Shirpur Education Society's

R. C. Patel Institute of Technology, Shirpur

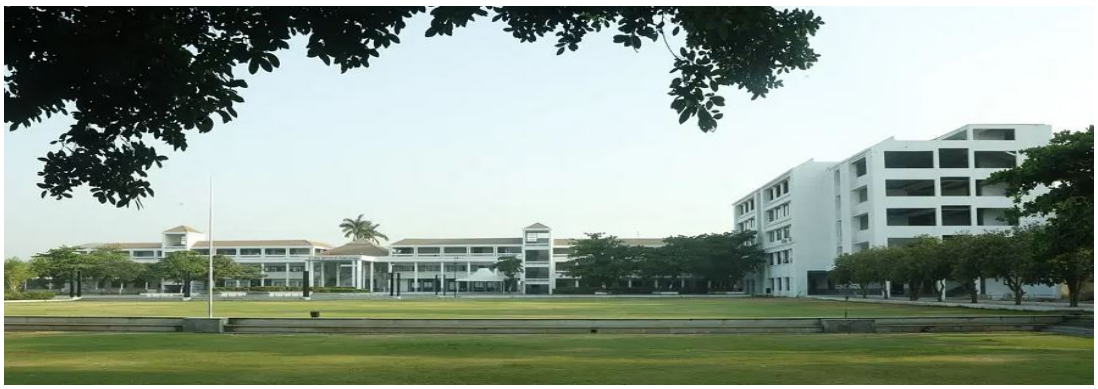
(An Autonomous Institute)

Course Structure

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

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	-	-	20	20	20	20	60	100	3
2	PC	RCP23MCPC302	Applied Thermodynamics	3	-	-	20	20	20	20	60	100	3
3	PC	RCP23MCPC303	Engineering Materials	2	-	-	20	20	20	20	60	100	2
4	PC	RCP23MLPC303	Engineering Materials Laboratory	-	-	2	25	-	-	-	25	50	1
5	PC	RCP23MCPC304	Manufacturing Processes	2	-	-	20	20	20	20	60	100	2
6	HS	RCP23ICHSX03	Economics and Financial Management	2	-	-	20	20	20	20	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	-	-	20	20	20	20	60	100	3
8	HS	RCP23ITHSX01	Professional and Business Communication Tutorial	-	2	-	50	-	-	-	-	50	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	320	120	120	120	485	925	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

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

R. C. Patel Institute of Technology, Shirpur SLS Autonomous

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	-	-	20	20	20	20	60	100	2
2	PC	RCP23MLPC401	Numerical and Statistical Techniques Laboratory	-	-	2	25	-	-	-	-	25	1
3	PC	RCP23MCPC402	Mechanics of Materials	3	-	-	20	20	20	20	60	100	3
4	PC	RCP23MLPC402	Mechanics of Materials Laboratory	-	-	2	25	-	-	-	25	50	1
5	PC	RCP23MCPC403	Advanced Manufacturing Processes	3	-	-	20	20	20	20	60	100	3
6	HS	RCP23ICHSX04	Universal Human Values	3	-	-	20	20	20	20	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 Corporate Social Responsibility Bioinformatics Human Resource Management Digital Marketing Management Logistics & Supply Chain Management	3	-	-	20	20	20	20	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	300	100	100	100	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.

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R. C. Patel Institute of Technology Autonomous

Shirpur Education Society's

R. C. Patel Institute of Technology, Shirpur

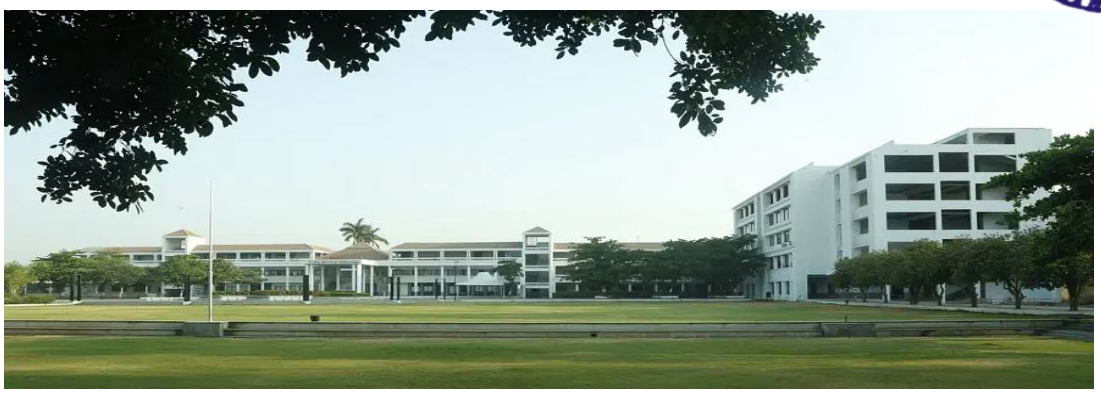
(An Autonomous Institute)

Syllabus Booklet

Second Year B.Tech in Mechanical Engineering

with effect from Year 2024-25

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



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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

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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: 50 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: - 50 marks.
2. Term Work shall comprise of:
3. Minimum 8 assignments: 25 marks.
4. Business Proposal presentation: 25 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.