, Nucleic acids, Proteins, lipids. Importance of special biomolecules: Properties and functions of enzymes, vitamins and hormones.	06	CO1
02	**Analogy of biological organs** Brain as a CPU system (architecture, CNS and Peripheral Nervous System, signal transmission, EEG, Robotic arms for prosthetics. Engineering solutions for Parkinson's disease) Eye as a Camera system (architecture of rod and cone cells, optical corrections, cataract, lens materials, bionic eye) Kidney as a Filtration system (architecture, mechanism of filtration, CKD, dialysis systems).Lungs as purification system (architecture, gas exchange mechanisms, spirometry, abnormal lung physiology - COPD, Ventilators, Heart-lung machine),Heart as a Pumping system Process: (architecture, electrical signalling - ECG monitoring and heart related issues, reasons for blockages of blood vessels, stents, pace makers). **Self Learning Topic:** CPR techniques. Photosynthesis & solar cells, Xylem & plumbing, Thermoregulation in human body & heat transfer in machine, Defense mechanism in organism, signaling processing in biology and electronics.	10	CO2
03	**Nature Inspired Materials and Mechanism :** Echolocation (ultrasonography, sonars), Photosynthesis (photovoltaic cells, bionic leaf). Bird flying (GPS and aircrafts), Lotus leaf effect (Super hydrophobic and self-cleaning surfaces), Plant burrs (Velcro), Shark skin (Friction reducing swim suits), Kingfisher beak (Bullet train).Biomaterials: Types, properties and applications **Self Learning Topic:**Human Blood substitutes - hemoglobin-based oxygen carriers (HBOCs) and perflourocarbons (PFCs).	08	CO3
04	**Biological Inspired Techniques.** Bioprinting techniques and materials, Electrical tongue and electrical nose in food science,Selfhealing Bioconcrete (based on bacillus spores, calcium lactate nutrients and biomineralization processes) and Bioremediation and Biomining via microbial surface adsorption (removal of heavy metals like Lead, Cadmium, Mercury, Arsenic). **Self Learning Topic:**DNA origami and Biocomputing, Bioimaging and Artificial Intelligence for disease diagnosis.	08	CO4

05	**Bio-Medical Devices** Diagnostic (X-ray machines, CT scanners and MRI machines.) Therapeutic (ventilators, infusion pumps and pacemakers) ,Monitoring (Oximeter, Glucometer,Thermometer, BP monitor),Implantable devices and Smart Devices.	**04**	**CO5**
06	**Bio-Engineering Applications** Bio-medical imaging: Principle, types and examples Biosensors: Principle, types and examples Bioprinting: 3D printing of biological tissues and organ engineering and transplanting Artificial Intelligence in biomedical field.	**06**	**CO6**

Text Books:

1. Stuart Fox, Krista Rompolski, "Human Physiology", McGraw-Hill eBook. 16th Edition, 2022
2. Leslie Cromwell, "Biomedical Instrumentation", Prentice Hall 2011.
3. Thyagarajan S., Selvamurugan N., Rajesh M.P., Nazeer R.A., Thilagaraj W., Barathi S., and Jaganthan M.K., "Biology for Engineers", Tata McGraw-Hill, New Delhi, 2012.
4. Ibrahim Ozbolat, "3D Bioprinting: Fundamentals, Principles and Applications" Academic Press, 2016.
5. N. A. Campbell, J. B. Reece, L. Urry, M. L. Cain and S. A. Wasserman, "Biology: A global approach", Pearson Education Ltd, 2018.
6. T Johnson, Biology for Engineers, CRC press, 2011 Molecular Biology and Biotechnology 2nd ed. J.M. Walker and E.B. Gingold. Panima Publications. PP 434.
7. Dr. U. Satyanarayana Dr. U. Chakrapani, "Biochemestry (with Clinical Concepts & Case Studies)", Elsevier 4th Edition, New Delhi 2013.

References:

1. E. E. Conn, P. K. Stumpf, G. Bruening and R. H. Doi, "Outlines of Biochemistry", John Wiley and Sons, 2009
2. Molecular Biology by G. Padmanabhan, K. SivaramSastry, C. Subramanyam, 1995, Mac Millan
3. AlbertsEt.Al. The molecular biology of the cell, 6/e, Garland Science, 2014
4. https://onlinecourses.nptel.ac.in/noc19_ge31/preview
5. VTU EDUSAT / SWAYAM / NPTEL / MOOCS / Coursera / MIT-open learning resource
6. https://freevideolectures.com/course/4877/nptel-biology-engineers-other-non-biologists
7. https://nptel.ac.in/courses/121106008

Internal Assessment (40 Marks)

A. Mid Semester Exam (20 Marks)

Mid semester examination will be based on 40 % to 50% of the syllabus.

B. Continuous Internal Evaluation (20 Marks)

1. Assignment: 5 Marks
2. Quiz/Open book test/Presentation: 10 Marks
3. Regularity and attendance: 5 Marks

End Semester Examination (60 Marks)

End semester will be based on the syllabus coverage up to Mid Semester Examination (MSE) carrying 20% to 30% weightage and the syllabus covered from MSE to ESE carrying 70% to 80% weightage.

Course Code	Course Name	Examination Scheme						Lecture
		Marks Distribution			Exam Duration (Hrs)		Total Marks	3 Hrs
		Internal Assessment		End Semester Exam (ESE)	MSE	ESE		Total Credits
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)					3
OE3012	Indian Constitution & Governance	20	20	60	1	2	100	

Prerequisite: Know-how of Indian history and polity	
Course Objectives: The course aims to	
1	To create awareness about Indian Constitution to undergraduate students
2	To give knowledge about the system of government (central and state) and also the fundamental rights and duties enshrined in the Indian Constitution
3	To create awareness about Indian Judiciary, Constitutional Bodies, Regulatory Bodies and Public Policy
4	To give knowledge about important aspects of Governance
Course Outcomes: Learners will be able to	
1	To remember and understand the fundamental Rights and Duties
2	To understand the system of Indian Government
3	To discuss and summarize the Powers and Functions of Central and State Government
4	To explain Indian Judiciary System and Constitutional Bodies
5	To outline the functionalities of various Regulatory Bodies
6	To understand the important aspects of Good Governance

Module	Detailed Contents	Hrs.	CO Mapping
01	**Constitutional Framework** Constitutional law as the Supreme law of land Historical Background of Indian Constitution Making of Indian Constitution Salient Features of the Constitution Preamble of the Constitution Fundamental Rights and Duties Directive Principles of State Policy **Self Learning Topic:** Sources of the Constitution, Comparison of the Constitutions, Government of India Act, 1935	08	CO1

02	**System of Indian Government** Parliamentary System Federal System Legislative Relations between the Centre and States Inter-State Relations Emergency Provisions **Self Learning Topic:** Parliament and its Committees	**07**	**CO2**
03	**Central (Union) and State Government** Election, Qualifications, Oath, Powers and Functions of: President and Vice-President Prime Minister State Governor Chief Minister Central and State Council of Ministers **Self Learning Topic:** Panchayati Raj and Municipalities	**0 7**	**CO3**
04	**Indian Judiciary and associated Constitutional Bodies** Supreme Court of India State High Court, Sub-ordinate Courts Election Commission of India Comptroller and Auditor General of India Attorney General of India Advocate General of the State	0**8**	**CO4**
05	**Regulatory Bodies and Public Policy** Insurance Regulatory and Development Authority (IRDAI) Securities and Exchange Board of India (SEBI) Telecom Regulatory Authority of India (TRAI) Bar Council of India (BCI) All India Council for Technical Education (AICTE) National Policy for Empowerment of Women, National Health Policy National Policy on Skill Development, Education Policy **Self Learning Topic:** Autonomous and Advisory Bodies	**07**	**CO5**
06	**Important Aspects of Governance** Good Governance, e-Governance,Citizen's Charter,People's Participation,Public Sector Reforms Corporate Governance	**05**	**CO6**

Text Books:

1. Lawman's Bare Act - The Constitution of India, Kamal Publishers, New Delhi.
2. M Laxmikanth, Indian Polity, 5th Edition, McGraw Hill Education
3. M Laxmikanth, Governance in India, 2nd Edition, McGraw Hill Education
4. Durga Das Basu, Introduction to the Constitution of India, 23rd Edition, LexisNexis

References:

1. https://iipa.org.in/upload/polity1.pdf
2. https://iipa.org.in/upload/polity2.pdf
3. https://cdnbbsr.s3waas.gov.in/s380537a945c7aaa788ccfcdf1b99b5d8f/uploads/2024/07/20240716890312078.pdf

Internal Assessment (40 Marks)

A. Mid Semester Exam (20 Marks)

Mid semester examination will be based on 40 % to 50% of the syllabus.

B. Continuous Internal Evaluation (20 Marks)

1. Assignment: 5 Marks
2. Quiz/Open book test/Presentation: 10 Marks
3. Regularity and attendance: 5 Marks

End Semester Examination (60 Marks)

End semester will be based on the syllabus coverage up to Mid Semester Examination (MSE) carrying 20% to 30% weightage and the syllabus covered from MSE to ESE carrying 70% to 80% weightage.

Course Code	Course Name	Examination Scheme						Lecture
		Marks Distribution			Exam Duration (Hrs)		Total Marks	3 Hrs
		Internal Assessment		End Semester Exam (ESE)	MSE	ESE		Total Credits
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)					3
OE3013	Human Psychology	20	20	60	1	2	100	

Prerequisite:	
Course Objectives: The course aims to	
1	Understand the fundamental concepts and theories of human psychology.
2	Analyse cognitive, emotional, and social development across the human lifespan.
3	Evaluate different psychological approaches to behaviour, perception and learning.
4	Apply psychological principles to real-life scenarios, including workplace and interpersonal relationships.
Course Outcomes: Learners will be able to	
1	Identify key psychological concepts and their relevance in daily life.
2	Understand and analyse cognitive functions like memory, perception and problem-solving.
3	Apply psychological theories to interpret human emotions and behaviour.
4	Examine different personality types and their influence on individual behaviour.
5	Evaluate mental health conditions and discuss various therapeutic approaches.
6	Relate psychology to real-world applications in education, workplace and health.

Module	Detailed Contents	Hrs.	CO Mapping
01	**Introduction to Psychology** Definition and scope of psychology, importance in daily life, historical perspectives, Functionalism, Psychoanalysis, Behaviourism, Humanism, Cognitive Psychology.	05	CO1
02	**Human Cognition & Personality** Sensation & perception, stages of memory (sensory, short-term, long-term), forgetting and memory enhancement techniques, intelligence (IQ, emotional intelligence). Theories of personality **Self-Learning Topic:** Memory Enhancement Techniques and their Effectiveness	06	CO2

03	**Emotions & Motivation** Basic emotions and their role in behaviour, Theories of emotion, Intrinsic vs. extrinsic motivation, major motivation theories, application of motivation in workplace and education. **Self-Learning Topic:**Case Study on Emotional Intelligence in Leadership and Workplace Productivity.	**07**	**CO3**
04	**Personality & Behavioural Psychology** Types of personalities, social perception and group behaviour, factors influencing attitude formation, persuasion, leadership styles, social influence (conformity, obedience, compliance), communication and its impact on behaviour. Overview of psychological disorders: Anxiety, Depression, Schizophrenia, OCD. **Self-Learning Topic:**The Role of social media in Shaping Human Behaviour and Perceptions.	**08**	**CO4**
05	**Stress & Well-being** Theories of stress, impact of stress on physical and mental health, coping mechanisms (problem-focused vs. emotion-focused coping), resilience and positive psychology techniques for well-being. **Self-Learning Topic:** Meditation, Mindfulness, and Stress Reduction Techniques – A Practical Guide.	**08**	**CO5**
06	**Applications of Psychology** Role of psychology in workplace settings (Industrial & Organizational Psychology), Human-Computer Interaction, ethical considerations in psychology (confidentiality, informed consent, ethical dilemmas). **Self-Learning Topic:**Psychological Factors Influencing Consumer Behaviour and Marketing Strategies	**08**	**CO6**

Text Books:

1. Psychology, Author: Saundra K. Ciccarelli, J. Noland White, Publisher: Pearson, 6th Edition.
2. Understanding Psychology, Author: Robert S. Feldman, Publisher: McGraw-Hill, 14th Edition.
3. Introduction to Psychology, Author: James W. Kalat, Publisher: Cengage Learning, 11th Edition.

References:

1. https://onlinecourses.nptel.ac.in/noc20_hs28/preview
2. https://www.apa.org/
3. https://positivepsychology.com/

Internal Assessment (40 Marks)

A. Mid Semester Exam (20 Marks)

Mid semester examination will be based on 40 % to 50% of the syllabus.

B. Continuous Internal Evaluation (20 Marks)

1. Assignment: 5 Marks
2. Quiz/Open book test/Presentation: 10 Marks
3. Regularity and attendance: 5 Marks

End Semester Examination (60 Marks)

End semester will be based on the syllabus coverage up to Mid Semester Examination (MSE) carrying 20% to 30% weightage and the syllabus covered from MSE to ESE carrying 70% to 80%

Course Code	Course Name	Examination Scheme						Lecture
		Marks Distribution			Exam Duration (Hrs)		Total Marks	3 Hrs
		Internal Assessment		End Semester Exam (ESE)	MSE	ESE		Total Credits
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)					3
OE3014	Disaster Management and Mitigation	20	20	60	1	2	100	

Prerequisite:Require knowledge of Environmental Science concepts	
Course Objectives: The course aims to	
1	Introduce the fundamental concepts of disaster management
2	Understand the causes,impact,and risk analysis of various disasters.
3	Familiarise students with disaster mitigation ,preparedness and response strategies
4	Educate about the role of technology,engineering solutions,and policies in disaster risk reduction
5	Enable students to design and implement disaster management strategies in engineering projects.
Course Outcomes: Learners will be able to	
1	Understand the different types of disasters and their effects on the environment and society
2	Analyse disaster risk and vulnerabilities related to engineering systems
3	Understand structural and non-structural mitigation measures
4	Apply disaster preparedness and response strategies in engineering practices
5	Understand use of recent technologies for disaster mitigation
6	Understand policies ,Governance and legal framework for disaster management

Module	Detailed Contents	Hrs.	CO Mapping
01	**Introduction to Disaster management** 1.1 Definition: Disaster, Hazard, Vulnerability, Risk, Direct and Indirect Effects of Disaster 1.2 Types of disasters: Natural (Earthquake, Flood, Cyclone, Drought, Tsunami, Landslides) & Man-Made (Industrial, Chemical, Nuclear, Biological, Fire, Accidents, Terrorism). 1.3 Phases of Disaster Management Cycle (Prevention, Mitigation, Preparedness, Response, Recovery, Rehabilitation).	08	CO1

	Self Learning Topic: List some natural and Man-made disasters that happened in India in the last 5 years.		
02	**Module Title: Risk Assessment and Vulnerability Analysis** 2.1 Hazard Identification and Risk Assessment (HIRA) with objectives, key components, Steps, tools and techniques used. 2.2 Vulnerability and Capacity Assessment (VCA): components and process. 2.3 Disaster Risk Reduction (DRR): Concepts and Approaches 2.4 Community-Based Disaster Risk Reduction (CBDRR): Principles and Key components.	**07**	**CO2**
03	**Disaster Mitigation measures.** 3.1 Structural Mitigation Measures: Earthquake-resistant structures, Cyclone shelters, Flood embankments, Landslide control structures 3.2 Non-Structural Mitigation Measures: Early Warning Systems, Public Awareness and Education, Insurance and Financial Mitigation.	**06**	**CO3**
04	**Disaster Preparedness and Response** 4.1 Preparedness Planning, Incident Command System (ICS), Emergency Operations Centers (EOC), Search and Rescue (SAR) operations, Relief and Rehabilitation measures 4.2 Logistics and Supply Chain in Disaster Management. 4.3 Role of Government, NGOs, Armed Forces, and International Agencies. 4.4 Do's and Don'ts in case of Disaster .	**07**	**CO4**
05	**Applications of Technology in Disaster Management** 5.1 Remote Sensing and GIS Applications. 5.2 Role of Internet and softwares for effective disaster management. 5.3 ICT and Communication Technologies. 5.4 Drones and Unmanned Systems 5.5 Case studies of Technological Interventions. **Self Learning Topic:** Roles of Engineers in disaster management and mitigation with examples.	**07**	**CO5**

06	**Policies,Governance and Legal Framework** 6.1 Paradigm shift in Disaster Management. 6.2 Disaster Management Act, 2005 (India) / Relevant National Acts. 6.3 National Institute of Disaster Management (NIDM), National Disaster Management Authority (NDMA) and State DMAs 6.4 International Frameworks: Sendai Framework, SDGs, Role of Policies in Engineering Practices. 6.5 Case studies on successful Disaster Management strategies.	**07**	**CO6**

Text Books:

1. “Disaster Management" by Harsh K. Gupta
2. "Introduction to International Disaster Management" by Damon P. Coppola
3. "Disaster Management and Preparedness" by Collins Larry M. and Schneid Thomas D.
4. “Disaster Management and Mitigation”, by B.K. Khanna, New India Publishing Agency.
5. “An Introduction to Disaster Management: Principles and Practice”, by Satish Modh.
6. Natural Hazards and Disaster Management, Vulnerability & Mitigation by R B Singh, Rawat Publications.

References:

1. National Disaster Management Authority (NDMA), India: Guidelines on Earthquakes, Floods, Cyclones, Industrial Disasters, Urban Flooding, etc. Available at: https://ndma.gov.in IS Codes for Earthquake Resistant Design (IS 1893, IS 13920).
2. United Nations Office for Disaster Risk Reduction (UNDRR).
3. UNISDR Guidelines and Sendai Framework Documents

A. Mid Semester Exam (20 Marks)

Mid semester examination will be based on 40 % to 50% of the syllabus.

B. Continuous Internal Evaluation (20 Marks)

1. Assignments/ Case studies: 5 Marks
2. Quiz/Open book test/Presentation: 10 Marks
3. Regularity and attendance: 5 Marks

End Semester Examination (60 Marks)

End semester will be based on the syllabus coverage up to Mid Semester Examination (MSE) carrying 20% to 30% weightage and the syllabus covered from MSE to ESE carrying 70% to 80% weightage.

Course Code	Course Name	Examination Scheme						Lecture
		Marks Distribution			Exam Duration (Hrs)		Total Marks	2 Hrs
		Internal Assessment		End Semester Exam (ESE)	MSE	ESE		Total Credits
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)					
EEMC301	Entrepreneurship & Financial Management	20	20	60	1	2	100	2

Course Objectives: The course aims to	
1	Introduce students to the concepts of entrepreneurship and help them to identify entrepreneurial opportunities.
2	Provide a brief overview of business planning and funding options.
3	Understand the basic concepts of time value of money, returns and risks, working capital and sources of finance.
4	To provide overview of capital budgeting, capital structure, dividend policy
Course Outcomes: Learners will be able to	
1	Understand the concept of fundamental entrepreneurship, develop an entrepreneurial mindset, and recognize the relevance of entrepreneurship across various industries.
2	Identify and evaluate entrepreneurial opportunities through systematic market research and develop a comprehensive and viable business plan for a startup.
3	Describe the essential aspects of funding and understand various sources of finance
4	Apply the principles of capital structure to effectively strategize funding for startups.
5	Analyse the concept of capital budgeting and working capital management
6	Evaluate investment, financing, and dividend decisions to optimize business performance and sustainability.

Module	Detailed Contents	Hrs	CO Mapping
01	**Foundations of Entrepreneurship**	04	CO1
	Understanding entrepreneurship: Definition, scope, and significance, Key characteristics of successful entrepreneurs, **Exploring entrepreneurial ecosystems:** Components and impact, **Developing an entrepreneurial mindset:** Creativity, risk-taking, and resilience, The role of entrepreneurship across industries		
	Self-Learning Topic: Case study on successful entrepreneurs.		

02	**Evaluating Entrepreneurship Opportunities** Assessing entrepreneurial opportunities, Market research and feasibility studies, Lean startup methodologies, Elements of business plan, Strategic marketing and sales approaches **Self-Learning Topic:** Understanding the procedure and types of permissions to initiate the startups.	04	CO2
03	**Fundamentals of Funding and Finance** Time value of money, return and risk, Stages of financing, Debt, venture capital and other forms of financing, Sources of startup funding, Introduction to venture capital and angel investors, Crowdfunding and bootstrapping Overview	04	CO3
04	**Capital Structure** **Determinants of capital structure:** Key factors influencing an entity's financial structure, **Theories and models of capital structure:** Analyzing various conceptual approaches, **Traditional and modern theories:** Net Income (NI) Approach, Net Operating Income (NOI) Approach	05	CO4
05	**Capital Budgeting and Working Capital Management** **Introduction to capital budgeting:** Meaning and importance of capital budgeting, Key Inputs for capital budgeting decisions, **Working capital management:** Meaning and concept of working capital, Importance of working capital management, **Investment appraisal techniques:** Accounting rate of return (ARR), Payback period & discounted payback period, Net present value (NPV), Profitability index (PI), Internal rate of return (IRR).	06	CO5
06	**Dividend Policy** **Introduction to dividend policy:** Meaning and significance of dividend policy in financial management, **Determinants of dividend decisions:** Key factors influencing an entity's dividend policy, **Overview of dividend policy theories and approaches:** Walter's Model- Relationship between dividend decisions and firm valuation, Gordon's Model- Dividend relevance and its impact on stock prices	05	CO6

Text Books:

1. Entrepreneurship: A Real -World Approach by Rhonda Abrams.
2. Entrepreneurship- Theory, Process Practice –by Kuratko &Hodgetts, Thompson South-Western Publication.
3. Alexander Osterwalder and Yves Pigneur, "Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers".
4. Indian Financial System, 9" Edition (2015) by M. Y. Khan; Publisher: McGraw Hill Education, New Delhi.
5. Financial Management, 11h Edition (2015) by I. M. Pandey; Publisher: S. Chand (G/L) & Company Limited, New Delhi.

References:

1. The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses" by Eric Ries.
2. Fundamentals of CORPORATE FINANCE, S. A. Ross, R. W. Westerfield, and B. D. Jordan (11th ed.), McGraw Hill, 2018.
3. https://onlinecourses.nptel.ac.in/noc25_ge11/preview
4. https://nptel.ac.in/courses/127105007
5. https://onlinecourses.nptel.ac.in/noc21_mg93/preview

Internal Assessment (40 Marks)

1.Mid Semester Exam (20 Marks)

Mid semester examination will be based on 40% to 50% of the syllabus.

2.Continuous Internal Evaluation (20 Marks)

1.Assignment/Case study: 5 Marks

2.Quiz/Open book test/Presentation: 10 Marks

3.Regularity and attendance: 5 Marks

End Semester Examination (60 Marks)

End semester will be based on the syllabus coverage up to Mid Semester Examination (MSE) carrying 20% to 30% weightage and the syllabus covered from MSE to ESE carrying 70% to 80% weightage.

Course Code	Course Name	Examination Scheme						Lecture
		Marks Distribution			Exam Duration (Hrs)		Total Marks	2 Hrs
		Internal Assessment		End Semester Exam (ESE)	MSE	ESE		Total Credits
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)					2
VEC301	Environment and Sustainability	NA	50	NA	NA	NA	50	

Prerequisite: Knowledge of Universal human values & geography	
Course Objectives: The course aims to	
1	To introduce the basic concepts of environment, ecosystems and biodiversity and emphasize on the biodiversity of India and its conservation.
2	Understand and identify environmental issues relevant to India and global concerns
3	To familiarize the concept of sustainable development goals
4	Familiarize environment related legislations
Course Outcomes: Learners will be able to	
1	Demonstrate an understanding of the basic concepts of the environment, ecosystems, and biodiversity
2	Identify and understand the Global Environmental concerns.
3	Learn & understand the concepts of Biodiversity.
4	Learn & understand the implementation of Environment Management.
5	Understand and apply the concept of Sustainable Development Goals (SDGs) in addressing environmental and socio-economic issues.
6	To Gain knowledge of environment related legislations.

Module	Detailed Contents	Hrs.	CO Mapping
01	**Introduction and Definition of Environment**:	06	CO1
	Significance of Environment Management for contemporary managers, Environmental issues relevant to India, The Energy scenario		
	Self-Learning Topic: Content of Environment		

02	**Module Title: Global Environmental concerns.**	**05**	**CO2**
	Global warming-causes, effect, process, Greenhouse effect , Acid Rain, Ozone Depletion, Hazardous Wastes, Energy resources, Endangered life-species, Loss of Biodiversity . Emerging technologies to address Global warming		
	Self-Learning Topic: Various types of Pollutions.		
03	**Module Title: Biodiversity**:	**04**	**CO3**
	Ecosystems and interdependence between living organisms,habitats, limiting factors, Types of biodiversity: genetic, species and ecosystem diversity– values of biodiversity, India as a mega-diversity nation , hot-spots of biodiversity , threats to biodiversity		
04	**Module Title: Implementation of Environment Management:**	**05**	**CO4**
	Role and functions of Government as a planning and regulating agency, NGO, Corporate Environmental practices, AI driven environmental management.		
05	**Module Title: Sustainability Practices & Management:**	**05**	**CO5**
	Sustainable practices, Environmental impact assessment, impact analysis, Environmental life cycle analysis, Environmental risk assessment, ecological Sustainable development, Principles of sustainable development, sustainable development goals, economic development & Environment ,green growth, AI and Sustainability practices.		
06	**Module Title: General overview of major legislations:**	**03**	**CO6**
	Environment Protection Act, Air (P & CP) Act, Water (P & CP) Act, Wildlife Protection Act, Forest Act, Factories Act.		
	Self-Learning Topic: Indian Constitution		

Text Books:

1. Environmental Management: An Indian Perspective, S N Chary and Vinod Vyasulu, Macmillan India, 2000
2. Environmental Management V Ramachandra and Vijay Kulkarni, TERI Press

.

References:

1. Indian Standard Environmental Management Systems Requirements with Guidance for Use, Bureau Of Indian Standards, February 2005.

Continuous Internal Evaluation (50 Marks)

1. Seminar: 10 Marks
2. Field Visit/ NSS activity as case study: 20 Marks
3. Regularity and attendance: 5 Marks

Course project & Report (Group activity) : 15 Marks

Course Code	Course Name	Examination Scheme						Lecture
		Marks Distribution			Exam Duration (Hrs)		Total Marks	2*+2 Hrs
		Internal Assessment		Oral & Practical	MSE	ESE		Total Credits
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)					2
MEVSEC301	CAD Modeling Lab	-	25	25	-	-	50	

Prerequisite: Engineering Drawing	
Course Objectives: The course aims to	
1	To impart the 3D modeling skills for development of 3D models of basic engineering components.
2	To introduce Product data exchange among CAD systems.
3	To familiarize with production drawings with important features like GD &T, surface finish, heat treatments etc.
Course Outcomes: Learners will be able to	
1	Illustrate basic understanding of types of CAD model creation.
2	Visualize and prepare 2D modeling of a given object using modeling software.
3	Build a solid model of a given object using 3D modeling software.
4	Visualize and develop the surface model of a given object using modeling software.
5	Generate assembly models of given objects using assembly tools of a modeling software
6	Perform product data exchange among CAD systems.

Module	Detailed Contents	Hrs.	CO Mapping
01	**CAD Introduction** CAD models Creation, Types and uses of models from different perspectives. Parametric modeling.	02	CO1
02	**2D Drafting** Geometric modeling of an Engineering component, demonstrating skills in sketching commands of creation (line, arc, circle etc.) modification (Trim, move, rotate etc.) and viewing using (Pan, Zoom, Rotate etc.)	08	CO2

03	**Solid Modeling** 3D Geometric modeling of an Engineering component, demonstrating modeling skills using commands like Extrude, Revolve, Sweep, Blend, Loft etc.	**14**	**CO3**
04	**Surface Modeling** Extrude, Sweep, Trim etc and Mesh of curves, free form surfaces etc. Feature manipulation using Copy, Edit, Pattern, Suppress, History operations etc.	**10**	**CO4**
05	**Assembly & Detailing** Constraints, Exploded views, interference check. Drafting (Layouts, Standard & Sectional Views, Detailing & Plotting).	**10**	**CO5**
06	**Data Exchange** CAD data exchange formats Like IGES, PDES, PARASOLID, DXF and STL along with their comparison and applicability.	**04**	**CO6**

References:

1. Machine Drawing by N.D. Bhatt.

2. A textbook of Machine Drawing by Laxminarayan and M.L.Mathur, Jain brothers Delhi

3.Machine Drawing by Kamat and Rao

4. Machine Drawing by M.B.Shah

5. A text book of Machine Drawing by R.B.Gupta, Satyaprakashan, Tech. Publication

6. Machine Drawing by K.I. Narayana, P. Kannaiah, K.Venkata Reddy

7. Machine Drawing by Sidheshwar and Kanheya

8. Autodesk Inventor 2011 for Engineers and Designers by ShamTickoo and SurinderRaina, Dreamtech Press

Continuous Internal Evaluation (25 Marks)

1. Lab Performance: 10 Marks
2. In-Semester Practical Exam during lab session: 10 Marks
3. Regularity and Attendance: 5 Marks

Oral & Practical Exam (25 Marks)

An Oral & Practical exam will be held based on the entire syllabus

Course Code	Course Name	Examination Scheme						Practical
		Marks Distribution			Exam Duration (Hrs)		Total Marks	2 Hrs
		Internal Assessment		Oral & Practical	MSE	ESE		Total Credits
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)					1
MEPCL301	Material Testing Lab	-	25	25	-	-	50	

Prerequisite: Strength of Materials(MEPCC301),Applied Chemistry (BSE103),Elements of Mechanical Engineering(PCC2014)	
Course Objectives: The course aims	
1	To acquire the ability to set up an experiment.
2	To acquaint with the material testing by performing experiment related to Hardness , Fatigue, Tension, , Deflection, Torsion, Impact and Flexural Test
3	To study the microstructures of ferrous (steel and cast iron) metals
4	To familiarize with the use of metallurgical microscope for study of metals
Course Outcomes: Learners will be able to	
1	Perform Tension test to analyze the stress - strain behavior of materials
2	Perform flexural test with central and multi point loading conditions
3	Measure torsional strength, hardness and impact resistance of the material
4	Able to determine the hardenability of steel samples
5	Able to prepare and observe metallographic combinations
6	Perform heat treatment process of metal sample

Suggested List of Experiments and Assignment

(Any four experiment from group A and any two experiment from group B and two assignments)

Sr. No.	List of Experiments	CO Mapping
	Part-A	
01	Tension test on mild steel bar	LO-1
02	Flexural test on beam (central loading)	LO-2
03	Flexural test on beam (Multi-point load)	LO-2

04	Torsion test on mild steel bar	LO-3
05	Brinell hardness Test	LO-3
06	Rockwell Hardness Test	LO-3
07	Izod Impact Test	LO-3
08	Charpy Impact Test	LO-3
	Part-B	
09	Determination of hardenability of steel using the Jominy End Quench Test	LO-4
10	Preparation of specimen for metallographic observations	LO-5
11	Experiments based on Annealing heat treatment method	LO-6
12	Experiments based on Normalizing heat treatment method	LO-6
13	Experiments based on Tempering heat treatment method	LO-6

Sr. No.	List of Assignment	CO Mapping
01	Assignment on Simple Stress and strain, Shear Force and Bending Moment in Beams and Bending and Shear stresses in beam	LO-1, LO-2,LO-3
02	Assignment on Deflection of Beams and Torsion, Thin Cylindrical and Spherical Shells, Strain Energy, Columns	LO-4, LO-5,LO-6

Continuous Internal Evaluation (25 Marks)

1. Lab Performance and assignments: 10 Marks
2. In-Semester Practical Exam during lab session: 10 Marks
3. Regularity and Attendance: 5 Marks

Oral & Practical Exam (25 Marks)

An Oral & Practical exam will be held based on entire syllabus.

Course Code	Course Name	Examination Scheme						Practical
		Marks Distribution			Exam Duration (Hrs)		Total Marks	2 Hrs
		Internal Assessment		Oral & Practical	MSE	ESE		Total Credits
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)					1
MEPCL302	Applied Thermodynamic Lab	-	25	25	-	-	50	

Prerequisite:	
Course Objectives: The course aims to	
1	Understanding of fundamental thermodynamic concepts such as the laws of thermodynamics, properties of pure substances, and thermodynamic processes.
2	Knowledge of energy transfer mechanisms, including heat transfer and work done in different thermodynamic systems.
3	Familiarity with pressure gauges, thermocouples, flow meters, and other measuring instruments used in thermal experiments.
4	Basic knowledge of components like Heat Pump,Heat Engine ,Refrigerator, Boilers, Compressors and Blower.
Course Outcomes: Learners will be able to	
1	Understand and apply the fundamental laws of thermodynamics through experimental analysis.
2	Evaluate the performance parameters of various thermodynamic systems.
3	Understand the working of the cooling tower and evaluate efficiency.
4	Evaluate performance of Heat Recovery Unit (Heat Pump)
5	Understand the working principles, functions, and requirements of various types of boilers along with their mountings and accessories.
6	Understand the working and Evaluate efficiency of different types of air compressors.

Suggested List of Experiments (Any Six)

Sr. No.	List of Experiments	CO Mapping
01	Verification of the Zeroth Law of Thermodynamics.	LO1
02	Determination of Specific Heat Capacity of a Solid Substance.	LO2

03	Performance Evaluation of cooling tower.	LO3
04	Experimental Analysis of COP in a Heat Recovery Unit (Heat Pump)	LO4
05	Experiment on boilers and their accessories and mountings.	LO5
06	Performance Evaluation of a Reciprocating Air Compressor: Volumetric Efficiency.	LO6
07	Experimental Study on Volumetric Efficiency of a Rotary Air Compressor.	LO6
08	Trial on Blower Test Rig.	LO6
09	Performance Evaluation of a Multistage compressor: Volumetric Efficiency.	LO6

Continuous Internal Evaluation (25 Marks)

1. Lab Performance: 10 Marks
2. In-Semester Practical Exam during lab session: 10 Marks
3. Regularity and Attendance: 5 Marks

Oral & Practical Exam (25 Marks)

An Oral & Practical exam will be held based on the entire syllabus.

Department of Mechanical Engineering

Second Year Engineering Curriculum: Semester IV

Course Code	Course Name	Examination Scheme						Lecture
		Marks Distribution			Exam Duration (Hrs)		Total Marks	3 Hrs
		Internal Assessment		End Semester Exam (ESE)	MSE	ESE		Total Credits
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)					3
MEPCC401	Applied Maths-II for Mechanical Engineering	20	20	60	1	2	100	

Prerequisite: Engineering Mathematics-I,II,III	
Course Objectives: The course aims to	
1	Provide the Basic knowledge on the concepts of mathematics pertaining to the field of engineering.
2	Build a foundation to the methodology necessary for solving problems by applying the knowledge of mathematics in the field of Engineering
Course Outcomes: Learners will be able to	
1	Analyse random variables and apply the concepts of probability for getting the spread of data.
2	Analyse the mathematical problem given and apply the concepts of distribution in finding probabilities.
3	Analyse and apply the concept of Sampling Theory to frame and make decisions on the hypothesis.
4	Analyse and interpret the data using Correlation and Regression.
5	Analyze complex power series and determine the value of complex integration using Cauchy's theorem and Cauchy's formula.
6	Analyze various types of singularities and apply its knowledge in finding contour integrals.

Module	Detailed Contents	Hrs.	CO Mapping
01	**Probability Theory and Random Variable** Conditional Probability, Bayes Theorem, Total Probability Theorem, Definition of Random Variable, Types of Random Variable: Discrete and Continuous, Probability Mass and Density Function, Measures of Central Tendency and Dispersion. **Self-Learning Topic:** Cumulative Distribution and Density Function	08	CO1
02	**Probability Distribution** Binomial distribution, Poisson Distribution, Fitting of a Poisson Curve, Gaussian Distribution, Normal Distribution (Standard Normal distribution, Reverse problem of Normal distribution). **Self-Learning Topic:** Joint Probability Distribution	07	CO2
03	**Sampling Theory** Introduction to Sampling Theory, Testing of Hypothesis: Level of Significance, Critical Region, One and Two Tailed Tests, Test significance of large samples test: One sample. Students' t-distribution: One sample, two sample, Chi-square test, F-test. **Self Learning Topic:** Test of significance of large sample: Two sample	08	CO3

04	**Correlation and Regression** Correlation, Karl Pearson's coefficients of correlation(r), Spearman's Rank correlation coefficient (R): Repeated Rank, Non-repeated rank, Regression, Line of regression, Curve fitting: Linear and SecondDegree Curves.	**07**	**CO4**
	Self Learning Topic: Fitting of an exponential Curve		
05	**Complex Integration-I** Line Integral, Cauchy's Integral theorem: Simple connected, multiply connected regions. Cauchy Integral formula (without proof). Taylor's and Laurent's series (without proof). **Self Learning Topic:** Winding Numbers	**06**	**CO5**
06	**Complex Integration-II** Definition of Singularity, Definition of Zeroes and Poles of f(z). Residues, Cauchy's Residue Theorem (without proof), Application of Residue Theorem to evaluate real integrals. **Self Learning Topic:** Application of Residue Theorem to evaluate improper real integrals.	**06**	**CO6**

Text Books:

1.Advanced Engineering Mathematics, H. K. Dass, Twenty-first Revised Edition, 2013, S.Chand and Company Ltd.

References:

1.Probability, Statistics and Random Processes, T Veerarajan, Second Edition, 2004, Tata McGraw-Hill Publishing Company Ltd.
2. Advanced Engineering Mathematics, Erwin Kreyszig, Eight Edition, 2010, Wiley Eastern Limited.
3. Complex Variables and Applications, S. Ponnusamy and Herb Silverman, First, 2006, Birkhauser Boston.
4. Higher Engineering Mathematics, Dr. B. S. Grewal, Forty Second Edition, 2017, Khanna Publication.

Other Resources :

1. NPTEL Course: Probability and Statistics By Dr. Somesh Kumar, Department of Mathematics, IIT Kharagpur :-Web link: https://youtu.be/VVYLpmKRfQ8?si=Gh3EtQrLSrEFZMNo
2. NPTEL Course: Complex Analysis by Prof. P. A. S. Sree Krishna, Department of Mathematics, IIT Guwahati :-Web link: https://youtu.be/Mwpz1zjPlzI?si=JU090YU2-MxJOXJD

Internal Assessment (40 Marks)

A. Mid Semester Exam (20 Marks)

Mid semester examination will be based on 40 % to 50% of the syllabus.

B. Continuous Internal Evaluation (20 Marks)

1. Assignment: 5 Marks
2. Quiz/Open book test/Presentation: 10 Marks
3. Regularity and attendance: 5 Marks

End Semester Examination (60 Marks)

End semester will be based on the syllabus coverage up to Mid Semester Examination (MSE) carrying 20% to 30% weightage and the syllabus covered from MSE to ESE carrying 70% to 80%weightage.

Course Code	Course Name	Examination Scheme						Lecture
		Marks Distribution			Exam Duration (Hrs)		Total Marks	3 Hrs
		Internal Assessment		End Semester Exam (ESE)	MSE	ESE		Total Credits
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)					3
MEPCC402	Manufacturing Technology	20	20	60	1	2	100	

Prerequisite: Knowledge of Elements of Mechanical Engineering (PCC2014) , Applied Physics I & II (BSC102,BSC202) & Applied Chemistry I & II (BSC103, BSC203)	
Course Objectives: The course aims	
1	To familiarize with the various production processes used on shop floors
2	To study appropriate production processes for a specific application
3	To introduce to the learner various machine tools used for manufacturing
4	To familiarize with principle and working of non-traditional manufacturing
5	To familiarize the structure -property correlation in materials
6	To acquaint with the processing dependency on the performance of the various materials
Course Outcomes: Learners will be able to	
1	Learn & Understand the Introduction to Production Processes and Metal Casting.
2	Learn, & understand and identify various Joining Processes.
3	Learn & understand the various Machine Tools, Machining Processes & Non-Traditional Machining Processes.
4	Learn & understand the various Polymer Processing & Powder Metallurgy.
5	Learn & Understand various Mechanism of Crystallization
6	Learn & understand the various Heat treatment.

Module	Detailed Contents	Hrs.	CO Mapping
01	**Introduction to Production Processes and Metal Casting**: 1.1.Classification of Production Processes and applications areas 1.2. Pattern making materials, Types of pattern and allowances. 1.3. Sand moulding and Machine moulding 1.4.Gating system: Types of risers, types of gates, solidification	06	CO1
02	**Joining Processes.** 2.1. Classification of various joining processes; Applicability, 2.2. Classification and working of various welding methods: Gas, Arc,Chemical, Radiant, Solid State etc.	07	CO2

	2.3. Welding Joints, Welding Positions, Welding defects and their remedies		
03	**Machine Tools, Machining Processes & Non-Traditional Machining Processes**: 3.1 Lathe Machines, Milling Machines, Drilling Machines, and Grinding Machines, Broaching machines, Lapping/Honing machines (Super Finishing Operations). 3.2 Non-Traditional Machining Processes: Electro-chemical machining (ECM), Electric-discharge machining (EDM),Ultrasonic machining (USM), Laser Beam Machining (LBM)	**09**	**CO3**
04	**Polymer Processing & Powder Metallurgy** 4.1 Polymer Moulding Techniques for thermoplastic and thermosetting plastics. Applications of Plastics in the engineering field**.** 4.2 Introduction to Powder Metallurgy, Powder making processes, Steps in Powder Metallurgy. Compaction and Sintering processes	**07**	**CO4**
05	**Mechanism of Crystallization** 5.1 Nucleation-Homogeneous and Heterogeneous Nucleation and Growth. Solidification of metals and alloys– Cooling curves 5.2 Classification of Alloys based on phases and phase diagram 5.3 Iron-Iron carbide phase diagram **Self-Learning Topic: Basic Properties of Metal**	**07**	**CO5**
06	**Heat treatment** 6.1 Overview, Objectives, Thorough treatments: Annealing and types, normalizing, hardening and tempering, austempering and martempering 6.2 Surface hardening processes: Carburizing, nitriding, cyaniding and carbonitriding, induction and flame hardening, Laser and Electron beam hardening 6.3 Strengthening mechanisms in material **Self-Learning Topic: Melting Points of Metals**	**06**	**CO6**

Text Books:

1. Elements of workshop technology. Vol. 1 I by S K Hajra Choudhury
2. Welding technology by O P Khanna
3. Production Technology by Raghuvanshi.

References:

1. https://nptel.ac.in/courses/112/107/112107219/
2. https://nptel.ac.in/courses/112/107/112107215/
3. https://nptel.ac.in/courses/112/107/112107084/

Internal Assessment (40 Marks)

A. Mid Semester Exam (20 Marks)

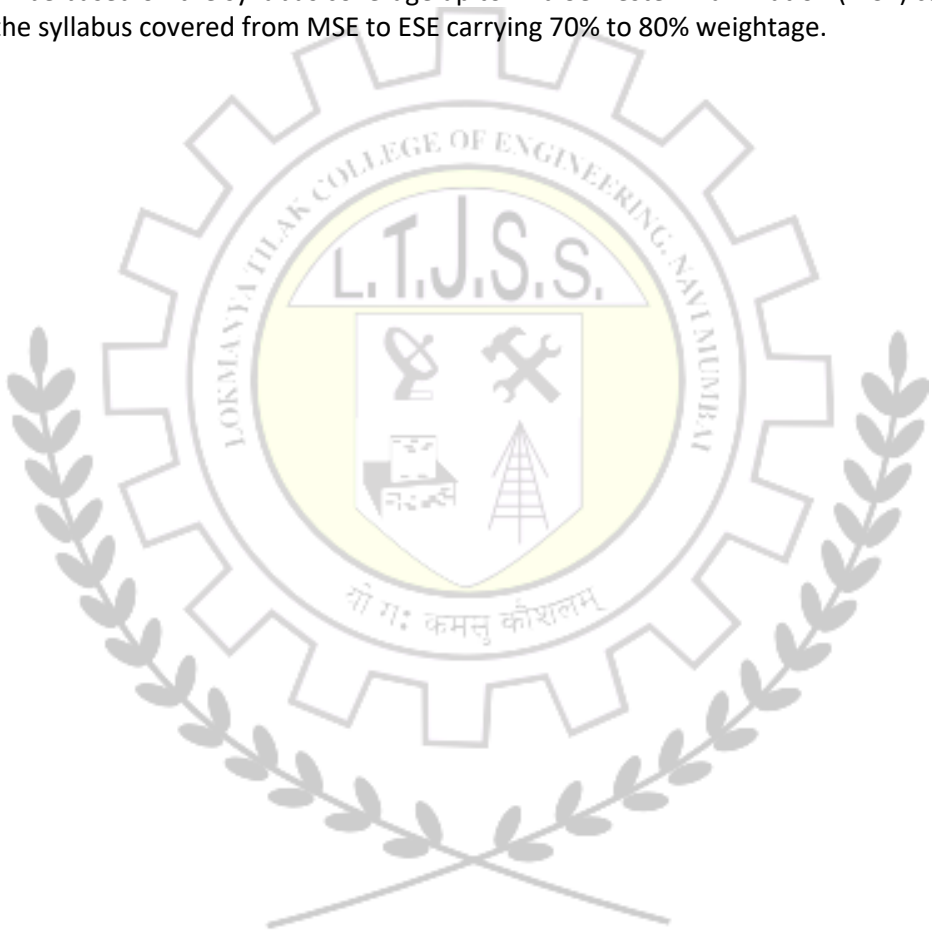
Mid semester examination will be based on 40 % to 50% of the syllabus.

B. Continuous Internal Evaluation (20 Marks)

1. Assignment: 5 Marks
2. Quiz/Open book test/Presentation: 10 Marks
3. Regularity and attendance: 5 Marks

End Semester Examination (60 Marks)

End semester will be based on the syllabus coverage up to Mid Semester Examination (MSE) carrying 20% to 30% weightage and the syllabus covered from MSE to ESE carrying 70% to 80% weightage.



Course Code	Course Name	Examination Scheme						Lecture
		Marks Distribution			Exam Duration (Hrs)		Total Marks	3 Hrs
		Internal Assessment		End Semester Exam (ESE)	MSE	ESE		Total Credits
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)					3
MEPCC403	**Fluid Mechanics & Hydraulic Machinery**	20	20	60	1	2	100	

Prerequisite:	
Course Objectives: The course aims to	
1	Study fluid statics and fluid dynamics
2	Study application of mass, momentum and energy equations in fluid flow.
3	Learn various flow measurement techniques.
4	Familiarize with the dynamics of fluid flows
5	Study utilization of hydraulic energy
Course Outcomes: Learners will be able to	
1	Calculate the forces exerted by fluid at rest on plane or curved submerged surfaces.
2	Categorize the type of flow and Apply Bernoulli equation to solve a variety of fluid flow problems.
3	Estimate the loss of energy of the incompressible fluid associated with pipe flow.
4	Compare the performance of the impulse and reaction Turbine
5	Analyze the performance, selection, and governing of hydraulic turbines.
6	Estimate performance parameters of Centrifugal and positive displacement pumps.

Module	Detailed Contents	Hrs.	CO Mapping
01	**Introduction and Fluid Statics** Significance Of Fluid mechanics**,** Definition of Fluid, Properties of fluid, Classification of fluid, Newton's Law of viscosity. Pascals Law, Hydrostatic law, Forces on horizontal, vertical and inclined submerged plane. Archimedes principle.	**06**	**CO1**
02	**Fluid Kinematics and Dynamics** Eulerian and Lagrangian approach, Classification of the fluid flow, Continuity equation, stream function, velocity potential, function, source flow, sink flow. Concept of control volume and surface, Importance of RTT , Euler's equations in one and three dimensions. Derivation of Bernoulli's equation from the principle of conservation of energy.Application of Bernoulli's equation in flow measurement device (venturimeter, orifice meter). Impulse momentum equation.	**08**	**CO2**

03	**Viscous and Turbulent Flow** Introduction to Reynolds number, Derivation of relationship between shear stress and pressure gradient, Laminar flow in circular pipe (Hagen-Poiseuille flow). **Flow through pipes**: Head loss in pipes due to friction (Darcy-Weisbach equation without proof), Loss of energy in pipe (major and minor losses), Pipes in series and parallel. Concept of formation of boundary layer, boundary layer parameters. (No Numerical) Concept of drag and lift, Types of drag, Streamlined and bluff bodies.	07	CO3
04	**Hydraulic Turbines** General layout of hydro-electric power plant. Classification of hydraulic turbines, definition of various turbine parameters , Pelton Turbine: Components, construction, working, work done and efficiency, velocity triangle, Calculation of velocity of jet, speed ratio, jet ratio, number of jets, head, power and efficiency. Francis Turbine: Components, construction and working, velocity diagram and numerical, Draft tube and its function.	07	CO4
05	**Similarity Relations and Performance Prediction in Turbines** Similarity relations in turbines, definition of unit quantities and specific quantities, selection of turbines. Prediction of results of prototypes from the model test. Cavitations in turbines - causes, effects and remedies, Thoma's cavitation parameter G. Use of G v/s specific speed graphs. Determination of safe height of installation for the turbine. Characteristics of turbines, governing of turbines.	07	CO5
06	**Hydraulic Pumps** Detailed classification of Pump applications. Reciprocating pumps: operating principle of reciprocating pump,Different types of head, discharge coefficient, slip. Calculation of work done and power input, concept of indicator diagram.Centrifugal Pumps: Different types of head, Euler's equation and velocity triangles, pump losses and efficiency, Priming of pumps,Concept of NPSH (No Numerical)	07	CO6

Text Books:

1. Fluid Mechanics by Yunus A Cengel and John M Cimbala, Tata McGraw Hill Education, 3rd Editio\n, 2014.
2. Fluid Mechanics and Machinery by C S P Ojha, Chandramouli and R Berndtsson, Oxford University Press, 1st Edition, 2010.
3. Fox and McDonald's Introduction to Fluid Mechanics by Philip J. Pritchard and John W. Mitchell, Wiley Publishers, 9th Edition,2016.
4. A textbook of Fluid Mechanics & Hydraulic machines by R K Bansal, Laxmi Publication, 9th Edition, 2005
5. A textbook of Fluid Mechanics & Hydraulic machines by R K Rajput, S. Chand & company ltd Laxmi Publication, 4th Edition, 2010
6. Fluid Mechanics by Frank M. White, McGraw Hill Education, 7th Edition, 2011.

7. Fluid Mechanics by Victor Streeter, Benjamin Wylie and K W Bedford, McGraw Hill Education, 9thEdition, 2010.
8. Engineering Fluid Mechanics by K. L. Kumar, Eurasia Publishing House (P) Ltd, 1 st Edition and Reprint 2016.
9. Fluid Mechanics and Hydraulic Machinery, Modi and Seth, Standard Book House
10. Introduction to Fluid Mechanics by James A. Fay, MIT Press, Campbridge, 1st Edition, 1996

Links for online NPTEL/SWAYAM courses:

1. https://nptel.ac.in/courses/112/105/112105269
2. https://swayam.gov.in/nd1_noc20_ce59/preview
3. https://nptel.ac.in/courses/112/106/112106303/ - Introduction to Turbomachines, IIT Madras
4. https://nptel.ac.in/courses/112/106/112106200/ - Fluid Dynamics and Turbomachines, IIT Madras

Internal Assessment (40 Marks)

A. Mid Semester Exam (20 Marks)

Mid semester examination will be based on 40 % to 50% of the syllabus.

B. Continuous Internal Evaluation (20 Marks)

1. Assignment: 5 Marks
2. Quiz/Open book test/Presentation: 10 Marks
3. Regularity and attendance: 5 Marks

End Semester Examination (60 Marks)

End semester will be based on the syllabus coverage up to Mid Semester Examination (MSE) carrying 20% to 30% weightage and the syllabus covered from MSE to ESE carrying 70% to 80% weightage.

Course Code	Course Name	Examination Scheme						Lecture
		Marks Distribution			Exam Duration (Hrs)		Total Marks	2 Hrs
		Internal Assessment		End Semester Exam (ESE)	MSE	ESE		Total Credits
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)					2
OE4011	Human Resource Management	20	20	60	1	2	100	

Prerequisite: Knowledge in Business Fundamentals.	
Course Objectives: The course aims to	
1	Develop an understanding of the fundamental concepts, functions and process of Human Resource Management.
2	Obtain the knowledge related to the nature and scope of organizational behaviour and its relevance in Organizational Management.
3	Understand the importance and process of Human resource planning and its applications.
4	Familiarize with various selection procedures and practices related to recruitment, selection and training.
5	Analyze the role of AI and similar technological trends in HR in the digital world.
Course Outcomes: Learners will be able to	
1	Understand the concepts, functions and process of Human Resource Management.
2	Acquire knowledge related to the nature and scope of organizational behavior.
3	Compare and classify concepts of Human resource planning and its applications.
4	Differentiate between various selection procedures and practices related to recruitment, selection and training.
5	Assess the role of AI and similar technological trends in HR in the digital world.

Module	Detailed Contents	Hrs.	CO Mapping
01	**Introduction to Human Resource Management (HRM)** Introduction and Significance of Human Resource Management, Definition, Scope, Features, Importance and Evolution of the concept of HRM, Functions and Objectives of HRM, Principles of HRM, Limitation of HRM, Role and Quality of Human Resource Managers, Need for HRM Approach.	04	CO1

02	**Organizational Behaviour (OB)** Introduction and Origin of Organizational Behaviour, Nature, Scope and its relevance to Organizational Effectiveness, Understanding employee behavior, Meaning and Determinants of Personality, Personality Development, Personality Types and assessment of Personality Traits ,Attitude and Behaviour, Group Behaviour , Team Effectiveness, Motivation and Theories of Motivation ,Leadership. **Self-Learning Topic:** Case studies on topics related to Group behaviour, Motivational Theories.	06	CO2
03	**Human Resource Planning (HRP)** Concept and Objective of Human Resource Planning, Importance and Process of Human Resource Planning, Challenges and Factors affecting HRP ,Steps and Effective HRP, Job Analysis, Job Description and Job Specification, Role Analysis. **Self-Learning Topic:** Study and comparison of various Job Descriptions in an organization.	06	CO3
04	**Recruitment ,Selection, Performance Management ,Training and Development** **Recruitment:** Definition, Recruitment policy, Constraints and Challenges of Recruitment, sources and methods of Recruitment, New Approaches to recruitment. **Selection:** Selection and its Process,Developing effective selection methods including different types of Tests, Interviews and assessments,Induction and Orientation. **Performance Management :** Internal Mobility, Compensation Management, Fixing of wages, Legislation and objectives of performance appraisal , Learning performance appraisal methods, Understanding the concepts of feedback and coaching, Wages and Benefits, Labour Laws. **Training and Development:** Objectives, Need, Importance of Training, Training Vs. Development, Systematic Approach to Training, Training Methods, Career Planning, Career Development. **Self-Learning Topic:** Recent Trends in Recruitment	07	CO4
05	**Emerging Trends in HR** The evolving role of HR in a digital world , The rise of Remote/Hybrid work, Employee engagement strategies,AI in HR, Data analytics in HRM . Self-Learning Topic: International HRM	05	CO5

Text Books:

1 K. Aswathappa, “Human Resource Management: Text and Cases”, McGraw-Hill Publication.

2 Laurie Mullins, “Management & Organizational Behavior”, Pearson Publication.

3 B.P.Singh, “Human Resource Management: Concepts and Practices”, Excel Books Publication.

4 Deepa Gupta,M.Gupta,Karth Gupta, “HR Analytics:The Future of HR”,PHI Learning

References:

1 Raymond Noe, John Hollenbeck, Barry Gerhart, Patrick Wright, “Fundamentals of Human Resource Management”, McGraw-Hill Publication.

2 Venkata Ratnam C. S. & Srivastava B. K., “Personnel Management and Human Resources”, Tata McGraw Hill, New Delhi.

3 P. C. Tripathi, "Personnel and Human Resource Management”, S. Chand & Sons Publication.

Assessments :

Internal Assessment (40 Marks)

6. **Mid Semester Exam (20 Marks)**

Mid semester examination will be based on 40 % to 50% of the syllabus.

7. **Continuous Internal Evaluation (20 Marks)**
4. Case Study : 5 Marks
5. Group Activity / Presentation: 10 Marks
6. Regularity and attendance: 5 Marks

End Semester Examination (60 Marks)

End semester will be based on the syllabus coverage up to Mid Semester Examination (MSE) carrying 20% to 30% weightage and the syllabus covered from MSE to ESE carrying 70% to 80% weightage.

Course Code	Course Name	Examination Scheme						Lecture
		Marks Distribution			Exam Duration (Hrs)		Total Marks	2 Hrs
		Internal Assessment		End Semester Exam (ESE)	MSE	ESE		Total Credits
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)					2
OE4012	Corporate and Cyber Laws	20	20	60	1	2	100	

Prerequisite: Basic Legal Awareness	
Course Objectives: The course aims to	
1	Provide fundamental knowledge of corporate laws
2	Analyse the legal and regulatory framework governing corporate transactions
3	Explore the fundamentals of cyber law and cybersecurity,
4	Examine emerging trends in corporate and cyber laws
Course Outcomes: Learners will be able to	
1	Understand corporate law fundamentals, business entity structures, and corporate governance.
2	Understand legal provisions of the Companies Act, SEBI regulations, CSR laws, and contract laws.
3	Identify cybercrimes, attack methods, and information security risks.
4	Explain cyber law aspects related to e-commerce, IPR, evidence, and criminal law.
5	Analyse IT Act provisions and cybersecurity compliance standards.
6	Evaluate emerging trends in corporate governance, AI regulation, and digital assets laws.

Module	Detailed Contents	Hrs.	CO Mapping
01	**Introduction to Corporate Laws** Concept, Nature, and Scope of Corporate Laws, Legal Personality of Companies, Types of Business Entities (Private, Public, LLP, Sole Proprietorship), Incorporation and Registration of Companies, Lifting or piercing the corporate Veil, Corporate Governance and Ethics. **Self Learning Topic:** Comparative Study of Corporate Laws Across Countries	05	CO1
02	**Regulatory Framework for Companies** Overview of the Companies Act, Key Legal Provisions (Formation, Compliance, Penalties), Shareholder Rights & Director Responsibilities, Company Act 2013 (Key Provisions). Securities and Exchange Laws (SEBI regulations). Corporate Social Responsibility (CSR) Regulations, Contract Law and Business Transactions, Mergers, Acquisitions, and Competition Law	06	CO2
03	**Introduction to Cybercrime** Definition of Cybercrime and information security, Classifications of cybercrime, Planning of Cyber-attacks, Social Engineering, Phishing, Password Cracking, Key loggers and Spywares, Virus and Worms, Identity Theft. **Self Learning Topic:** Botnets, DoS and DDoS Attacks, SQL Injection, Buffer Overflow.	04	CO3

04	**The Concept of Cyberspace** E-Commerce, The Contract Aspects in Cyber Law, The Security Aspect of Cyber Law, The Intellectual Property Aspect in Cyber Law, The Evidence Aspect in Cyber Law, The Criminal Aspect in Cyber Law, Legal Framework for Electronic Data Interchange Law Relating to Electronic Banking. **Self Learning Topic:** Global Trends in Cyber Law	**05**	**CO4**
05	**Indian IT Act & Information Security Standard compliances** Penalties, Adjudication and Appeals Under the IT Act 2000, IT Act 2008 and its Amendments. Compliance Standards: SOX, HIPAA, ISO, NERC, PCI-DSS, NIST **Self Learning Topic:** GLBA, FISMA	**05**	**CO5**
06	**Emerging Trends in Corporate and Cyber Laws** Environmental, Social, and Governance Compliance, Digital Corporate Governance, Artificial Intelligence (AI) Regulation, Digital Assets and Cryptocurrency Regulations	**03**	**CO6**

Text Books:

4. "Company Law" by Avtar Singh, Eastern Book Company
5. "Indian Corporate Law" by N.D. Kapoor, Sultan Chand & Sons
6. "Business Law Including Company Law" by S.S. Gulshan and G.K. Kapoor
7. Nina Godbole, Sunit Belapure, Cyber Security, Wiley India, New Delhi
8. "Cyber Security & Cyber Laws" by Nilakshi Jain & Ramesh Menon.

References/Online Resources:

2. The Information technology Act, 2000; Bare Act- Professional Book Publishers, New Delhi.
3. Cyber Law Emerging Trends and Challenges, Dr. Aditya Tomer, Dr. Harshita Singh & Ms. Garima Wadhwa, Redshine Publication
4. https://www.geeksforgeeks.org/corporate-law/
5. https://www.geeksforgeeks.org/cyber-laws-in-india/

Internal Assessment (40 Marks)

A. Mid Semester Exam (20 Marks)

Mid semester examination will be based on 40 % to 50% of the syllabus.

B. Continuous Internal Evaluation (20 Marks)

4. Assignment: 5 Marks
5. Quiz/Open book test/Presentation: 10 Marks
6. Regularity and attendance: 5 Marks

End Semester Examination (60 Marks)

End semester will be based on the syllabus coverage up to Mid Semester Examination (MSE) carrying 20% to 30% weightage and the syllabus covered from MSE to ESE carrying 70% to 80% weightage.

Course Code	Course Name	Examination Scheme						Lecture
		Marks Distribution			Exam Duration (Hrs)		Total Marks	2 Hrs
		Internal Assessment		End Semester Exam (ESE)	MSE	ESE		Total Credits
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)					2
OE4013	Stock Market & Personal Finance	20	20	60	1	2	100	

Prerequisite: Statistical calculations	
Course Objectives: The course aims to	
1	**Explain students with knowledge of Securities Market**
2	**Impart the students to understand the legal frame work of securities Market**
3	**Empowers the students to have depth knowledge in different segment of stock exchange**
4	**Build long term personal finance portfolio**
Course Outcomes: Learners will be able to	
1	**Understand the basic concept of stock market**
2	**Exercise the Trading on Stock Market**
3	**Analyze the fundamental and technical aspect of the stock**
4	**Understand the legal Frame work of Securities Market**
5	**Calculate the personal financial needs**
6	**Determine the personal financial goals**

Module	Detailed Contents	Hrs.	CO Mapping
01	**Introduction to Stock Market and Trading** 1.1 Overview of Stock Market: History, evolution, and types of stock markets. 1.2 Trading Basics: Understanding buying and selling (Entry and Exit form stock), bulls and bears, and market trends. 1.3. Investment Goals and Risk Management: Setting investment objectives, risk tolerance, and asset allocation. 1.4. Stock Market Indices and Sectors: Understanding major stock market indices (e.g., Sensex, Nifty 50, S&P 500, Dow Jones) and sectors (e.g., technology, finance). **Self Learning Topic: Stock brokers in India, fees and charges levied on trader**	04	CO1
02	**Financial Markets and Instruments** 2.1 Types of Financial Markets: Money market, bond market, commodity market, and foreign exchange market. 2.2. Stock Market Instruments: Stocks, bonds, ETFs, mutual funds, and derivatives (options, futures). 2.3 Market Participants: Understanding the roles of investors, traders, brokers, and market makers. 2.4 Trading psychology- A practical approach **Self Learning Topic: Difference between Investor and trader, Difference between Investment and Saving**	04	CO2

03	**Stock Analysis and Selection** 3.1 Introduction to Technical Analysis: Understanding charts, trends, and patterns. 3.2 Chart Types and Patterns: Line charts, bar charts, candlestick charts, and common patterns (e.g., head and shoulders, triangles). 3.3 Trend Analysis and Indicators: Moving averages, relative strength index (RSI), and other technical indicators. 3.4 Charting Tools and Software: Overview of popular charting platforms (e.g., TradingView, MetaTrader). 3.5 Fundamental Analysis- SMA, EMA, MACD, Bollinger bands, 3.6 Stock analysis through Ratios – P/E ratio, P/B ratio, ROE, EPS, Debt-to-capital ratio, Interest coverage ratio (ICR), Enterprise value to EBIT, Operating margin, Quick ratio **Self Learning Topic: Find the long term stocks, short term stocks in current scenario of market and Explain Why to invest in these stocks.**	**06**	**CO3**
04	**Stock Market regulations** 4.1 SEBI Acts - Securities Contracts (Regulation) Act, 1956, Securities and Exchange Board of India Act, 1992, Depositories Act 1996, Securities Laws (Amendment) Act, The Finance Act. 4.2 Role of SEBI, Stock exchanges, Stock brokers and Investors 4.3 Stock market Surveillance – ASM, GSM, ESM, T2T 4.4 Investor protection, Investor education, Investor awareness	**04**	**CO4**
	Self Learning Topic: Case study of Stock Market Frauds		
05	**Introduction to Personal Finance** 5.1 Need for Personal Finance Management 5.2 Income tax planning 5.3 Assessment of personal risk profile 5.4 Understanding the Salary slips 5.5 Insurance (Need of Insurance, Separating investment from insurance Life Insurance, Term Insurance, Mediclaim, Property) **Self Learning Topic: Learn and Understand the Union Budget, Global Budget**	**05**	**CO5**
06	**Financial Planning for Engineers** 6.1 Time value of money, Return on Investment, Modes of personal Investment and savings (Gold, bonds, Fixed Deposits, Mutual Funds, Crypto currency, Real estate etc. 6.2 Portfolio building (Personal portfolio components, Self-analysis, Govt and Private Agencies) 6.3 Money management (Engineering Students loan, home loan, credit card, Cash) 6.4 Handling the finance in uncertainty and risk – Pandemic, personal, social, professional life **Self Learning Topic: Build your dream portfolio, make your own balance sheet as an engineering student**	**05**	**CO6**

Reference Books

1. How the stock market works, M Becket, Kogan Page, 3rd Edition, 2010 (https://procapital.mohdfaiz.com/books/books-image/mainBook/245114947.pdf)
2. The Intelligent Investor, Benjamin Graham, Perfect Bound, eISBN 0-06-058328-2, June 2003 (https://sims.sairam.edu.in/wp-content/uploads/sites/7/2024/03/THE-INTELLIGENT-INVESTOR.pdf)

3. How to Make Money in Stocks, William J. O'Neil, 4th edition, 2009 (https://tradingpsychologist.in/wp-content/uploads/2023/09/How-to-Make-Money-In-Stocks.pdf)
4. Hand Book For Investing & Investor Protection, Dr. Naresh Maheshwari, ICWA New Delhi, January 2011, https://www.farsightshares.com/wp-content/uploads/2019/05/hand_book.pdf

Web Material

Module	Text Books	References/links
1	Introduction to Stock Markets, Zerodha	https://zerodha.com/varsity/modules/
2	Technical Analysis, Fundamental Analysis, Zerodha	https://zerodha.com/varsity/module/technical-analysis/
3	NCFM Technical Analysis Module, NSE limited	https://zerodha.com/z-connect/wp-content/uploads/2014/06/TA_wrkbk.pdf
4	Hand Book For Investing & Investor Protection, Dr. Naresh Maheshwari, ICWA New Delhi, January 2011	https://www.farsightshares.com/wp-content/uploads/2019/05/hand_book.pdf
5	Financial Education Booklet, SEBI, November 2020	https://investor.sebi.gov.in/pdf/downloadable-documents/Financial%20Education%20Booklet%20-%20English.pdf
6	Personal Financial Planning, IDOL, University of Mumbai, May 2023	https://mu.ac.in/wp-content/uploads/2023/05/M.Com-Sem-IV-Personal-Financial-Planning.pdf

NPTEL and Swayam Links

4. Financial Markets, Institutions and Financial Services By Prof. Divya Verma | Guru Gobind Singh Indraprastha University, Delhi https://onlinecourses.swayam2.ac.in/cec25_mg11/preview
5. Financial Institutions and Markets, Dr. Jitendra Mahakud, IIT Kharagpur **https://archive.nptel.ac.in/courses/110/105/110105121/**

Internal Assessment (40 Marks)

A. Mid Semester Exam (20 Marks)

Mid semester examination will be based on 40 % to 50% of the syllabus.

B. Continuous Internal Evaluation (20 Marks)

7. Assignment/Paper trading/Dummy trading: 5 Marks
8. Quiz/Open book test/Presentation/Trading Demonstration: 10 Marks
9. Regularity and attendance: 5 Marks

End Semester Examination (60 Marks)

End semester will be based on the syllabus coverage up to Mid Semester Examination (MSE) carrying 20% to 30% weightage and the syllabus covered from MSE to ESE carrying 70% to 80% weightage.

Course Code	Course Name	Examination Scheme						Lecture
		Marks Distribution			Exam Duration (Hrs)		Total Marks	2 Hrs
		Internal Assessment		End Semester Exam (ESE)	MSE	ESE		Total Credits
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)					2
OE4014	**Nutrition Literacy and Health**	20	20	60	1	2	100	

Prerequisite:

Course Objectives: The course aims to

1 Understand the fundamentals of nutrition and its role in human health.
2 Learn about energy balance and the principles of diet planning.
3 Analyze the impact of nutrition on lifestyle diseases and their prevention.
4 Gain knowledge about food safety, preservation techniques, and quality control.
5 Explore sustainable nutrition practices and advancements in food technology.
6 Understand dietary recommendations for special conditions and future trends in nutrition.

Course Outcomes: Learners will be able to

1 Understand the fundamental concepts of nutrition, including macronutrients, micronutrients, and their roles in maintaining health.
2 Analyze energy balance, metabolism, and the principles of diet planning for different age groups and lifestyles.
3 Identify the impact of nutrition on common lifestyle diseases and understand preventive measures through diet and lifestyle modifications.
4 Evaluate food safety standards, food labeling, and regulations to promote healthy food choices.
5 Assess the significance of nutritional requirements during different life stages.
6 Apply nutrition literacy principles to enhance personal well-being and spread awareness about balanced diets and healthy eating habits.

Module	Detailed Contents	Hrs.	CO Mapping
01	**Fundamentals of Nutrition** Introduction to Nutrition: Definition, Importance, and Scope Food Groups and Their Nutritional Value Essential Nutrients: Macronutrients and Micronutrients Water and Dietary Fiber Nutritional Deficiencies: Causes, Symptoms, and Prevention	**05**	**CO1**
02	**Energy Balance and Diet Planning** Energy Metabolism: Basal Metabolic Rate (BMR) and Total Energy Expenditure (TEE) Principles of a Balanced Diet Dietary Guidelines and Food Pyramid Meal Planning for Different Age Groups Special Dietary Considerations: Pregnancy, Lactation, and Vegetarianism	**05**	**CO2**

03	**Nutrition and Lifestyle Diseases** Role of Nutrition in Preventing Lifestyle Diseases Obesity, Diabetes, and Cardiovacular Diseases Hypertension and Osteoporosis Nutritional Management and Intervention Strategies	**04**	**CO3**
04	**Food Safety and Quality** Food Contamination and Foodborne Diseases Food Preservation Techniques Food Adulteration and its Detection Food Safety Standards and Regulations	**04**	**CO4**
05	**Sustainable Nutrition and Food Technology** Sustainable Food Production and Consumption Genetically Modified Foods and Their Impact Functional Foods and Nutraceuticals Role of Technology in Food Science	**05**	**CO5**
06	**Special Diets and Future Trends** Diets for Specific Health Conditions Personalized Nutrition and Nutrigenomics Emerging Trends in Nutrition and Health Future Challenges in Nutrition Science	**05**	**CO6**

Text Books:

9. **Srilakshmi, B.** – *Dietetics*, New Age International Publishers, 8th Edition, 2019.
10. **Srilakshmi, B.** – *Nutrition Science*, New Age International Publishers, 6th Edition, 2021.
11. **Swaminathan, M.** – *Essentials of Food and Nutrition*, Vol. I & II, The Bangalore Printing and Publishing Co. Ltd., 2nd Edition, 2012.
12. **Rao, U.** – *Advanced Human Nutrition*, CBS Publishers & Distributors, 1st Edition, 2014.

References:

6. **Wardlaw, G. M., Smith, A. M.** – *Contemporary Nutrition*, McGraw-Hill Education, 11th Edition, 2018.
7. **Gibney, M.J., Lanham-New, S.A., Cassidy, A., Vorster, H.H.** – *Introduction to Human Nutrition*, Wiley-Blackwell, 2nd Edition, 2013.
8. **Whitney, E., Rolfes, S.R.** – *Understanding Nutrition*, Cengage Learning, 15th Edition, 2018.
9. **Bamji, M. S., Krishnaswamy, K., Brahmam, G.N.V.** – *Textbook of Human Nutrition*, Oxford & IBH Publishing, 4th Edition, 2019.

Internal Assessment (40 Marks)

A. Mid Semester Exam (20 Marks)

Mid semester examination will be based on 40 % to 50% of the syllabus.

B. Continuous Internal Evaluation (20 Marks)

10. Assignment: 5 Marks
11. Quiz/Open book test/Presentation: 10 Marks
12. Regularity and attendance: 5 Marks

End Semester Examination (60 Marks)

End semester will be based on the syllabus coverage up to Mid Semester Examination (MSE) carrying 20% to 30% weightage and the syllabus covered from MSE to ESE carrying 70% to 80% weightage.

Course Code	Course Name	Examination Scheme						Lecture
		Marks Distribution			Exam Duration (Hrs)		Total Marks	2 Hrs
		Internal Assessment		End Semester Exam (ESE)	MSE	ESE		Total Credits
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)					2
EEMC401	Digital Business Management	–	50	–	–	–	50	

Prerequisite: Entrepreneurship and finance management	
Course Objectives: The course aims to	
1	Familiarize with digital business concept along with drivers
2	Acquaint with E-commerce
3	Understand and various approaches and techniques for E-business and management
4	Give insights into E-business and its strategies
Course Outcomes: Learners will be able to	
1	Understand the fundamental concepts and drivers of digital business management.
2	Analyze impact of e-commerce on business model
3	Develop insights into building digital business application & infrastructure.
4	Acquire knowledge management skills for E-business operations.
5	Understand different E-business strategies
6	Prepare business plan and analyze case study.

Module	Detailed Contents	Hrs.	CO Mapping
01	**Introduction to Digital Business:**	**08**	**CO1**
	Introduction, Background and current status, E-market places, structures, mechanisms, economics and impacts Difference between physical economy and digital economy, **Drivers of digital business-** Big Data & Analytics, Mobile, Cloud Computing, Social media, BYOD, and Internet of Things(digitally intelligent machines/services) Opportunities and Challenges in Digital Business.		
02	**Overview of E-Commerce:**	**05**	**CO2**
	E-Commerce- Meaning, Retailing in e-commerce-products and services, consumer behavior, market research and advertisement B2B-E-commerce-selling and buying in private e-markets, public B2B exchanges and support services, e-supply chains, Collaborative Commerce, Intra business EC and Corporate portals. Other E-C models and applications, innovative EC System-From E-government and learning to C2C, mobile commerce and pervasive computing.		
	Self Learning Topic: OLA , UBER Application		
03	**Digital Business Support services:**	**05**	**CO3**
	ERP as e –business backbone, knowledge Tope Apps, Information and referral system **Application Development:** Building Digital business Applications and Infrastructure.		
	Self Learning Topic: ERP for some application		
04	**Managing E-Business:**	**03**	**CO4**
	Managing Knowledge, Management skills for e-business, Managing Risks in e –business Security Threats to e-business -Security Overview, Electronic Commerce Threats.		
05	**E-Business Strategy:**	**04**	**CO5**
	E-business Strategic formulation- Analysis of Company‘s Internal and external environment, Selection of strategy, E-business strategy into Action, challenges and E-Transition (Process of Digital Transformation)		
06	**Materializing e-business:**	**03**	**CO6**
	From Idea to Realization-Business plan preparation		
	Self Learning Topic: Case Study		

Text Books:

1. Introduction to E-business-Management and Strategy, Colin Combe, ELSVIER, 2006
2. Trend and Challenges in Digital Business Innovation, VinocenzoMorabito, Springer
3. Electronic Commerce- A Managerial and Social Networks Perspective ,Eighth Edition, Efraim Turban ,David King ,Jae KyuLee,Ting-Peng Liang ,Deborrah C. Turban, Springer
4. Digital Business and E-Commerce Management, 6th Ed, Dave Chaffey, Pearson, August 2014
5. Digital Business Concepts and Strategy, Eloise Coupey, 2nd Edition, Pearson
6. Perspectives the Digital Enterprise –A framework for Transformation, TCS consulting journal Vol.5
7. Measuring Digital Economy-A new perspective- DoI:10.1787/9789264221796-enOECD Publishing

References:

1. E-commerce from vision to fulfilment, Elias M. Awad, PHI-Restricted, 2002
2. Digital Business Discourse Erika Darics, April 2015, Palgrave Macmillan
3. E-Governance-Challenges and Opportunities in : Proceedings in 2nd International Conference theory and practice of Electronic Governance
4. https://onlinecourses.nptel.ac.in/noc19_mg54/preview
5. https://nptel.ac.in/courses/110105083
6. https://onlinecourses.swayam2.ac.in/imb25_mg31/preview

Internal Assessment (50 Marks)

A. **Continuous Internal Evaluation (50 Marks)**
   1. Assignment: 15 Marks
   2. Quiz/Open book test: 10 Marks
   3. Case study/Presentation: 20
   4. Regularity and attendance: 5 Marks

Course Code	Course Name	Examination Scheme						Lecture
		Marks Distribution			Exam Duration (Hrs)		Total Marks	2*+2 Hrs
		Internal Assessment		Oral & Practical	MSE	ESE		Total Credits
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)					2
VEC401	Business Communication Skills	–	25	–	–	–	25	

Prerequisite: Learners should have completed FE Semester I Professional Communication and Ethics course.	
Course Objectives: The course aims to enable learners to	
1	Draft effective Business and Technical Reports and Proposals
2	Learn impactful oral and visual aids to make effective presentations
3	Strategize and document business meetings
4	Lead people and successful projects using interpersonal skills
5	Apply Skills necessary for employment purposes and emerge successful
Course Outcomes: Learners will be able to	
1	Prepare well drafted documents like Business and Technical Reports and Proposals
2	Develop impactful presentations using oral and visual aids
3	Plan and prepare strategies for business meetings and document it
4	Manage andeople and successful projects using interpersonal skills
5	Acquire skills for employment purposes to successfully navigate industry and career challenges

Module	Detailed Contents	Hrs.	CO Mapping
01	**Business and Technical Writing Skills** ● Project based learning :Project Report Preparation o Purpose and classification of reports o Types of Reports o Parts and Formats o Preparation of a Report (Group work): Front Matter, Main matter, Back matter/Appended Pages etc. ● Business Proposal **Self Learning Topic:** 1. Business Vocabulary and Writing strategies 2. APA, MLA, IEEE style 3. Plagiarism checker tools	**08**	**CO1**
02	**Business Presentation Skills** ● Four *P*'s of Presentation (*Plan, Prepare, Practice, Perform*) ● Making Effective Slides ● Types of Presentation Aids ● Closing a Presentation and Handling Questions ● Group Presentation based on project Report **Self Learning Topic:** 1. Design softwares and Apps (e.g. Canva) 2. Social Media Presentation	**04**	**CO2**
03	**Business Meetings and Documentation** ● Effective Meeting Strategies and Skills ● Documentation of a Meeting: o Notice o Agenda, and o Minutes of a Meeting **Self Learning Topic:** 1. Meeting Roles and Responsibilities (Chairperson, Secretary, Analyst etc.)	**04**	**CO3**

04	**Interpersonal Skills** ● Emotional Intelligence ● Time Management ● Assertiveness and Self confidence ● Team building ● Leadership ● Conflict Resolution and Negotiation.	**06**	**CO4**
	Self Learning Topics: 1. Oral speaking skills 2. Listening skills 3. Dressing etiquette		
05	**Employment Skills** ● Structured and Unstructured Group Discussions ● Types of Group Discussions (Factual, Abstract, Strategic, Case Study, Picture based) ● Resume Writing: How to build your Resume ● Interview skills: ○ Formats (Structured, Behavioural, Situational, Stress, Case interviews etc.) ○ Types of Questions (Open ended, Closed, Hypothetical, Leading, Loaded etc.) ○ Strategies for successful interviews ○ Interview File ○ Mock Interviews	**06**	**CO5**
	Self Learning Topic: 1. Statement of Purpose (SOP) 2. Vocabulary building 3. Sentence construction and Grammar rectifications.		

Text Books:

1. Meenakshi Raman, Sangeeta Sharma, Technical Communication, Principles and Practice (2004), Oxford Press.
2. Bovee C.L. & Thill J.V. , Business Communication Today (2021), NJ: Pearson
3. Butterfield J., Verbal Communication: Soft Skills for a Digital Workplace (2017), Boston MA Cengage Learning.

References:

1. BCOLA-138 Business Communication - Course https://onlinecourses.swayam2.ac.in/nou25_cm09/preview
2. Business Communication Essentials - Course https://onlinecourses.swayam2.ac.in/imb25_mg05/preview
3. Softskills for Business - Course https://onlinecourses.swayam2.ac.in/imb25_mg87/preview

Suggested List of Assignments

Sr. No.	List of Experiments	CO Mapping
01	Synopsis of Report	CO 1
02	Print out of PPT slides	CO 2
03	Notice, Agenda and Minutes of Meeting	CO 3
04	Activity sheets of Interpersonal skills	CO 4
05	Employment skills record (Resume and Group Discussion)	CO 5

Continuous Internal Evaluation (25 Marks)

1. Assignment/ Role play/ Activity: 10 Marks
2. Project Book Report: 05 Marks
3. Project Presentation: 05 Marks
4. Regularity and attendance: 5 Marks

Course Code	Course Name	Examination Scheme						Practical
		Marks Distribution			Exam Duration (Hrs)		Total Marks	2 Hrs
		Internal Assessment		Oral & Practical	MSE	ESE		Total Credits
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)					1
MEPCL402	FM & HM Lab	-	25	25	-	-	50	

Prerequisite:	
Course Objectives: The course aims to	
1	Study measurement as well as calibration principles
2	Familiarize with hydraulic energy conversion devices.
3	Practically verify the concepts learnt in theory course
Course Outcomes: Learners will be able to	
1	Measure hydrostatic forces
2	Calibrate Venturimeter, Orificemeter
3	Verify the Bernoulli's Principle
4	Study of impulse turbine and its performance
5	Study of reaction turbine and its performance
6	study of Reciprocating / Gear pump/centrifugal pump and its performance

Suggested List of Experiments(Conduct Any Six)

Sr. No.	List of Experiments	LO Mapping
01	Calibration of Venturimeter	LO1
02	Calibration of Orifice meter	LO2
3	Determination of Metacentric height	LO2
4	Determination of minor losses in pipe fittings	LO2
5	Verification of Bernoulli's equation	LO3
6	Determination of type of floe using Reynolds Experiment	LO3
7	Impact of jet on vanes	LO4
8	Experiment on Pelton Wheel	LO4
9	Experiment on Francis turbine	LO5
10	Experiment on Reciprocating/ Gear pump/Centrifugal pump	LO6

Continuous Internal Evaluation (25 Marks)

Lab Performance: 10 Marks

In-Semester Practical Exam during lab session: 10 Marks

Regularity and Attendance: 5 Marks

Virtual Labs
http://fm-nitk.vlabs.ac.in/# - Fluid Mechanics Lab, NITK Surathkal
https://fmc-nitk.vlabs.ac.in/fluid-machinery/ - Fluid Machinery Lab, NITK Surathkal

Oral & Practical Exam (25 Marks)
An Oral & Practical exam will be held based on the entire syllabus

Course Code	Course Name	Examination Scheme						Practical
		Marks Distribution			Exam Duration (Hrs)		Total Marks	2 Hrs
		Internal Assessment		Oral & Practical	MSE	ESE		Total Credits
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)					1
MEPCL403	**Machine Shop**	-	25	25	-	-	50	

Prerequisite: Manufacturing Technology ME402	
Course Objectives: The course aims to	
1	To impart knowledge of various manufacturing processes. Machining processes such as turning, shaping, milling, drilling, grinding etc.
2	To get practical hands-on knowledge of performing various operations on the different machines.
Course Outcomes: Learners will be able to	
1	Know the specifications, controls and safety measures related to machines and machining operations.
2	Use the machines for making various engineering jobs.
3	Perform various machining operations on the lathe machine.
4	Execute machining operation using Shapping machine.
5	Execute machining operation using Milling machine.

Suggested List of Experiments

Sr. No.	List of Experiments	LO Mapping
01	**Lathe machine operations** 1.1 Introduction to Lathe Machine. 1.2 Demonstration & Practice of various machining operations performed on Lathe machine. 1.3 One job on Lathe machine consisting of facing, plain turning, taper turning, grooving, center drilling operations.	1,2,3
02	**Shaping machine operations** 2.1 Demonstration of Various machining operations performed on shaping machine. 2.2 One job on shaping machine to make horizontal and inclined surfaces. Carry out Surface grinding operation of Two Parallel surfaces on same job.	4
03	**Milling machine operations** 3.1 Demonstration of Various machining operations performed on milling machine. 3.2 One job on milling machine involving at least one milling operation.	5

Note: Student should perform two experiments of above.

Continuous Internal Evaluation (25 Marks)

Lab Performance: 10 Marks
In-Semester Practical Exam during lab session: 10 Marks
Regularity and Attendance: 5 Marks

Oral & Practical Exam (25 Marks)

An Oral & Practical exam will be held based on entire syllabus

Course Code	Course Name	Examination Scheme						Practical
		Marks Distribution			Exam Duration (Hrs)		Total Marks	2 Hrs
		Internal Assessment		Oral & Practical	MSE	ESE		Total Credits
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)					1
MECEP401	Mini Project-1	-	25	25	-	-	50	

Program Outcomes addressed:

1. PO1 Engineering knowledge
2. PO2 Problem Analysis
3. PO3 Design/Development of Solutions
4. PO4 Conduct investigations of complex problems
5. PO5 Modern Tool Usage
6. PO6 The Engineer & Society
7. PO7 Environment & Sustainability
8. PO8 Ethics
9. PO9 Individual & team work
10. PO10 Communication
11. PO11 Project Management & Finance
12. PO12 Life-long learning

Course Objectives :

1.To familiarize students about available infrastructure at Department/Institute level, online resources, plagiarism,expectations from MP 1A and 1B, etc.
2.To guide students in identifying societal or research needs and formulating them into problem statements.
3.To facilitate problem-solving in group settings.
4.To apply basic engineering principles to address identified problems.
5.To foster self-learning and research skills.

Course Outcomes : At the end of the course, learners will be able to:

1. Identify problems based on societal or research needs and methodology for solving them.
2. Apply knowledge and skills to solve societal problems collaboratively.
3.Develop interpersonal skills necessary for teamwork.
4.Analyze, verify, and validate results effectively through various methodologies, including, test cases/benchmark data/theoretical/inferences/experiments/simulations, etc.
5.Evaluate the societal and environmental impacts of proposed solutions.
6.Adhere to standard engineering practices.
7.Excel in written and oral communication by technical report writing, oral presentation, and publishing results in
· Research/white paper/article/blog writing/publication, etc.
· Business plan for entrepreneurship product creation
· Patent filing.
8.Gain technical competencies by participating in competitions, hackathons, etc.
9.Demonstrate lifelong learning capabilities through self-directed group projects.
10. Apply project management principles effectively.

Guidelines for the Mini Project

- At the beginning of semester-III, project guides are required to conduct around 4 hours' orientation sessions including following topics: -

➢ Familiarizing students about infrastructure available at Department/Institute level and how to use it.

➢ How to identify societal problems and formulate project problem statements.

➢ How to carry out literature surveys.

➢ What is plagiarism and what care needs to be taken while writing a report.

➢ What is the project report template and how should it be used?

➢ What are expectations from mini-projects 1A and 1B.

· Mini project may be carried out in one or more form of following:

Product preparations, prototype development model, fabrication of set-ups, laboratory experiment development, process modification/development, simulation, software development, integration of software (frontend-backend) and hardware, statistical data analysis, creating awareness in society/environment etc.

· Students must form groups of 2 to 4 members either from the same departments.

· Groups should conduct surveys to identify needs and develop problem statements in consultation with faculty.

· An implementation plan covering weekly activities must be submitted to the faculty supervisor.

· Each group must maintain a logbook to record weekly progress, to be verified by the faculty supervisor.

· Faculty input should emphasize guiding by faculty and self-learning by group members.

· The solution to be validated with proper justification and report to be compiled in standard format of the Institute. Research papers, competition certificates may be submitted as part of annexure to the report.

· With the focus on self-learning, innovation, addressing societal/research/innovation problems and entrepreneurship quality development within the students through the Mini Projects, it is preferable that a single project of appropriate level and quality be carried out in two semesters by all the groups of the students.

· However, based on the individual students or group capability, with the mentor's recommendations, if the proposed Mini Project adhering to the qualitative aspects mentioned above, gets completed in odd semester, then that group can be allowed to work on the extension of the Mini Project with suitable improvements/modifications or a completely new project idea in even semester. This policy can be adopted on a case by case basis.

In-Semester Continuous Assessment and End-Semester Examination Guidelines

➢ The Head of the Department & Project coordinator will assign a guide to each of the mini-projects and shall form a progress monitoring committee. The guide will carry out weekly monitoring of the project's progress. The committee shall carry out in-semester project evaluation based on presentations with a minimum of two evaluations per semester.

➢ Assessment will be based on individual contributions, understanding, and responses to questions asked.

Continuous Assessment marks distribution in semester IV (25 marks): -

05 marks for the Topic Approval Presentation in front of the progress monitoring committee.

20 marks for the Mid-Semester Progress Presentation in front of the progress monitoring committee

End-Semester Examination in Semester IV (25 marks):

1. Presentation and demonstration to internal and external examiners: **10 marks.**

2. Emphasis on problem clarity, innovativeness, societal impact, functioning of the model, skill utilization, and communication clarity: **15 marks.**

Course Code	Course Name	Examination Scheme						Lecture
		Marks Distribution			Exam Duration (Hrs)		Total Marks	3 Hrs
		Internal Assessment		End Semester Exam (ESE)	MSE	ESE		Total Credits
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)					3
CEMDM401	Data Structure and Algorithm	20	20	60	1	2	100	

Prerequisite: Concepts in C Programming and Python	
Course Objectives: The course aims to	
1	Introduce the fundamental knowledge & need of Data Structures and abstract the concept of Algorithm for problem solving.
2	Implement fundamental knowledge and applications of Stack, Queue, Linked List, Trees, Graphs etc.
3	Understand the working of different Sorting, Searching & Hashing techniques.
4	Understand about writing algorithms and step by step approach in solving problems with the help of fundamental data structures.
Course Outcomes: Learners will be able to	
1	Classify and apply linear and non-linear data structure concepts and compare functions using asymptotic analysis to describe the relative merits.
2	Apply various operations on Stack and Queue.
3	Develop the ability to demonstrate the operations of Linked list.
4	Demonstrate and apply Trees & Graph data structures.
5	Analyse various Sorting and Searching Algorithms and their performance characteristics.
6	Describe the hash function and concepts of collision and its resolution methods

Module	Detailed Contents	Hrs.	CO Mapping
	Prerequisite: Control Structures, Arrays, Recursion, Pointers, Structures, Memory Allocation Techniques, Self-referential structures.		
01	**Introduction** Introduction to Data Structures, Concept of ADT, Types of Data Structures- Linear and Nonlinear, Operations on Data Structures. Algorithm: Performance characteristics of algorithm, Importance of Algorithm Analysis, Complexity of an Algorithm, Introduction to Asymptotic Analysis and Notations.	08	CO1
02	**Stack & Queue** Introduction to Stack, ADT of Stack, Operations on Stack, Array Implementation of Stack. Applications of Stack- Infix Expression to Postfix Expression Conversion, Infix Expression to Prefix Expression Conversion, Postfix Expression Evaluation. Introduction to Queue, ADT of Queue, Operations on Queue, Array Implementation of Queue, Types of Queues, Applications of various types of Queues.	08	CO2

	Self-Learning Topic: Well form-ness of Parenthesis using Stack		
03	**Linked List** Introduction, Representation of Linked List, Types of Linked List - Singly Linked List, Doubly Linked List. Operations on Singly Linked List and Doubly Linked List. Linked representation of Stacks, and Linked representation of Queues. Application of Linked List-Polynomial Representation and Addition. **Self-Learning Topic:** Linked List v/s Array.	**08**	**CO3**
04	**Trees & Graph** Introduction, Tree Terminologies, Binary Tree, Binary Tree Representation, Types of Binary Tree, Binary Tree Traversals, Binary Search Tree, Operations on Binary Search Tree, AVL tree. Applications of Binary Tree- Expression Tree, Huffman Encoding. Graph: Introduction, Graph Terminology, Memory Representation of Graph, Operations Performed on Graph. Graph Traversal, Breadth First Search, Depth First Search, Applications of the Graph, Shortest Path, Minimum Spanning Tree.	**09**	**CO4**
05	**Searching & Sorting** **Searching:** Sequential Search, Index Sequential Search, Binary Search **Sorting:** Bubble Sort, Quick Sort, Merge Sort, Selection Sort, Insertion Sort	**05**	**CO5**
06	**Hashing** Hashing-Concept, Hash Functions, Common hashing functions Collision resolution Techniques.	**04**	**CO6**

Text Books:

1. Jean Paul Tremblay, P. G. Sorenson, "Introduction to Data Structure and its Applications", McGraw-Hill Higher Education.
2. "Fundamentals of Computer Algorithms" Ellis Horowitz, Sartaj Sahani and Sanguthevar Rajasekaran, Second Edition, Universities Press (India) Pvt. Ltd.
3. "Learning with Python" Allen Downey, Jeffrey Elkner, Chris Meyers, Dreamtech Press.

References:

1. Jean Paul Tremblay, Paul G. Sorenson; An introduction to data structures with applications; Tata McGraw-Hill; 1984
2. Sanjoy Dasgupta, Christos Papadimitriou, Umesh Vazirani, "Algorithms", Tata McGraw-Hill Edition.
3. Narasimha Karumanchi, Data Structures and Algorithms, 5th Edition, CareerMonk, 2016.
4. https://nptel.ac.in/courses/106/102/106102064/

Internal Assessment (40 Marks)

A. Mid Semester Exam (20 Marks)

Mid semester examination will be based on 40 % to 50% of the syllabus.

B. Continuous Internal Evaluation (20 Marks)

1. Assignment: 5 Marks
2. Quiz/Open book test/Presentation: 10 Marks
3. Regularity and attendance: 5 Marks

End Semester Examination (60 Marks)

End semester will be based on the syllabus coverage up to Mid Semester Examination (MSE) carrying 20% to 30% weightage and the syllabus covered from MSE to ESE carrying 70% to 80% weightage.

Course Code	Course Name	Examination Scheme						Lecture
		Marks Distribution			Exam Duration (Hrs)		Total Marks	3 Hrs
		Internal Assessment		End Semester Exam (ESE)	MSE	ESE		Total Credits
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)					3
ETMDM401	Microprocessor and Microcontroller	20	20	60	1	2	100	

Prerequisite: Basic electronics, Number systems, Computer Organization and Architecture	
Course Objectives: The course aims to	
1	Understand the architecture, operation, and memory organization of Intel 8086 microprocessor and 8051 microcontroller.
2	Prepare students for advanced processor architectures.
3	Explore instruction sets, addressing modes, and assembly language programming for Intel 8086 microprocessor and 8051 microcontroller to develop basic programs.
4	Analyze peripheral interfacing techniques with microcontrollers.
5	Apply microcontroller concepts in industrial process control.
Course Outcomes: Learners will be able to	
1	Describe the architecture, operation, and interrupt handling of the Intel 8086 microprocessor
2	Utilize Intel 8086 instruction sets, addressing modes, and assembly language programming to develop basic programs.
3	Demonstrate the architecture and architectural features of Intel 80386DX and Pentium processor
4	Illustrate the architecture and memory organization of the Intel 8051 microcontroller.
5	Apply instruction sets, addressing modes, and assembly language programming of the Intel 8051 microcontroller to develop basic programs.
6	Implement peripheral interfacing techniques and process control using the Intel 8051 microcontroller

Module	Detailed Contents	Hrs.	CO Mapping
01	**Intel 8086 Microprocessor Architecture** Intel 8086 Microprocessor features, Pipelined architecture and operation Intel 8086 Programmer's model, Memory banking Segmentation - Logical address, Offset and Physical address Multiplexed buses in 8086 processor and the demultiplexing Intel 8284 Clock generator- Power-on-reset and CK generation Minimum and Maximum mode configurations, Minimum mode timing diagram Interrupt mechanism and Interrupt processing in Intel 8086 processor (Self learn- Intel 8288 Bus Controller) **Self learning topic:** Intel 8288 Bus Controller	07	CO1

02	**Intel 8086 Instruction Set and Programming** Major Instruction groups in Intel 8086 Microprocessor Data Transfer instructions, String instructions with repeat prefixes Arithmetic instructions, Rotate and Shift instructions Classification and concepts of branch instructions Addressing modes of Intel 8086 Microprocessor Simple programs based on the assembly language of Intel 8086 Microprocessor **Self learning topic:** Assembler directives	**07**	**CO2**
03	**Introduction to Intel 80386DX and Pentium Processor** Intel 80386DX Microprocessor- 32 bit Microprocessor architecture block diagram Registers of 80386DX processor- Data, Pointer, Index, Eflag and Control registers Operating modes- Real, Protected and V-86 modes Protected mode address translation mechanism Pentium processor – Features, Block diagram of pentium and it's Superscalar operation Integer and Floating point pipeline stages of Pentium L1 Data and Code Cache designs of Pentium Processor **Self learning topic:** Branch prediction, Pentium versions, Pentium-4's Net-Burst Architecture	**07**	**CO3**
04	**Intel 8051 Microcontroller Architecture** Block diagram of Intel 8051 Microcontroller Details of the general registers and SFR's Internal RAM and ROM organization I/O port functionality, Counters and timers, Serial ports Interrupt mechanism of 8051 controller and Interrupt priorities Interfacing external memory to 8051 microcontroller	**06**	**CO4**
05	**Intel 8051 Instruction Set and Programming** Major Instruction groups in Intel 8051 Microcontroller Data Transfer instructions, Logical and bit level instructions Arithmetic instructions Branching instructions – JUMP and CALL instructions Addressing modes of Intel 8051 Microcontroller Simple programs based on the assembly language of Intel 8051 Microcontroller	**07**	**CO5**
06	**Interfacing I/O devices to Intel 8051 Microcontroller** Concept of matrix keyboard interfacing Interfacing of 7-segment display, LCD display interfacing Stepper motor interfacing, Printer interfacing Interfacing High power devices through an Optoisolator, relays Concept of A/D and D/A converter interfacing Case study of Industrial Process Control system like liquid level control, temperature level control etc.	**08**	**CO6**

Text Books:

1. John Uffenbeck: The 80X86 Family Design Programming and Interfacing, 2nd Edition, Pearson Education
2. Barry B. Brey: Intel Microprocessors, 2nd Edition, Prentice Hall Publication
3. Mazidi, Mazidi & McKinlay: The 8051 Microcontroller and Embedded Systems, 2nd Edition, Pearson Education
4. Raj Kamal: Microcontrollers Architecture, Programming, Interfacing and System Design, Pearson Education

References:

1. Douglas Hall: Microprocessors and Interfacing, McGraw Hill Publication
2. Kenneth Ayala: The 8051 Microcontroller, 3rd Edition, Thomson Learning
3. https://archive.nptel.ac.in/courses/108/103/108103157/
4. https://archive.nptel.ac.in/courses/108/105/108105102

Internal Assessment (40 Marks)

A. Mid Semester Exam (20 Marks)

Mid semester examination will be based on 40 % to 50% of the syllabus.

B. Continuous Internal Evaluation (20 Marks)

1. Assignment: 5 Marks
2. Quiz/Open book test/Presentation: 10 Marks
3. Regularity and attendance: 5 Marks

End Semester Examination (60 Marks)

End semester will be based on the syllabus coverage up to Mid Semester Examination (MSE) carrying 20% to 30% weightage and the syllabus covered from MSE to ESE carrying 70% to 80% weightage.

Course Code	Course Name	Examination Scheme						Lecture
		Marks Distribution			Exam Duration (Hrs)		Total Marks	3 Hrs
		Internal Assessment		End Semester Exam (ESE)	MSE	ESE		Total Credits
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)					3
ARMDM401	Artificial Intelligence	20	20	60	1	2	100	

Prerequisite:Discrete Mathematics, Data Structures	
Course Objectives: The course aims to	
1	To conceptualize the basic ideas and techniques underlying the design of intelligent systems.
2	To make students understand and Explore the mechanism of mind that enables intelligent thought and action.
3	To make students understand advanced representation formalism and search techniques.
4	To make students understand how to deal with uncertain and incomplete information.
Course Outcomes: Learners will be able to	
1	Ability to develop a basic understanding of AI building blocks presented in intelligent agents.
2	Ability to choose an appropriate problem solving method and knowledge representation technique.
3	Ability to analyze the strength and weaknesses of AI approaches to knowledge– intensive problem solving.
4	Ability to design models for reasoning with uncertainty as well as the use of unreliable information.
5	Ability to design and develop AI applications in real world scenarios.
6	Ability to understand Emerging AI Technologies and Future Trends in Mechanical Engineering.

Module	Detailed Contents	Hrs.	CO Mapping
01	Fundamentals of AI and Machine Learning Introduction to AI, Machine Learning (ML), and Deep Learning Role of AI in Mechanical Engineering Types of Machine Learning: Supervised, Unsupervised, and Reinforcement Learning Data Collection and Preprocessing for Mechanical Applications Case Study: AI-Driven Material Selection for Engineering	06	CO1
02	AI in Mechanical Design and Product Development Generative Design and AI-Assisted Computer-Aided Design (CAD) AI in Finite Element Analysis (FEA) and Computational Fluid Dynamics (CFD) Optimization Techniques for Mechanical Systems Using AI AI-Driven Topology Optimization for Lightweight Structures Case Study: AI in Aerospace Component Design.	07	CO2
03	AI in Manufacturing and Smart Factories AI in Industry 4.0 and Digital Twins Computer Vision for Quality Control and Defect Detection AI for Process Automation and Control in Manufacturing AI-Based Supply Chain and Inventory Management	08	CO3

	Case Study: AI-Powered Predictive Quality Control in Automotive Manufacturing		
04	AI in Robotics and Autonomous Systems AI in Industrial Robotics and Automation Path Planning and Motion Control Using AI AI in Collaborative Robotics (Cobots) AI for Autonomous Vehicles and Drones in Mechanical Applications Case Study: AI-Driven Robotic Assembly System	**08**	**CO4**
05	AI for Predictive Maintenance and Condition Monitoring AI-Based Fault Detection and Diagnosis Machine Learning for Vibration Analysis and Wear Prediction IoT and AI Integration for Real-Time Condition Monitoring AI in Energy Efficiency and Performance Optimization Case Study: Predictive Maintenance in Heavy Machinery	**07**	**CO5**
06	Emerging AI Technologies and Future Trends in Mechanical Engineering AI for Sustainable and Green Engineering AI in Additive Manufacturing (3D Printing) AI in Human-Machine Interaction and Augmented Reality Ethical Considerations and Challenges in AI Adoption Capstone Project: AI-Driven Solution for a Mechanical Engineering Problem	**07**	**CO6**

Text Books:

1. Stuart J. Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach", Fourth Edition" Pearson Education, 2020.
2. Saroj Kaushik, "Artificial Intelligence", Cengage Learning, First edition, 2011
3. George F Luger, "Artificial Intelligence" Low Price Edition, Fourth edition, Pearson Education.,2005
4. Ramin S. Esfandiari"Artificial Intelligence Techniques in Mechanical Engineering: A Practical Approach"McGraw-Hill Education.

References:

1.Nils J. Nilsson, Principles of Artificial Intelligence, Narosa Publication.
2.Deepak Khemani, A First Course in Artificial Intelligence, McGraw Hill Publication
3.Patrick H. Winston, Artificial Intelligence, 3rd edition, Pearson Education.
4.Elaine Rich and Kevin Knight, "Artificial Intelligence", Third Edition, McGraw Hill Education,2017 .

Useful Links

1.https://nptel.ac.in/courses/106/105/106105078/
2.https://thestempedia.com/blog/simple-ai-and-machine-learning-projects-for-students-and-beginners/
3.https://nptel.ac.in/courses/106/105/106105079/

Internal Assessment (40 Marks)

A. Mid Semester Exam (20 Marks)

Mid semester examination will be based on 40 % to 50% of the syllabus.

B. Continuous Internal Evaluation (20 Marks)

1. Assignment: 5 Marks
2. Quiz/Open book test/Presentation: 10 Marks
3. Regularity and attendance: 5 Marks

End Semester Examination (60 Marks)

End semester will be based on the syllabus coverage up to Mid Semester Examination (MSE) carrying 20% to 30% weightage and the syllabus covered from MSE to ESE carrying 70% to 80% weightage.

Course Code	Course Name	Examination Scheme						Lecture
		Marks Distribution			Exam Duration (Hrs)		Total Marks	3 Hrs
		Internal Assessment		End Semester Exam (ESE)	MSE	ESE		Total Credits
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)					3
ITMDM401	Internet of Things and Applications	20	20	60	1	2	100	

Prerequisite:Student should be able to a solid foundation in basic electrical principles, including AC circuits, magnetism, and electro mechanical energy conversion.	
Course Objectives: The course aims to	
1	Understand the fundamentals of IoT architecture and protocols.
2	Explore sensors, actuators, and embedded systems in electrical engineering.
3	Apply IoT technologies to solve electrical engineering problems.
4	Analyze case studies in smart grids, energy management, automation, and power systems.
Course Outcomes: Learners will be able to	
1	Understand the concept of IoT.
2	Illustrate IOT architecture and applications in various fields.
3	Demonstrate use Devices, Gateways and Data Management in IoT.
4	Understand various wired and wireless protocols.
5	Understand emerging technological options, platforms and case studies of IoT implementation in home & city automation.
6	Understand Data Analytics and Security in IoT.

Module	Detailed Contents	Hours	CO Mapping
01	**Introduction to IoT:** Defining IoT, Characteristics of IoT, Physical design of IoT, Logical design of IoT, Functional blocks of IoT, Sources of IoT; Sensing, Actuation, Basics of Networking; Software Architectures and Software Inter operability, Applications in Electrical Engineering. **Self Learning Topic: Privacy and Security**	06	CO1
02	**IoT Architecture:** Introduction, Functional View, Information View, Deployment and Operational View, Real-World Design Constraints- Introduction, Technical Design constraints, Data representation and visualization, **Self Learning Topic:** Interaction and remote control.	06	CO2
03	Sensors and Embedded Systems Types of Sensors Used in Electrical Applications (Voltage, Current, Power, Temperature), Interfacing Sensors with Microcontrollers (e.g., Arduino, Raspberry Pi, ESP32), Signal Conditioning and Data Acquisition, Postioning and localization, Medium access control, Introduction to Embedded Programming (C/C++, Python) **Self Learning Topic:** operating systems, time synchronization	06	CO3
04	Networking and Communication Protocols for IoT: Cloud based IoT platforms, Zigbee and Zwave, advantage of low power mesh networking. Long distance Zigbee; Bluetooth/BLE: Low power vs high power, speed of detection, class of BLE. Wireless protocols such as Piconet and packet structure for BLE and Zigbee. Web Communication Protocols for connected devices, Web connectivity using Gateway, SOAP, REST, HTTP, RESTful and WebSockets (Publish –Subscribe), MQTT, AMQP, CoAP Protocols. **Self Learning Topic:** ThingsBoard, Blynk, Firebase, AWS IoT	10	CO4
05	**IoT Applications:** IoT in Power and Energy Systems Smart Grids and IoT Integration, Energy Monitoring and Management Systems, Real-time Load Monitoring, Predictive Maintenance of Electrical Equipment using IoT, Fault Detection in Power Lines, Smart Street Lighting Systems, IoT-enabled Electric Vehicle Charging Stations. **Industrial and Home Automation** IoT-based Control of Electrical Loads, Home Automation: Lighting, HVAC, Smart Meters, Industrial Automation: PLCs, SCADA Systems with IoT Integration, Safety and Fault Detection Systems. Case Study: Agriculture, Healthcare, Activity monitoring. **Self Learning Topic:** IoT for Renewable Energy Monitoring (Solar, Wind)	10	CO5

06	**Data Analytics and Security in IoT**	04	CO6
	Basics of Data Logging and Visualization, Introduction to Edge and Cloud Computing, Cybersecurity in IoT Systems, IoT Standards and Compliance		
	Self Learning Topic: IEEE standards used in protection and data management.		

Text /Reference Books:-

1. Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands-on-Approach)", 1st Edition, VPT, 2014.
2. Misra, A. Mukherjee, and A. Roy, Introduction to IoT. Cambridge University Press, 2020.
3. S. Misra, C. Roy, and A. Mukherjee, Introduction to Industrial Internet of Things and Industry 4.0. CRC Press. 2020.
4. Adrian McEwen, Hakim Cassimally Designing the Internet of Things , John Wiley, 2014
5. Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1 st Edition, Apress Publications, 2013.
6. CunoPfister, "Getting Started with the Internet of Things", OReilly Media, 2011
7. A. McEwen, H. Cassimally, "Designing the Internet of Things", Wiley, 2013.
8. Samuel Greenguard, "Internet of Things", MIT Press, 2015.
9. Mandler, B., Barja, J., Mitre Campista, M.E., Cagáová, D., Chaouchi, H., Zeadally, S., Badra, M., Giordano, S., Fazio, M., Somov, A., Vieriu, R.-L., Internet of Things. IoT Infrastructures, Springer International Publishing
10. Olivier Hersent, David Boswarthick, Omar Elloumi, The Internet of Things: Key Applications and Protocols, Wiley-Blackwell.
11. Internet of things (IoT): Technologies, Applications, Challenges, and Solutions Edited by B.K. Tripathy J. Anuradha, CRC Press, 2018
12. Simone Cirani, Gianluigi Ferrari, Luca Veltri, "Internet of Things: Architectures, Protocols and Standards"

Web Reference /Video Courses:

1. NPTEL Course: Introduction to Internet of Things By Prof. Sudip Misra, IIT Kharagpur

References:

1. Introduction to the Internet of Things (IoT), Publisher: Cisco Networking Academy
2. Internet of Things (IoT) – Lecture Notes & Tutorials, Author: Dr. Rajkumar Buyya (University of Melbourne)
3. A Reference Architecture for the Internet of Things, Publisher: IEEE / ITU-T
4. The Internet of Things: Enabling Technologies, Platforms, and Use Cases, Author: Pethuru Raj
5. IoT Fundamentals: Networking Technologies, Protocols, and Use Cases, Authors: David Hanes, Gonzalo Salgueiro, Patrick Grossetete

Internal Assessment (40 Marks)

A. Mid Semester Exam (20 Marks)

Mid semester examination will be based on 40 % to 50% of the syllabus.

B. Continuous Internal Evaluation (20 Marks)

1. Assignment: 5 Marks
2. Quiz/Open book test/Presentation: 10 Marks
3. Regularity and attendance: 5 Marks

End Semester Examination (60 Marks)

End semester will be based on the syllabus coverage up to Mid Semester Examination (MSE) carrying 20% to 30% weightage and the syllabus covered from MSE to ESE carrying 70% to 80% weightage.

Course Code	Course Name	Examination Scheme						Lecture
		Marks Distribution			Exam Duration (Hrs)		Total Marks	3 Hrs
		Internal Assessment		End Semester Exam (ESE)	MSE	ESE		Total Credits
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)					3
MEMDM401	Basics of Mechanical Engineering	20	20	60	1	2	100	

Prerequisite: Engineering Mechanics, chemistry,	
Course Objectives: The course aims to	
1	Explain: Fundamental concepts, laws of classical thermodynamics, principle of working and operation of thermodynamic cycles, scope and applications in research
2	To understand the nature of stresses developed in simple geometries
3	To understand the material used and their application in manufacturing
Course Outcomes: Learners will be able to	
1	Understand the fundamental concepts of Mechanical engineering
2	Understand & apply the basic laws of thermodynamics to analyze energy conversion systems
3	Understand the Basics of kinematics and various mechanism.
4	Understand the working principles and applications of common mechanical mechanisms such as linkages, gears.
5	Classify engineering materials and explain their mechanical properties, structure, and industrial applications.
6	Understand the working principles of Power Plants & types of Renewable energy sources

Module	Detailed Contents	Hrs.	CO Mapping
01	**Fundamentals of Mechanical Engineering** Introduction to Mechanical Engineering and its applications Basic concepts: systems, units, energy, force, work, power Engineering materials: types, properties, and applications, Stress-strain basics and Hooke's Law, Simple numerical problems on stress and strain	06	CO1
02	**Basics of Thermodynamics** Introduction to Thermodynamics and basic definitions,Zeroth, First, and Second Laws of Thermodynamics,Properties of pure substances (pressure, volume, temperature),Heat and work interactions,Ideal and real gases. Introduction to heat engines, refrigerators, and heat pumps Introduction to I.C. Engines: SI and CI engines Engine components and working principles,2-Stroke vs 4-Stroke engines.	09	CO2

03	**Theory of Machines** Basics of kinematics and dynamics of machines, Types of links, kinematic pairs and chains,Four-bar mechanism, slider-crank mechanism, Gear trains: simple and compound, Cam and follower basics, Flywheel and governor (conceptual overview)	**07**	**CO3**
04	**Mechanical Systems and Machines** Basic machine elements: gears, belts, pulleys, bearings,Introduction to mechanisms and kinematics of machines,Simple lifting machines (screw jack, pulley block) Power transmission: shaft, couplings, and keys.Basics of vibrations and balancing (introductory)	**08**	**CO4**
05	**Materials Science & Manufacturing Processes** Classification of materials: metals, ceramics, polymers, composites,Mechanical properties: hardness, toughness, ductility, strength,Heat treatment process. **Overview of manufacturing:** importance and types Basic casting process: pattern, moulding, and casting Introduction to welding, brazing, and soldering. **Basics of machining:** turning, milling, drilling , Introduction to 3D printing and modern manufacturing trends	**07**	**CO5**
06	**Power Plants & Renewable energy sources** Overview of power plants: thermal, hydro, nuclear (layout & working briefly) Renewable energy sources: solar, wind, biomass (brief)	**05**	**CO6**

References & Text Books:

1. R.K. Rajput – *Basic Mechanical Engineering*
2. V. B. Bhandari – *A Textbook of Machine Design*
3. R.S. Khurmi – *Theory of Machines*
4. Kalpakjian & Schmid – *Manufacturing Engineering and Technology*
5. William D. Callister – *Materials Science and Engineering*

Internal Assessment (40 Marks)

A. Mid Semester Exam (20 Marks)

Mid semester examination will be based on 40 % to 50% of the syllabus.

B. Continuous Internal Evaluation (20 Marks)

1. Assignment: 5 Marks
2. Quiz/Open book test/Presentation: 10 Marks
3. Regularity and attendance: 5 Marks

End Semester Examination (60 Marks)

End semester will be based on the syllabus coverage up to Mid Semester Examination (MSE) carrying 20% to 30% weightage and the syllabus covered from MSE to ESE carrying 70% to 80% weightage.

Course Code	Course Name	Examination Scheme						Lecture
		Marks Distribution			Exam Duration (Hrs)		Total Marks	3 Hrs
		Internal Assessment		End Semester Exam (ESE)	MSE	ESE		Total Credits
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)					3
EEMDM401	Elements of Electrical Systems	20	20	60	1	2	100	

Course Objectives:

1. To list & describe the different methods of Power generation
2. To elaborate the various types of transmission lines
3. To understand the basics of illumination and various types of electrical loads
4. To understand and calculate the power consumption in electrical system
5. To explain the various types of electrical energy storage system
6. To discuss the various types of electrical meters

Course Outcomes:

1. Understand the different methods of Power generation
2. Evaluate the sending end and receiving end voltage of transmission line
3. Study the basics of illumination and various types of electrical loads
4. Understand the ratings and calculate the electrical energy consumption
5. Study the various types of electrical storage
6. Illustrate the working of different types of meters in electrical system

Sr. No.	Name of Module	Detailed Content	Hours	CO Mapping
I	Generation of Electrical Power	Basics of different Power generating systems: thermal (fossil fuels, nuclear), renewable (solar, wind, hydro, geothermal), nuclear and emerging technologies (tidal, wave, biomass). Basic Layout of hydroelectric power station, thermal power plant, solar generation, nuclear power plant with their advantages and disadvantages. Cost of generation, peak load and base load plant.	**10**	**CO1**
II	Transmission	Study of different types of transmission lines (Short, medium and long) ,Different types of conductors used (Single and three phase transmission line).Application of KVL, KCL to find sending end and receiving end voltage and Calculations of Power transmitted.	**07**	**CO2**
III	Utilization of Electrical Energy	Basic structure of Electrical power Generation, Transmission and distribution systems: grid structure. Illumination:Introduction,Terms used in illumination,Laws of illumination,Numericals on illumination. Types of Electrical loads: Residential:Basics of refrigeration and air-conditioning Industrial :Machines (Motors and generators: AC vs. DC) Self learning topics:Electric Heating and welding.Basics of DC motors,single and three phase induction motor.	**10**	**CO3**
IV	Ratings & Calculation of Energy Consumption	Power rating of household appliances such as tube light, fan, air conditioners, PCs, laptops, printers, etc. Definition of “unit” used for consumption of electrical energy, understand the calculation of electricity bill for LT & HT consumers.	**05**	**CO4**
V	Energy Storage	Battery Technologies: Chemistry basics: lead-acid, lithium-ion, sodium-ion, solid-state batteries. Charging and discharging characteristics. Battery management systems (BMS). Battery storage: types (lead-acid, lithium-ion, flow batteries), applications.	**05**	**CO5**
VI	Measurement in Electrical Energy Systems	Importance of measurement in electrical energy systems. Basic principles of Digital and analog electrical measurement. Moving coil and Moving iron Ammeters & Voltmeters, Power measurement by wattmeter in single phase circuit	**05**	**CO6**

Text Books:

1. Mahesh Verma, Power Plant Engineering, Metrolitan Book Co Pvt Ltd
2. RK Rajput, A Text Book of Power System engineering, Laxmi Publication
3. D. P. Kothari, I. J. Nagrath, Power System Engineering, 3 Edition, Mc GrawHill
4. B.R. Gupta, Power System Analysis And Design, S.Chand
5. Mehta V.K., Principles of Power System, S Chand
6. AK Sawhney, Electrical & Electronic Measurements and Instrumentation, Dhanpat Rai & Sons
7. Dincer I., and Rosen M. A. (2011); Thermal Energy Storage: Systems and Applications,Wiley

References:

1. W. D. Stevenson, Elements of Power System, 4 Edition TMH
2. Trevor M. Letcher, Storing Energy with Special Reference to Renewable Energy Source, Elsevier, 2016.
3. RS Sirohi & Radhakrisnan, Electrical Measurement & Instrumentation, New Age International

Online References:

Sr. No.	Website Name
1	https://www.energy.gov/eere/renewable-energy

Internal Assessment (40 Marks)

A. Mid Semester Exam (20 Marks)

Mid semester examination will be based on 40 % to 50% of the syllabus.

B. Continuous Internal Evaluation (20 Marks)

1. Assignment: 5 Marks
2. Quiz/Open book test/Presentation: 10 Marks
3. Regularity and attendance: 5 Marks

End Semester Examination (60 Marks)

End semester will be based on the syllabus coverage up to Mid Semester Examination (MSE) carrying 20% to 30% weightage and the syllabus covered from MSE to ESE carrying 70% to 80% weightage.

Course Code	Course Name	Examination Scheme						Practical
		Marks Distribution			Exam Duration (Hrs)		Total Marks	2 Hrs
		Internal Assessment		Oral & Practical	MSE	ESE		Total Credits
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)					1
CEMDML401	Data Structure and Algorithm Lab	-	25	-	-	-	25	

Prerequisite:	
Course Objectives: The course aims to	
1	Introduce the essential concepts and requirements of data structures.
2	Apply fundamental knowledge and applications of Stack, Queue, Linked List, Trees, Graphs etc.
3	Understand the working of different Sorting, Searching & Hashing techniques.
4	Understand about writing algorithms and step by step approach in solving problems with the help of fundamental data structures.
Course Outcomes: Learners will be able to	
1	Classify and apply linear and nonlinear data structure concepts, as well as perform operations including insertion, deletion, and traversal.
2	Apply various operations on Stack and Queue.
3	Develop the ability to demonstrate the operation of Linked list.
4	Demonstrate and apply Trees & Graph data structures.
5	Analyse various Sorting and Searching Algorithms and their performance characteristics.
6	Describe the hash function and concepts of collision and its resolution methods

Suggested List of Experiments

Sr. No.	List of Experiments	LO Mapping
01	Implementation of Insertion and deletion in a specific position in an Array using Function.	LO1
02	Array Implementation of Stack.	LO2
03	Array Implementation of Linear Queue.	LO2
04	Array Implementation of Circular Queue.	LO2
05	Implement Singly Linked List.	LO3
06	Implementation of Queue using Linked List.	LO3
07	Implementation of Stack using Linked list.	LO3
08	Implementation of Binary Search Tree and its traversal methods.	LO4
09	Program to count Number of leaf nodes, find the biggest and smallest and height of the tree.	LO4
10	Implementation of binary search and selection search algorithm.	LO5
11	Implementation of selection sort and insertion sort algorithm.	LO5
12	Study of hash function for immutable and mutable objects.	LO6
13	Program to illustrate how to hash a file	LO6

Continuous Internal Evaluation (25 Marks)

1. Lab Performance: 10 Marks
2. In-Semester Practical Exam during lab session: 10 Marks
3. Regularity and Attendance: 5 Marks

Course Code	Course Name	Examination Scheme						Practical
		Marks Distribution			Exam Duration (Hrs)		Total Marks	2 Hrs
		Internal Assessment		Oral & Practical	MSE	ESE		Total Credits
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)					
ETMDML401	Microprocessor and Microcontroller Lab	-	25	-	-	-	25	1

Prerequisite: Basic electronics concepts	
Course Objectives: The course aims to	
1	Implement assembly language programs for Intel 8086 and 8051 microcontroller toperform various operations.
2	Interface general purpose peripheral devices with the Intel 8051 microcontroller for real-time applications.
Lab Outcomes: Learners will be able to	
1	Develop simple programs based on the assembly language of Intel 8086 Microprocessor using various instructions and addressing modes.
2	Write appropriate instructions for simple programs based on 8051 microcontroller
3	Interfacing of peripherals for 8051 microcontroller

Suggested List of Experiments

Sr. No.	List of Experiments	LO Mapping
01	Simple assembly language program for addition, subtraction and multiplication for 8086 processor.	LO1
02	Simple assembly language program for packed BCD arithmetic operations for 8086 processor.	LO1
03	Simple assembly language program for unpacked BCD arithmetic operations for 8086 processor.	LO1
04	Memory block transfer program for 8086 processor.	LO1
05	Finding largest/smallest number from given array.	LO1
06	Sorting the given array in ascending order.	LO1
07	Any program based on mixed language for 8086 processor.	LO1
08	Simple program for addition and subtraction for 8051 microcontroller.	LO2
09	Simple program for multiplication and division for 8051 microcontroller.	LO2
10	Software delay generator using 8051 microcontroller.	LO2
11	Interface single LED to 8051 microcontroller and write a program to blink that LED with some delay.	LO3
12	Interface 7-segment display to 8051 and write a program to display a character on it.	LO3
13	Interface LCD panel to 8051 microcontroller and write a program to display a sample message.	LO3
14	Interface D/A converter to 8051 microcontroller and generate waveforms using this interface.	LO3
15	Stepper motor interfacing to 8051 microcontroller.	LO3

Continuous Internal Evaluation (25 Marks)

1. Lab Performance: 10 Marks
2. In-Semester Practical Exam during lab session: 10 Marks
3. Regularity and Attendance: 5 Marks

Course Code	Course Name	Examination Scheme						Practical
		Marks Distribution			Exam Duration (Hrs)		Total Marks	2 Hrs
		Internal Assessment		Oral & Practical	MSE	ESE		Total Credits
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)					
ARMDML401	Artificial Intelligence Lab	-	25	-	-	-	25	1

Course Objectives: The course aims to	
1	To provide hands-on experience in using AI and machine learning techniques for solving mechanical engineering problems like design, manufacturing, and maintenance.
Course Outcomes: Learners will be able to	
1	Familiar with basic tools for AI and prepare data for analysis.
2	Apply machine learning to predict mechanical properties.
3	Group similar data points (e.g., materials or components) without labeled data.
4	Use reinforcement learning to optimize a mechanical system & designing optimized mechanical structure.
5	Use machine learning to enhance FEA simulations & AI based quality control
6	Predict and diagnose mechanical failures before they happen. & path planning for robotics

Sr. No.	List of Experiments	LO Mapping
01	Introduction to Python for AI and Data Preprocessing	LO1
02	Using Supervised Learning for Mechanical Data	LO2
03	Clustering Mechanical Data (Unsupervised Learning)	LO3
04	Reinforcement Learning for System Optimization	LO4
05	Generative Design for Structural Optimization	LO4
06	AI in Finite Element Analysis (FEA)	LO5
07	AI-Based Quality Control	LO5
08	Predictive Maintenance Using AI	LO6
09	Path Planning for Robotics	LO6

Continuous Internal Evaluation (25 Marks)

1. Lab Performance and assignments: 10 Marks
2. In-Semester Practical Exam during lab session: 10 Marks
3. Regularity and Attendance: 5 Marks

Course Code	Course Name	Examination Scheme						Practical
		Marks Distribution			Exam Duration (Hrs)		Total Marks	2 Hrs
		Internal Assessment		Oral & Practical	MSE	ESE		Total Credits
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)					1
ITMDML401	Internet of Things and Applications-Lab	-	25	-	-	-	25	

Prerequisite: Students know the construction, working principle and operation of DC machines, transformers and Induction motors	
Course Objectives: The course aims to	
01	To Understand the definition and significance of the Internet of Things.
02	To Discuss the architecture, operation, and business benefits of an IoT solution.
03	To Explore the relationship between IoT, cloud computing, and Data Analytics.
04	To Explore the interconnection and integration of the physical world and be able to design & develop IOT applications.
Course Outcomes: Learners will be able to	
01	Adapt different techniques for data acquisition using various IoT sensors for different applications.
02	Demonstrate the working of actuators based on the collected data.
03	Use different IoT simulators and correlate working of IoT protocols.
04	Adapt different techniques for Integrating IoT services to other third-party Clouds.
05	Execute data analysis and encryption methodologies for deployment of IoT applications.
06	Implement IoT protocols for communication to realize the revolution of internet in mobile devices, cloud and sensor networks.

Suggested List of Experiments

Sr. No.	List of Experiments	LO Mapping
01	To measure voltage, current, and power consumption of an appliance using ESP32 and display the data on an OLED screen or send it to a cloud platform.	LO1
02	To control a light or appliance remotely using a mobile app (Blynk) using ESP32.	LO1
03	To measure room temperature and send the data to an online IoT platform using ESP32	LO1
04	To monitor transformer temperature and raise alerts on overheating.	LO2
05	To display power usage data from a sensor on a custom web dashboard using RasberyPi	LO2
06	To automate a streetlight system based on surrounding light intensity using ESP32	LO2
07	To monitor the ON/OFF status of an appliance and view it remotely using ESP32.	LO2
08	To detect motion and capture an image using Raspberry Pi camera using Raspberry Pi	LO2
09	Simulate an energy meter that calculates power usage using Arduino and sensors.	LO3
10	Simulate a weather station that logs temperature and humidity online using Tinkercad + ThingSpeak	LO3
11	Simulate an automatic light that turns on when it gets dark using Tinkercad or Proteus	LO3
12	Simulate a simple smart grid system that balances load using IoT control logic using MATLAB Simulink	LO3
13	Simulate control of home devices via mobile interface using Tinkercad + Blynk API Simulation	LO3
14	To study and demonstrate working of 6LoWPAN in Contiki OS (simulator)	LO4
15	Write a program on Raspberry Pi to push and retrieve the data from cloud like thingspeak/thingsboard/AWS/ Azure etc	LO4
16	Write a program to collect data from sensor encrypt data send it to receiver (server) and decrypt is at receiving end Ardino/Raspberry Pi/ Contiki OS (simulator)	LO5
17	To study and implement IoT Data processing using Pandas.	LO5
18	Write a program for Arduino / Raspberry Pi Publishing MQTT Messages to ESP8266	LO6
19	To study and implement interfacing of actuators based on the data collected using IoT sensors. (like led switch ON/OFF, stepper motor)	LO6
20	Write a program to Control Your ESP8266 From Anywhere in the World	LO6

Online References:

1. https://spoken-tutorial.org/watch/Arduino/Introduction+to+Arduino/English/

2. https://pythonprogramming.net/introduction-raspberry-pi-tutorials/

3. https://iotbytes.wordpress.com/basic-iot-actuators/

4. http://www.contiki-os.org/

5. https://www.bevywise.com/iot-simulator/

6. https://mqtt.org/

Continuous Internal Evaluation (25 Marks)

1. Lab Performance: 10 Marks
2. In-Semester Practical Exam during lab session: 10 Marks
3. Regularity and Attendance: 5 Marks

Course Code	Course Name	Examination Scheme						Practical
		Marks Distribution			Exam Duration (Hrs)		Total Marks	2 Hrs
		Internal Assessment		Oral & Practical	MSE	ESE		Total Credits
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)					
MEMDML401	Mechanical Engineering Lab	-	25	-	-	-	25	1

Prerequisite:	
Course Objectives: The course aims to	
1	Practically verify the concepts learnt in theory course
2	Fundamental laws of thermodynamics through experimental analysis.
3	To acquaint with the material testing by performing experiment related to Hardness , Fatigue, Tension, , Deflection, Torsion, Impact and Flexural Test
Course Outcomes: Learners will be able to	
1	Verify Law of Thermodynamics & various boilers accessories and mountings
2	Understand and demonstrate the working of 2-stroke & 4-stroke Engine.
3	Verify the Bernoulli's Principle & Calibration of Venturimeter,Orifice meter
4	Perform Tension test to analyze the stress - strain behavior of materials
5	Perform heat treatment process of metal sample
6	Perform flexural test with central and multi point loading conditions

Sr. No.	List of Experiments	LO Mapping
01	Verification of the Zeroth Law of Thermodynamics.	LO1
02	Experiment on boilers and their accessories and mountings.	LO1
03	Demonstration of 2-stroke & 4-stroke Engine.	LO2
04	Calibration of Venturimeter,Orifice meter	LO3
05	Verification of Bernoulli's equation	LO3
06	Tension test on mild steel bar	LO4
07	Brinell hardness Test	LO4
08	Experiments based on heat treatment method	LO5
09	Flexural test on beam (Multi-point load)	LO6

Continuous Internal Evaluation (25 Marks)

1. Lab Performance and assignments: 10 Marks
2. In-Semester Practical Exam during lab session: 10 Marks
3. Regularity and Attendance: 5 Marks

Course Code	Course Name	Examination Scheme						Practical
		Marks Distribution			Exam Duration (Hrs)		Total Marks	2 Hrs
		Internal Assessment		Oral & Practical	MSE	ESE		Total Credits
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)					1
EEMDML401	Elements of Electrical Systems Lab	-	25	-	-	-	25	

Course Objectives:

1. Evaluate the performance of transmission lines.
2. Understand the performance parameters of a generator.
3. Evaluate the characteristics of batteries.
4. Study the operation and performance of an electric motor.
5. Analyze the performance of renewable energy sources.
6. Familiarize with electrical measurement techniques.

Course Outcomes:

1. To study various aspects of performance of different renewable energy sources.
2. To study different types of lamps used in Electrical system..
3. To evaluate the efficiency and performance of DC machines (motor and generator) under varying speed and load conditions.
4. To demonstrate the effective use of various meters to perform voltage, current and power measurements of single and three phase circuits.
5. To study the nature of V-I characteristics for single phase and three phase loads.
6. To analyze the behavior of a transmission line under varying load conditions

Online Resources:

Sr. No.	Website Name
1.	https://www.vlab.co.in/broad-area-electrical-engineering
2.	https://www.vlab.co.in/broad-area-electronics-and-communications

Suggested List of Experiments:

Sr No	List of Experiments
01	Measure and plot the no load magnetization (open circuit) characteristic (V-I curve) of a DC generator.
02	Calculate efficiency and voltage regulation of DC generator using external characteristics.
03	Case study to get the current-voltage (I-V) characteristics of a solar PV panel under different light intensities (simulated using lamps).
04	Calculate the MPPT of a solar PV panel under different light intensities (simulation using lamps).
05	Measure speed-torque characteristics of a DC motor under different load conditions.
06	Calculate efficiency and analyze the starting and running performance of a DC motor under different load conditions.
07	Measure charge-discharge characteristics of different types of batteries (e.g., lead-acid, lithium-ion).
08	To analyze efficiency, capacity, and voltage profiles of different types of batteries (e.g., lead-acid, lithium-ion) (simulation based or hands on).
09	Perform voltage, current and power measurements in single phase circuit using analog meters and verify Ohm's law.
10	Perform voltage, current and power measurements in single phase circuit using digital meters and verify Ohm's law.
11	Perform voltage, current and power measurements in three phase circuit using analog meters and verify Ohm's law.
12	Perform voltage, current and power measurements in three phase circuit using digital meters and verify Ohm's law.
13	To perform load test using 1- phase and 3 phase sources and loads using MATLAB Simulink
14	To deduce the transmission line performance i.e. sending end voltage and receiving end voltage for long, medium and short transmission lines using MATLAB Simulink.
15	Generation of sinusoidal voltage waveform using MATLAB Simulink.
16	Simulation of transmission line model using MATLAB Simulink
17	To perform speed control of DC motor using MATLAB Simulink
18	To perform practical using breadboard to extract the charging and discharging characteristics of capacitor.
19	Case Study to compare efficiency and reliability of different renewable energy sources
20	Case Study to analyze the effectiveness of energy storage in balancing supply and demand in distribution networks.
21.	Study of different types of lamps and to measure the intensities of different lamps using lux meter.
22.	To measure voltage,current and power of different types of lamps.

Continuous Internal Evaluation (25 Marks)

1. Lab Performance: 10 Marks
2. Mid Semester Oral & Practical Exam during lab session: 10 Marks
3. Regularity and Attendance: 5 Marks

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