Shirpur Education Society's

R. C. Patel Institute of Technology, Shirpur

(An Autonomous Institute)

Course Structure

Second Year B.Tech in Mechanical Engineering

with effect from Year 2024-25

Shahada Road, Near Nimzari Naka, Shirpur, Maharashtra 425405 Ph: 02563 259 802.

Web: www.rcpit.ac.in

Department of Mechanical Engineering

(Autonomous - RCP23 NEP)

Semester – III (w.e.f.2024-25)

Sr	Course Category	Course Code	Course Title	Teaching Scheme (hrs.)			Evaluation Scheme (CA) (marks)				ESE (marks)	Total	Credit
				L	T	P	TA	Term Test 1 (TT1)	Term Test 2 (TT2)	Average (TT1 & TT2)			
							[A]			[B]	[C]	[A+B+C]	
1	PC	RCP23MCPC301	Mathematics for Mechanical Engineering	3	-	-	25	15	15	15	60	100	3
2	PC	RCP23MCPC302	Applied Thermodynamics	3	-	-	25	15	15	15	60	100	3
3	PC	RCP23MCPC303	Engineering Materials	2	-	-	25	15	15	15	60	100	2
4	PC	RCP23MLPC303	Engineering Materials Laboratory	-	-	2	25	-	-	-	25	50	1
5	PC	RCP23MCPC304	Manufacturing Processes	2	-	-	25	15	15	15	60	100	2
6	HS	RCP23ICHSX03	Economics and Financial Management	2	-	-	25	15	15	15	60	100	2
7 @	OE	RCP23OCOE301 RCP23OCOE302 RCP23OCOE303 RCP23OCOE304 RCP23OCOE305 RCP23OCOE306 RCP23OCOE307 RCP23OCOE308	Product Lifecycle Management Management Information System Operations Research Personal Finance Management Public Systems & Policies Fundamentals of Biomedical Instruments IPR & Patenting Entrepreneurship and Startup Ecosystem	3	-	-	25	15	15	15	60	100	3
8	HS	RCP23ITHSX01	Professional and Business Communication Tutorial	-	2	-	25	-	-	-	-	25	2
9	MD	RCP23MLMD301	Python for Mechanical Engineering Laboratory	-	-	2	25	-	-	-	25	50	1
10	SC	RCP23MLSC301	Manufacturing Processes Laboratory	-	-	4	50	-	-	-	50	100	2
11	SC	RCP23IPSC301	Semester Project I	-	-	2	25	-	-	-	25	50	1
12	EL	RCP23ILELX05	Community Engagement Service	-	-	2	25	-	-	-	-	25	1
			Total	15	2	12	325	90	90	90	485	900	23

PC-Professional Course, HS – Humanity and science, OE- Open Elective, MD- Multidisciplinary, SC- Skill Course, EL- Experiential Learning.

@ Any 1 Open Elective from given list.

Prepared by
Prof. R. R. Ozarkar

Checked by
Prof. S. V. Yeole

Department R.C.P.I.T. OFFICE SEAL SHIRPUR

BOS Chairman
Prof. P. L. Sarode

Dean Academic/Dy. Director
Prof. Dr. P. J. Deore

C.O.E.
Prof. S. P. Shukla

Director
Prof. Dr. J. B. Patil

Department of Mechanical Engineering
(Autonomous - RCP23 NEP)

Semester – IV (w.e.f.2024-25)

Sr	Course Category	Course Code	Course Title	Teaching Scheme (hrs.)			Evaluation Scheme (CA) (marks)				ESE (marks)	Total	Credit
				L	T	P	TA	Term Test 1 (TT1)	Term Test 2 (TT2)	Average (TT1 & TT2)			
							[A]			[B]	[C]	[A+B+C]	
1	PC	RCP23MCPC401	Numerical and Statistical Techniques	2	-	-	25	15	15	15	60	100	2
2	PC	RCP23MLPC401	Numerical and Statistical Techniques Laboratory	-	-	2	25	-	-	-	-	25	1
3	PC	RCP23MCPC402	Mechanics of Materials	3	-	-	25	15	15	15	60	100	3
4	PC	RCP23MLPC402	Mechanics of Materials Laboratory	-	-	2	25	-	-	-	25	50	1
5	PC	RCP23MCPC403	Advanced Manufacturing Processes	3	-	-	25	15	15	15	60	100	3
6	HS	RCP23ICHSX04	Universal Human Values	3	-	-	25	15	15	15	60	100	3
7 #	OE	RCP23OCOE401 RCP23OCOE402 RCP23OCOE403 RCP23OCOE404 RCP23OCOE405 RCP23OCOE406 RCP23OCOE407 RCP23OCOE408 RCP23OCOE409	Project Management Cyber Security, Policies and Laws Advanced Operations Research Corporate Finance Management Corporate Social Responsibility Bioinformatics Human Resource Management Digital Marketing Management Logistics & Supply Chain Management	3	-	-	25	15	15	15	60	100	3
8	HS	RCP23ILHSX02	Design Thinking Laboratory	-	-	2	25	-	-	-	-	25	1
9	SC	RCP23MLSC401	Computer Aided Machine Drawing Laboratory	-	-	4	50	-	-	-	50	100	2
10	SC	RCP23MLSC402	Advance Manufacturing Processes Laboratory	-	-	4	50	-	-	-	50	100	2
11	SC	RCP23IPSC401	Semester Project II	-	-	2	25	-	-	-	25	50	1
			Total	14	-	16	325	75	75	75	450	850	22

PC-Professional Course, HS – Humanity and science, OE- Open Elective, MD- Multidisciplinary, SC- Skill Course.

Any 1 Open Elective from given list.

Prepared by
Prof. R. R. Ozarkar

Checked by
Prof. S. V. Yeole

Mechanical Department R.C.P.I.T. OFFICE SEAL SHIRPUR

BOS Chairman
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Dean Academic/Dy. Director
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Shirpur Education Society's

R. C. Patel Institute of Technology, Shirpur

(An Autonomous Institute)

Syllabus Booklet

Second Year B.Tech in Mechanical Engineering

with effect from Year 2024-25

Shahada Road, Near Nimzari Naka, Shirpur, Maharashtra 425405 Ph: 02563 259 802

Web: www.rcpit.ac.in

Mathematics for Mechanical Engineering
(RCP23MCPC301)

Teaching Scheme	**Examination Scheme**
Lectures: 03 Hr/week	Term Test : 20 Marks
Tutorial: 00 Hr/week	Teacher Assessment : 20 Marks
Credit : 03	End Sem Exam : 60 Marks

Prerequisites:

1. Mathematics-I
2. Mathematics-II
3. Vector algebra and vector differentiation

Course Objectives

1. To inculcate an ability to relate engineering problems to mathematical context.
2. To provide a solid foundation in mathematical fundamentals required to solve engineering problems.
3. To inculcate an ability to use the fundamentals of linear algebra to solve mechanical engineering problems.
4. To study the basic principles of linear algebra, vector calculus, and transforms like Laplace and Fourier.

Course Outcomes:

CO	Course Outcomes	Bloom's Level	Bloom's Description
CO1	Evaluate functions of square matrices using eigenvalues and eigenvectors.	L5	Evaluate
CO2	Use Laplace and Inverse Laplace to solve Ordinary Differential Equations.	L3	Apply
CO3	Expand periodic functions into infinite Fourier series and represent them as Fourier integrals. Interpret Fourier transform and inverse Fourier transform.	L3	Apply
CO4	Correlate the mechanical engineering problem with vector integration and solve them.	L3	Apply

Course Contents

Unit-I 08 Hrs.

Linear Algebra

Characteristic equation, Eigenvalues and Eigenvectors with properties. Cayley-Hamilton theorem. Diagonalizability of matrices. Functions of square matrix.

Unit-II 07 Hrs.

Laplace Transform (LT)

LT of standard functions such as $1, t^n, e^{at}, \sin(at), \cos(at), \sinh(at), \cosh(at)$. Linearity property of Laplace Transform, First Shifting property, Change of Scale property of L.T. (without proof).

$$L\{t^n f(t)\}, L\{\frac{f(t)}{t}\}, L\{\int_0^t f(u)du\}, L\{\frac{d^n f(t)}{dt^n}\}$$

Unit-III 07 Hrs.

Inverse Laplace Transform

Inverse Laplace Transform
Linearity property, Partial fractions method and convolution theorem. Applications to solve ordinary differential equations with one dependent variable with given boundary conditions.
Laplace Transform of special functions (Flip classroom - self-study).
Heaviside Unit step function, Dirac Delta function, Periodic functions.

Unit-IV 11 Hrs.

Fourier Series and Fourier Transform

Fourier Series
Definition, Dirichlet's conditions, Fourier series of periodic function with period 2π $2l$. Even and odd functions, Half range sine and cosine series, Parseval's identities (without proof).
Fourier Transform (FT)
Fourier integral theorem (only statement), Fourier transform, Fourier sine cosine transforms, Inverse Fourier Transforms.

Unit-V 06 Hrs.

Vector Integration

Green's theorem (without proof) for planes, Stokes theorem and Gauss divergence theorem (without proof and verification).

Books Recommended

Textbooks:

1 Seymour Lipschutz and Marc Lipson, 'Linear Algebra', 4th Edition, Schaum's outlines, 2008.

2 Gilbert Strang, 'Linear Algebra and its Applications', 4th Edition, Cengage, 2005.

3 B. S. Grewal, 'Higher Engineering Mathematics', Khanna Publication.

Reference Books:

1 Erwin Kreyszig, 'Advanced Engineering Mathematics', Wiley India

2 Deisentoth, Faisal, Ong, 'Mathematics for machine learning', Cambridge University Press.

Evaluation Scheme

Continuous Assessment (A):

Subject teacher will declare Teacher Assessment criteria at the start of the semester.

Continuous Assessment (B):

1. Two term tests of 20 marks each will be conducted during the semester.
2. Total duration allotted for writing each of the papers is 1 hour.
3. Average of the marks scored in both the tests will be considered for final grading.

End Semester Examination (C):

1. Question paper will be based on the entire syllabus summing up to 60 marks.
2. Total duration allotted for writing the paper is 2 hours.

Applied Thermodynamics
(RCP23MCPC302)

Teaching Scheme	**Examination Scheme**
Lectures: 03 Hr/week	Term Test : 20 Marks
Tutorial: 00 Hr/week	Teacher Assessment : 20 Marks
Credit : 03	End Sem Exam : 60 Marks

Prerequisites:

Nil

Course Objectives

1. To familiarize the concepts of Energy in general and Heat and Work in particular.
2. To study the fundamentals of quantification and grade of energy.
3. To study the effect of energy transfer on the properties of substances in the form of charts and diagrams.
4. To familiarize application of the concepts of thermodynamics in vapour power and gas power cycles.

Course Outcomes:

CO	Course Outcomes	Bloom's Level	Bloom's Description
CO1	Demonstrate application of the first law of thermodynamics to flow and non-flow system.	L2	Understand
CO2	Analyze thermodynamic cycles including vapour power cycles, refrigeration cycles, and heat pump.	L4	Analyze
CO3	Use thermodynamic relations in the evaluation of thermodynamic properties.	L3	Apply
CO4	Use steam table and Mollier chart to compute thermodynamic interactions.	L3	Apply
CO5	Evaluate the performance of air standard cycles.	L5	Evaluate
CO6	Demonstrate application of the first law of thermodynamics to air conditioning processes.	L2	Understand

Course Contents

Unit-I 06 Hrs.

Application of First Law of Thermodynamics

First law of thermodynamics for a closed system undergoing processes, First Law of Thermodynamics applied to open system – Steady Flow Energy Equation, Perpetual motion Machine of First kind. Application of first law of thermodynamics to open Systems like Steam Nozzle, Boiler, Steam Turbine, Pump, Heat Exchanger.

Unit-II 09 Hrs.

Second Law of Thermodynamics

Limitation of first law of thermodynamics, Thermal Reservoir – Source and Sink, Concept of Heat Engine, Heat Pump and Refrigerator, Second law of thermodynamics – Kelvin Planck and Clausius Statements. Equivalence of Clausius and Kelvin Planck Statement, Reversible and Irreversible Process. Causes of Irreversibility, Perpetual Motion Machine of Second Kind, Need of Carnot theorem and its corollaries, Carnot cycle, Thermodynamic Temperature Scale and its equivalence with Ideal Gas Scale. Entropy: Clausius Inequality, Clausius Theorem, Entropy is Property of a system, Isentropic Process, Temperature Entropy Plot and its relationship with heat interactions, Entropy Principle, Entropy change During a Process. Interpretation of concept of entropy.

Unit-III 04 Hrs.

Thermodynamic Relations

Reciprocal Relation, Cyclic Relation Property relations, Maxwell Relations, TdS equations, Heat capacity relations, Volume Expansivity, Isothermal Compressibility, Clausius-Clapeyron Equation.
Exergy: High grade and Low-Grade Energy, Available and Unavailable Energy, Dead State, Available energy with respect to a process and a cycle.

Unit-IV 09 Hrs.

Properties of Pure Substance and Vapour Power Cycle

Pure substance and Phase changes: Phase change processes of pure substance, Property diagrams for phase change process (T-v, T-s and p-h diagrams), Understanding of Steam Table and Mollier chart. Vapour Power cycle: Carnot cycle and its limitations as a vapour cycle, Rankine cycle with different turbine inlet conditions, mean temperature of heat addition, Methods to improve thermal efficiency of Rankine cycle – Reheat cycle and Regeneration Cycle.

Unit-V 06 Hrs.

Gas Power Cycles

Assumptions of Air Standard Cycle, Analysis of Otto cycle, Diesel Cycle and Dual cycle (Numericals included).

Unit-VI 05 Hrs.

Psychometrics of Air-Conditioning Processes

Need for air conditioning, Principle of psychrometry, Basic Psychometric properties, Need of psychometric chart and plotting basic psychometric properties on psychometric chart.

Books Recommended

Textbooks:

1 P K Nag, Thermodynamics, Tata McGraw Hill Publishers.

2 Onkar Singh, Thermodynamics, New Age International.

3 P Chattopadhyay, Engineering Thermodynamics, Oxford University Press India.

Reference Books:

1 Yunus A. Cengel and Michael A. Boles, Thermodynamics: An Engineering Approach, 7th edition, TMH.

2 Michael J. Moran and Howard N. Shapiro, Fundamentals of Engineering Thermodynamics, Wiley Publications.

3 Claus Borgnakke and Richard E. Sonntag, Fundamentals of Thermodynamics, Wiley Publications.

Evaluation Scheme

Continuous Assessment (A):

Subject teacher will declare Teacher Assessment criteria at the start of the semester.

Continuous Assessment (B):

1. Two term tests of 20 marks each will be conducted during the semester.
2. Total duration allotted for writing each of the papers is 1 hour.
3. Average of the marks scored in both the tests will be considered for final grading.

End Semester Examination (C):

1. Question paper will be based on the entire syllabus summing up to 60 marks.
2. Total duration allotted for writing the paper is 2 hours.

Engineering Materials
(RCP23MCPC303)

Teaching Scheme	**Examination Scheme**
Lectures: 02 Hr/week	Term Test : 20 Marks
Tutorial: 00 Hr/week	Teacher Assessment : 20 Marks
Credit : 02	End Sem Exam : 60 Marks

Prerequisites:

Knowledge of Basic crystal structures and properties

Course Objectives

1. To impart knowledge on materials selection based on properties and application requirements, crystal defects, mechanical behavior of materials subjected to different loads and basic characterization methods.
2. To understand alloy phase diagrams and their application, iron-iron carbide phase diagram, exposure to microstructural development in ferrous materials, heat treatment processes and their effect on structure and properties of materials.
3. To know the effect of alloying elements in ferrous materials.
4. To learn nonferrous and nonmetallic materials.

Course Outcomes:

CO	Course Outcomes	Bloom's Level	Bloom's Description
CO1	Acquire knowledge on materials classification & selection, structure-property correlation, imperfections, deformation mechanism in crystalline material & demonstrate sample preparation for various microscopy & microstructural information obtained by it.	L2	Understand
CO2	Identify and comprehend failure modes of engineering materials and related issues.	L2	Understand
CO3	Interpret phase diagrams, describe iron-iron carbide system and understand the microstructural development and property changes in steels and cast irons.	L2	Understand
CO4	Select and justify proper industrial heat treatment process for steel in order to obtain desirable properties to suit application requirements.	L3	Apply
CO5	Analyze the effect of alloying elements in steel and learn about alloy steels.	L4	Analyze
CO6	Classify nonferrous and nonmetallic materials and recognize their need to cater to engineering demand.	L3	Apply

Course Contents

Unit-I 06 Hrs.

Introduction to Engineering Materials and Basic Characterization Techniques

Engineering Materials: Brief history, Classification of solid engineering materials, structure-property correlations, defects in crystals.
Deformation in Crystalline Material: Elastic and Plastic deformation, deformation by slip and twin, slip systems, critical resolved shear stress, strain hardening effect, frank reed source, recovery, recrystallization and grain growth.
Principle, construction, operation and applications of light microscopy and electron microscopy.

Unit-II 04 Hrs.

Materials Failure

Modes of Failure: failure by plastic deformation, ductile fracture, brittle fracture.
Ductile to brittle transition temperature (DBTT).
Fatigue Failure: Definition, Examples, Types of fluctuating stresses, fatigue test, S-N Curve, Macro and microstructural aspects of fatigue, prevention of fatigue, concept of thermal and corrosion fatigue.
Creep Failure: Definition, Examples, Creep test, Creep Curve, Effect of stress and temperature on creep behavior of material, and Creep resistant materials.

Unit-III 05 Hrs.

Solidification and Alloy Phase Diagrams

Solidification: Nucleation and growth of crystals, formation of solid solutions, Hume Rothery rule.
Basics of phase diagram: Construction of unary, binary, ternary and isomorphous phase diagrams, Gibb's phase rule, Tie line and lever rule, Invariant Reactions.
Study of Polymorphism in Pure iron and Iron – Iron carbide phase diagram: Construction, important phases, composition, temperature and phase transformation.
Slow cooling behavior of hypoeutectoid steel, hypereutectoid steel and cast iron.
Types of cast irons and their industrial applications.

Unit-IV 05 Hrs.

Heat Treatment in Steels

Purpose of Heat treatment, Heat treatment cycle, Microstructures and Properties associated with Annealing, Normalizing, Quenching, and Tempering, Martempering, and Maraging Heat treatment process.
Construction, interpretation and application of TTT and CCT diagrams.
Hardenability and Jominy End Quench test.
Surface/Case Hardening Methods: Carburizing, Nitriding, Carbonitriding and Cyaniding.

Unit-V 04 Hrs.

Alloying Elements and Alloy Steels

Common alloying elements in steels and their effect on structure and properties of steel.
Ferrite & Austenite Stabilizers, Strong Carbide forming elements.
Effect of alloying elements on Iron – Iron carbide diagram, TTT CCT diagram and Hardenability of steel.
Stainless steel and HSS: Composition, Types, Properties and Applications.

Unit-VI 06 Hrs.

Study of Nonferrous and Nonmetallic materials

Classification, Properties and Industrial Applications of light metals and alloys (alloys of Al, Cu, Ti etc), Ceramics, Polymers and Composites.

Books Recommended

Textbooks:

1 William D. Callister, David G. Rethwisch, Materials Science and Engineering: An Introduction, 10th Edition, John Wiley and Sons, 2020.

2 G. E. Dieter, Mechanical Metallurgy, 3rd Edition, McGraw Hill International New Delhi, 2017.

3 William F Smith, Javed Hasemi and Ravi Prakash, Materials Science and Engineering, 5th Edition, McGraw Hill Publications, 2017

Reference Books:

1 S. H. Avner, Introduction to Physical Metallurgy, McGraw Hill, 2017.

2 V Raghavan, Physical Metallurgy: Principles and Practice, 3rd Edition, PHI Learning Pvt. Ltd., 2015.

3 W. Bolton, Engineering Materials Technology, 3rd Edition, (Oxford) Butterworth-Heinemann, 2001.

Evaluation Scheme

Continuous Assessment (A):

Subject teacher will declare Teacher Assessment criteria at the start of the semester.

Continuous Assessment (B):

1. Two term tests of 20 marks each will be conducted during the semester.
2. Total duration allotted for writing each of the papers is 1 hour.
3. Average of the marks scored in both the tests will be considered for final grading.

End Semester Examination (C):

1. Question paper will be based on the entire syllabus summing up to 60 marks.
2. Total duration allotted for writing the paper is 2 hours.

Engineering Materials Laboratory
(RCP23MLPC303)

Teaching Scheme	**Examination Scheme**
Practical : 02 Hrs./week	Teacher Assessment: 25 Marks
Credit : 01	End Sem Exam : 25 Marks

Prerequisites:

Knowledge of Basic crystal structures and properties

Course Objectives

1. To impart knowledge on materials selection based on properties and application requirements, crystal defects, mechanical behavior of materials subjected to different loads and basic characterization methods.
2. To understand alloy phase diagrams and their application, iron-iron carbide phase diagram, exposure to microstructural development in ferrous materials, heat treatment processes and their effect on structure and properties of materials.
3. To know the effect of alloying elements in ferrous materials.
4. To learn nonferrous and nonmetallic materials.

Course Outcomes:

CO	Course Outcomes	Bloom's Level	Bloom's Description
CO1	Acquire knowledge on materials classification & selection, structure-property correlation, imperfections, deformation mechanism in crystalline material & demonstrate sample preparation for various microscopy & microstructural information obtained by it.	L2	Understand
CO2	Identify and comprehend failure modes of engineering materials and related issues.	L2	Understand
CO3	Interpret phase diagrams, describe iron-iron carbide system and understand the microstructural development and property changes in steels and cast irons.	L2	Understand
CO4	Select and justify proper industrial heat treatment process for steel in order to obtain desirable properties to suit application requirements.	L3	Apply
CO5	Analyze the effect of alloying elements in steel and learn about alloy steels.	L4	Analyze
CO6	Classify nonferrous and nonmetallic materials and recognize their need to cater to engineering demand.	L3	Apply

Suggested Experiments

1 Study and Demonstration of Light/Optical/Metallurgical Microscope.

2 Metallographic sample preparation.

3 To study the microstructures of plain carbon steels and cast irons.

4 To study the microstructures of nonferrous materials.

5 To study the heat treatment of steel (Annealing, Normalizing, Quenching) and to investigate the variation in hardness and microstructure of heat treated specimens.

6 To study the tempering characteristic of hardened steel.

7 To determine the hardenability of steel by Jominy End Quench Test.

8 Fatigue Test.

9 To perform any two non-destructive testing methods (Magnetic particles inspection, Dye penetrant test, Ultrasonic testing).

Minimum 8 experiments from the above-suggested list or any other experiments based on syllabus will be included, which would help the learner to apply the concept learnt. Assignments/Mini project/case study/literature based seminar/presentation relevant to the subject may be included.

Books Recommended

Textbooks:

1 William D. Callister, David G. Rethwisch, Materials Science and Engineering: An Introduction, 10th Edition, John Wiley and Sons, 2020.

2 G. E. Dieter, Mechanical Metallurgy, 3rd Edition, McGraw Hill International New Delhi, 2017.

3 William F Smith, Javed Hasemi and Ravi Prakash, Materials Science and Engineering, 5th Edition, McGraw Hill Publications, 2017

Reference Books:

1 S. H. Avner, Introduction to Physical Metallurgy, McGraw Hill, 2017.

2 V Raghavan, Physical Metallurgy: Principles and Practice, 3rd Edition, PHI Learning Pvt. Ltd., 2015.

3 W. Bolton, Engineering Materials Technology, 3rd Edition, (Oxford) Butterworth-Heinemann, 2001.

Evaluation Scheme

The distribution of marks shall be as follows:

Continuous Assessment (A):

Term work shall consist of minimum 8 experiments.

1. Performance in Experiments: 05 Marks
2. Journal Submission: 05 Marks
3. Viva-voce: 05 Marks
4. Subject Specific Lab Assignment/Case Study/ Mini project: 10 Marks

End Semester Examination (C):

Oral examination will be based on the entire syllabus including, the practicals performed during Laboratory sessions.

Manufacturing Processes

(RCP23MCPC304)

Teaching Scheme	**Examination Scheme**
Lectures: 02 Hr/week	Term Test: 20 Marks
Tutorial: 00 Hr/week	Teacher Assessment: 20 Marks
Credit: 02	End Sem Exam: 60 Marks

Prerequisites:

Nil

Course Objectives

1. To impart knowledge of manufacturing processes such as casting, forging, rolling, and metal cutting.
2. To familiarize students with unconventional machine tools and machining processes.
3. To train students in machining various operations on CNC to enhance their practical skills.
4. To educate students about ethical, environmental, and safety standards.

Course Outcomes:

CO	Course Outcomes	Bloom's Level	Bloom's Description
CO1	Identify various metal casting and metal joining processes, analyze defects, their probable causes, and remedial measures.	L4	Analyze
CO2	Identify various metal forming processes, analyze defects, their probable causes, and remedial measures.	L4	Analyze
CO3	Describe types of machine tools, illustrate machine tool capabilities, and limitations of machining operations to generate cylindrical and planar components.	L2	Understand
CO4	Understand the working principles and applications of CNC machines to execute various operations using canned cycles and subroutines.	L2	Understand
CO5	Determine operation planning sequences by analyzing part prints for estimating manufacturing time to meet manufacturing requirements.	L5	Evalute

Course Contents

Unit-I 04 Hrs.

Introduction to Manufacturing Processes

Need and classification of manufacturing processes based on additive and subtractive processes, chipless and chip-removal processes.
Metal Casting Process: Expendable and permanent mould casting processes – sand casting, investment casting, shell moulding, die casting, centrifugal casting, vacuum casting, casting defects and their remedies.

Unit-II 07 Hrs.

Rolling, Forging, Extrusion and Sheet Metal Operations

Rolling: Principles and process characteristics, rolling types, rolling parameters, thread rolling, production of seamless tubes through rolling, defects, and remedies in the rolling process.
Forging: Basic operations, types of forging, forging hammers/presses, forging stages, forging applications, defects, and remedies in the forging process.
Extrusion: Equipment and principles, types of extrusion (direct, indirect, impact, continuous, hydrostatic, tube extrusion), metal flow in extrusion, defects and remedies in extrusion, wire drawing process.
Sheet Metal Operations: Theory in press working, different elements of a press tool, press working operations.

Unit-III 05 Hrs.

Metal Cutting and Joining Processes

Metal Cutting Process: Merchant theory of metal cutting, machine tools required to generate cylindrical and planar components, finishing and super finishing processes, thread cutting, and gear cutting.
Metal Joining Processes: Classification of welding (fusion welding, solid-state welding), soldering, brazing processes, welding defects, inspection and testing of welds, safety in welding.

Unit-IV 07 Hrs.

CNC Basics, Tooling and Programming

CNC Basics: DNC, motion controller, interpolation, adaptive control system, spindle drive, axis drive, actuation and feedback devices, ATC, APC, tool pre-setter, touch probe system.
CNC Tooling and Programming: CNC turning and milling tools, types of controllers, tool nose radius and length compensation, canned cycle, looping, jumping, subprogram, turning and vertical machining centre programming.

Unit-V 03 Hrs.

Manufacturability Assessment of Given Product Design

Classifying operations: Basic process operation, principal process, and auxiliary process.
Preliminary part print analysis.
Process planning for a given component.

Books Recommended

Textbooks:

1 Mikell P. Groover, *Fundamentals of Modern Manufacturing: Materials, Processes and Systems*, 7th Edition, 2020, John Wiley & Sons, Inc.

2 Serope Kalpakjian and Steven R. Schmid, *Manufacturing Processes for Engineering Materials*, 6th Edition, 2017, Pearson.

3 P. N. Rao, *CAD/CAM: Principles and Applications*, 3rd Edition, 2017, Tata McGraw Hill.

4 Ghosh & Mallik, *Manufacturing Science*, 3rd Edition, 2010, Affiliated East-West Press.

5 O. P. Khanna, *Welding Technology*, 1st Edition, 2015, Dhanpat Rai Publication.

6 Eary & Johnson, *Process Engineering for Manufacturing*, 1962, Prentice-Hall.

Evaluation Scheme

Continuous Assessment (A)

Subject teacher will declare Teacher Assessment criteria at the start of the semester.

Continuous Assessment (B)

1. Two term tests of 20 marks each will be conducted during the semester.
2. Duration allotted for each test is 1 hour.
3. Average of the marks scored in both tests will be considered for final grading.

End Semester Examination (C)

1. The question paper will be based on the entire syllabus, summing up to 60 marks.
2. Duration allotted for writing the paper is 2 hours.

Economics and Financial Management (RCP23ICHSX03)

Teaching Scheme	**Examination Scheme**
Lectures: 02 Hr/week	Term Test: 20 Marks
Tutorial: 00 Hr/week	Teacher Assessment: 20 Marks
Credit: 02	End Sem Exam: 60 Marks

Prerequisites:

Knowledge of current affairs in the Economics and Finance domain

Course Objectives

1. To describe the relationships among variables to analyze economic issues.
2. To explain the function of the market and prices as an allocative mechanism.
3. To identify key macroeconomic indicators and measures of economic change, growth, and development.
4. To understand basic concepts of financial management and their application in investment and financing decisions.
5. To explore the relationship between financial management and financial statements.

Course Outcomes:

CO	Course Outcomes	Bloom's Level	Bloom's Description
CO1	Analyze individual decision making, how prices and quantities are determined in product and factor markets, and microeconomic and macroeconomic outcomes.	L4	Analyze
CO2	Analyze the performance and functioning of government, RBI, markets, and institutions in the context of social and economic problems.	L4	Analyze
CO3	Analyze the current economic status of India at global levels and provisions in the budget to address economic issues at the national level.	L4	Analyze
CO4	Describe the overall role and importance of the finance function.	L2	Understand
CO5	Analyze financial performance and make appropriate inferences.	L4	Analyze

Course Contents

Unit-I 06 Hrs.

Introduction to Economics

Fundamentals of Economics: Definition and scope, the nature of the economic problem, finite resources and unlimited wants, factors of production and their rewards, opportunity cost, and its influence on decision making.
Microeconomics and Macroeconomics:
The role of markets in allocating resources, the market system, introduction to the price mechanism, demand, supply, and price determination. Price elasticity of demand and supply (PED).

Unit-II 04 Hrs.

Role of Government and RBI

Money, banking, households, firms, economies and diseconomies of scale, market structure, fiscal policy, monetary policy, economic growth, causes and consequences of recession, causes of economic growth, measurement of economic growth, inflation, deflation, living standards, and indicators of living standards.

Unit-III 04 Hrs.

Government Policies

Last 20 years Journey of Indian Economy, Measures taken to grow Indian Economy, Meaning of India is the world's fifth-largest economy by nominal GDP and the third-largest by purchasing power parity (PPP), On a per capita income basis, India ranked 139th by GDP (nominal) and 127th by GDP (PPP) (Data reference year 2023), Comparison of top 5 largest economies in world, Discuss key points of India latest union budget and its impact on Indian economy and citizens, Meaning of Initiatives like Make in India, Digital India, Skill India etc. and expected impact on Indian Economy.

Unit-IV 04 Hrs.

Overview of Financial Management

Fundamentals of financial management, principles and functions of the financial management, Strategy, methods, and techniques of the financial management, Overview of financial instruments, financial markets, financial Institutions

Unit-V 08 Hrs.

Overview of Financial Statements

Balance Sheet, Profit and Loss Account, and Cash Flow Statement; Purpose of Financial Ratio Analysis; Liquidity Ratios; Efficiency or Activity Ratios; Profitability Ratios; Capital Structure Ratios; Stock Market Ratios.

Books Recommended

Textbooks :

1 Gaurav Datt & Biswajit Nag, *Datt & Sundharam's Indian Economy*, 73rd Edition, 2024, S. Chand Publications.

2 Prasanna Chandra, *Fundamentals of Financial Management*, 7th Edition, 2020, McGraw Hill Publications.

Reference Books :

1 Burkhard Heer, *Public Economics: The Macroeconomic Perspective*, 2019, Springer International Publications.

2 Raj Kumar Sen, *Indian Economy: Economic Ideas, Development, and Financial Reforms*, 2008, Deep & Deep Publications.

3 Dr. V. C. Sinha, *Indian Economy: Performance and Policies*, 2021, SBPD Publications.

4 C. Paramasivan & T. Subramanian, *Financial Management*, 2009, New Age Publications.

5 Sandeep Goel, *Financial Management Practices in India*, 2016, Taylor & Francis Publications.

Evaluation Scheme

Continuous Assessment (A)

Subject teacher will declare Teacher Assessment criteria at the start of the semester.

Continuous Assessment (B)

1. Two term tests of 20 marks each will be conducted during the semester.
2. Duration allotted for each test is 1 hour.
3. Average of the marks scored in both tests will be considered for final grading.

End Semester Examination (C)

1. The question paper will be based on the entire syllabus, summing up to 60 marks.
2. Duration allotted for writing the paper is 2 hours.

Product Life Cycle Management
(RCP23OCOE301)

Teaching Scheme	**Examination Scheme**
Lectures: 03 Hr/week	Term Test : 20 Marks
Tutorial: 00 Hr/week	Teacher Assessment : 20 Marks
Credit : 03	End Sem Exam : 60 Marks

Prerequisites:

Nil

Course Objectives

1. To familiarize the students with the need, benefits and components of PLM.
2. To acquaint students with Product Data Management PLM strategies.
3. To give insights into new product development program and guidelines for designing and developing a product.
4. To familiarize the students with Virtual Product Development.
5. To acquaint students with the need of Environmental aspects in PLM & its implementation.

Course Outcomes:

CO	Course Outcomes	Bloom's Level	Bloom's Description
CO1	Gain knowledge about phases of PLM, PLM strategies and methodology for PLM feasibility study and PDM implementation.	L2	Understand
CO2	Illustrate various approaches and techniques for designing and developing products.	L3	Apply
CO3	Acquire knowledge in applying virtual product development tools.	L3	Apply
CO4	Acquire knowledge in implementation of Environmental aspects in PLM.	L2	Understand

Course Contents

Unit-I 07 Hrs.

Introduction to Product Lifecycle Management (PLM

Product Lifecycle management (PLM), Need for PLM, Product Lifecycle Phases, Opportunities of Globalization, Pre-PLM Environment, PLM Paradigm, Importance & Benefits of PLM, Widespread Impact of PLM, Focus and Application, A PLM Project, Starting the PLM Initiative, PLM Applications.
PLM Strategies: Industrial strategies, Strategy elements, its identification, selection and implementation, Developing PLM Vision and PLM Strategy, Change management for PLM

Unit-II 07 Hrs.

Product Design and Development

Product Design and Development Process, Engineering Design, Organization and Decomposition in Product Design, Typologies of Design Process Models, Reference Model, Product Design in the Context of the Product Development Process, Relation with the Development Process Planning Phase, Relation with the Post design Planning Phase.

Unit-III 10 Hrs.

Methodological Evolution of Product Design

Methodological Evolution of Product Design
Concurrent Engineering, Characteristic Features of Concurrent Engineering, Concurrent Engineering, Life Cycle Approach, Characteristic Features of Life Cycle Approach.
The Design for X System, Objective Properties and Design for X Tools, Choice of Design for X Tools and Their Use in the Design Process.
New Product Development (NPD) and Strategies, Product Configuration and Variant Management.
Integration of Environmental Aspects in Product Design:
Sustainable Development Design for Environment, Need for Life Cycle Environmental Strategies, Useful Life Extension Strategies, End-of-Life Strategies, Introduction of Environmental Strategies into the Design Process, Life Cycle Environmental Strategies and Considerations for Product Design, Tools and techniques for integrated design, Implementation of international standards.

Unit-IV 07 Hrs.

Product Data Management (PDM)

Product Data Management (PDM):
Product and Product Data, PDM systems and importance, Components of PDM, Reason for implementing a PDM system, financial justification of PDM, barriers to PDM implementation.
Virtual Product Development Tools:
For components, machines, and manufacturing plants, 3D CAD systems and realistic rendering techniques, Digital mock-up, Model building, Model analysis, Modelling and simulations in Product Design, Examples/Case studies.

Unit-V 08 Hrs.

Engineering Methods for Product Design Evaluation

Engineering Methods for Product Design Evaluation:
Durability of Products and Components, Design for Fatigue, Infinite Life Approach, Design for Finite Life.
Product Recovery Planning & Analysis:
Approach to the Recovery Problem, Method for Recovery Cycles Planning, Calculation Models for Recovery Cycles Planning, Basic procedure, Determinant Factors for Recovery, Effective Component Reusability, Recovery Fractions, Extension of Useful Life.

Books Recommended

Textbooks:

1 John Stark, "Product Lifecycle Management: Paradigm for 21st Century Product Realisation", Springer-Verlag, 2004. ISBN: 1852338105

2 Fabio Giudice, Guido La Rosa, Antonino Risitano, "Product Design for the environment-A life cycle approach", Taylor & Francis 2006, ISBN: 0849327229.

Reference Books:

1 Saaksvuori Antti, Immonen Anselmie, "Product Life Cycle Management", Springer, Dreamtech, ISBN: 3540257314

2 Michael Grieve, "Product Lifecycle Management: Driving the next generation of lean thinking", Tata McGraw Hill, 2006, ISBN: 0070636265

3 François Villeneuve, Luc Mathieu, Max Giordano "Product Life-Cycle Management: Geometric Variations", 2010. United Kingdom: Wiley.

Evaluation Scheme

Continuous Assessment (A):

Subject teacher will declare Teacher Assessment criteria at the start of the semester.

Continuous Assessment (B):

1. Two term tests of 20 marks each will be conducted during the semester.
2. Total duration allotted for writing each of the papers is 1 hour.
3. Average of the marks scored in both the tests will be considered for final grading.

End Semester Examination (C):

1. Question paper based on the entire syllabus will comprise of 4 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 60 marks.
2. Total duration allotted for writing the paper is 2 hours.

Management Information System (RCP23OCOE302)

Teaching Scheme	**Examination Scheme**
Lectures: 03 Hr/week	Term Test: 20 Marks
Tutorial: 00 Hr/week	Teacher Assessment: 20 Marks
Credit: 03	End Sem Exam: 60 Marks

Pre-requisite:

1. Nil

Course Objectives

1. The course is a blend of management and technical fields.
2. Discuss the roles played by information technology in today's business and define various technology architectures on which information systems are built.
3. Define and analyze typical functional information systems and identify how they meet the needs of the firm to deliver efficiency and competitive advantage.
4. Identify the basic steps in systems development.

Course Outcomes:

CO	Course Outcomes	Bloom's Level	Bloom's Description
CO1	Explain the fundamental concepts of the management information systems used in business.	L2	Understand
CO2	Describe IT infrastructure and its components and its current trends.	L2	Understand
CO3	Use the tools and technologies for accessing information from databases to improve business performance and decision making.	L3	Apply
CO4	Identify and explain the security and ethical challenges in MIS along with the measures to be taken.	L2	Understand
CO5	Select a suitable social computing platform for the given requirements that integrates AI and IoT.	L3	Apply
CO6	Explain the processes involved in the information system within the organization including information acquisition and enterprise and global management technologies.	L2	Understand

Course Contents

Unit-I 04 Hrs.

Foundation Concepts

- Definition and scope of Management Information Systems (MIS) in business
- Functional area information system
- The components of information systems
- Impact of IT on organizations and society
- Business Process – BPR and BPI
- Business Pressure, Organizational responses
- Competitive Advantage and Strategic IS's

Unit-II 05 Hrs.

Information Technology Infrastructure

- Overview of IT infrastructure
- Hardware and software
- Computer systems: End user and enterprise
- Computing computer peripherals: Input, output, and storage technologies
- Application software: End user applications
- System software: Computer system management
- Data resource management: Technical foundations of database management, Managing data resources, Big data, Data warehouse and data marts, Knowledge management
- Networks: The networked enterprise (wired and wireless), Pervasive computing, Cloud computing models

Unit-III 10 Hrs.

MIS Tools and Applications for Decision Making

- ERP and ERP support of business
- Business intelligence (BI): Managers and Decision Making
- Decision Support System (DSS): types, components, Data mining
- Executive information system
- Role of AI in decision making
- Role of predictive analytics and data visualization in business

Unit-IV 08 Hrs.

Security and Ethical Challenges

- Information security fundamentals
- Key principles of information security
- Common threats and vulnerabilities in MIS
- Security measures and controls
- Access control mechanisms: authentication, authorization, and accounting (AAA)
- Encryption techniques and cryptographic protocols
- Ethical, and societal challenges of IT
- Legal and regulatory framework
- Privacy Policies

Unit-V 06 Hrs.

Social Computing (SC)

- Web 2.0 and 3.0: static and dynamic platform, integration with AI and IoT
- SC in business-shopping: leveraging social media platforms, Social listening and sentiment analysis
- Social computing in Customer Relationship Management (CRM)
- Marketing, operational and analytic CRM
- E-business and E-commerce – B2B B2C, E-commerce platforms and payment gateways
- Mobile commerce: growth trends, mobile wallets, contactless payments, shopping apps and platforms

Unit-VI 06 Hrs.

Information System within Organization

- Acquiring Information Systems and Applications: Various System development life cycle models
- Enterprise and Global Management of Information Technology: Managing Information Technology, Managing Global IT
- Business processes and information systems

Books Recommended

Textbooks:

1. A. K. Gupta, "Management Information System", S. Chand Limited, 2010.
2. K. K. Ghosh, Saini Das, and S. Mukherjee, "Management Information System", Management, IIT, Kharagpur, 2021.

Reference Books:

1. J. A. O'Brien, G. Marakas, "Management Information Systems", McGraw-Hill Companies, Incorporated, 2006.
2. K. Rainer, B. Prince, "Management Information Systems", Wiley, 2016.

Web References

Management Information System:
https://nptel.ac.in/courses/110105148

Management Information System:
https://archive.nptel.ac.in/courses/110/105/110105148/

Evaluation Scheme

Continuous Assessment (A):

Subject teacher will declare Teacher Assessment criteria at the start of the semester.

Continuous Assessment (B):

1. Two term tests of 20 marks each will be conducted during the semester.
2. Total duration allotted for writing each of the papers is 1 hour.
3. Average of the marks scored in both the tests will be considered for final grading.

End Semester Examination (C):

1. Question paper based on the entire syllabus will comprise of 4 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 60 marks.
2. Total duration allotted for writing the paper is 2 hours.

Operations Research
(RCP23OCOE303)

Teaching Scheme	**Examination Scheme**
Lectures: 03 Hr/week	Term Test: 20 Marks
Tutorial: 00 Hr/week	Teacher Assessment: 20 Marks
Credit: 03	End Sem Exam: 60 Marks

Pre-requisite:

1. Knowledge of Mathematics.
2. Probability.

Objectives

1. Formulate a real-world problem as a linear programming problem and be able to solve it.
2. Understand the optimisation tools that are needed to solve linear programming problems.

Course Outcomes

CO	Course Outcomes	Bloom's Level	Bloom's Description
CO1	Formulate the real-world optimisation problem into a Linear Programming Problem (LPP) and analyse the solution obtained using LPP optimisation models.	L4	Analyz
CO2	Solve Linear Programming Problems using transportation and assignment models.	L3	Apply
CO3	Apply Decision Theory to determine the optimal course of action when a number of alternatives are available, and their consequences cannot be forecast with certainty and uncertainty.	L3	Apply
CO4	Apply Game Theory for decision making under conflicting situations where there are one or more opponents (players).	L3	Apply
CO5	Break down a large problem into smaller sub-problems and solve them recursively or iteratively using Dynamic Programming models.	L4	Analyze

Course Contents

Unit-I 12 Hrs.

Introduction to Operations Research and LPP

Introduction to Operations Research
Introduction, Structure of the Mathematical Model, Limitations of Operations Research.
Linear Programming:
Introduction, Linear Programming Problem, Requirements of LPP, Mathematical Formulation of LPP, Graphical method, Simplex Method, Penalty Cost Method or Big M-method, Two Phase Method.

Unit-II 08 Hrs.

Transportation and Assignment Problem

Transportation Problem:
Formulation, solution, unbalanced Transportation problem. Finding basic feasible solutions – North-west corner rule, least cost method and Vogel's approximation method. Optimality test: MODI method.
Assignment Problem:
Introduction, Mathematical Formulation of the Problem, Hungarian Method Algorithm, Processing of n Jobs Through Two Machines and m Machines, Graphical Method of Two Jobs m Machines Problem Routing Problem

Unit-III 06 Hrs.

Decision Theory

Steps in Decision Theory approach, Decision-making Environment, Decision making under condition of certainty, Decision making under condition of uncertainty, Decision making under condition of risk, Maximum likelihood criterion.

Unit-IV 06 Hrs.

Game Theory

Competitive games, rectangular game, saddle point, minimax/maximin method of optimal strategies, value of the game. Solution of games with saddle points, dominance principle. Rectangular games without saddle point – mixed strategy for 2 X 2 games.

Unit-V 07 Hrs.

Dynamic Programming

Characteristics of dynamic programming. Dynamic programming approach for Priority Management employment smoothening, capital budgeting, Stagecoach/Shortest Path, cargo loading and Reliability problems.

Books Recommended

Textbooks:

1. Operations Research - An Introduction: Taha, H. A., Pearson Education, 2022.
2. Operations Research: Gupta, P. K. and Hira, D. S., S. Chand Publications, 2014.

Reference Books:

1. Operations Research: Introduction to Models and Methods, Boucherie, R. J., Tijms, H. and Braaksma, A., 2021.
2. Introduction to Operations Research: Hiller, F. S. and Liebermann, G. J., McGraw-Hill Higher Education, 2010.
3. Operations Research: Principles and Practice: Ravindran, A., Phillips, D. T. and Solberg, J. J., Wiley India Pvt. Limited, 2009.

Evaluation Scheme

Continuous Assessment (A):

Subject teacher will declare Teacher Assessment criteria at the start of the semester.

Continuous Assessment (B):

1. Two term tests of 20 marks each will be conducted during the semester.
2. Total duration allotted for writing each of the papers is 1 hour.
3. Average of the marks scored in both the tests will be considered for final grading.

End Semester Examination (C):

1. Question paper based on the entire syllabus will comprise of 4 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 60 marks.
2. Total duration allotted for writing the paper is 2 hours.

Personal Finance Management
(RCP23OCOE304)

Teaching Scheme	**Examination Scheme**
Lectures: 03 Hr/week	Term Test: 20 Marks
Tutorial: 00 Hr/week	Teacher Assessment: 20 Marks
Credit: 03	End Sem Exam: 60 Marks

Pre-requisite:

1. Nil

Objectives

1. To create awareness and educate consumers on access to financial services.
2. To make the students understand the basic concepts, definitions, and terms related to direct taxation.
3. To help the students compute the Goods and Service Tax (GST) payable by a supplier after considering the eligible input tax credit.
4. To familiarize the students with microfinance for accelerating the expansion of local microbusinesses.

Course Outcomes

CO	Course Outcomes	Bloom's Level	Bloom's Description
CO1	Understand the Indian financial system.	L2	Understand
CO2	Use a framework for financial planning to understand the overall role finances play in his/her personal life.	L3	Apply
CO3	Compute income from salaries, house property, business/profession, capital gains, and income from other sources.	L3	Apply
CO4	Compute the amount of CGST, SGST, and IGST payable after considering the eligible input tax credit.	L3	Apply
CO5	Understand how Microfinance can help in financial inclusion.	L2	Understand

Course Contents

Unit-I 07 Hrs.

Indian Financial System and Personal Finance

Overview of Indian Financial System:
Characteristics, Components and Functions of Financial System. Financial Instruments and Financial Markets, Financial inclusion.
Introduction to Personal Finance:
Personal Financial Planning in Action, Money Management Skills, Taxes in Your Financial Plan, Savings and Payment Services. Consumer Credit: Advantages, Disadvantages, Sources and Costs.

Unit-II 07 Hrs.

Personal Financial Management

Loans:
Home, Car, Education, Personal, Loan against property, and Jewel loan.
Insurance:
Types of Insurance – ULIP and Term; Health and Disability Income Insurance, Life Insurance.
Investment:
Investing Basics and Evaluating Bonds, Investing in Stocks and Mutual Funds, Planning

Unit-III 09 Hrs.

Income Tax

Income Tax Act Basics-
Introduction to Income Tax Act, 1961
Heads of Income and Computation of Total Income and Tax Liability-
Heads of Income and Computation of Total Income under various heads, Clubbing Provisions, Set off and carry forward of Losses, Deductions, Assessment of Income and tax liability of different persons.
Tax Management, Administrative Procedures and ICDS -
TDS, TCS and Advance Tax Administrative Procedures, ICDS.

Unit-IV 08 Hrs.

Goods and Services Tax

GST Constitutional framework of Indirect Taxes before GST (Taxation Powers of Union State Government); Concept of VAT: Meaning, Variants and Methods; Major Defects in the structure of Indirect Taxes prior to GST; Rationale for GST; Structure of GST (SGST, CGST, UTGST IGST); GST Council, GST Network, State Compensation Mechanism, Registration.
Levy and Collection of GST
Taxable event- "Supply" of Goods and Services; Place of Supply: Within state, Interstate, Import and Export; Time of supply: Valuation for GST- Valuation rules, taxability of reimbursement of expenses; Exemption from GST: Small supplies and Composition Scheme: Classification of Goods and Services.

Unit-V 08 Hrs.

Introduction to Microfinance

Introduction to Micro – finance
Micro-Finance:
Definitions, Scope Assumptions, Types of Microfinances, Customers of Micro-finance, Credit Delivery Methodologies, SHG concept, origin, Formation Operation of Self-Help Groups (SHGs).
Models in Microfinance -
Joint Liability Groups (JLG), SHG Bank Linkage Model and GRAMEEN Model: Achievements Challenges.
Institutional Mechanism
Current Challenges for Microfinance, Microfinance Institutions (MFIs): Constraints Governance Issues, Institutional Structure of Microfinance in India: NGO-MFIs, NBFC-MFIs, Co-operatives, Banks, Microfinance Networks and Associations; Demand Supply of Microfinance Services in India, Impact assessment and social assessments of MFIs.

Books Recommended

Textbooks:

1. Banking and Financial Sector Reforms in India, by Asha Singh, M.S. Gupta, Serials Publication.
2. Indian Banking Sector: Essays and Issues (1st), by M.S. Gupta & J.B. Singh, Serials Publication.
3. Basics Of Banking & Finance, by K.M. Bhattacharya O.P. Agarwal, Himalaya Publishing House.
4. Agricultural Finance and Management, by S. Subba Reddy, P. Raghu Ram.
5. The Indian Financial System and Development, by Dr. Vasant Desai, Himalaya Publishing House; Fourth Edition.
6. Income Tax Management, Simple Way of Tax Management, Tax Planning and Tax Saving, By Sanjay Kumar Satapathy.
7. Direct Tax System Income Tax by Dr. R. K. Jain, SBPD Publications.
8. Simplified Approach to GST Goods and Services Tax, By S K Mishra, Educreation Publishing.
9. Introduction To Microfinance, By Todd A Watkins, World Scientific Publishing Company.

Evaluation Scheme

Continuous Assessment (A):

Subject teacher will declare Teacher Assessment criteria at the start of the semester.

Continuous Assessment (B):

1. Two term tests of 20 marks each will be conducted during the semester.
2. Total duration allotted for writing each of the papers is 1 hour.
3. Average of the marks scored in both the tests will be considered for final grading.

End Semester Examination (C):

1. Question paper based on the entire syllabus will comprise of 4 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 60 marks.
2. Total duration allotted for writing the paper is 2 hours.

Public Systems and Policies
(RCP23OCOE305)

Teaching Scheme	**Examination Scheme**
Lectures: 03 Hr/week	Term Test: 20 Marks
Tutorial: 00 Hr/week	Teacher Assessment: 20 Marks
Credit: 03	End Sem Exam: 60 Marks

Pre-requisite:

1. Basic Knowledge of Social Science and Current Affairs

Objectives

1. To explain public policy and its operations with special focus on policy relating to Government finance.
2. To analyze and evaluate the impact of public policy on firms and the economy at large.

Course Outcomes

CO	Course Outcomes	Bloom's Level	Bloom's Description
CO1	Understand the importance of public systems in a fast-changing environment in the global context.	L2	Understand
CO2	Analyse the transformations in public systems with emphasis on current initiatives and emerging challenges in the field.	L4	Analy
CO3	Explain public policy and its operations with special focus on policy relating to Government finance.	L2	Understand
CO4	Make policies and know about the happenings in the world, in the nation and those in their locality.	L5	Evaluate
CO5	Analyze and evaluate the impact of public policy on firms and the economy at large and work under various fields as policymakers.	L5	Evalute

Course Contents

Unit-I 10 Hrs.

Introduction and Overview of Public Systems

Ideology of Public Systems; Mechanistic and Organic view of Society and Individuals, The Legal Framework; Federal Government; State and Local Governments, Government growth; The size of Government.

Unit-II 06 Hrs.

Public Sector in the Economics Accounts

Public Sector in the circular flow; Public Sector in the National Income Accounts.

Unit-III 08 Hrs.

Public Choice and Fiscal Politics

Direct Democracy; Representative Democracy; The Allocation Function; The Distribution Function; The Stabilization Function; Coordination of Budget Functions; The Leviathan Hypothesis.

Unit-IV 10 Hrs.

Introduction and Overview of Public Policy

Markets and Government; Social goods and Market failure, public expenditure and its evaluation; Cost Benefit Analysis, Public policy and Externalities, Taxation Policy and its impact, Income distribution, redistribution and social security issues Fiscal & Budgetary Policy, Fiscal Federalism in India.

Unit-V 05 Hrs.

Case Studies in Expenditure Policy: Public Services

A) National Defense B) Highways C) Outdoor Recreation D) Education.

Books Recommended

Reference Books:

1. Charles J, Wheelan, "Introduction to Public Policy", W.W. Norton & Company, New York, 2011.
2. Thomas R, Dye, "Understanding Public Policy", Prentice Hall, 2008.
3. Anderson, James E, "Public Policy-Making: An Introduction", Boston, 2011.
4. Avasthi & Maheshwari, "Public Administration", Lakshmi Narain Agarwal, 2008.

5. Mohit Bhattacharya, “New Horizons of Public Administration”, Jawahar Publishers, New Delhi, 2011.

6. Nicholas Henry, “Public Administration and Public Affairs”, Prentice Hall of India, New Delhi, 2017.

7. Harvey S Rosen and Ted Gayer, “Public Finance” 10th Edition, McGraw-Hill Education, 2013.

8. Richard A Musgrave and Peggy B Musgrave, “Public Finance in Theory and Practice”, 5th Edition, Mcgraw Hill Book, 2017.

Evaluation Scheme

Continuous Assessment (A):

Subject teacher will declare Teacher Assessment criteria at the start of the semester.

Continuous Assessment (B):

1. Two term tests of 20 marks each will be conducted during the semester.
2. Total duration allotted for writing each of the papers is 1 hour.
3. Average of the marks scored in both the tests will be considered for final grading.

End Semester Examination (C):

1. Question paper based on the entire syllabus will comprise of 4 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 60 marks.
2. Total duration allotted for writing the paper is 2 hours.

Fundamentals of Biomedical Instruments (RCP23OCOE306)

Teaching Scheme	**Examination Scheme**
Lectures: 03 Hr/week	Term Test: 20 Marks
Tutorial: 00 Hr/week	Teacher Assessment: 20 Marks
Credit: 03	End Sem Exam: 60 Marks

Pre-requisite:

1. Basic knowledge of Human Anatomy
2. Basic knowledge of Electronics

Objectives

1. To understand the basic principles and working of various medical instruments.
2. To familiarize the learners with the various medical imaging modalities, their operating principles, instrumentation and clinical applications.

Course Outcomes

CO	Course Outcomes	Bloom's Level	Bloom's Description
CO1	Associate & describe the different physiological processes taking place within the human body.	L2	Understand
CO2	Identify the use of biomaterials and apply principles of various transducers & sensors.	L3	Apply
CO3	Demonstrate the working principle of various medical instruments.	L3	Apply
CO4	Demonstrate principles used in imaging modalities and analysis.	L3	Apply
CO5	Identify different processes used in telemetry and telemedicine.	L2	Understand

Course Contents

Unit-I 04 Hrs.

Basic Human Physiology

Cell:
Electrical activity of excitable cells (Structure and functions of cell. Polarization and depolarization of cell)
Cardiovascular System:
Heart, Conductive tissues of heart, Cardiac cycle, Heart Valves, System and Pulmonary Circulation, Transmission of Cardiac Impulse, Blood Pressure, ECG (Einthoven's Triangle, Various leads and Waveforms).
Muscle Physiology:
Muscle physiology and aspects of skin resistance. Generation of EMG
Nervous System:
Different parts, their functions. Reflex actions and reflex arc, Function of Sympathetic and Parasympathetic nervous system. Generation of EEG

Unit-II 10 Hrs.

Biomaterial, Transducers and Sensors

Biomaterials used in fabrication of biodevices and implants:
Polymeric, Composite biomaterials, Metallic biomaterials, and Ceramic biomaterials.
Biopotential electrodes:
Electrode tissue interface, Electrode electrolyte interface Electrodes used for ECG, EEG & EMG.
Transducers & sensors:
temperature transducer, pulse sensor, glucose sensor, respiration sensor
Introduction of biomaterials, Classification of biomaterials

Unit-III 08 Hrs.

Overview of Medical Instruments

Classification, application and specifications of diagnostic, therapeutic and clinical laboratory equipment
Method of operation of these Bio Medical Instruments
ECG, EEG, EMG

Unit-IV 09 Hrs.

Imaging Modalities and Analysis

Radio graphic techniques, Computer Tomography
MRI, PET, SPECT
Ultrasonography
Endoscopy
Thermography, Retinal Imaging
Imaging application in Biometric systems

Unit-V 08 Hrs.

Telemetry & Telemedicine

Introduction to Biotelemetry
Physiological parameters compliant to biotelemetry
Components of Biotelemetry system
Applications of telemetry in medical field (ECG, EEG & EMG)

Books Recommended

Textbooks:

1. Leslie Cromwell, Biomedical Instrumentation and Measurement, Prentice hall of India, New Delhi, 2007.
2. M.Arumugam, 'Bio-Medical Instrumentation', Anuradha Agencies, 2003.
3. Khandpur R.S, Handbook of Biomedical Instrumentation, Tata McGraw-Hill, New Delhi, 2 Edition, 2003.
4. John G. Webster, Medical Instrumentation Application and Design, John Wiley and sons, NewYork, 1998.
5. Biomaterials Science - An Introduction to Materials in Medicine. B.D. Ratner, A.S. Hoffmann, F. J. Schoen, J. E. Lemons, Academic Press, 1997.

Reference Books:

1. Electronic Measurement and Instrumentation by Dr Rajendra Prasad
2. Ed. Joseph D. Bronzino, The Biomedical Engineering Hand Book, Third Edition, Boca Raton, CRC Press LLC, 2006.
3. Curry, T. S., Dowdey, J. E., & Murry, R. C. (1990). Christensen's physics of diagnostic radiology. Lippincott Williams & Wilkins.
4. Biomaterials: An Introduction, Joon Park, R. S. Lakes, Springer Science & Business Media

Evaluation Scheme

Continuous Assessment (A):

Subject teacher will declare Teacher Assessment criteria at the start of the semester.

Continuous Assessment (B):

1. Two term tests of 20 marks each will be conducted during the semester.
2. Total duration allotted for writing each of the papers is 1 hour.
3. Average of the marks scored in both the tests will be considered for final grading.

End Semester Examination (C):

1. Question paper based on the entire syllabus will comprise of 4 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 60 marks.
2. Total duration allotted for writing the paper is 2 hours.

IPR & Patenting
(RCP23OCOE307)

Teaching Scheme	**Examination Scheme**
Lectures: 03 Hr/week	Term Test: 20 Marks
Tutorial: 00 Hr/week	Teacher Assessment: 20 Marks
Credit: 03	End Sem Exam: 60 Marks

Pre-requisite:

1. NIL

Course Objectives

1. To promote the knowledge of intellectual property laws of India and international treaties.
2. To encourage innovation.

Course Outcomes

CO	Course Outcomes	Bloom's Level	Bloom's Description
CO1	Map a given project/idea to a suitable intellectual property rights.	L3	Apply
CO2	Explain the fundamentals of the patents, copyrights, and design registrations.	L2	Understand
CO3	Draft applications to protect various intellectual property rights.	L6	Create
CO4	Communicate with national and/or international intellectual property organisations.	L4	Analyze

Course Contents

Unit-I 03 Hrs.

Introduction to Intellectual Property Rights (IPR)

- Concept & meaning of IP and IPR.
- General principles of intellectual property rights.
- Need for intellectual property.
- Categories of IPR instruments - Patents, Trademarks, Copyrights, Industrial Designs, Plant variety protection, Trade secrets, Geographical Indications etc.
- Ownership, assignment, licenses, infringement, validity period.
- International treaties on IPR.

Unit-II 09 Hrs.

Copyright and Design

- The Indian Copyright Act, 1957.
- Meaning of copyrights and rights of copyrighted works.
- Types of copyright.
- Process of filing a copyright application.
- Introduction to Designs Law – Definitions.
- Registration of designs and procedure.

Unit-III 09 Hrs.

Basics of Patents

- The Indian Patent Act and The Indian Patent Rules.
- Conditions of patentability.
- Patentable and non-patentable inventions.
- Types of patent applications and patent specification.
- Inventors and Applicants.
- Category of applicants - natural person, small entity, startup and others.
- Patent databases and prior art search.
- International Patent Classification code.

Unit-IV 09 Hrs.

Patent Application Drafting

- Patent application drafting:
  - Application.
  - Specification.
  - Claims drafting:
    - Independent and dependent claims drafting.
    - Process patent and product patent claims.
  - Abstract.
  - Drawings.
  - Declaration as to inventorship.
  - Statement and undertaking.

- Drafting response to communications from patent office.
  - Reading and understanding examination reports.
  - Drafting response.

Unit-V 09 Hrs.

Procedure for Filing a Patent Application, Timelines and Fees

- Application for grant of patent.
- Forms and Fees.
- Request for (early) publication and/or (early) examination.
- Patent examination and hearing.
- Pre-grant and post-grant opposition.

Books Recommended

Textbooks:

1. A Durafe and D Toradmalle, "Intellectual Property Rights", Wiley, 2020.
2. H Rockman, "Intellectual property law for engineers, scientists, and entrepreneurs", Wiley-IEEE Press, 2020.

Reference Books:

1. Bare Act, "The Patents Act, 1970 with The Patents Rules, 2003", Universal, 2023.
2. Bare Act, "The Copyright Act, 1957", Universal and LexisNexis, 2021.
3. Bare Act, "The Designs ACT, 2000", Commercial Law Publishers (India) Pvt. Ltd. 2021.

Online Resources:

1. W. Fisher, "Maps of Intellectual Property"
   https://cyber.harvard.edu/people/tfisher/IP/IPMaps.htm
2. World Intellectual Property Organisation courses
   https://www.wipo.int/academy/en/
3. Prof. Feroz Ali, "Patent Drafting for Beginners",
   https://onlinecourses.nptel.ac.in/noc24_hs59/preview

Evaluation Scheme

Continuous Assessment (A):

Subject teacher will declare Teacher Assessment criteria at the start of the semester.

Continuous Assessment (B):

1. Two term tests of 20 marks each will be conducted during the semester.
2. Total duration allotted for writing each of the papers is 1 hour.
3. Average of the marks scored in both the tests will be considered for final grading.

End Semester Examination (C):

1. Question paper based on the entire syllabus will comprise of 4 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 60 marks.
2. Total duration allotted for writing the paper is 2 hours.

Entrepreneurship and Startup Ecosystem (RCP23OCOE308)

Teaching Scheme	**Examination Scheme**
Lectures: 03 Hr/week	Term Test: 20 Marks
Tutorial: 00 Hr/week	Teacher Assessment: 20 Marks
Credit: 03	End Sem Exam: 60 Marks

Pre-requisite:

1. Nil

Objectives

1. To foster an entrepreneurial mindset.
2. To guide participants in building effective Business Models.
3. To educate participants regarding Intellectual Property and Fundraising for Innovative Ventures.

Course Outcomes

CO	Course Outcomes	Bloom's Level	Bloom's Description
CO1	Effectively navigate the global startup landscape.	L3	Apply
CO2	Cultivate an entrepreneurial mindset.	L4	Analyze
CO3	Create effective business models.	L6	Create
CO4	Understand the significance of Intellectual Property rights.	L2	Understand
CO5	Master fundraising strategies.	L5	Evaluate

Course Contents

Unit-I 06 Hrs.

Understanding the Entrepreneurial Ecosystem

- Introduction to Entrepreneurship and Startups.
- Role of Entrepreneurship in the economy.
- Global and Local Entrepreneurial Landscapes.
- Role of Incubators and Accelerators.
- Case Studies of Successful Startups.

Unit-II 08 Hrs.

Developing a Startup Mindset

- Cultivating an Entrepreneurial Mindset.
- Market Analysis and Segmentation.
- Opportunity Recognition.
- Innovation and Idea Generation.
- Feasibility Analysis of Business Ideas.
- Role of Innovation in Entrepreneurship.
- Fostering Creativity.
- Practical Exercises and Workshops on Creative Problem Solving.

Unit-III 10 Hrs.

Business Model Development

- Introduction to Business Models.
- Lean Startup Methodology.
- Prototyping and Minimum Viable Product (MVP).
- Financial Projections and Budgeting.
- Various Forms of Business Ownership.
- Compliance and Legal Regulations.
- Operations and Supply Chain Management.
- Human Resource Management.
- Developing a Marketing Strategy.
- Managing Growth Challenges.

Unit-IV 08 Hrs.

Technological Innovation and Intellectual Property

- Technology and Entrepreneurship.

- Intellectual Property Basics (Patents, Trademarks, Copyrights).
- Patent Search and Analysis.
- Strategies for Protecting Intellectual Property.
- Ethical Considerations in Technology and Innovation.

Unit-V 07 Hrs.

Fundraising and Investment Strategies

- Fundraising Options for Startups.
- Angel Investors and Venture Capital.
- Crowdfunding Platforms.
- Financial Modelling for Startups.
- Crafting an Effective Pitch.

Books Recommended

1. Alexander Osterwalder and Yves Pigneur, "Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers", John Wiley & Sons, Jul 2010.
2. Peter Thiel and Blake Masters, "Zero to One: Notes on Startups, or How to Build the Future", Virgin Books, 2015.
3. Alejandro Cremades, "The Art of Startup Fundraising: Pitching Investors, Negotiating the Deal, and Everything Else Entrepreneurs Need to Know", John Wiley & Sons, Inc., Hoboken, New Jersey, 2016.
4. Clayton M. Christensen, "The Innovator's Dilemma: When New Technologies Cause Great Firms to Fail", Harvard Business School Press, 1997.
5. Brad Feld and Jason Mendelson, "Venture Deals: Be Smarter Than Your Lawyer and Venture Capitalist", Wiley; 4th edition, 1 October 2019.

Evaluation Scheme

Continuous Assessment (A):

Subject teacher will declare Teacher Assessment criteria at the start of the semester.

Continuous Assessment (B):

1. Two term tests of 20 marks each will be conducted during the semester.
2. Total duration allotted for writing each of the papers is 1 hour.
3. Average of the marks scored in both the tests will be considered for final grading.

End Semester Examination (C):

1. Question paper based on the entire syllabus will comprise of 4 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 60 marks.
2. Total duration allotted for writing the paper is 2 hours.

Professional and Business Communication Tutorial

(RCP23ITHSX01)

Teaching Scheme	**Examination Scheme**
Practical : 02 Hrs./week	Teacher Assessment: 25 Marks
Credit : 02	End Sem Exam : 00 Marks

Prerequisites:

1. Nil

Course Objectives

1. To inculcate a professional and ethical attitude in the workplace.
2. To enhance communication and interpersonal skills.
3. To develop effective employability skills.
4. To hone written skills for technical documentation.

Course Outcomes

CO	Course Outcomes	Bloom's Level	Bloom's Description
CO1	Apply group discussion techniques in professional situations.	L3	Apply
CO2	Use employability skills to optimize career opportunities.	L3	Apply
CO3	Employ storytelling techniques for effective presentation.	L3	Apply
CO4	Prepare technical documents using appropriate style, format, and language.	L6	Create
CO5	Analyze the concept of professional ethics.	L4	Analyze
CO6	Demonstrate interpersonal skills in professional and personal situations.	L3	Apply

Course Description

The course is designed to equip students with essential skills crucial for navigating the contemporary job market successfully and fostering a positive work environment through effective communication and collaboration. The assignments comprise a combination of interactive activities, discussions, case studies, and real-world simulations to help students not only ace job interviews and professional interactions but also contribute positively to the ethical and productive functioning of any organization. For the project work, students must prepare and present a well-researched and persuasive business proposal in groups, integrating the skills and knowledge acquired throughout the course.

Description of Tutorial Activities

Unit-I — No of Assignment -01

Group Discussion

- Purpose of a GD, types of GD, criteria for evaluating GD, Dos and Don'ts of GD.
- **Activity:** Students will be divided into groups of 8-12 and each group will be given a topic/case to discuss within a given time frame. Each student will submit a write-up on their observations of the GD.

Unit-II — No of Assignments -02

Employment Skills

- **Resume Writing:** Types of resumes, structure, content, and formatting of resume.
- **Activity:** Students will prepare and submit their individual resume according to professional requirements.
- **Interview Skills:** Types and modes of interview, preparation for interview, Dos and Don'ts of interview, frequently asked questions during interview.
- **Activity:** Students will submit a write-up on the FAQs and participate in mock interviews.

Unit-III — No of Assignment -01

Corporate Storytelling

- Elevator pitch, product stories, event stories, stories in presentations, storytelling in SOPs and interviews, storytelling to manage conflict or to motivate.
- **Activity:** Students will be divided into groups of 8-12 and asked to give a team presentation using storytelling techniques and submit the hardcopy of the PPT.

Unit-IV — No of Assignment -01

Technical Writing and Documentation

- Business Proposal Writing: Types of business proposals, format of proposal, language and style, presentation of proposal.
- Meeting Documentation: Planning layout of meetings, observing meeting decorum, drafting notice, agenda, and minutes of meeting.
- **Activity:** Students will be divided into groups of 8-12 and each group will conduct a mock meeting based on an agenda and submit a write-up of the meeting documentation.

Unit-V — No of Assignment -01

Professional Ethics

- Effective work habits, accountability, integrity, and excellence.
- **Activity:** Students will be divided into groups of 8-12 and each group will analyze a case involving an ethical issue and submit the write-up.

Unit-VI No of Assignments -02

Interpersonal Skills

- Team Building: Difference between group and team, importance of teamwork, strategies to be a good team player.
- **Activity:** Students will be divided into groups of 8-12 and each group will be assigned a task to be accomplished as a team, for which they will submit the write-up.
- Leadership: Types of leadership, leadership styles, case studies.
- **Activity:** Each student will submit a write-up involving a leader they admire, analyzing various aspects of his leadership style.
- Time Management: Importance of time management, cultural views of time, 80/20 rule, time wasters, setting priorities and goals.
- **Activity:** Each student will submit a write-up about a case involving time management.

Batchwise tutorial work of minimum eight assignments from the above suggested list or any other assignments based on the syllabus will be included, which would help the learner to apply the concepts learned.

Books Recommended

Main Textbooks:

1. Fred Luthans, *Organizational Behavior*, McGraw Hill.
2. Lesiker and Petit, *Report Writing for Business*, McGraw Hill.
3. Huckin and Olsen, *Technical Writing and Professional Communication*, McGraw Hill.

Additional References:

1. Wallace and Masters, *Personal Development for Life and Work*, Thomson Learning, 12th edition.
2. Heta Murphy, *Effective Business Communication*, McGraw Hill.
3. Sharma R.C. and Krishna Mohan, *Business Correspondence and Report Writing*, Tata McGraw-Hill Education.
4. Ghosh, B. N., *Managing Soft Skills for Personality Development*, Tata McGraw Hill.
5. Lehman, Bell, Smith, *Management Communication*, Wiley India Edition, 3rd edition.
6. Dr. Alex K., *Soft Skills*, S Chand and Company.
7. Subramaniam, R., *Professional Ethics*, Oxford University Press.
8. Sandeep Das, *How Business Storytelling Works: Increase Your Influence and Impact*, Penguin Random House India Pvt. Ltd.

Evaluation Scheme

Continuous Assessment (A)

1. Term Work: - 25 marks.
2. Term Work shall comprise of:
3. Minimum 8 assignments: 15 marks.
4. Business Proposal presentation: 10 marks.

Python for Mechanical Engineering Laboratory (RCP23MLMD301)

Teaching Scheme	**Examination Scheme**
Practical : 02 Hrs./week	Teacher Assessment: 25 Marks
Credit : 01	End Sem Exam : 25 Marks

Prerequisite:

Structured Programming using C

Course Objectives

1. To understand the coding environment of Python Programming.
2. To apply Python coding skills to solve various Mechanical problems.

Course Outcomes

CO	Course Outcomes	Bloom's Level	Bloom's Description
CO1	Understand the coding environment of Python software.	L2	Understand
CO2	Understand the basics of Python.	L2	Understand
CO3	Read, analyze, and visualize data using Python.	L4	Analyze
CO4	Apply Python skills to solve Mechanical problems.	L3	Apply

Course Content

Unit-I 04 Hrs.

Introduction to Python

Python history, Introduction to Anaconda, Spyder IDE, programming basics, understanding the layout of the programming environment and Spyder.

Unit-II 06 Hrs.

Basics of Python

Assignment Statement, variables and datatypes, Loops, Strings, Lists, Operators, Arrays, Sorting, Functions, and Dictionaries.

Unit-III 06 Hrs.

Data Handling and Manipulation

Reading Data, Introduction to Pandas DataFrame and NumPy, Data Visualization, exploratory Data Analysis.

Unit-IV 10 Hrs.

Using Python for Mechanical Applications

Applications in Design, Thermal analysis, and Manufacturing processes.

Suggested Programs

1. Program to demonstrate the input function.
2. Program to calculate the discounted price of a product.
3. Program to calculate BMI Index.
4. Program to print the multiplication table of 7.
5. Program to calculate the sum of first n integers.
6. Program to print the factorial of a given number.
7. Program to manage visitors at a police station.
8. Program to perform mathematical operations on a sequence of 5 numbers entered by the user.
9. Program to calculate area and perimeter.
10. Program to print numbers in descending order.
11. Program to perform numerical operations on a list.
12. Program to find second maximum and second minimum in a list.
13. Program to print numbers which are not multiples of 5.
14. Program to flip digits of a binary number.
15. Program to demonstrate the Fizz buzz game.
16. Program to draw a square in Turtle.
17. Program to draw letter E in Turtle.
18. Program to draw concentric circles in Turtle.
19. Program to draw a pentagon in Turtle.
20. Program to draw diagonally opposite squares in Turtle.
21. Program to demonstrate understanding of try/except.
22. Program to build a password generator.
23. Program to plot natural frequency/time period against static deflection.
24. Program to plot displacement, velocity and acceleration for a given spring-mass system as separate plots.
25. Program to plot displacement, velocity and acceleration for a given spring-mass system on a single plot.
26. Program to determine driving tensions of a belt drive.
27. Program to determine current in an electric circuit which comprises three closed loops.
28. Program to determine displacement, velocity and acceleration of a particle with known motion.

Minimum 25 programs from the above suggested list or any other program based on the syllabus will be included, which would help the learner to apply the concepts learnt.

Books Recommended

Reference Books:

1. Problem Solving and Programming; S. Kuppuswamy, S. Malliga, C.S. Kanimozhi Selvi, K. Kousalya; 2019; Tata McGraw Hill.
2. Introducing Python Modern Computing in Simple Packages; Bill Lubanovic; 1st edition; 2014; O'Reilly Media.
3. Python: The Complete Reference; Martin C; 1st edition; 2018; Tata McGrawHill.
4. Core Python Programming; R. Nageswara Rao; 2nd edition; 2018; DreamTech Press.
5. Let Us Python; Yashavant Kanetkar; 2019; BPB Publication.

Textbooks and other references can be added as per your institution's recommendations.

Evaluation Scheme

Continuous Assessment (A):

Term work shall consist of a minimum of 25 programs and 1 Mini Project. The distribution of marks for term work shall be as follows:

1. Laboratory work (Performance of Experiments): 20 Marks
2. Mini Project: 05 Marks

End Semester Examination (B):

Practical examination will be based on the entire syllabus, including the practicals performed during laboratory sessions.

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

Manufacturing Processes Laboratory (RCP23MLSC301)

Teaching Scheme	**Examination Scheme**
Practical: 04 Hrs./week	Teacher Assessment: 50 Marks
Credit: 02	End Sem Exam: 50 Marks

Pre-requisites:

Nil

Course Objectives

1. To impart knowledge of machine tools and basic machining processes such as turning, drilling, boring, broaching, milling, shaping, planning, slotting, and grinding.
2. To provide insight into different machine tools, accessories, and attachments.
3. To train students in machine operations to enhance their practical skills.
4. To inculcate team qualities and expose students to shop floor activities.
5. To educate students about ethical, environmental, and safety standards.

Course Outcomes

CO	Course Outcomes	Bloom's Level	Bloom's Description
CO1	Demonstrate precautions and safety norms followed in the machine shop and exhibit interpersonal skills for team work.	L3	Apply
CO2	Read working drawings, understand operational symbols, select cutting parameters and tooling, and execute machining operations.	L3	Apply
CO3	Understand the construction, working, and operation of various conventional machine tools, and the accessories and attachments used.	L2	Understand
CO4	Perform a wide range of machining operations including turning, threading, shaping, keyway cutting, indexing, and gear cutting while estimating cutting times, and understand the significance of grinding and super finishing operations.	L3	Apply
CO5	Prepare programs, demonstrate, simulate, and operate CNC machines for various machining operations.	L6	Create

Suggested Experiments

1. One job involving plain turning, taper turning, step turning, thread cutting, facing, knurling, drilling, boring, internal thread cutting, and eccentric turning on a lathe machine. Exercises should include selection of cutting parameters and cutting time estimation.
2. One job involving cutting gear teeth or a hexagonal nut using a milling machine and cutting a V groove, dovetail, or rectangular groove using a shaper. Exercises should include selection of cutting parameters and cutting time estimation.
3. One group job using a cylindrical grinding machine. Exercises should include selection of cutting parameters and cutting time estimation.
4. One job involving programming, simulation, and fabrication of a component on a CNC turning center.

Books Recommended

Reference Books:

1. W. A. J. Chapman, *Workshop Technology Vol I & II*
2. Hazra Choudhary, *Workshop Technology Vol. I & II*

Evaluation Scheme

The distribution of marks shall be as follows:

Continuous Assessment (A):

Term work shall consist of a minimum of 4 experiments.

1. Performance in Experiments: 30 Marks
2. Journal Submission: 10 Marks
3. Viva-voce: 10 Marks

End Semester Examination (C):

Practical examination will be based on the entire syllabus including, the practicals performed during Laboratory sessions.

The final certification and acceptance of the laboratory journal/manual/report will be subject to satisfactory performance in laboratory work and fulfillment of the minimum passing criteria in the teacher assessment.

Semester Project-I

(RCP23IPSC301)

Practical Scheme
Practical: 02 Hrs./week
Credit : 01

Examination Scheme
Teacher Assessment : 25 Marks
End Sem Exam: 25 Marks

Course Outcomes:

Students are expected to design, simulate/implement a project based on the knowledge acquired from current semester subjects.

Course Outcomes:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Conduct a survey of several available literatures in the preferred field of study.	L4	Analyze
CO2	Demonstrate various/alternate approaches to complete a project.	L2	Understand
CO3	Ensure a collaborative project environment by interacting and dividing project work among team members.	L3	Apply
CO4	Present their project work in the form of a technical report/paper and thereby improve technical communication skills.	L3	Apply
CO5	Demonstrate the ability to work in teams and manage the conduct of the research study.	L2	Understand

Semester Project:

The purpose of introducing a semester project at the second-year level is to provide exposure to students with a variety of projects based on the knowledge acquired from the semester subjects. This activity is supposed to enrich their academic experience and bring enough maturity to the student while selecting the project. Students should take this as an opportunity to develop skills in implementation, presentation, and discussion of technical ideas/topics. Therefore, proper attention shall be paid to the content of the semester project report, which is being submitted in partial fulfillment of the requirements of the Second Year, and it is imperative that a standard format be prescribed for the report.

Each student shall work on a project approved by the departmental committee approved by the Head of the Department. A group of 3 to 5 students (maximum allowed: 5 students in extraordinary cases, subject to the approval of the department committee and the Head of the department) shall be allotted for each Semester Project. Each group shall submit at least 3 topics for the Semester Project. The departmental committee shall finalize one topic for every group. The Semester Project Title or Theme should be based on the knowledge acquired during the semester. The project work shall involve sufficient work so that students get acquainted with different aspects of knowledge acquired from semester subjects.

Student is expected to:

- Select an appropriate project title based on acquired knowledge from current semester subjects.
- Maintain a Log Book of weekly work done (Log Book Format will be as per Table 1).
- Report weekly to the project guide along with the log book.

Table 1: Log Book Format

Sr	Week (Start Date:End Date)	Work Done	Sign of Guide	Sign of Coordinator
1				

Assessment Criteria:

- At the end of the semester, after confirmation by the project guide, each project group will submit a project completion report in the prescribed format for assessment to the departmental committee (including project guide).
- Assessment of the project (at the end of the semester) will be done by the departmental committee (including project guide).

Prescribed project report guidelines:
The size of the report shall be a minimum of 25 pages. The Project Report should include appropriate content for:

- Introduction
- Literature Survey
- Related Theory
- Implementation details
- Project Outcomes
- Conclusion
- References

Assessment criteria for the departmental committee (including project guide) for Continuous Assessment:
Guide will monitor weekly progress, and marks allocation will be as per Table 2.
Assessment criteria for the departmental committee (including project guide) for End

Table 2: Continuous Assessment table

Sr	PRN	Name of Student	Student Attendance	Log Book Maintain	Literature Review	Depth of Understanding	Report	Total
			5	5	5	5	5	25

Table 3: Evalution Table

Sr	PRN	Name of Student	Project Selection	Design/ Simulation	model/ programming	Result Verification	Presentation	Total
			5	5	5	5	5	25

Semester Exam:
The departmental committee (including project guide) will evaluate the project as per Table 3.

Each group shall present/publish a paper based on the semester project in reputed/peer-reviewed Conference/Journal/TechFest/Magazine before the end of the semester.

Community Engagement Service

(RCP23ILELX05)

Teaching Scheme
Practical : 02 Hrs./week
Credit : 01

Examination Scheme
Term Work: 25 Marks

Pre-requisite:

1. Fundamentals of core branch
2. Communication Skills

Course Objectives

1. To sensitize the student / learner to recognize community-level problems and challenges and engage in activities to solve them.

Course Outcomes

CO	Course Outcomes	Bloom's Level	Bloom's Description
CO1	Applies knowledge understandings acquired from one's academic study/field/discipline for community-level education, information dissemination by participation and engagement in community welfare activities.	L3	Apply
CO2	Identify and experience commitment for community engagement activities that reinforce a sense of belongingness and gratitude towards societal causes.	L5	Evaluate
CO3	Witness diversity in communities and cultures and demonstrate a change in approach/attitude as evidence of unconditional acceptance.	L3	Apply
CO4	Recognize, experience, and value the effectiveness of working in a team, demonstrating the co-existence of roles - sincere worker and effective leader.	L3	Apply

Description of Activities

Unit-I

Open Activities

- Participation in: blood donation camps organizer / donor, day-long tree plantation or afforestation / seed dispersal / cleanliness (water bodies, surrounding etc.) drives.
- Literacy drives for children / youth / adults. One day hand holding activities in work-shop conduct for under privilege kids in the areas of – basic science, math, technical skill demonstration and building..

Unit-II

Technical (Program core related)

- Cyber-crime, security awareness and vulnerabilities – sensitization, information dissemination and awareness sessions in indicated focus areas.
- Promotion and Sensitization for Sustainable living – focusing on solar power, water recycling, e-waste responsible disposal, waste recycling etc. in indicated focus areas.
- Focus areas: residential societies, schools, under-privileged areas, governments /private offices, and similar other establishments.

OR

Unit-II

Field Survey

- Reporting on proactively conducted survey in the areas of resource management for – water, vegetables, electricity, crops etc.

Activities to be performed

Among the listed activities students are expected to complete one open activity mandatorily, and one technical (program core) OR field survey activity. The activities mentioned are exemplary in nature and any other additional activity of similar nature too can be undertaken by the learners, provided it is approved and endorsed by the faculty mentor / head of the department.

Suggested Activities

1 Undertaking cyber safety / security awareness sensitization drive / program especially for uninitiated students / individuals in schools / colleges / residential complex / offices etc. Typical suggested tabulation.

Participant No.	**Name**	**Age**	**School/ College/ Residence/ Office**	**Email**	**Contact Number**	**Awareness Level**	**Remarks**

2 Energy / Power assessment for establishments (societies, schools, colleges, residential complex, shops etc.) involving computing power devices ratings, power consumption over operating period, calculating energy cost from tariff card / rates for every group of appliances / devices or equipment. Typical suggested tabulation pattern.

Device/ Appliance Group	**Number of Appliances / Devices**	**Power Rating (kW)**	**Operating Hours (h/day)**	**Energy Consumption (kWh/day)**	**Tariff Rate (Rs. / kWh)**	**Energy Cost (Rs.)**
Lighting Fixtures						
Ceiling Fans						
Air Conditioner						
Security Systems						
Water Pump						

3 Traffic light monitoring viz-e-viz average traffic density on road. Analysing the data and commenting on results. Evaluating and comparing impact on road repairs related lane blockage and proportional recommendation for lights timing variations. Typical suggested tabulation pattern.

Sr. No.	**Timestamp**	**Traffic Density**	**Traffic Light Status**	**Road Repair Status**	**Remarks**
1					
2					

4 Help compute green footprint of select number of household (per member) - say 10 houses of 3+ members. This is for evaluating dependence upon non green energy sources and habits and changes in lifestyle for attempts at their reductions. Learners are encouraged to use typically available online carbon-footprint calculators. The table herewith maybe used for reference calculations.

House No.	Household Name	Number of Members	Energy Usage (kWh)	Water Usage (liters)	Waste Production (kg)	Transportation Habits	Green Footprint
1							
2							

5 Compulsion of having a borewell for non-potable water supply in city residential complexes is a modern-day rule. Increased pace of re-development, as well as number of occupants in given area, has resulted in increased number of borewells being dug within and outside city limits. Reduced yield, quality and quantity of water adds to the recurring maintenance cost of borewells, especially in the city areas. Poor water recharge systems along-with depleting open soil cover area in wake of wall-to-wall of concrete carpet aggravate the problem. Study, analyse and report a residential society's – capacity of water requirement, present day borewells in action, approximate yield, maintenance cost and frequency, borewell flushing iterations in wake of re-development in neighborhood. A typical tabulation mechanism for inferences can be as below:

Borewell No.	Location	Depth (ft)	Yield (Liters/ Day)	Water Quality	Maintenance Cost (Rs.)	Remarks
1						
2						

6 Detection of Adulteration in food / fruits / vegetables / milk / mava /saffron etc. or contamination of potable drinking water.
Ex. Adulteration in fruits could be apple waxing, injecting chemicals in watermelon, pomegranate etc. to give it a bright red color, artificial ripening of mangos etc.
For a given activity, samples from more than one area, specifically from mofussil /interiors / 'gaothans' etc, may be obtained, to evaluate sample purity or extent of adulteration. Learners are encouraged to use online resources provided by 'Food Safety and Standards Authority of India' (fssai), for handholding in requisite procedures.
YouTube link:
Food Safety and Standards Authority of India: goo.gl/Y8Lzbu
Ex. 1 Milk Adulteration: https://www.youtube.com/watch?v=pbnmeRUBxKk
Ex.2 Watermelon Adulteration: https://www.youtube.com/watch?v=yrLAj7oJies

Product	Adulterant	Testing Method	Result	Remarks

Evaluation Scheme

Continuous Assessment (A):

1 Open-Ended Activity (10 marks)

2 Technical Activity OR Field Survey Activity (15 marks)

Rubric for Open Ended Activity (10 marks)

- Participation certificate/proof

Rubric for Technical Activity (15 marks)

- Pre-requisite documents (permission letter, presentation material, permission letters, etc.) [5 marks]
- Participant Feedback [5 marks]
- Participant Attendance [5 marks]

OR

Rubric for Field Survey Activity (15 marks)

- Topic selection [3 marks]
- Survey preparation [3 marks]
- Field work [3 marks]
- Analysis [3 marks]
- Report writing [3 marks]

Certificates and Formats

Activity Endorsement Certificate

Date: _____

Community engagement service is a mandatory course, of two credits, introduced at second year of engineering under the autonomous structure of the institute.

Course Objective: To sensitise the student / learner into recognising social problems & challenges and give them an opportunity to engage in activities for solving the same.

Course Outcomes:

(a) **Knowledge application:** Applies knowledge understandings acquired from one's academic study/ field/ discipline for community level education, information dissemination by participation and engagement in community welfare activities.

(b) **Commitment for cause:** Identify and experience commitment for community engagement activities that reinforce sense of belongingness and gratitude towards societal cause.

(c) **Diversity:** Witness diversity in communities and cultures and demonstrate change in approach / attitude as an evidence of unconditional acceptance.

(d) **Team:** Recognise, experience and value effectiveness of working in a team, demonstrating co-existence of the roles - sincere worker and effective leader.

This is to certify that Mr./Ms. _____ bearing PRN _____ is a student of S.Y. B.Tech., _____ branch of engineering. He / She is a bonafide student of SES's R. C. Patel Institute of Technology, Shirpur. He / She is reliable, sincere, hardworking and capable of conducting _____ activity in your premises. We request you to kindly allow for the conduction of the activity and we also solicit your earnest co-operation in the same.

Signature

Community Service Disclaimer Form

Name of Department Head: _____

Disclaimer

(This form must be read, signed, and submitted prior to the beginning of the community service activity.)

Student Details

Name: _____
PRN: _____
Program: _____
Class/Div: _____
Date: _____
Time: _____
Address: _____

Activity Details

Activity: _____
Program: _____

I, the undersigned _____ accept the following terms and conditions unconditionally:

(a) I accept and understand that the community activity identification and selection has been done willingly by me.

(b) I undertake to convey that I am apparently in good health and well-being, and suffer no physical impairment that would or should prevent my participation in the activity.

(c) I undertake to bear all related expenses and risk of travel related to the activity and shall not hold any personnel from the institute responsible with regards to claims and/or loss in the process of conduct of activity.

(d) I undertake that my parents or legal/local guardians are aware of said activity and agree to above mentioned terms and conditions.

Student's name & signature: _____
Parent or Guardian's name & signature: _____

Guidelines for Assessment of the work

- The review/progress monitoring committee shall be constituted by the Head of the Department. The progress of selected/assigned activities is to be evaluated on a continuous basis, holding at least one review in the semester.

- In the continuous assessment, focus shall also be on each individual student's contribution to the team activity, their understanding and involvement as well as responses to the questions being raised at all points in time.

- Each group needs to submit the following forms to the respective supervisor after conducting both activities:
  - Activity Conduction Report
  - Participant Feedback (online/offline)
  - Participant Attendance (online/offline)
  - Survey Report
  - Participation certification

Activity Conduction Report

Name of the Activity	
Date of Activity	
Activity Type	**(Open / Technical)**
Activity Objectives	
Place of Activity	
PRN and Names of Students	
Name of the Association	
Activity Description	
No. of Participants	
Photos (Geo tagged)	

Participant Feedback

Indicators	**Scale: 1 (Lowest) to 5 (Highest)**
The objectives of the training were clearly defined.	
The content was organized and easy to follow.	
This training experience will be useful to me.	
The trainer was knowledgeable about the training topics.	
The training objectives were met.	

Numerical and Statistical Techniques (RCP23MCPC401)

Teaching Scheme	**Examination Scheme**
Lectures: 02 Hr/week	Term Test : 15 Marks
Tutorial: 00 Hr/week	Teacher Assessment : 25 Marks
Credit : 02	End Sem Exam : 60 Marks

Prerequisites:

1. Basics of Probability.
2. Mathematics I and Mathematics II.
3. Mathematics for Mechanical Engineering.

Course Objectives

1. To apply differential equations to solve the applications in the domain of design, thermal, fluid mechanics, structural, etc.
2. To interpret statistical measures for quantitative data.
3. To develop regression models and predict the system's behavior for the experimental and field failure data.
4. To apply the laws of probability and probability distributions for modeling and analyzing the data.
5. To understand uncertain occurrences in data in a logical manner.

Course Outcomes:

On completion of the course, the learner will be able to:

CO	Course Outcomes	Bloom's Level	Bloom's Description
CO1	Analyze the statistical data using the concepts of correlation and regression.	L4	Analyze
CO2	Solve partial differential equations by applying numerical methods.	L3	Apply
CO3	Apply the theoretical discrete and continuous probability distributions in the relevant application areas.	L3	Apply
CO4	Examine data using different hypothesis tests and make conclusions about acceptance and rejections of sample data.	L4	Analyze
CO5	Apply the Chi-Square test to assess relationships between variables and interpret the significance of the results in real-world contexts. Analyze the variances of multiple variables simultaneously.	L5	Evaluate

Course Contents

Unit-I 07 Hrs.

Regression Analysis and Partial Differential Equations [PDE]

Regression Analysis:
Statistical diagram: scattered diagram. Correlation: Karl Pearson's Coefficient of correlation and its mathematical properties, Spearman's Rank correlation and its interpretations. The measure of association between two variables. Linear Regression.
Partial Differential Equations [PDE]:
Bender-Schmidt Method and Crank- Nicolson method.

Unit-II 09 Hrs.

Probability:

Probability:
Discrete and Continuous random variables, Probability mass and density function, Probability distribution for random variables, Expected value, and Variance.
Probability distributions:
Discrete – Binomial, Poisson. Continuous - Normal.

Unit-III 06 Hrs.

Test of Hypotheses and significance for large , small samples

Test of Hypotheses:
Sampling distribution: Test of Hypothesis. Level of significance, critical region. One-tailed and two-tailed tests. Interval Estimation of population parameters. Large and small samples.
Test of significance for large samples:
Test for significance of the difference between samples mean and population means, Test for significance of the difference between the means of two samples.
Test of significance of small samples:
Student's t-distribution and its properties, Test for significance of the difference between samples mean and population means, Test for significance of the difference between the means of two Samples, paired t-test.

Unit-IV 04 Hrs.

Chi Square Distribution and Analysis of Variance

Chi Square Distribution:
Chi-square test, Test for the Goodness of fit, Association of attributes.
Analysis of Variance (F-Test):
One-Way classification, Two-way classification (short-cut method).

Books Recommended

Textbooks:

1 B. S. Grewal, 'Numerical Methods in Engineering and Science', Khanna Publication, 2018.

2 B. S. Grewal, 'Higher Engineering Mathematics', Khanna Publication, 2012.

Reference Books:

1 Erwin Kreyszig, 'Advanced Engineering Mathematics', Wiley India, 2010.

2 Joe D. Hoffman, and Steven Frankel, 'Numerical Methods for Engineers and Scientists', CRC Press, 2018.

3 Sheldon M. Ross, 'Introduction to Probability and Statistics for Engineers and Scientists', 5e, by Elsevier Academic Press, 2014.

4 S. C. Gupta, V. K. Kapoor, 'Fundamentals of Mathematical Statistics', Sultan Chand Sons –2020.

5 P. Kandasamy, K. Thilagavathy, and K. Gunavathi, 'Numerical methods', S Chand and Company, 2006.

Web References:

1 Numerical Methods for Engineers (https://nptel.ac.in/courses/127106019)

2 Applied Numerical Methods (https://nptel.ac.in/courses/112104318)

3 Probability and Statistics (https://nptel.ac.in/courses/111105041).

Evaluation Scheme

Continuous Assessment (A): Subject teacher will declare Teacher Assessment criteria at the start of the semester.

Continuous Assessment (B): Two term tests of 15 marks each (1 hour duration) will be conducted, with the average score considered for final grading.

End Semester Examination (C): The question paper, based on the entire syllabus, will carry 60 marks with a total duration of 2 hours.

Numerical and Statistical Techniques Laboratory (RCP23MLPC401)

Teaching Scheme	**Examination Scheme**
Practical : 02 Hrs./week	Teacher Assessment: 25 Marks
Credit : 01	End Sem Exam : 00 Marks

Prerequisites:

1. Basics of Probability.
2. Mathematics I and Mathematics II.
3. Mathematics for Mechanical Engineering.

Course Objectives

1. To apply differential equations to solve the applications in the domain of design, thermal, fluid mechanics, structural, etc.
2. To interpret statistical measures for quantitative data.
3. To develop regression models and predict the system's behavior for the experimental and field failure data.
4. To apply the laws of probability and probability distributions for modeling and analyzing the data.
5. To understand uncertain occurrences in data in a logical manner.

Course Outcomes:

On completion of the course, the learner will be able to:

CO	Course Outcomes	Bloom's Level	Bloom's Description
CO1	Analyze the statistical data using the concepts of correlation and regression.	L4	Analyze
CO2	Solve partial differential equations by applying numerical methods.	L3	Apply
CO3	Apply the theoretical discrete and continuous probability distributions in the relevant application areas.	L3	Apply
CO4	Examine data using different hypothesis tests and make conclusions about acceptance and rejections of sample data.	L4	Analyze
CO5	Apply the Chi-Square test to assess relationships between variables and interpret the significance of the results in real-world contexts. Analyze the variances of multiple variables simultaneously.	L5	Evaluate

Suggested Experiments

1 Develop a program to compute the correlation coefficient and analyse the relationship between two variables.

2 Generate a program to perform linear regression, determine the regression line equation, and analyse the fit.

3 Write a program to numerically solve PDEs using the explicit Bender-Schmidt method for heat conduction problems.

4 Develop a program to solve PDEs using the implicit Crank-Nicolson method for time-dependent problems.

5 Create a program to compute the expected value and variance for a given set of data or probability distribution.

6 Design a program to generate and analyse binomial or Poisson distributions for various parameters.

7 Write a program to generate and analyse normal distribution curves with specified mean and variance.

8 Write a program to perform a Z-test for large sample hypothesis testing and interpret the results.

9 Develop a program to conduct t-tests for comparing sample means under different conditions and draw conclusions.

10 Create a program to apply the chi-square test for goodness of fit or independence and analyse the findings.

11 Implement a program to carry out ANOVA for comparing multiple samples means and determine statistical significance.

A minimum of 8 experiments from the above-suggested list or any other experiment based on the syllabus will be included, which would help the learner to apply the concept learned.
Experiments should be performed using suitable software package/ programming language whenever required.

Books Recommended

Textbooks:

1 B. S. Grewal, 'Numerical Methods in Engineering and Science', Khanna Publication, 2018.

2 B. S. Grewal, 'Higher Engineering Mathematics', Khanna Publication, 2012.

Reference Books:

1 Erwin Kreyszig, 'Advanced Engineering Mathematics', Wiley India, 2010.

2 Joe D. Hoffman, and Steven Frankel, 'Numerical Methods for Engineers and Scientists', CRC Press, 2018.

3 Sheldon M. Ross, 'Introduction to Probability and Statistics for Engineers and Scientists', 5e, by Elsevier Academic Press, 2014.

4 S. C. Gupta, V. K. Kapoor, 'Fundamentals of Mathematical Statistics', Sultan Chand Sons –2020.

5 P. Kandasamy, K. Thilagavathy, and K. Gunavathi, 'Numerical methods', S Chand and Company, 2006.

Web References:

1 Numerical Methods for Engineers (https://nptel.ac.in/courses/127106019)

2 Applied Numerical Methods (https://nptel.ac.in/courses/112104318)

3 Probability and Statistics (https://nptel.ac.in/courses/111105041).

Evaluation Scheme

The distribution of marks shall be as follows:

Continuous Assessment (A):

1. Performance in Experiments: 05 Marks
2. Journal Submission: 05 Marks
3. Viva-voce: 05 Marks
4. Subject Specific Lab Assignment/Case Study/ Mini project: 10 Marks

Mechanics of Materials
(RCP23MCPC402)

Teaching Scheme	**Examination Scheme**
Lectures: 03 Hr/week	Term Test : 15 Marks
Tutorial: 00 Hr/week	Teacher Assessment : 25 Marks
Credit : 03	End Sem Exam : 60 Marks

Prerequisites:

1. Basic knowledge of Engineering Mechanics.
2. Basic knowledge of types of loads, free body diagram and beams.

Course Objectives

1. To gain knowledge of different types of stresses, strains and deformations induced in the mechanical components due to external loads.
2. To study the distribution of various stresses in the mechanical elements that deform under loads.
3. To study the effect of component dimensions and properties of materials due to stresses and deformations.

Course Outcomes:

On completion of the course, the learner will be able to:

CO	Course Outcomes	Bloom's Level	Bloom's Description
CO1	Evaluate stresses, strains, deformation and properties of materials in mechanical components/ structures.	L5	Evaluate
CO2	Draw SFD and BMD for different types of loads and support conditions for a beam.	L3	Apply
CO3	Compute and plot direct, bending and shear stresses across sections of given beam.	L3	Apply
CO4	Compute torsional shear stresses and strain energy in mechanical components.	L3	Apply
CO5	Compute deflections and slopes in beams and analyze buckling phenomenon in columns and struts.	L4	Analyze

Course Contents

Unit-I 10 Hrs.

Stress and Strain:

Stress and Strain:
Definition, Simple stress-strain, uni-axial, bi-axial and tri-axial stresses, tensile stress, compressive stress and shear stresses, elastic limit, Hooke's law, deformation due to self-weight, bars of varying sections, composite sections, deformation of tapering members, Thermal Stresses. Theories of failures.
Elastic Constants and their relations:
Poisson's ratio, Modulus of elasticity, Modulus of rigidity, Bulk modulus, yield stress, ultimate stress. Factor of safety, state of simple shear, relation between elastic constants, Volumetric strain for tri-axial loading.
Principal stresses and Strains:
Principal plane and principal stresses, analytical and graphical method (Mohr's circle) for determining of stresses on oblique section.

Unit-II 06 Hrs.

Shear Force and Bending Moment in Beams

Shear Force and Bending Moment in Beams:
Axial force, shear force and bending moment diagrams for statically determinate beams (excluding beams with internal hinges), relationship between rates of loading, shear force and bending moment.
Moment of Inertia:
Area Moment of Inertia, Parallel axis theorem, Polar moment of inertia, Principal axes, Principal moment of inertia.

Unit-III 07 Hrs.

Bending and shear stresses:

Bending stresses:
Theory of pure Bending, Assumptions, Flexural formula for straight beams, moment of resistance, bending stress distribution, Section modulus, beams of uniform strength.
Direct & Bending Stresses:
Combined stresses, Eccentricity, Stress distribution, Core /kernel of Section.
Shear Stresses:
Distribution of shear stresses for the section of beam.

Unit-IV 08 Hrs.

Torsion and Strain Energy

Torsion:
Torsion of circular shafts-solid and hollow, stresses in shafts when transmitting power, shafts in series and parallel.
Strain Energy:
Resilience, Proof Resilience, strain energy stored in the member due to gradually applies load, suddenly applied load, impact load. Strain energy stored due to Shear, Bending and Torsion.

Unit-V 08 Hrs.

Deflection of Beams, Columns and Struts

Deflection of Beams:
Deflection of Cantilever, simply supported and over hanging beams using Macaulay's or double integration method for different type of loadings.
Columns and Struts:
Buckling load, crushing load, Types of end conditions for column, Euler's column theory and its limitations, Rankine- Gordon Formula.

Books Recommended

Textbooks:

1 S. Ramamrutham, Strength of Materials, Dhanpat Rai Pvt. Ltd.

2 S.S.Ratan, Mechanics of Materials, Tata McGraw Hill Pvt. Ltd.

3 R. Subramanian, Strength of Materials, Oxford University Press, Third Edition 2016.

Reference Books:

1 Ryder, Strength of Materials , Macmillan.

2 James M. Gere and Barry J. Goodno, Mechanics of Materials , Cengage Learning.

3 Gere and Timoshenko, Mechanics of Materials, CBS.

4 Basavrajaiah and Mahadevappa, Strength of Materials, Khanna Publishers,New Delhi.

5 Timoshenko and Youngs, Elements of Strength of Materials, Affiliated East -West Press.

6 Beer, Jhonston, DEwolf and Mazurek, Mechanics of Materials , TMH Pvt Ltd., New Delhi.

7 S.B. Junnarkar, Mechanics of Structures, Charotar Publication.

8 Shames, Introduction to Solid Mechanics by, PHI.

9 Nag and Chandra, Strength of Materials by, Wiley India.

10 W.Nash, Strength of Materials, Schaum's Outline Series, McGraw Hill Publication.

Evaluation Scheme

Continuous Assessment (A): Subject teacher will declare Teacher Assessment criteria at the start of the semester.

Continuous Assessment (B): Two term tests of 15 marks each (1 hour duration) will be conducted, with the average score considered for final grading.

End Semester Examination (C): The question paper, based on the entire syllabus, will carry 60 marks with a total duration of 2 hours.

Mechanics of Materials Laboratory

(RCP23MLPC402)

Teaching Scheme	**Examination Scheme**
Practical : 02 Hrs./week	Teacher Assessment: 25 Marks
Credit : 01	End Sem Exam : 25 Marks

Prerequisites:

1. Basic knowledge of Engineering Mechanics.
2. Basic knowledge of types of loads, free body diagram and beams.

Course Objectives

1. To gain knowledge of different types of stresses, strains and deformations induced in the mechanical components due to external loads.
2. To study the distribution of various stresses in the mechanical elements that deform under loads.
3. To study the effect of component dimensions and properties of materials due to stresses and deformations.

Course Outcomes:

On completion of the course, the learner will be able to:

CO	Course Outcomes	Bloom's Level	Bloom's Description
CO1	Evaluate stresses, strains, deformation and properties of materials in mechanical components/ structures.	L5	Evaluate
CO2	Draw SFD and BMD for different types of loads and support conditions for a beam.	L3	Apply
CO3	Compute and plot direct, bending and shear stresses across sections of given beam.	L3	Apply
CO4	Compute torsional shear stresses and strain energy in mechanical components.	L3	Apply
CO5	Compute deflections and slopes in beams and analyze buckling phenomenon in columns and struts.	L4	Analyze

Suggested Experiments

1 Tension test on mild steel bar (stress-strain behavior, determination of yield strength and modulus of elasticity) using a Universal Testing Machine (UTM).

2 Impact test on the metal specimen (Izod test/ Charpy test).

3 Hardness test on metals – (Brinell Hardness Number / Rockwell Hardness Number).

4 Flexural test on beam (central loading).

5 Flexural test on beam (two point loading).

6 Torsion test on mild steel bar / cast iron bar.

The above tests are conducts as per the ASTM standard.
Minimum 5 experiments from the above suggested list or any other experiment based on syllabus and minimum 5 assignments based on syllabus will be conducted or Mini project relevant to the subject will be included, which would help the learner to apply the concept learnt.

Books Recommended

Textbooks:

1 S. Ramamrutham, Strength of Materials, Dhanpat Rai Pvt. Ltd.

2 S.S.Ratan, Mechanics of Materials, Tata McGraw Hill Pvt. Ltd.

3 R. Subramanian, Strength of Materials, Oxford University Press, Third Edition 2016.

Reference Books:

1 Ryder, Strength of Materials , Macmillan.

2 James M. Gere and Barry J. Goodno, Mechanics of Materials , Cengage Learning.

3 Gere and Timoshenko, Mechanics of Materials, CBS.

4 Basavrajaiah and Mahadevappa, Strength of Materials, Khanna Publishers,New Delhi.

5 Timoshenko and Youngs, Elements of Strength of Materials, Affiliated East -West Press.

6 Beer, Jhonston, DEwolf and Mazurek, Mechanics of Materials , TMH Pvt Ltd., New Delhi.

7 S.B. Junnarkar, Mechanics of Structures, Charotar Publication.

8 Shames, Introduction to Solid Mechanics by, PHI.

9 Nag and Chandra, Strength of Materials by, Wiley India.

10 W.Nash, Strength of Materials, Schaum's Outline Series, McGraw Hill Publication.

Evaluation Scheme

The distribution of marks shall be as follows:

Continuous Assessment (A):

1. Performance in Experiments: 05 Marks
2. Journal Submission: 05 Marks
3. Viva-voce: 05 Marks
4. Subject Specific Lab Assignment/Case Study/ Mini project: 10 Marks

Advanced Manufacturing Processes (RCP23MCPC403)

Teaching Scheme	**Examination Scheme**
Lectures: 03 Hr/week	Term Test : 15 Marks
Tutorial: 00 Hr/week	Teacher Assessment : 25 Marks
Credit : 03	End Sem Exam : 60 Marks

Prerequisites:

1. Knowledge of fundamental machining techniques and various manufacturing processes.

Course Objectives:

1. To familiarize the students with unconventional modern machine tools manufacturing practices.
2. To familiarize oneself with various micro manufacturing techniques like Meso, Micro and Nano manufacturing.
3. To acquaint the knowledge of additive manufacturing processes, and its capabilities in the modern digital manufacturing industry.

Course Outcomes:

On completion of the course, the learner will be able to:

CO	Course Outcomes	Bloom's Level	Bloom's Description
CO1	Illustrate the fundamentals of various non-conventional machining processes, highlighting their capabilities and areas of application.	L2	Understand
CO2	Understand the operation of MEMS micro devices and microsystems, including their applications and manufacturing processes, such as bulk and surface micromachining techniques.	L2	Understand
CO3	Gain insights into micro machining techniques as well as the challenges and methods involved in MEMS packaging.	L2	Understand
CO4	Understand the principles of various nano-finishing techniques essential for enhancing surface quality and achieving ultra-smooth surfaces at the nanoscale level.	L2	Understand
CO5	Review the differences between traditional and additive manufacturing techniques, while understanding the fundamental principles of various additive manufacturing (AM) technologies, including solid-based, liquid-based, and powder-based techniques.	L3	Analyze

Course Contents

Unit-I 08 Hrs.

Unconventional Machining:

Unconventional machining processes:
Classification of the Non-traditional machining process. Basic principles, machines, advantage, disadvantages, and applications of water jet machining (WJM), Abrasive jet machining (AJM), abrasive water jet machining (AWJM), ultrasonic machining (USM), electrical discharge machining (EDM), chemical machining (CHM), electrochemical machining (ECM), laser beam machining (LBM), plasma arc machining (PAM), electron beam machining (EBM).
Introduction to Hybrid machining

Unit-II 09 Hrs.

MEMS Fabrication

MEMS Introduction:
Intrinsic Characteristics of MEMS, Components of MEMS, Applications of MEMS and Microsystems, Overview of Commonly Used Mechanical Structures in MEMS (Beams, Cantilevers, Plates, Diaphragms), and Typical Applications.
MEMS Fabrication Technology
Challenges in Meso, Micro and Nano manufacturing, Overview about micro fabrication methods: Chemical vapour deposition (CVD); physical vapour deposition (PVD), optical and electron beam lithography; dry and wet etching.

Unit-III 06 Hrs.

Micro Machining

Micro Machining
Mechanics of micro machining, difference between micro and macro machining Micro turning, Micro Milling, Micro grinding.
MEMS packaging challenges, MEMS packaging process.

Unit-IV 06 Hrs.

Nano Finishing Techniques

Abrasive Flow Machining (AFM), Magnetic Abrasive Finishing (MAF), Magneto Rheological Finishing (MRF), Magneto Rheological Abrasive Flow Finishing (MRAFF), Magnetic Float Polishing (MFP), Elastic Emission Machining (EEM), Chemical Mechanical Polishing (CMP).

Unit-V 10 Hrs.

Additive Manufacturing (AM)

Introduction to Additive Manufacturing (AM):
History of AM, traditional manufacturing v/s additive manufacturing, discussion on various materials used in AM, role of solidification rate in AM, and the influence of grain structure and microstructure in AM.
Extrusion based AM processes:
Fused deposition modelling (FDM), history of FDM, basic principles, material requirements, benefits and limitations, and post-processing. Powder Bed Fusion AM Process: Selective laser sintering (SLS): process workflow and material requirements, powder fusion mechanism, polymer ageing and recycling. Vat Polymerization AM process: Stereo lithography apparatus (SLA), history of SLA, material requirements, workflow, scan patterns, applications, benefits and limitations.

Books Recommended

Reference Books:

1 Jain V. K, "Advanced Machining Processes", 12th reprint, Allied Publishers Ltd, 2010.

2 Hassan Abde, Gabad El Hoffy, "Advanced Machining Processes", McGraw Hill, 2005.

3 Tai-Ran Hsu, "MEMS and Microsystems: Design, Manufacture, and Nanoscale Engineering", Wiley publications, 2020.

4 Jain V. K, "Introduction to Micromachining", Narosa Publishing House, 2010.

5 Mark J. Jackson, "Micro and Nano-manufacturing", McGraw Hill publications, 2015.

6 N.P.Mahik, "Micro Manufacturing and Nanotechnology", Springer, 2006.

7 M.J.Madou , "Fundamentals of microfabrication and nanotechnology Volume –II",3rd edition,CRC Press, 2011.

8 Waqar Ahmed, Mark J. Jackson, "Emerging Nanotechnologies for Manufacturing",2nd Edition, Elsevier, 2015.

9 Ian Gibson, David W. Rosen, Brent Stucker, "Additive manufacturing technologies: rapid prototyping to direct digital manufacturing", Springer, 2010.

10 Andreas Gebhardt, "Understanding additive manufacturing: rapid prototyping, rapid tooling, rapid manufacturing", Hanser Publishers, 2011.

11 O. P. Khanna, "A Textbook of Production Technology Vol.II.", Dhanpat Rai Publication, 2000.

Evaluation Scheme

Continuous Assessment (A): Subject teacher will declare Teacher Assessment criteria at the start of the semester.

Continuous Assessment (B): Two term tests of 15 marks each (1 hour duration) will be conducted, with the average score considered for final grading.

End Semester Examination (C): The question paper, based on the entire syllabus, will carry 60 marks with a total duration of 2 hours.

Universal Human Values
(RCP23ICHSX04)

Teaching Scheme	**Examination Scheme**
Lectures: 03 Hr/week	Term Test : 15 Marks
Tutorial: 00 Hr/week	Teacher Assessment : 25 Marks
Credit : 03	End Sem Exam : 60 Marks

Prerequisites:

1. –

Course Objectives

1. To help students distinguish between values and skills, and understand the need, basic guidelines, content and process of value education.
2. To help students initiate a process of dialog within themselves to know what they 'really want to be' in their life and profession
3. To help students understand the meaning of happiness and prosperity for a human being.
4. To facilitate the students to understand harmony at all the levels of human living, and live accordingly.
5. To facilitate the students in applying the understanding of harmony in existence in their profession and lead an ethical life

Course Outcomes:

On completion of the course, the learner will be able to:

CO	Course Outcomes	Bloom's Level	Bloom's Description
CO1	Understand the significance of value inputs in a classroom, distinguish between values and skills, understand the need, basic guidelines, content and process of value education, explore the meaning of happiness and prosperity and do a correct appraisal of the current scenario in the society.	L2	Understand
CO2	Distinguish between the Self and the Body, and understand the meaning of Harmony in the Self and the Co-existence of Self and Body.	L4	Apply
CO3	Understand the value of harmonious relationships based on trust, respect and other naturally acceptable feelings to ensure a harmonious society.	L2	Understand
CO4	Understand the harmony in nature and existence, and explore mutually fulfilling participation in the nature.	L2	Understand
CO5	Distinguish between ethical and unethical practices, and start working out the strategy to actualize a harmonious environment wherever they work.	L3	Apply

Course Contents

Unit-I 07 Hrs.

Course Introduction - Need, Basic Guidelines, Content and Process for Value Education

Understanding the need, basic guidelines, content and process for Value Education, Self-Exploration–what is it? - its content and process; 'Natural Acceptance' and Experiential Validation- as the mechanism for self-exploration, Continuous Happiness and Prosperity- A look at basic Human Aspirations, Right understanding, Relationship and Physical Facilities- the basic requirements for fulfillment of aspirations of every human being with their correct priority, Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario, Method to fulfill the above human aspirations: understanding and living in harmony at various levels.

Unit-II 08 Hrs.

Understanding Harmony in the Human Being - Harmony in Myself

Understanding human being as a co-existence of the sentient 'I' and the material 'Body', Understanding the needs of Self ('I') and 'Body'. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer), Understanding the characteristics and activities of 'I' and harmony in 'I', Understanding the harmony of I with the Body; correct appraisal of Physical needs, meaning of Prosperity in detail, Programs to ensure Self-regulation and health.

Unit-III 12 Hrs.

Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship

Understanding harmony in the Family- the basic unit of human interaction, understanding values in human-human relationship; meaning of Justice and program for its fulfillment. Trust and Respect as the foundational values of relationship, Understanding the meaning of Trust; Difference between intention and competence, Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship, Understanding the harmony in the society (society being an extension of family). Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family!

Unit-IV 06 Hrs.

Understanding Harmony in the Nature and Existence - Whole existence as Co-existence

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

Unit-V 06 Hrs.

Implications of the above Holistic Understanding of Harmony on Professional Ethics

Natural acceptance of human values, Definitiveness of Ethical Human Conduct, Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order, Competence in Professional Ethics: a) Ability to utilize the professional competence for augmenting universal human order, b) Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, technologies and management models, Case studies of typical holistic technologies, management models and production systems, Strategy for transition from the present state to Universal Human Order: a) At the level of individual: as socially and ecologically responsible engineers, technologists and managers, b) At the level of society: as mutually enriching institutions and organizations.

Books Recommended

Textbooks:

1 R R Gaur, R Sangal, G P Bagaria, 'Human Values and Professional Ethics' Excel Books, New Delhi, 2010.

Reference Books:

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

2 A.N. Tripathi, "Human Values" New Age Intl. Publishers, New Delhi, 2004.

3 The Story of Stuff (Book).

4 Mohandas Karamchand Gandhi, "The Story of My Experiments with Truth".

5 E. F Schumacher, "Small is Beautiful".

6 Cecile Andrews, "Slow is Beautiful".

7 J C Kumarappa, "Economy of Permanence".

8 Pandit Sunderlal, "Bharat Mein Angreji Raj".

9 Dharampal, "Rediscovering India".

10 Mohandas K. Gandhi, "Hind Swaraj or Indian Home Rule".

11 Maulana Abdul Kalam Azad, "India Wins Freedom".

12 Romain Rolland, "Vivekananda". (English)

13 Romain Rolland, "Gandhi". (English)

Evaluation Scheme

Continuous Assessment (A): Subject teacher will declare Teacher Assessment criteria at the start of the semester.

Continuous Assessment (B): Two term tests of 15 marks each (1 hour duration) will be conducted, with the average score considered for final grading.

End Semester Examination (C): The question paper, based on the entire syllabus, will carry 60 marks with a total duration of 2 hours.

Project Management
(RCP23OCOE401)

Teaching Scheme	**Examination Scheme**
Lectures: 03 Hr/week	Term Test : 15 Marks
Tutorial: 00 Hr/week	Teacher Assessment : 25 Marks
Credit : 03	End Sem Exam : 60 Marks

Prerequisites:

1. Basic concepts of Management.

Course Objectives :

1. To familiarize the students with the use of a structured methodology/approach for every unique project undertaken, utilizing project management concepts, tools and techniques.
2. To appraise the students with the project management life cycle and make them knowledgeable about the various phases from project initiation through closure.

Course Outcomes:

On completion of the course, the learner will be able to:

CO	Course Outcomes	Bloom's Level	Bloom's Description
CO1	Explain project management life cycle and the various project phases as well as the role of project manager.	L2	Understand
CO2	Apply selection criteria and select an appropriate project from different options.	L3	Apply
CO3	Create a work break down structure for a project and develop a schedule based on it. Manage project risk strategically.	L6	Create
CO4	Use Earned value technique and determine & predict status of the project. Capture lessons learned during project phases and document them for future reference.	L3	Apply
CO5	Differentiate between traditional waterfall approach and agile scrum methodology for software development projects.	L4	Analyze

Course Contents

Unit-I 07 Hrs.

Project Management Foundation

Definition of a project, Project Vs Operations, Necessity of project management, Triple constraints, Project life cycles (typical atypical). Project phases and stage gate process. Role of project manager, Negotiations and resolving conflicts, Introduction to project leadership, ethics in projects, Multicultural and virtual projects, Project management in various organization structures, PM knowledge areas as per Project Management Institute (PMI).

Unit-II 08 Hrs.

Initiating Projects

How to get a project started, selecting project strategically, Project selection models (Numeric /Scoring Models and Non-numeric models), Project portfolio process, Project sponsor and creating charter, Effective project team, Stages of team development growth (forming, storming, norming & performing), team dynamics.

Unit-III 08 Hrs.

Project Planning and Risk Management

Project Planning: Work Breakdown structure (WBS) and linear responsibility chart, Project cost estimation and budgeting, Top down and bottoms up budgeting, Networking and Scheduling techniques, PERT, CPM. Crashing project time Resource loading and levelling (Only Theory), Project Stakeholders and Communication plan.
Risk Management in projects: Risk management planning, Risk identification and risk register, Qualitative and quantitative risk assessment, Probability, and impact matrix. Risk response strategies for positive and negative risks.

Unit-IV 08 Hrs.

Monitoring and Controlling Projects

Monitoring and Controlling Projects: Planning monitoring and controlling cycle, Information needs and reporting, engaging with all stakeholders of the projects, communication and project meetings. Earned Value Management techniques for measuring value of work completed, using milestones for measurement, change requests and scope creep, Project audit, Project Contracting: Project procurement management, contracting and outsourcing.
Closing the Project: Customer acceptance, Reasons of project termination, Various types of project terminations (Extinction, Addition, Integration, Starvation), Process of project termination, completing a final report, doing a lessons learned analysis, acknowledging successes and failures.

Unit-V 08 Hrs.

Agile Project

Agile project management: Agile principle, Agile Manifesto, Agile process framework, Characteristics of Agile Approaches and Scrum, Benefits of Agile project management, Implementing Agile project management.
Agile Project Planning: Comparison of Agile Project Management with Traditional Waterfall Approach, Project Planning with Scrum, Scrum Artifacts Supporting Project Planning , Scrum Events for Project Planning. Scheduling with scrum, Techniques for scrum scheduling- Poker estimation.
Agile Tools for Tracking Project Progress: Task Boards, Burnup and Burndown Charts.

Books Recommended

Textbooks:

1 Project Management: A managerial approach, Jack Meredith Samuel Mantel, 11th Edition, Wiley India.

2 Project Management: The Managerial Process, 8th edition, Erik Larson, Clifford Gray, McGraw Hill Education.

3 Agile Project Management, Jim Highsmith, Pearson Education, Low Price Edition, India.

Reference Books:

1 A Guide to the Project Management Body of Knowledge (PMBOK® Guide), 7th Ed, Project Management Institute PA, USA.

2 Project Management, Gido Clements, Cengage Learning.

3 Project Management, Gopalan, Wiley India.

4 Project Management, Dennis Lock, 9th Edition, Gower Publishing England.

5 Agile Essentials You Always Wanted to Know, Kalpesh Ashar, Vibrant Publishers U.S.A.

Evaluation Scheme

Continuous Assessment (A): Subject teacher will declare Teacher Assessment criteria at the start of the semester.

Continuous Assessment (B): Two term tests of 15 marks each (1 hour duration) will be conducted, with the average score considered for final grading.

End Semester Examination (C): The question paper, based on the entire syllabus, will carry 60 marks with a total duration of 2 hours.

Cyber Security, Policies and Laws (RCP23OCOE402)

Teaching Scheme	**Examination Scheme**
Lectures: 03 Hr/week	Term Test : 15 Marks
Tutorial: 00 Hr/week	Teacher Assessment : 25 Marks
Credit : 03	End Sem Exam : 60 Marks

Prerequisites:

1. Fundamentals of Computers.

Course Objectives

1. Familiarize with the provisions and implications of the Digital Personal and Data Protection Act, the obligations of data fiduciaries, the rights and duties of data principals, and mechanisms for resolving breaches.
2. Equip individuals and organizations with the knowledge and tools to create secure cyber ecosystems, strengthen regulatory frameworks, and develop incident response plans.

Course Outcomes:

On completion of the course, the learner will be able to:

CO	Course Outcomes	Bloom's Level	Bloom's Description
CO1	Understand and describe the major types of cybercrime and navigate legal frameworks and regulations concerning digital personal and data protection.	L2	Understand
CO2	Implement strategies for cybersecurity outlined in the National Cyber Security Policy.	L3	Apply
CO3	Apply appropriate law enforcement strategies to both, prevent and control cybercrime.	L3	Apply
CO4	Comprehend regulations and strategies pertaining to AI (Artificial Intelligence) and large language models.	L2	Understand

Course Contents

Unit-I 08 Hrs.

Cyber Crime:

Definition and Origin of the Word, Cyber Crime and Information Security, who are Cyber Criminals, Classification of Cybercrimes, E-mail Spoofing, Spamming, Cyber Defamation, Internet Time Theft, Salami Attack, Salami technique Data Diddling, Forgery, Newsgroup Spam, Online Frauds, Pornographic Offenders, Email Bombing, Password Sniffing, Credit Card Frauds.

Unit-II 08 Hrs.

Cyber Offenses:

How Criminals plan them, Categories of Cyber Crimes, How Criminal Plans the Attack: Active Attacks, Passive Attacks, Social Engineering, Classification of Social Engineering, Cyber Stalking: types of Stalkers, Cyber Cafe and Cyber Crimes, Botnets, Attack Vectors, Cyber Crime and Cloud Computing.

Unit-III 08 Hrs.

Indian IT Act

Cyber Crime and Criminal Justice, Penalties, Adjudication and Appeals Under the IT Act, 2000, IT Act. 2008 and its Amendments Security aspect in Cyber-Law, The Contract Aspects in Cyber Law, The Security Aspect of Cyber Law, Security Standards: SOX, GLBA, HIPAA, NIST Cyber Security Framework (CSF).

Unit-IV 07 Hrs.

India's Digital Personal and Data Protection Act (2023)

Preliminary, Obligations of Data Fiduciary, Rights and Duties of Data Principal, Special Provisions, Data Protection Board of India, Powers, Functions and Procedure to Be Followed by Board, Appeal and Alternate Dispute Resolution, Penalties and Adjudication.

Unit-V 08 Hrs.

India's AI Regulation and Strategy

Privacy, Security and Artificial Intelligence, Differential Privacy, Security in AI. National Artificial Intelligence Strategy, Principles for Responsible AI, Information Technology (Intermediary Guidelines and Digital Media Ethics Code-2021), Draft National Data Governance Framework Policy (NDGFP), Rules against Deepfakes, Due diligence advisory for AI, AI regulations framework (June 2024).

Books Recommended

Textbooks:

1 Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by Nina Godbole, Sunit Belapur, Wiley-2011.

2 Understanding Cybersecurity Management in Decentralized Finance: Challenges, Strategies, and Trends by Gurdip Kaur, Springer-2023.

Reference Books:

1 The Information Technology Act, 2000; Bare Act- Professional Book Publishers, New Delhi.

2 Izzat Alsmadi , The NICE Cyber Security Framework: Cyber Security Intelligence and Analytics, Springer-2023.

References (Web Resources)

1. Digital Personal Data Protection Act 2023.pdf (https://www.meity.gov.in)
2. National Cyber Security Policy (draft v1) (https://www.meity.gov.in)
3. CISO Roles and Responsibilities (https://www.example.com/CISO_Roles_Responsibilities.pdf)
4. Standards (https://www.bis.gov.in)
5. AI, Machine Learning Big Data Laws Regulations — India (https://www.globallegalinsights.com)

Evaluation Scheme

Continuous Assessment (A): Subject teacher will declare Teacher Assessment criteria at the start of the semester.

Continuous Assessment (B): Two term tests of 15 marks each (1 hour duration) will be conducted, with the average score considered for final grading.

End Semester Examination (C): The question paper, based on the entire syllabus, will carry 60 marks with a total duration of 2 hours.

Advanced Operations Research
(RCP23OCOE403)

Teaching Scheme	**Examination Scheme**
Lectures: 03 Hr/week	Term Test : 15 Marks
Tutorial: 00 Hr/week	Teacher Assessment : 25 Marks
Credit : 03	End Sem Exam : 60 Marks

Prerequisites:

1. Operation Research
2. Mathematics (Calculus)

Course Objectives :

1. To develop an ability to analyse the structure and mathematical model of various complex system occurring in manufacturing system, service system, and business applications.
2. To develop knowledge of the mathematical structure of linear and nonlinear optimization models.
3. To develop an understanding of the techniques used to solve linear and nonlinear optimization models using their mathematical structure.
4. To develop an understanding of the use of modelling languages for expressing and solving optimization models.

Course Outcomes:

On completion of the course, the learner will be able to:

CO	Course Outcomes	Bloom's Level	Bloom's Description
CO1	Apply Duality theory to solve linear programming problem and analyse optimum solution.	L4	Analyze
CO2	Construct linear integer programming models and apply the O.R. algorithms and techniques to solve linear integer programming problems.	L3	Apply
CO3	Determine best satisfying solution under a varying quantity of resources and priorities of the goals.	L5	Evaluate
CO4	Set up decision models and solve nonlinear programming-unconstrained optimization problems.	L6	Create
CO5	Set up decision models and solve nonlinear programming-constrained optimization problems.	L6	Create

Course Contents

Unit-I 06 Hrs.

Dual Linear Programs

Primal, dual, and duality theory - The dual simplex method -The primal-dual algorithm-Duality applications. Post optimization problems: Sensitivity analysis.

Unit-II 06 Hrs.

Integer Programming

Pure and mixed integer programming problems, Solution of Integer programming problems – Gomory's all integer cutting plane method and mixed integer method, branch and bound method, Zero-one programming.

Unit-III 05 Hrs.

Goal Programming

Concept of Goal Programming, GP model formulations, Graphical method of GP, The simplex method of GP, Application areas of GP.

Unit-IV 11 Hrs.

Nonlinear Programming- Unconstrained optimization

Minimization and maximization of convex functions- Local Global optimum- Convergence-Speed of convergence. one-dimensional unconstrained optimization – Newton's method – Golden-section search method , multidimensional unconstrained optimization –Gradient method — steepest ascent (descent) method – Newton's method.

Unit-V 11 Hrs.

Nonlinear Programming- Constrained optimization

Constrained optimization with equality and inequality constraints. Lagrangian method - Sufficiency conditions - Kuhn-Tucker optimality conditions Rate of convergence - Engineering Applications Quadratic programming problems-convex programming problems.

Books Recommended

Textbooks:

1 Operations Research, Gupta, P. K. and Hira, D. S., S. Chand Publications, 2014.

2 Operations research: Principles and applications, Srinivasan, G., Prentice Hallof India, 2007.

3 Non-Linear Programming-A Basic Introduction, Nita H. Shah, Poonam Prakash Mishra, CRC Press, 2020.

Reference Books:

1 Introduction to Operations Research, Frederick S. Hillier Gerald J. Lieberman, McGraw-Hill: Boston MA; 8th. (International) Edition, 2005.

2 Operations Research – Principle and Practice Ravindran, Philips and Soleberg, Second Edition, John Wiley, and sons, 2007.

3 Operations Research - An Introduction: Taha, H. A., Pearson Education, 2022.

4 Operations Research: models and methods, Paul A. Jensen, Jonathan F. Bard, Wiley Publications, 2003

5 Optimization Techniques in Operation Research, C. B Gupta, I.K. International Publishing House Pvt. Limited, 2008.

Evaluation Scheme

Continuous Assessment (A): Subject teacher will declare Teacher Assessment criteria at the start of the semester.

Continuous Assessment (B): Two term tests of 15 marks each (1 hour duration) will be conducted, with the average score considered for final grading.

End Semester Examination (C): The question paper, based on the entire syllabus, will carry 60 marks with a total duration of 2 hours.

Corporate Finance Management
(RCP23OCOE404)

Teaching Scheme	**Examination Scheme**
Lectures: 03 Hr/week	Term Test : 15 Marks
Tutorial: 00 Hr/week	Teacher Assessment : 25 Marks
Credit : 03	End Sem Exam : 60 Marks

Prerequisites:

1. –

Course Objectives

1. Overview of Indian financial system, instruments and market.
2. Basic concepts of value of money, returns and risks, corporate finance, working capital and its management.
3. Knowledge about sources of finance, capital structure, dividend policy.

Course Outcomes:

On completion of the course, the learner will be able to:

CO	Course Outcomes	Bloom's Level	Bloom's Description
CO1	Understand Indian finance system.	L2	Understand
CO2	Apply concepts of time value money and risk returns to product, services and business.	L3	Apply
CO3	Understand corporate finance and working capital management.	L2	Understand
CO4	Take Investment and finance decisions.	L5	Evaluate
CO5	Take dividend decisions.	L5	Evaluate

Course Contents

Unit-I 08 Hrs.

Indian Financial System

Overview of Indian Financial System: Characteristics, Components and Functions of Financial System.
Financial Instruments: Meaning, Characteristics and Classification of Basic Financial Instruments - Equity Shares, Preference Shares, Bonds-Debentures, Certificates of Deposit, and Treasury Bills.
Financial Markets: Meaning, Characteristics and Classification of Financial Markets - Capital Market, Money Market and Foreign Currency Market.
Financial Institutions: Meaning, Characteristics and Classification of Financial Institutions - Commercial Banks, Investment-Merchant Banks and Stock Exchanges.

Unit-II 08 Hrs.

Concepts of Returns and Risks and Time Value of Money

Concepts of Returns and Risks: Measurement of Historical Returns and Expected Returns of a Single Security and a Two-security Portfolio; Measurement of Historical Risk and Expected Risk of a Single Security and a Two-security Portfolio.
Time Value of Money: Future Value of a Lump Sum, Ordinary Annuity, and Annuity Due; Present Value of a Lump Sum, Ordinary Annuity, and Annuity Due; Continuous Compounding and Continuous Discounting.

Unit-III 07 Hrs.

Overview of Corporate Finance and Working Capital Management

Overview of Corporate Finance: Objectives of Corporate Finance; Functions of Corporate Finance-investment Decision, Financing Decision, and Dividend Decision.
Working Capital Management: Concepts of Meaning Working Capital; Importance of Working Capital Management; Factors Affecting an Entity's Working Capital Needs; Estimation of Working Capital Requirements; Management of Inventories; Management of Receivables; and Management of Cash and Marketable Securities.

Unit-IV 08 Hrs.

Capital Budgeting

Meaning and Importance of Capital Budgeting; Inputs for Capital Budgeting Decisions; Investment Appraisal Criterion—Accounting Rate of Return, Payback Period, Discounted Payback Period, Net Present Value (NPV), Profitability Index, Internal Rate of Return (IRR), and Modified Internal Rate of Return (MIRR).

Unit-V 08 Hrs.

Capital Structure and Dividend Policy

Capital Structure: Factors Affecting an Entity's Capital Structure; Overview of Capital Structure Theories and Approaches — Net Income Approach, Net Operating Income Approach; Traditional Approach, and Modigliani-Miller Approach. Relation between Capital Structure and Corporate Value; Concept of Optimal Capital Structure.
Dividend Policy: Meaning and Importance of Dividend Policy; Factors Affecting an Entity's Dividend Decision; Overview of Dividend Policy Theories and Approaches — Gordon's Approach, Walter's Approach, and Modigliani- Miller Approach.

Books Recommended

Textbooks:

1 Financial Management, Theory Practice 8th Edition (2011), by Prasanna Chandra: Tata McGraw Hill Education Private Limited, New Delhi.

2 Indian Financial System, 9th Edition (2015) by M. Y. Khan; Publisher: McGraw Hill Education, New Delhi.

3 Financial Management, 11th Edition (2015) by I. M. Pandey; Publisher: S. Chand (G/L) Company Limited, New Delhi.

Reference Books:

1 Fundamentals of Financial Management, 13th Edition (2015) by Eugene F. Brigham and Joel F. Houston; Publisher: Cengage Publications, New Delhi.

2 Analysis for Financial Management, l0th Edition (2013) by Robert C. Higgins; Publishers: McGraw Hill Education, New Delhi.

Evaluation Scheme

Continuous Assessment (A): Subject teacher will declare Teacher Assessment criteria at the start of the semester.

Continuous Assessment (B): Two term tests of 15 marks each (1 hour duration) will be conducted, with the average score considered for final grading.

End Semester Examination (C): The question paper, based on the entire syllabus, will carry 60 marks with a total duration of 2 hours.

Corporate Social Responsibility
(RCP23OCOE405)

Teaching Scheme	**Examination Scheme**
Lectures: 03 Hr/week	Term Test : 15 Marks
Tutorial: 00 Hr/week	Teacher Assessment : 25 Marks
Credit : 03	End Sem Exam : 60 Marks

Prerequisites:

1. -

Course Objectives

1. To make students understand the concept, theories and application of CSR for the Development of the Society.

Course Outcomes:

On completion of the course, the learner will be able to:

CO	Course Outcomes	Bloom's Level	Bloom's Description
CO1	Analyse and critique the ethical dimensions of Corporate Social Responsibility initiatives, demonstrating a comprehensive understanding of CSR principles and their ethical underpinnings.	L4	Analyze
CO2	Understanding of the legislative frameworks shaping Corporate Social Responsibility both in India and globally, alongside recognizing the key drivers fostering CSR practices within the Indian context.	L2	Understand
CO3	Identify and discuss the significance of social responsibility and community engagement initiatives, demonstrating an understanding of their impact on both businesses and society.	L2	Understand

Course Contents

Unit-I 07 Hrs.

Introduction to Corporate Social Responsibility (CSR)

- Understanding the concept of CSR
- Historical evolution and development of CSR
- Importance and benefits of CSR for businesses and society
- Stakeholder theory and its relevance to CSR.

Unit-II 08 Hrs.

Ethical Foundations of CSR

- Ethical theories relevant to CSR (Utilitarianism, Deontology, Virtue Ethics)
- Ethical decision-making frameworks in business
- Corporate governance and ethics
- Ethical issues in supply chain management

Unit-III 08 Hrs.

CSR-Legislation in India and the World

Section 135 of Companies Act 2013.Scope for CSR Activities under Schedule VII, Appointment of Independent Directors on the Board, and Computation of Net Profit's Implementing Process in India.

Unit-IV 08 Hrs.

The Drivers of CSR in India

Market based pressure and incentives, civil society pressure, the regulatory environment in India Counter trends, Review of current trends and opportunities in CSR, Review of successful corporate initiatives and challenges of CSR. Case Studies of Major CSR Initiatives, Corporate Social Responsibility and Public-Private Partnership (PPP).

Unit-V 08 Hrs.

Social Responsibility and Community Engagement

- Social issues and challenges in contemporary society
- Corporate philanthropy and community development initiatives
- Stakeholder engagement strategies
- Corporate volunteering and employee engagement programs
- CSR as a strategic business tool vital for sustainable development

Books Recommended

Textbooks:

1 Andrew Crane, Dirk Matten , "Corporate Social Responsibility: Definition, Core Issues, and Recent Developments" Oxford University Press.

2 O. C. Ferrell, John Fraedrich, Linda Ferrell , "Business Ethics: Ethical Decision Making & Cases", Cengage Learning.

3 orporate Social Responsibility in India, Sanjay K Agarwal, Sage Publications, 2008.

4 Corporate Social Responsibility in India, Bidyut Chakrabarty, Routledge, New Delhi, 2015.

Reference Books:

1 Corporate Social Responsibility: An Ethical Approach, Mark S. Schwartz, Broadview Press, 2011

2 Attaining Sustainable Growth through Corporate Social Responsibility, George Pohle and Jeff Hittner, IBA Global Business Services, 2008

3 Strategic Corporate Social Responsibility: Stakeholders in a Global Environment, William B. Werther Jr. and David Chandler, 2nd Edition, Sage Publications, 2011.

Evaluation Scheme

Continuous Assessment (A): Subject teacher will declare Teacher Assessment criteria at the start of the semester.

Continuous Assessment (B): Two term tests of 15 marks each (1 hour duration) will be conducted, with the average score considered for final grading.

End Semester Examination (C): The question paper, based on the entire syllabus, will carry 60 marks with a total duration of 2 hours.

Bioinformatics
(RCP23OCOE406)

Teaching Scheme	**Examination Scheme**
Lectures: 03 Hr/week	Term Test : 15 Marks
Tutorial: 00 Hr/week	Teacher Assessment : 25 Marks
Credit : 03	End Sem Exam : 60 Marks

Prerequisites:

1. -

Course Objectives

1. To provide an overview of bioinformatics and its significance in modern biological research.
2. To enable students to apply bioinformatics methods in practical scenarios for biological data analysis and interpretation.

Course Outcomes:

On completion of the course, the learner will be able to:

CO	Course Outcomes	Bloom's Level	Bloom's Description
CO1	Understand the structure and function of cells, organelles, and biomolecules.	L2	Understand
CO2	Understand the types of data stored in bioinformatics databases and their relevance to biological research.	L2	Understand
CO3	Explore genomic databases and understand the structure and content of protein databases.	L2	Understand
CO4	Understand system biology concepts and molecular evolution.	L2	Understand
CO5	Apply knowledge of cellular and molecular biology concepts to analyze a biological problem.	L3	Apply

Course Contents

Unit-I 08 Hrs.

Foundations of Molecular and Cellular Biology

Introduction to molecular biology: DNA, RNA, proteins, and their roles in cellular processes.
Cell structure and function: Organelles, membrane structure, and cellular transport.
Cell cycle regulation: phases of the cell cycle, checkpoints, and cell cycle control mechanisms.

Unit-II 08 Hrs.

Genetics and Genomics

Mendelian genetics: Inheritance patterns, Punnett squares, and genetic crosses Chromosome structure and organization: karyotyping, gene mapping, and genetic linkage.
Introduction to genomics: genome structure, organization, and variation.
Techniques in molecular genetics: PCR, DNA sequencing, and gene cloning.

Unit-III 08 Hrs.

Genomic and Protein Databases

Types of genomic databases such as GenBank, Ensemble, and UCSC Genome Browser, Understand the structure and content of protein databases such as UniProt and Protein Data Bank (PDB), Searching, Retrieving, and Analysing Genomic and Protein data from online databases.

Unit-IV 08 Hrs.

Systems Biology

Introduction to Systems Biology: Modeling biological systems and network analysis, Bioinformatics tools for systems biology and modeling complex biological processes.
Principles of molecular evolution: Mutation, Selection, and genetic drift.
Phylogenetic analysis: Tree construction, sequence alignment, and molecular clock.

Unit-V 07 Hrs.

Applications and Case Studies

Applications of Bioinformatics in Medicine, Agriculture, and Biotechnology, Case Studies (Integrating Cellular and Molecular Biology with Bioinformatics) and Research Examples, Ethical and Legal Issues in Bioinformatics, Future Trends and Emerging Technologies in Bioinformatics.

Books Recommended

Textbooks:

1 Bioinformatics For Dummies", Jean-Michel Claverie and Cedric Notredame, For Dummies. (2019)

2 Bioinformatics Algorithms: An Active Learning Approach" by Phillip Compeau and Pavel Pevzner, Active Learning Publishers (2019)

Reference Books:

1 Introduction to Bioinformatics, Arthur Lesk, Biologist Bioinformatics Expert, 2019

2 Introduction to Biomedical Data Science, Robert Hoyt, Informatics Education, 2019

3 Python for Biologists: A Complete Programming Course for Beginners, Martin Jones, Oxford University Press, 2013

4 An Introduction to Bioinformatics Algorithms, Neil C. Jones, and Pavel A. Pevzne, MIT Press,2004.

5 Exploring Bioinformatics: A Project-Based Approach, Caroline St. Clair, and Jonathan E. Visick, Jones Bartlett Learning, 2014.

Evaluation Scheme

Continuous Assessment (A): Subject teacher will declare Teacher Assessment criteria at the start of the semester.

Continuous Assessment (B): Two term tests of 15 marks each (1 hour duration) will be conducted, with the average score considered for final grading.

End Semester Examination (C): The question paper, based on the entire syllabus, will carry 60 marks with a total duration of 2 hours.

Human Resource Management

(RCP23OCOE407)

Teaching Scheme	**Examination Scheme**
Lectures: 03 Hr/week	Term Test : 15 Marks
Tutorial: 00 Hr/week	Teacher Assessment : 25 Marks
Credit : 03	End Sem Exam : 60 Marks

Prerequisites:

1. -

Course Objectives :

1. To introduce the students with basic concepts, techniques and practices of the human resource management
2. To provide opportunity of learning Human resource management (HRM) processes, related with the functions, and challenges in the emerging perspective of today's organizations
3. To familiarize the students about the importance of the labour relations in the organization.

Course Outcomes:

On completion of the course, the learner will be able to:

CO	Course Outcomes	Bloom's Level	Bloom's Description
CO1	Understand and distinguish the changing environment of the HRM and the role of the HR managers.	L2	Understand
CO2	Understand and analyse the recruitment process and the application of the IT.	L4	Analyze
CO3	Understand and examine the importance of the training and development.	L2	Understand
CO4	Understand and determine the pay plans, performance appraisal and compensation.	L2	Understand
CO5	Understand and explain the importance of the labour relation, the employee security and collective bargaining.	L2	Understand

Course Contents

Unit-I 07 Hrs.

Human Resource Function

Human Resource Philosophy – Changing environments of HRM – Strategic human resource management – Using HRM to attain competitive advantage – Trends in HRM – Organisation of HR departments – Line and staff functions – Role of HR Managers.

Unit-II 10 Hrs.

Recruitment & Placement

Job analysis: Methods - IT and computerised skill inventory - Writing job specification - HR and the responsive organisation.
Recruitment and selection process: Employment planning and forecasting - Building employee commitment: Promotion from within - Sources, Developing and Using application forms - IT and recruiting on the internet.
Employee Testing selection: Selection process, basic testing concepts, types of test, work samples simulation, selection techniques, interview, common interviewing mistakes, Designing conducting the effective interview, small business applications, computer aided interview.

Unit-III 08 Hrs.

Training & Development

Orientation Training: Orienting the employees, the training process, need analysis, Training techniques, special purpose training, Training via the internet.
Developing Managers: Management Development - The responsive managers - On-the-job and off the-job Development techniques using HR to build a responsive organisation.
Performance appraisal: Methods - Problem and solutions - MBO approach - The appraisal interviews - Performance appraisal in practice.
Managing careers: Career planning and development - Managing promotions and transfers.

Unit-IV 08 Hrs.

Compensation & Managing Quality

Establishing Pay plans: Basics of compensation - factors determining pay rate - Current trends in compensation - Job evaluation - pricing managerial and professional jobs - Computerised job evaluation.
Pay for performance and Financial incentives: Money and motivation - incentives for operations employees and executives - Organisation wide incentive plans - Practices in Indian organisations.
Benefits and services : Statutory benefits - non-statutory (voluntary) benefits - Insurance benefits -retirement benefits and other welfare measures to build employee commitment.

Unit-V 06 Hrs.

Labour relations and employee security

Industrial relation and collective bargaining: Trade unions - Collective bargaining - future of trade unionism. Discipline administration - grievances handling - managing dismissals and separation. Labour Welfare: Importance Implications of labour legislations - Employee health - Auditing HR functions, Future of HRM function.

Books Recommended

Textbooks:

1 Pattanayak, Biswajeet, Human Resource Management, 6th Ed,PHI Learning Pvt. Ltd., 1 Jul 2020

2 Gary Dessler, Human Resource Management, 16th Ed, Pearson Publications, 2020

Reference Books:

1 Stephen Robbins, Organizational Behavior, 16th Ed, 2013

2 Aswathapa, Human resource management: Text cases, 6th edition, 2011

3 C. B. Mamoria and S V Gankar, Dynamics of Industrial Relations in India, 15th Ed, 2015, Himalaya Publishing, 15thedition, 2015

4 P. Subba Rao, Essentials of Human Resource management and Industrial relations, 5th Ed, 2013, Himalaya Publishing

5 Laurie Mullins, Management Organizational Behavior, Latest Ed, 2016, Pearson Publications

6 Raymond J. Stone, Anne Cox, Mihajla Gavin, Human Resource Management, 10th Ed,John Wiley Sons, 14 Dec 2020.

7 V S P Rao, Human Resource Management, 3rd Ed, 2010, Excel publishing.

Evaluation Scheme

Continuous Assessment (A): Subject teacher will declare Teacher Assessment criteria at the start of the semester.

Continuous Assessment (B): Two term tests of 15 marks each (1 hour duration) will be conducted, with the average score considered for final grading.

End Semester Examination (C): The question paper, based on the entire syllabus, will carry 60 marks with a total duration of 2 hours.

Digital Marketing Management
(RCP23OCOE408)

Teaching Scheme	**Examination Scheme**
Lectures: 03 Hr/week	Term Test : 15 Marks
Tutorial: 00 Hr/week	Teacher Assessment : 25 Marks
Credit : 03	End Sem Exam : 60 Marks

Prerequisites:

1. -

Course Objectives

1. Explain the evolution and technology of digital marketing, including underlying frameworks.
2. Understand digital business strategy and emerging business structures.
3. Cover digital marketing planning, operations setup, and implementation of search campaigns, alongside emerging concepts like Big Data, IoT, SMB, B2B marketing, and SoLoMo.

Course Outcomes:

On completion of the course, the learner will be able to:

CO	Course Outcomes	Bloom's Level	Bloom's Description
CO1	Understand the digital marketing framework & model and consumer behaviour.	L2	Understand
CO2	Develop digital marketing strategy roadmap.	L6	Create
CO3	Explain the terminology and concepts for developing web-specific media plans.	L2	Understand
CO4	Understand concepts related to digital campaign management and revenue generation models.	L2	Understand
CO5	Get a perspective on global digital marketing technology/tools and future trends.	L2	Understand

Course Contents

Unit-I 06 Hrs.

Introduction

Introduction to Digital Marketing:
Emergence of Digital Marketing as a tool, media consumption drivers for new marketing environment, applications and benefits of digital marketing.
Digital Marketing Framework:
Delivering enhanced customer value, market opportunity analysis and digital services development, ASCOR framework.
Digital Marketing Models Creation:
Factors impacting digital marketplace, value chain digitization, business models.
The Consumer for Digital Marketing:
Consumer behavior on the internet, evolution of consumer behavior models, managing consumer demand, integrated marketing communications (IMC).

Unit-II 12 Hrs.

Digital Marketing Strategy

Digital marketing Strategy Development :
Elements of assessment phase, macro-micro environmental analysis, marketing situation analysis.
Digital Marketing Internal Assessment and Objectives Planning :
Analyzing present offerings mix, marketing mix, core competencies analysis and internal resource mapping. Digital presence analysis, digital marketing objectives development and review.
Digital Marketing Strategy Definition :
Understanding digital business strategy and structures, consumer development strategy, offering mix for Digital, digital pricing models, managing promotional channels and developing the extended Ps-People, process, programs and performance.
Digital marketing Strategy Roadmap :
Developing digital marketing strategy roadmap, the 6s digital marketing implementation strategy, marketing across the product life cycle.

Unit-III 08 Hrs.

Digital Marketing Planning and Operations

Digital Marketing Planning and Setup :
Understanding digital media planning terminology and stages, steps to creating marketing communications strategy, introduction to search marketing, display marketing, social media marketing.
Digital Marketing Operations Setup:
Basics of lead generation and conversion marketing, website content development and management, elements of user experience, web usability and evaluation.

Unit-IV 08 Hrs.

Digital Marketing Execution

Digital marketing Execution :
Basic elements of digital campaign management, search execution, display execution, social media execution, content marketing.
Digital marketing Execution Elements :
Digital revenue generation models, managing service delivery and payments, managing digital implementation challenges like e commerce, internal & external and consumer specific challenges.

Unit-V 05 Hrs.

Digital Business – Present and Future

Digital Marketing – Global Landscape, digital marketing overview – global spend, advertising spend, and technology/tools landscape.
Data technologies (Big data and IOT) impacting marketing, segment based digital marketing and SoLoMo – the next level of hyperlocal marketing.

Books Recommended

Textbooks:

1 Sunil Chopra, Peter Meindl "Supply Chain Management-Strategy, Planning, and Operation", Pearson Publications 2016

2 David Simchi-Levi, Philip Kaminsky, Edith Simchi-Levi, "Designing and Managing the Supply Chain-Concepts, Strategies, and Case Studies", McGraw-Hill/Irwin 2008.

Reference Books:

1 Ian Sadler, "Logistics and Supply Chain Integration", SAGE Publications, 2007

2 Donald Waters, "Supply Chain Management - An Introduction to Logistics", Bloomsbury Publishing, 2019

3 Dimitris Folinas, "E-Logistics and E-Supply Chain Management-Applications for Evolving Business, IGI Global publications, 2013

4 Martin Christopher, "Logistics Supply Chain Management", Pearson Education publications, 2016.

Evaluation Scheme

Continuous Assessment (A): Subject teacher will declare Teacher Assessment criteria at the start of the semester.

Continuous Assessment (B): Two term tests of 15 marks each (1 hour duration) will be conducted, with the average score considered for final grading.

End Semester Examination (C): The question paper, based on the entire syllabus, will carry 60 marks with a total duration of 2 hours.

Logistics and Supply Chain Management (RCP23OCOE409)

Teaching Scheme	**Examination Scheme**
Lectures: 03 Hr/week	Term Test : 15 Marks
Tutorial: 00 Hr/week	Teacher Assessment : 25 Marks
Credit : 03	End Sem Exam : 60 Marks

Prerequisites:

1. Latest trend of information technology in retail industry and logistic applications.

Course Objectives

1. To develop advanced strategic thinking skills in supply chain management and logistics to effectively analyze and optimize supply networks.
2. To attain proficiency in leveraging cutting-edge tools and technologies to enhance supply chain efficiency and supply chain transformation.
3. Design and implement collaborative supply chain and sourcing strategies to promote information sharing and optimise coordination.

Course Outcomes:

On completion of the course, the learner will be able to:

CO	Course Outcomes	Bloom's Level	Bloom's Description
CO1	Develop a sound understanding of the important role of supply chain management in today's business environment.	L2	Understand
CO2	Develop criteria and standards to achieve improved business performance by integrating and optimizing the total logistics and supply-chain process.	L6	Create
CO3	Summarize the value of focusing on information business logistics systems which drives improved accuracy and decision-making at all levels of management.	L2	Understand
CO4	Become familiar with current supply chain information technology management trends.	L2	Understand
CO5	Use available technologies to enhance work performance and support supply chain functions, processes, transactions, and communications.	L3	Apply

Course Contents

Unit-I 05 Hrs.

Introduction

What Is Supply Chain Management? The Development Chain, Global Optimization, Managing Uncertainty and Risk, The Complexity in Supply Chain Management, Key Issues in Supply Chain Management.

Unit-II 06 Hrs.

Network planning

Introduction, Network Design- Data Collection, Data Aggregation, Transportation Rates, Mileage Estimation, Warehouse Costs, Warehouse Capacities, Potential Warehouse Locations, Service Level Requirements, Future Demand, Model and Data Validation, Solution Techniques, Key Features of a Network Configuration Supply Chain Planning; Inventory Positioning and Logistics Coordination -Strategic Safety Stock.

Unit-III 08 Hrs.

The Value of Information

Introduction, The Bullwhip Effect-Quantifying the Bullwhip Effect, The Impact of Centralized Information on the Bullwhip Effect, Methods for Coping with the Bullwhip Effect, Information Sharing and Incentives, Effective Forecasts, Information for the Coordination of Systems, Locating Desired Products, Lead- Time Reduction, Information and Supply Chain Trade-offs-Conflicting Objectives in the Supply Chain, Designing the Supply Chain for Conflicting Goals ,Decreasing Marginal Value of Information.

Unit-IV 08 Hrs.

Supply Chain Integration

Introduction, Push, Pull, and Push-Pull Systems-Push-Based Supply Chain, Pull- Based Supply Chain, Push-Pull Supply Chain ,Identifying the Appropriate Supply Chain Strategy, Implementing a Push-Pull Strategy The Impact of Lead Time Demand-Driven Strategies The Impact of the Internet on Supply Chain Strategies-what is E-Business, the Grocery Industry , the Book Industry , the Retail Industry and Impact on Transportation and Fulfillment.

Unit-V 06 Hrs.

Information Technology and Business Process

Introduction, The Importance of Business Processes, Goals of Supply Chain IT Supply Chain Management System Components, Decision-Support Systems IT for Supply Chain Excellence, Sales and Operations Planning Integrating Supply Chain Information Technology. Implementation of ERP and Decision Support System.

Unit-VI 06 Hrs.

Technology Standards

Introduction, IT Standards, Information Technology Infrastructure-Interface Devices, System Architecture and Electronic Commerce. Service-Oriented Architecture (SOA)-Technology Base: IBM and Microsoft and ERP Vendor Platform: SAP and Oracle. Radio Frequency Identification (RFID)- applications, point of sale data , business benefits and supply chain efficiency.

Books Recommended

Textbooks:

1 Sunil Chopra, Peter Meindl "Supply Chain Management-Strategy, Planning, and Operation", Pearson Publications 2016

2 David Simchi-Levi, Philip Kaminsky, Edith Simchi-Levi, "Designing and Managing the Supply Chain-Concepts, Strategies, and Case Studies", McGraw-Hill/Irwin 2008.

Reference Books:

1 Ian Sadler, "Logistics and Supply Chain Integration", SAGE Publications, 2007

2 Donald Waters, "Supply Chain Management - An Introduction to Logistics", Bloomsbury Publishing, 2019

3 Dimitris Folinas, "E-Logistics and E-Supply Chain Management-Applications for Evolving Business, IGI Global publications, 2013

4 Martin Christopher, "Logistics Supply Chain Management", Pearson Education publications, 2016.

Evaluation Scheme

Continuous Assessment (A): Subject teacher will declare Teacher Assessment criteria at the start of the semester.

Continuous Assessment (B): Two term tests of 15 marks each (1 hour duration) will be conducted, with the average score considered for final grading.

End Semester Examination (C): The question paper, based on the entire syllabus, will carry 60 marks with a total duration of 2 hours.

Design Thinking Laboratory
(RCP23ILHSX02)

Teaching Scheme	**Examination Scheme**
Practical : 02 Hrs./week	Teacher Assessment: 25 Marks
Credit : 01	End Sem Exam : 00 Marks

Prerequisites:

1. Basic understanding with the development life cycle of products, processes, software, or services.
2. Basic knowledge of iterative frameworks (not mandatory).

Course Objectives:

1. To introduce students to the fundamentals, history, and importance of design thinking and its role in solving complex real-world problems.
2. To develop students' empathy and user-research skills by teaching them how to gather insights, create personas, and map user journeys.
3. To equip students with the skills to define and reframe problem statements effectively, identifying opportunity areas and stakeholder touch-points.
4. To foster creative ideation, prototyping, and testing skills through hands-on exercises that incorporate strategic innovation and rapid prototyping techniques.

Course Outcomes:

On completion of the course, the learner will be able to:

CO	Course Outcomes	Bloom's Level	Bloom's Description
CO1	Understand and apply the design thinking process to analyze and solve real-world problems.	L3	Apply
CO2	Develop the ability to empathize with users, create user personas, and design empathy and journey maps tailored to specific challenges.	L4	Analyze
CO3	Demonstrate proficiency in defining clear and actionable problem statements that uncover areas of opportunity.	L3	Apply
CO4	Generate diverse ideas using ideation techniques, such as brainstorming and SCAMPER, to approach problem-solving creatively and collaboratively.	L6	Create
CO5	Create and test prototypes, iterating based on feedback and validating solutions through digital platforms and peer review.	L6	Create

Course Contents

Unit-I 08 Hrs.

Introduction to Design Thinking and Strategic Innovation

- Introduction to Design Thinking
  - Understanding the fundamentals of design thinking.
  - Exploring the history and evolution of design thinking.
  - The importance of empathy in the design thinking process.
  - Conduct market & industry research by observing and contextualizing various macro & micro trends.
  - Case Study - conduct their research on how Design Thinking helped solve some of the biggest and most critical problems of our time.
- Design Thinking for Strategic Innovation
  - Types of innovations, strategic innovation.
  - Features of strategic innovation.
  - Design thinking and strategic innovation.
  - Practices of integrating design thinking in strategic innovation.

Unit-II 04 Hrs.

Empathize Phase

- Techniques for conducting user research and gathering insights.
- Creating user personas and empathy maps.
- Practicing active listening and observation skills.
- To apply various empathizing techniques to the problem statement selected.
- Use walk-a-mile immersion and heuristic reviews to first empathize with end users and then to build an empathy map and customer journey map.

Unit-III 04 Hrs.

Define Phase

- Defining problem statements and reframing challenges.
- Tools for synthesizing research findings.
- Developing a clear and actionable problem statement.
- Start building from Persona map and conduct interviews/ Gemba walk to plot user's journeys from start to end.
- Define the problem space using the HMW statement. Now highlight areas of opportunities in the journey map and enlist potential channels/touchpoints as well as stakeholders for proposed solution interventions.

Unit-IV 04 Hrs.

Ideate Phase

- Generating creative ideas through brainstorming sessions.
- Techniques for divergent and convergent thinking.
- Prototyping and experimenting with ideas.
- Apply suitable ideation techniques to quickly generate diverse ideas that could be applied to target problem space – either partially or in full.
- Brain Writing – Build on each other's ideas and constructively creatively develop better ideas using SCAMPER technique.
- Evaluation of ideas.

Unit-V 06 Hrs.

Prototype and Validation

- Introduction to prototyping tools and techniques.
- Rapid prototyping methods.
- Testing prototypes with users and gathering feedback.
- Refining solutions based on user insights.
- Develop user storyboard to layout solution proposition in visual and easily explainable form. Run a quick peer validation.
- Peer-validated the storyboard.
- Build an interactive digital prototype using any digital rapid prototyping platform and seek user validation.

Suggested Experiments

Below is a list of assignments/ activities/ experiments that would be carried out by students as a mini project in groups consisting of 3-4 students.
Problem statement for these assignments/ activities/ experiments will be provided by facilitator/ instructor/ faculty to the groups/ teams/ batches within each class.
This list of experiments will help students learn various design thinking methods and practice the corresponding tools available.

1. To conduct market and industry research and analyze case studies demonstrating the application of design thinking. (Increased understanding of how design thinking has been applied to solve critical problems in various contexts.)
2. To exercise empathizing techniques to understand the needs and pain points of a target audience.
3. Developing empathy maps and customer journey maps based on collected insights.
4. To exercise different tools and techniques (such as affinity diagrams, journey mapping, and user story mapping) for synthesizing research findings.
5. Develop user personas to represent different user archetypes and their needs concerning the problem at hand.

6. To practice SCAMPRE technique, Brainstorming and brain writing as a collaborative ideation technique to create multiple creative ideas / solution for the problem at hand.
7. Create a mind map to generate a wide range of solutions to a problem at hand.
8. To explore different prototyping tools and platforms, such as Adobe XD, Figma, Sketch, and InVision.
9. To Conduct rapid prototyping sessions to build low fidelity / High fidelity prototype based on the ideas generated in Ideation phase and iterate based on feedback received.
10. Develop a plan for implementing the final solution, considering factors like scalability and feasibility.
11. Conduct usability testing to gather feedback on prototypes.Use A/B testing to compare different versions of a solution and determine which performs better.

A minimum of five experiments from the above-suggested list or any other assignment based on the syllabus will be included, which would help the learner to apply the concept. The mini-project is mandatory.

Books Recommended

Textbooks:

1 I. Mootee, "Design Thinking for Strategic Innovation: What They Can't Teach You at Business or Design School",Wiley, 2013.

2 M. Lewrick, P. Link, and L. Leifer, "The Design Thinking Playbook: Mindful Digital Transformation of Teams, Products, Services, Businesses and Ecosystems", Wiley, 2018.

3 T. Lockwood, "Design Thinking: Integrating Innovation, Customer Experience, and Brand Value", Allworth Press, 2010.

4 K. T. Ulrich and S. D. Eppinger, "Product Design and Development", McGraw-Hill Hill Education, 6^{th} Edition, 2016.

5 C. J. Meadows and C. Parikh, "The Design Thinking Workbook: Essential Skills for Creativity and Business Growth", Emerald Publishing, 2022.

Reference Books:

1 T. Kelley and D. Kelley, "Creative Confidence: Unleashing the Creative Potential Within Us All", HarperCollins Publisher, 2013.

2 T. Brown, "Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation", HarperCollins, 2013.

3 J. Knapp, J. Zeratsky, and B. Kowitz, "Sprint: How to Solve Big Problems and Test New Ideas in Just Five Days", Simon & Schuster, 2016.

4 Chakrabarti, "Engineering Design Synthesis: Understanding, Approaches and Tools", Springer, 2002.

5 K. Otto, and K. Wood, "Product Design", Prentice Hall, 2000.

Web References:

1 **Design and Innovation:**

a. https://openstax.org/books/entrepreneurship/pages/4-suggested-resources

2 **Overview of Design Thinking:**

a. https://www.interaction-design.org/literature/topics/design-thinking

b. *10 Models for Design Thinking. In 2004, business consultants Hasso... — by Libby Hoffman — Medium*

c. https://www.tcgen.com/design-thinking/What_is_Design_Thinking_and_How_Does_it_Relate_to_Produ

3 **Understand, Observe, and Define the Problem:**

a. https://www.nngroup.com/articles/empathy-mapping/

b. https://uxdesign.cc/the-purpose-of-a-journey-map-and-how-can-it-galvanize-action-9a628b7ae6e

4 **Ideation and Prototyping:**

a. https://www.interaction-design.org/literature/topics/prototyping

b. https://www.uxmatters.com/mt/archives/2019/01/prototyping-user-experience.php

5 **Testing and Implementation:**

a. https://www.nngroup.com/articles/usability-testing-101/

b. https://www.interaction-design.org/literature/article/test-your-prototypes-how-to-gather-feedback-and-maximise-learning

6 **Design Thinking in Various Sectors:**

a. https://www.tutorialspoint.com/design_thinking/design_thinking_quick_guide.htm

Swayam Courses:

1 Creative Engineering Design

2 Understanding Creativity and Creative Writing

3 Understanding Design Thinking & People-Centred Design

4 Design Thinking - A Primer

5 Product Engineering and Design Thinking

Evaluation Scheme

The distribution of marks shall be as follows:

Continuous Assessment (A):

1. Performance in Experiments: 05 Marks
2. Journal Submission: 05 Marks
3. Viva-voce: 05 Marks
4. Mini project: 10 Marks

Computer Aided Machine Drawing Laboratory

(RCP23MLSC401)

Teaching Scheme	**Examination Scheme**
Practical : 04 Hrs./week	Teacher Assessment: 50 Marks
Credit : 02	End Sem Exam : 50 Marks

Prerequisites:

1. -

Course Objectives:

1. To study conventional representation of various machining and mechanical details.
2. To impart knowledge and skills of CAD modelling software.
3. To become conversant with 3D drafting of machine components from the given assembly/detail drawing.

Course Outcomes:

On completion of the course, the learner will be able to:

CO	Course Outcomes	Bloom's Level	Bloom's Description
CO1	Visualize and interpret the machine components from the given assembly/detail drawing.	L2	Understand
CO2	Using CAD software, prepare 3D models of the machine components from the given assembly/detail drawing.	L3	Apply
CO3	Conversion of detailed drawings to assembly drawings and assembly drawings to detailed drawings.	L4	Analyze

Course Contents

Unit-I 08 Hrs.

Introduction

Introduction of CAD Softwares: Review of graphic interface, various tools and settings for preparation of graphics workspace. Introduction of basic sketching commands (Line, circle, arc, rectangle, slot, spline, fillet, polygon, text, dimensioning, etc.) modify commands (move, trim, copy, replace, extend, split, offset, etc.), feature commands (extrude, revolve, loft, sweep, rib, coil, emboss, etc.) and navigational commands (Pan, zoom in, zoom out, orientation, etc.). Types of drawing sheets and its sizes, Drawing units, grid and snap, title block. Conversion of 3D views into orthographic projections of simple machine parts like (nuts, bolts, keys, screws, springs, etc.), Editing, Hidden line view, shaded view, render view, presentation of various views along with different orientations.

Unit-II 06 Hrs.

Introduction to Detail & Assembly Drawings

Details and assembly drawings:
Types of assembly drawings, part drawings, drawings for catalogues and instruction manuals, patent drawings, drawing standards, Introduction to unit assembly drawing, steps involved in preparing assembly drawing from details and vice-versa.
Geometric Dimensions and Tolerances (GD&T):
Introduction of Limits, fits, deviations, and tolerances with their applications, dimensioning with tolerances indicating various types of fits in details and assembly.
Threaded Fasteners:
Types of threads, thread designation, Thread terminology, sectional views of threads. ISO Metric (Internal External), BSW (Internal External), Square, Acme and American Standard thread, Conventional representation of threaded parts.

Unit-III 12 Hrs.

Preparation of details/assembly drawings of Machinery parts, Joints, Keys and Couplings

Machinery parts: Clapper block, Single tool post, Lathe and Milling tail stock, jigs and fixtures.
Joints and Keys: Cotter joints, knuckle joints, taper key, feather key, woodruff key, etc.
Couplings: Muff coupling, flanged coupling, Protected type flange coupling, Pin type flexible coupling, Oldham's coupling and Universal Coupling.

Unit-IV 12 Hrs.

Preparation of details / assembly drawings of Bearings,pulleys, Pipe joints

Bearings: Solid bearing, Bushed bearing, Pedestal bearing/Plummer block and footstep bearing.
Pulleys: Flat belt pulleys, V-belt pulleys, rope pulleys, Fast and loose pulleys.
Pipe joints: Flanged joints, Socket and spigot joint, Gland and stuffing box expansion joint and Union joint.

Unit-V 14 Hrs.

Preparation of details / assembly drawings of Valves, I.C. Engine Parts and RE

Valves: Air cock, blow off cock, Steam stop valve, Gate valve, Globe valve and **Non-Return Valve:**
I.C. Engine parts:
Piston, Connecting rod, Crankshaft, Carburetor, Injector and Spark plug.
Introduction to Reverse Engineering:
Historical Background, scope and task of Reverse Engineering in Modern Industries.

Suggested Experiments

1. General machine elements - nuts, bolts, keys, cotter, screws, springs, etc. (any one)
2. Details/Assembly of Clapper block, Single tool post, Lathe and Milling tail stock, jigs and fixtures. (any one)
3. Details/Assembly of coupling - simple, muff, flanged Protected flange coupling, Oldham's coupling, Universal coupling. (any one)
4. Details/Assembly of ball and roller bearing, Pedestal bearing, footstep bearing. (any one)
5. Details/Assembly of different types of pulleys. (any one)
6. Details/Assembly of pipe joints - Flanged joints, Socket and spigot joint, Gland and stuffing box, expansion joint. (any one)
7. Details/Assembly of Air cock; Blow off cock, Steam stop valve, Gate valve, Globe valve, Non return Valve. (any one)
8. Details/Assembly of Piston, Connecting rod, Cross head, Crankshaft, Carburetor, Fuel pump, injector, and Spark plug. (any one)

Any of 6 experiments from the above-suggested list.
Printouts / plots of the problems solved in practical class from the practical part of each module. Problems from practical parts of each module should be solved using any standard CAD packages like Autodesk Inventor, Fusion 360, PRO-E, CATIA, Solid Works, etc.

Books Recommended

Reference Books:

1 N.D. Bhatt, Machine Drawing, N.D. Bhatt, Charotar Publishing Home Pvt. Ltd, 51st Edition, 2022.

2 K.I. Narayana, P. Kannaiah and K. Venkata Reddy, Machine Drawing, New Age International (P) Limited, Publishers. 5th Edition, 2016,

3 K. C. John, Textbook of Machine Drawing 2010, PHI Learning Pvt. Ltd. New Delhi,2010.

4 M. B. Shah, Engineering Drawing Pearson Education India. 2nd Edition, 2009

5 Laxminarayan and M.L.Mathur, A textbook of Machine Drawing, 3rd Edition, Jain Brothers Delhi. 2017,

6 R.B.Gupta, A textbook of Machine Drawing Satyaprakashan, Tech. Publication. 10th Edition, 2019,

7 R. K. Dhawan, A textbook of Machine Drawing, S. Chand Publication ,2006.

Evaluation Scheme

The distribution of marks shall be as follows:

Continuous Assessment (A):

1. Performance in Experiments, Printouts/Plots: 40 Marks
2. Attendance & participation : 10 Marks

End Semester Practical & Oral Examination :

1. Practical examination duration : 3 hours
   - **Session-I: 20 marks** Preparation of a minimum of 5 detailed 3D part drawings from a given assembly drawing.
   - **Session-II: 20 marks** Preparation of 3D models of parts, assembling parts, and preparing views of the assembly from a given detailed drawing.
   - **Oral: 10 marks** conducted to check the knowledge of conventional and CAD drawing.
2. Questions provided for the practical examination should contain a minimum of five and not more than ten parts.
3. Evaluation of the practical examination is to be done based on the printout of the student's work.

Advanced Manufacturing Process Laboratory (RCP23MLSC402)

Teaching Scheme	**Examination Scheme**
Practical : 04 Hrs./week	Teacher Assessment: 50 Marks
Credit : 02	End Sem Exam : 50 Marks

Prerequisites:

1. Knowledge of fundamental machining techniques and various manufacturing processes.

Course Objectives:

1. To apply safety precautions and adhere to norms while demonstrating effective interpersonal skills for successful teamwork and hands-on learning.
2. To evaluate the effects of process parameters on various responses in non-conventional machining processes.
3. To fabricate a simple component using 3D printing techniques, and to fabricate and assemble mechanical components by applying various manufacturing techniques. To demonstrate expertise in CNC control systems by determining parameters and executing CNC programs for a range of machining operations.

Course Outcomes:

On completion of the course, the learner will be able to:

CO	Course Outcomes	Bloom's Level	Bloom's Description
CO1	Demonstrate lifelong learning with a commitment to professional, safety, environmental, and social responsibilities for career excellence.	L3	Apply
CO2	Fabricate and assemble mechanical components using diverse manufacturing techniques.	L3	Apply
CO3	Assess the effects of process parameters on MRR, TWR in EDM of mild steel, and DOP, HOC in ECDM of glass.	L4	Analyze
CO4	Apply engineering expertise in additive manufacturing for the creation of functional 3D printed models.	L3	Apply
CO5	Exhibit CNC control systems, compute technological parameters, and develop, simulate, and execute CNC programs for various machining operations.	L6	Create

Suggested Experiments

1. To fabricate and assemble mechanical components through the application of conventional, non-conventional, and advanced manufacturing techniques. (16 hrs)
2. To analyze the influence of process parameters on the EDM process and determine the material removal rate (MRR), tool wear rate (TWR), and surface roughness of mild steel (M.S) using a copper electrode. (04 hrs)
3. To examine the effects of process parameters on ECDM and determine the depth of penetration (DOP) and hole overcut (HOC) in glass using a tungsten carbide electrode (04 hrs)
4. To fabricate a simple component using one of the 3D Printing techniques below 1) Selective laser printing (SLS) 2) Stereolithography (SLA) 3) Fused deposition modelling (FDM). (12 hrs)
5. To program, simulate, and fabricate a component on a CNC Vertical Machining Center, involving part programming, interpolation, contour motion, pocket milling (circular and rectangular), and mirror commands etc. (16 hrs)

Semester Project-II

(RCP23IPSC401)

Practical Scheme
Practical: 02 Hrs./week
Credit : 01

Examination Scheme
Teacher Assessment : 25 Marks
End Sem Exam: 25 Marks

Course Outcomes:

Students are expected to design, simulate / implement a project based on the knowledge acquired from current semester subjects.

Course Outcomes:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Conduct a survey of several available literatures in the preferred field of study.	L4	Analyze
CO2	Demonstrate various/alternate approaches to complete a project.	L2	Understand
CO3	Ensure a collaborative project environment by interacting and dividing project work among team members.	L3	Apply
CO4	Present their project work in the form of a technical report/paper and thereby improve technical communication skills.	L3	Apply
CO5	Demonstrate the ability to work in teams and manage the conduct of the research study.	L2	Understand

Semester Project:

The purpose of introducing a semester project at the second-year level is to provide exposure to students with a variety of projects based on the knowledge acquired from the semester subjects. This activity is supposed to enrich their academic experience and bring enough maturity to the student while selecting the project. Students should take this as an opportunity to develop skills in implementation, presentation, and discussion of technical ideas/topics. Therefore, proper attention shall be paid to the content of the semester project report, which is being submitted in partial fulfillment of the requirements of the Second Year, and it is imperative that a standard format be prescribed for the report.

Each student shall work on a project approved by the departmental committee approved by the Head of the Department. A group of 3 to 5 students (maximum allowed: 5 students in extraordinary cases, subject to the approval of the department committee and the Head of the department) shall be allotted for each Semester Project. Each group shall submit at least 3 topics for the Semester Project. The departmental committee shall finalize one topic for every group. The Semester Project Title or Theme should be based on the knowledge acquired during the semester. The project work shall involve sufficient work so that students get acquainted with different aspects of knowledge acquired from semester subjects.

Student is expected to:

- Select an appropriate project title based on acquired knowledge from current semester subjects.
- Maintain a Log Book of weekly work done (Log Book Format will be as per Table 1).
- Report weekly to the project guide along with the log book.

Table 1: Log Book Format

Sr	Week (Start Date:End Date)	Work Done	Sign of Guide	Sign of Coordinator
1				

Assessment Criteria:

- At the end of the semester, after confirmation by the project guide, each project group will submit a project completion report in the prescribed format for assessment to the departmental committee (including project guide).
- Assessment of the project (at the end of the semester) will be done by the departmental committee (including project guide).

Prescribed project report guidelines:
The size of the report shall be a minimum of 25 pages. The Project Report should include appropriate content for:

- Introduction
- Literature Survey
- Related Theory
- Implementation details
- Project Outcomes
- Conclusion
- References

Assessment criteria for departmental committee (including project guide) for Continuous Assessment: Guide will monitor weekly progress, and marks allocation will be as per Table 2.

Table 2: Continuous Assessment table

Sr	PRN	Name of Student	Student Attendance	Log Book Maintain	Literature Review	Depth of Understanding	Report	Total
			5	5	5	5	5	25

Assessment criteria for departmental committee (including project guide) for End Semester Exam: evaluate the project as per Table 3.

Table 3: Evalution Table

Sr	PRN	Name of Student	Project Selection	Design/ Simulation	model/ programming	Result Verification	Presentation	Total
			5	5	5	5	5	25

Each group shall present/publish a paper based on the semester project in reputed/peer-reviewed Conference/Journal/TechFest/Magazine before the end of the semester.