Shirpur Education Society's

R. C. Patel Institute of Technology, Shirpur

(An Autonomous Institute)

Course Structure

Second Year B. Tech. (Electrical Engineering)

with effect from Academic Year 2025-26

Shahada Road, Near Nimzari Naka, Shirpur, Maharashtra 425405
Ph. No.: 02563 259 802, web: www.rcpit.ac.in

Second Year B. Tech. Electrical Engineering Semester-III (with effect from 2025-26) (NEP) (RCP23 Scheme)

S. N.	Course Category	Course Code	Course Title	Teaching Scheme			Evaluation Scheme					Total	Credits	
							Continuous Assessment (CA)				ESE			
				L	T	P	TA	Term Test-I (TT-I)	Term Test-II (TT-II)	Average of TT-I and TT-II				
							[A]			[B]	[C]	[A+B+C]		
1	PC	RCP23LPC201	Engineering Mathematics for Electrical Engineering	3			25	15	15	15	60	100	3	3
2	PC	RCP23LPC202	Analog and Digital Electronics	3			25	15	15	15	60	100	3	4
	PC	RCP23LPC202L	Analog and Digital Electronics Laboratory			2	25				25	50	1	
3	PC	RCP23LPC203	Electrical Measurement and Instrumentation	3			25	15	15	15	60	100	3	4
	PC	RCP23LPC203L	Electrical Measurement and Instrumentation Laboratory			2	25				25	50	1	
4	MD	RCP23LMD201L	Python Programming Laboratory			2	25				25	50	1	1
5	OE#	RCP23XOE211	Product Life Cycle Management	3			25	15	15	15	60	100	3	3
		RCP23XOE212	Management Information System	3			25	15	15	15	60	100	3	
		RCP23XOE213	Operations Research	3			25	15	15	15	60	100	3	
		RCP23XOE214	Personal Finance Management	3			25	15	15	15	60	100	3	
		RCP23XOE215	Public Systems and Policies	3			25	15	15	15	60	100	3	
		RCP23XOE216	Fundamentals of Biomedical Instruments	3			25	15	15	15	60	100	3	
		RCP23XOE217	IPR and Patenting	3			25	15	15	15	60	100	3	
		RCP23XOE218	Entrepreneurship and Startup Ecosystem	3			25	15	15	15	60	100	3	
6	SC	RCP23XSC201P	Semester Project-I			2	25				25	50	1	1
7	HS	RCP23XHS232	Universal Human Values	3			25	15	15	15	60	100	3	3
8	HS	RCP23XHS234	Economics and Financial Management	2			25	15	15	15	60	100	2	2
9	EL	RCP23XEL201L	Community Engagement Service			2	25					25	1	1
			Total	**17**		**10**	**275**			**90**	**460**	**825**		**22**

PC:Programme Core, MD: Multidisciplinary, OE#: Any 1 Open Elective, SC : Vocational and Skill Enhancement Course, HS: Humanities and Social Science, EL : Experiential Learning

Prepared by	Checked by	BOS Chairman	Dean Academic / Dy. Director	C.O.E.	Director
Dr. Y. K. Kirange	Dr. Nadeem Akhtar	Dr. S. A. Patil	Prof. Dr. P. J. Deore	Prof. S. P. Shukla	Prof. Dr. J. B. Patil

ELECTRICAL ENGINEERING DEPT. R.C.P.I.T. Office Seal SHIRPUR

Second Year B. Tech. Electrical Engineering Semester-IV (with effect from 2025-26) (NEP) (RCP23 Scheme)

S. N.	Course Category	Course Code	Course Title	Teaching Scheme			Evaluation Scheme					Total	Credits	
							Continuous Assessment (CA)				ESE			
				L	T	P	TA	Term Test-I (TT-I)	Term Test-II (TT-II)	Average of TT-I and TT-II				
							[A]			[B]	[C]	[A+B+C]		
1	PC	RCP23LPC251	Power System-I	3			25	15	15	15	60	100	3	4
	PC	RCP23LPC251L	Power System-I Laboratory			2	25				25	50	1	
2	PC	RCP23LPC252	Electrical Machine - I	3			25	15	15	15	60	100	3	4
	PC	RCP23LPC252L	Electrical Machine - I Laboratory			2	25				25	50	1	
3	PC	RCP23LPC253	Microcontroller and Applications	3			25	15	15	15	60	100	3	4
	PC	RCP23LPC253L	Microcontroller and Applications Laboratory			2	25				25	50	1	
4	MD	RCP23LMD251	Data Structures and Algorithms	3			25	15	15	15	60	100	3	4
	MD	RCP23LMD251L	Data Structures and Algorithms Laboratory			2	25				25	50	1	
5	OE#	RCP23XOE261	Project Management	3			25	15	15	15	60	100	3	3
		RCP23XOE262	Cyber Security, Policies and Laws	3			25	15	15	15	60	100	3	
		RCP23XOE263	Advanced Operations Research	3			25	15	15	15	60	100	3	
		RCP23XOE264	Corporate Finance Management	3			25	15	15	15	60	100	3	
		RCP23XOE265	Corporate Social Responsibility	3			25	15	15	15	60	100	3	
		RCP23XOE266	Bioinformatics	3			25	15	15	15	60	100	3	
		RCP23XOE267	Human Resource Management	3			25	15	15	15	60	100	3	
		RCP23XOE268	Digital Marketing Management	3			25	15	15	15	60	100	3	
		RCP23XOE269	Logistics and Supply Chain Management	3			25	15	15	15	60	100	3	
6	SC	RCP23XSC251P	Semester Project-II			2	25				25	50	1	1
7	HS	RCP23XHS281T	Professional and Business Communication Tutorial		2		25					25	2	2
8	HS	RCP23XHS283L	Design Thinking Laboratory			2	25				25	50	1	1
			Total	**15**	**2**	**12**	**300**			**75**	**450**	**825**		**23**

PC:Programme Core, MD: Multidisciplinary, OE#: Any 1 Open Elective, SC : Vocational and Skill Enhancement Course, HS: Humanities and Social Science.

Prepared by	Checked by	BOS Chairman	Dean Academic / Dy. Director	C.O.E.	Director
Dr. Y. K. Kirange	Dr. Nadeem Akhtar	Dr. S. A. Patil	Prof. Dr. P. J. Deore	Prof. S. P. Shukla	Prof. Dr. J. B. Patil

ELECTRICAL ENGINEERING DEPT. R.C.P.I.T. Office Seal SHIRPUR

Program: Electrical Engineering	S. Y. B. Tech.	Semester: III
Engineering Mathematics for Electrical Engineering (RCP23LPC201)		

Course Objectives

1. To build the strong foundation in Mathematics of learner needed for the field of Electronics and Telecommunication Engineering.
2. To provide learner with mathematics fundamentals necessary to formulate, solve and analyses complex engineering problems.
3. To prepare student to apply reasoning informed by the contextual knowledge to engineering practice.

Course Outcomes

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Identify diagonalizable and derogatory matrices and find functions as a square matrix using eigenvalues and eigenvectors	L1	Remembering
CO2	Find Fourier Series of periodic functions and simplify infinite series	L4	Analyzing
CO3	Evaluate vector diffentiations and integrals	L4	Analyzing
CO4	Identify analytic and harmonic functions.	L1	Remembering
CO5	Use Laplace and inverse Laplace Transform to solve the Ordinary Differential Equations.	L3	Applying

Engineering Mathematics for Electrical Engineering (RCP23LPC201) Course Contents

Unit-I 08 Hrs.

Matrix Theory: Eigenvalues and Eigenvectors, properties of Eigenvalues and Eigenvectors, Cayley-Hamilton theorem, Examples based on verification of Cayley-Hamilton theorem, Similarity of matrices, Diagonalization of matrices,Function of square matrix, Quadratic forms over real field, Reduction of quadratic form to a diagonal, canonical form, Rank, index and signature of quadratic form, class value of quadratic forms, definite, Semi-definite and indefinite.

Unit-II 08 Hrs.

Fourier Series: Introduction, Orthogonal and orthonormal set of functions,Introduction of Dirichlet's conditions, Euler's formulae. Fourier Series of Functions: Exponential, trigonometric functions of any period 2L. Even and odd functions, half range sine and cosine series. Complex form of Fourier series.

Unit-III 06 Hrs.

Vector Algebra, Vector Differentiation and Vector Integral: Vector differentiation, Gradient of scalar point function, Divergence and Curl of vector point function Properties: Solenoidal and irrotational vector fields, conservative vector field.

Vector Integral: Green's theorem in a plane, Gauss divergence theorem and Stokes' theorem.

Unit-IV 06 Hrs.

Complex Variable: Analytic Function: Necessary and sufficient conditions (No Proof), Cauchy Riemann equation Cartesian form (No Proof) Cauchy Riemann Equation in polar form (with Proof), Milne Thomson Method and its application, Harmonic function, orthogonal trajectories.

Mapping: Conformal mapping, Bilinear transformations, cross ratio, fixed points.

Unit-V 05 Hrs.

Laplace Transform: LT of standard functions such as Heaviside Unit step function, Dirac Delta function, Periodic functions Linearity property of Laplace Transform, First Shifting property, Second Shifting property, Change of Scale property, Multiplication by power of t property of LT, Division by power of t property, LT of Integral, LT of Derivatives (without proof).

Unit-VI 05 Hrs.

Inverse Laplace Transform: Properties, Partial fractions method and convolution theorem. Applications to solve ordinary differential equations with one dependent variable with given boundary conditions.

Text Books

1. Dr. B. S. Grewal, Higher Engineering Mathematics, Khanna Publication, 43^{rd} Edition, 2020.
2. B. V. Ramana, Higher Engineering Mathematics, Tata Mc-Graw Hill Publication, 6^{th} Edition, 2017.

Reference Books

1. Erwin Kreyszig, Advanced Engineering Mathematics, Wiley Eastern Limited, 10^{th} Edition,2009.
2. Wylie and Barret, Advanced Engineering Mathematics, Tata Mc-Graw Hill, 6^{th} Edition, 1995.
3. Dennis G. Zill and Warren S. Wright, Advanced Engineering Mathematics, Jones and Bartlett Publishers, 1^{st} Edition, 2009.

Program: Electrical Engineering	S. Y. B. Tech.	Semester: III
Analog and Digital Electronics (RCP23LPC202)		
Analog and Digital Electronics Laboratory (RCP23LPC202L)		

Prerequisite: Basic Electrical and Electronics Engineering, Concepts of semiconductors and P-N junction, Gate and Number System

Course Objectives

1. To provide an understanding of the fundamental concepts of analog and digital electronics
2. To develop skills in analyzing, designing, and troubleshooting analog and digital circuits.
3. To introduce students to the practical applications of analog and digital electronics in electrical engineering
4. To familiarize students with the use of simulation tools for circuit analysis and design.
5. To encourage critical thinking and problem-solving skills through practical laboratory experiments.

Course Outcomes

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Understand the Fundamental Concepts of Analog and Digital Electronics.	L2	Understand
CO2	Analyze and Interpret Characteristics and Operation of Electronic Components	L4	Analyze
CO3	Design Analog and Digital Circuits	L6	Create
CO4	Evaluate Performance of Electronic Circuits	L5	Evaluate
CO5	Apply Knowledge of Analog and Digital Electronics to Solve Engineering Problems	L3	Apply

Analog and Digital Electronics (RCP23LPC202)
Course Contents

Unit-I 08 Hrs.

Diode, BJT and Coupling: P-N junction diode, V-I characteristics of a diode, half-wave, full wave rectifiers and bridge rectifiers, Filter circuit, clamper, clipper, Introduction, Types of Configuration: common base, common emitter and common collector configurations, operating point, DC load line analysis, stability and DC biasing circuits, Cascade amplifier and introduction of MOSFET

Unit-II 08 Hrs.

Op-Amp Its Linear and Non-Linear Applications and Timer IC: Ideal op-amp, non-idealities in an op-amp. Linear Applications: Idealized analysis of op-amp circuits, virtual ground concept, inverting and non-inverting amplifier, differential amplifier, adder, subtractor, Integrator, Differentiator, instrumentation amplifier, Non-Linear Applications: Comparator, Zero Crossing Detector, Schmitt trigger with hysteresis, active filters-Low pass, high pass, band pass, all pass, band reject (notch) filters. Multivibrator: IC 555 Astable, Monostable and Bistable.

Unit-III 08 Hrs.

Combinational and Sequential Circuits: Review of postulates of Boolean algebra, Theorems of Boolean algebra, Boolean function and k- map minimization technique for multiple outputs, multiplexer, demultiplexer, priority encoder, comparator, half and full adders, tristate buffers. Latches – S-R latch, D latch, flip-flops-D, J-K , T , master slave J-K F/F, conversion of one F/F to another F/F.

Unit-IV 08 Hrs.

Sequential Circuits and its Applications: Counters: Modulus of Counter, Synchronous and Asynchronous counters, Ripple counters, drawbacks of ripple counters, Ring counters, Twisted Ring Counters, Shift registers, types of shift registers, design using Flip Flops- Bidirectional shift register, Universal shift register,

Unit-V 08 Hrs.

D/A, A/D Converters and Memory: Digital to analog converters: weighted resistor/convertor, R-2R Ladder D/A converter, specifications for D/A converters, analog to digital converters, parallel comparator A/D converter, successive approximation A/D converter, counting A/D converter, dual slope A/D converter, specifications of A/D and Digital memories: RAM, ROM and content addressable memory (CAM), ROM as a PLD, Programmable logic array, Programmable array logic.

Analog and Digital Electronics Laboratory (RCP23LPC202L)

List of Laboratory Experiments

Suggested Experiments: (Any 8)

1. To design, assemble and test the wave shaping circuit using diode - clipping and clamping circuits.
2. To Plot I/P and O/P characteristics of BJT (CE Configuration)
3. To Plot DC Load Line for BJT (Voltage Divider biasing circuit)
4. Design and implementation of integrator, differentiator
5. Design and implementation of instrument amplifier
6. Setup ADC circuit Using IC LM 741 and study its performance
7. Design of the astable multivibrator using IC 555
8. Voltage Follower and Buffer Circuit Design: To design and implement a voltage follower and buffer circuit using the IC741 operational amplifier, and to analyze its characteristics and applications.
9. Sequential Timer(IC-555) for DC Motor Control)
10. Design and implementation of 4 bit Gray to Binary Code Converter
11. Design and implementation of Half and Full Adder circuits
12. Design and implementation of Half and Full subtractor circuits
13. Demonstration of the JK, D and T flip flops using ICs
14. Implement BCD adder using four-bit binary adder IC-7483.
15. Design and implementation of multiplexer and de-multiplexer using ICs
16. Design and implementation of ripple counter using ICs.
17. Design and implementation of 3-bit Synchronous Up/Down counter
18. Construction of adder circuit using Shift Register and full Adder.
19. Code conversion circuits- BCD to Excess-3 and vice-versa.

Any other experiment based on syllabus may be included which would help the learner to understand topic/concept.

The Oral/Practical examination will be based on the entire syllabus, including the experiments performed during laboratory sessions.

Text Books

1. Sergio Franco, "Design with Op-Amps and analog Integrated Circuits", Tata McGraw-Hill Publication, 3^{rd} Edition, 2001.

2. Allen Mottershead, "Electronic Devices and Circuits: An Introduction", Prentice Hall India, 10^{th} Edition, 2010.

3. A. Anand Kumar, "Fundamentals of Digital Circuits", Prentice Hall India, 4^{th} Edition, 2014.

Reference Books

1. R.A. Gayakwad, "Op-Amps and Linear Integrated Circuits", Prentice Hall India, 4^{th} Edition, 2012.

2. R. L. Boylestad and Louis Nashelsky, "Electronic Devices and Circuit Theory", Pearson Publications, 10^{th} Edition, 2009.

3. M. Moris Mano and Michael Ciletti, "Digital Design", Pearson Publications, 5^{th} Edition, 2018.

Program: Electrical Engineering	S. Y. B. Tech.	Semester: III
Electrical Measurement and Instrumentation (RCP23LPC203)		
Electrical Measurement and Instrumentation Laboratory (RCP23LPC203L)		

Prerequisite: Basic Electrical and Electronics Engineering.

Course Objectives

1. Basic concepts of errors in measurements and basic fundamentals of measuring systems, philosophy of measurement and standards.
2. Skills to classify bridges, measuring instruments and equipments and also demonstrate digital instruments, advance instruments.
3. Basic knowledge of transducer and recorders.

Course Outcomes

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	To understand the philosophy of measurement systems, types of errors, standards.	L2	Understand
CO2	To understand the construction, working principle of analog and digital instruments, bridges, transducers and recorders.	L2	Understand
CO3	To analyze the different parameters of electrical quantity in analog and digital instruments.	L4	Analyze
CO4	To analyze the various parameters of DC and AC bridges.	L4	Analyze
CO5	To analyze the various errors produced in analog and digital instruments.	L4	Analyze

Electrical Measurement and Instrumentation (RCP23LPC203) Course Contents

Unit-I 08 Hrs.

Introduction to Measurement and Instrumentation: Philosophy of Measurement: Methods of Measurement, Measurement System, Classification of instrument system, Characteristics of instruments and measurement system, Errors in measurement and its analysis, Standards.

Unit-II 08 Hrs.

Analog Measurement of Electrical Quantities: Electro dynamic, Thermocouple, Electrostatic and Rectifier type Ammeters and Voltmeters, Electro dynamic Wattmeter, Three Phase Wattmeter, Power in three phase system. Instrument Transformer and their applications in the extension of instrument range, measurement of speed, frequency and power factor .

Unit-III 08 Hrs.

Digital Measurement of Electrical Quantities: Concept of digital measurement, block diagram Study of digital voltmeter, frequency meter Power Analyzer and Harmonics Analyzer; Electronic Multimeter

Unit-IV 08 Hrs.

Measurement of Parameters: Different methods of measuring low, medium and high resistances, measurement of inductance and capacitance with the help of AC Bridges, Q Meter.

Unit-V 08 Hrs.

Introduction to Transducers: Definition, different types of transducers, criteria for selection, general characteristics, dynamic characteristics, transducers for measurement of displacement (RVDT and LVDT), speed, angular rotation, altitude, force, torque, humidity and moisture, pressure, strain and temperature (Thermocouple and RTD method), Hall Effect transducer and applications.

Electrical Measurement and Instrumentation Laboratory (RCP23LPC203L)

List of Laboratory Experiments

Suggested Experiments: (Any 8)

1. Study of Various analog and Digital measuring Instruments.
2. Measurement of active power by using two wattmeter method.
3. Measurement of reactive power by using two wattmeter method.
4. Calibration of single phase energy meter.
5. Study of different bridges.
6. Earth resistance measurement using earth tester.
7. Insulation measurement using Megger.
8. Study of Digital torque measurement.
9. Study of Linear Variable differential Transformer.
10. Study of digital frequency meter and digital voltmeter.
11. Strain measurement using strain gauge.
12. Study of Instrument Transformer and its types.

Any other experiment based on syllabus may be included which would help the learner to understand topic/concept.

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

Text Books

1. E. W. Golding, "Electrical Measurements and Measuring Instruments", Reem Publication, 23rd Edition, 2011.
2. C. T. Baldwin, "Fundamentals of Electrical Measurements", Kalyani Publication, 2nd Edition, 1961.
3. Cooper and Derfllick, "Electronic Instrumentation and Measurements Techniques", Prentice-Hall of India, , 3rd Edition, 1992.
4. J. B. Gupta, "Electrical and Electronic Measurement and Instrumentation", S. K. Kataria and Son, 14th Edition, 2013.
5. R. K. Rajput, "Electrical and Electronic Measurement and Instrumentation", S. Chand Publication, 4th Edition, 2016.

Reference Books

1. A. K. Sawhney. "Electrical and Electronic Measurement and Instrumentation", Dhanpant Rai and Company, 2021.

Program: Electrical Engineering	S. Y. B. Tech.	Semester: III
Python Programming Laboratory (RCP23LMD201L)		

Course Objectives

1. Python programming basics, Functions in Python and files handling.
2. GUI Programming and Databases operations in Python
3. Data handling using Python

Course Outcomes

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Describe the various data types, control statements, conditional statements and functions in Python	L2	Understand
CO2	Understand different File handling and exception handling operations using Python	L2	Understand
CO3	Apply Database techniques in python using MySQL with Python	L3	Apply
CO4	Design GUI, apply different database operations and array handling in Python	L3	Apply
CO5	Implement Visualization of dataset using Pandas Dataframe and Matplotlib	L3	Apply

Python Programming Laboratory (RCP23LMD201L)
Course Contents

Unit-I 06 Hrs.

Introduction to Python: History of Python, Data types and Regular expression, Basic Data types identifiers, Basic Data types, Integer Data Type, Float and Complex Data Type, Mathematical Functions, String Data Types, String Manipulation Functions, String Slices Basic Data Types Collections- Lists: Working with Lists, Basic Operations, Sorting, Count and Append, List Comprehension , Dictionary: Definition, Update dictionary, Dictionary Comprehension , Sets, Tuples and Frozen Sets, Data type Conversion

List of Suggested Practical (Any three)

1. To read a number 'n' and print patterns
2. Program to map a list into a dictionary and vice versa
3. Program to study list and dictionary comprehension
4. To implement different string manipulation functions.
5. To count the number of letters/ vowels/ consonants in a string or a list or a dictionary. (Multiple variations of the above suggested programs can be performed)

Unit-II 06 Hrs.

Control statements and Functions in Python: While, for, Nested loops. Use of Continue, Pass and Break statement. Range function, Conditional Statements: if, else, elif, nested if and Switch Case statements , Function arguments pass by value and reference, Recursive Functions.

List of Suggested Practical (Any three)

Use of the control statements to implement:

1. Factorial of a number
2. Palindrome of number or a string
3. Fibonacci series
4. Sine and Cosine series
5. Pythagoras triplets
6. Any one program to demonstrate the method of recursive function

Unit-III 06 Hrs.

Files Directories and Flow Control:

Making and List directories, Changing directory, List files in directories. File and Directory manipulation. File functions, File object attributes, close () method, Opening a binary file. File Attributes, read (read fixed size) readline ( ) tell (). Read data from keyboard. File handling: Opening and closing file, Reading and writing files. Exception Handling, Except Clause, User defined Exceptions

List of Suggested Practical (Any three)

1. Open a file and read the contents of a file and print
2. Open a file and write to a file (overwrite and append).

3. Open a file and count the characters present in the file.
4. Program to demonstrate Exception Handling
5. Splitting of lines by file handling.

Unit-IV 04 Hrs.

Python Database:

Introduction to Python Database, Connections and Executing queries, Transactions and Handling Errors

List of Suggested Practical (Any Two)

1. Install MySQL db
2. Establish database connection
3. Creating Database Table.
4. Use of Insert/Read/Update Operations in database.

Unit-V 04 Hrs.

Introduction to GUI Programming:

Introduction to Tkinter Working with Widgets Controlling Layout with Geometry Managers , Creating and using labels, Buttons, Check buttons, Radio Buttons , Making Applications Interactive

List of Suggested Practical (Any Two)

1.Example App: Temperature Converter
2. Example App: Text Editor
3. Tic tac toe Game using GUI
4. Scientific calculator.

Unit-VI 04 Hrs.

Visualization of Data:

Working with numpy, constructing numpy arrays, Printing arrays, Arithmetic operations on matrix, Slicing Arrays, Random number generation. Working with Matplotlib, Working with pandas: Installation and implementation

List of Suggested Practical (Any Two)

1. Data visualization with matplotlib.
2. Array manipulation/strings/indexing/slicing and other numpy library functions.
3. Histogram using matplotlib.
4. Statistical functions in numpy.
5. Any one tool kits to extend python matplotlib functionality.

Python Programming Laboratory (RCP23LLMD301)

List of Laboratory Experiments

Suggested Experiments: (Any 8)

1. Output all the data entered in the table.
2. Create a table from the given data.
3. Insert Data into the table.
4. Add a column to the table and set default values.
5. Update the data in the given row(s) of the given table.
6. Delete all rows in the table.
7. Create a table with the given constraints.
8. Use a select query to fetch data.
9. Use distinct queries to fetch unique data.
10. Use the where clause to obtain information that meets specific conditions.
11. Use the BETWEEN clause along with WHERE to filter the table based on 2 values.
12. Use the AND clause with WHERE to filter the table based on 2 separate conditions.
13. Use the OR clause is used along with WHERE to filter the table that meets any one of the given multiple conditions.
14. Use the LIKE operator along with WHERE to filter similar values.
15. Use of additional queries - IS NULL, ORDER BY & LIMIT.
16. Renaming of columns during output.
17. Use the MAX() and MIN() functions to retrieve the maximum and minimum values from a column.
18. Combining table - Joins two tables and outputs a single table.
19. Use a left join to output data.
20. Use a cross join to output the data.
21. Use UNION to place a table right on top of another table.
22. Use the WITH query to create temporary tables.
23. Use the EXCEPT query to output the data.
24. Use the INTERSECT query to output the data.
25. Execute a non-correlated subquery independently of the outer query.

Any other experiment based on syllabus may be included which would help the learner to understand topic/concept.

The Oral/Practical examination will be based on the entire syllabus, including the experiments performed during laboratory sessions.

Text Books

1. James Payne,"Beginning Python: Using Python 2.6 and Python 3.1",Wrox Publication, 2010.
2. Dr. R. Nageswara Rao,"Core Python Programming" Dreamtech Press, Wiley Publication, 2nd Edition, India.

Reference Books

1. Lutz, "Learning Python" O'Really Publication, 2th Edition, 2013.
2. E. Balaguruswamy," Introduction to Computing and Problem Solving using Python", McGraw Hill Education India Pvt.,Ltd, 2017.
3. Magnus Lie Hetland,"Beginning Python from Novice to Professional", 2nd Edition, Apress Publication, 2006.
4. Charles Dierbach, "Introduction to Computer Science using Python", John Wiley and Sons Ltd, 2013
5. Laura Cassel, Alan Gauld "Python Projects", Wrox Publication, 2015.

Program: Electrical Engineering	S. Y. B. Tech.	Semester: III
Product Life Cycle Management (RCP23XOE211)		

Prerequisite: Knowledge of basic concepts of Management.

Course Objectives

1. To familiarize the students with the need, benefits and components of PLM.
2. To acquaint students with Product Data Management and 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 and its implementation.

Course Outcomes

COs	Course Outcomes	Blooms Level	Blooms 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

Product Life Cycle Management (RCP23XOE211)
Course Contents

Unit-I 07 Hrs.

Introduction to Product Lifecycle Management (PLM): Product Lifecycle Management, Need for PLM, Product Lifecycle Phases, Opportunities of Globalization, Pre-PLM Environment, PLM Paradigm, Importance and 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: 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 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 Duration Design and Evaluation: Durability of Products and Components, Design for Fatigue, Infinite Life Approach, Design for Finite Life.

Product Recovery Planning and 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.

Text Books

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

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

Reference Books

1. Saaksvuori Antti, Immonen Anselmie,"Product Life Cycle Management", Springer, Dreamtech, 2009, 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", United Kingdom: Wiley, 2010.

Program: Electrical Engineering	S. Y. B. Tech.	Semester: III
Management Information System (RCP23XOE212)		

Course Objectives

1. The course is blend of Management and Technical field.
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

COs	Course Outcomes	Blooms Level	Blooms 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 includes information acquisition and enterprise and global management technologies.	L2	Understand

Management Information System (RCP23XOE212)
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

Text Books

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. James A O’Brien, George M., Ramesh Behl,“Management Information Systems”, 11^{th} Edition, Tata McGraw Hill, 2019.
2. Kelly Rainer, Brad Prince,“Management Information Systems”, Wiley, 2016.

Web References:

1. Management Information System (https://nptel.ac.in/courses/110105148)
2. Management Information System (https://archive.nptel.ac.in/courses/110/105/110105148/)

Program: Electrical Engineering	S. Y. B. Tech.	Semester: III
Operations Research (RCP23XOE213)		

Prerequisite: Knowledge of Mathematics, and Probability.

Course Objectives

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

Course Outcomes

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Formulate the real-world optimisation problem into a Linear Programming Problem (LPP) and analyse the solution obtained using LPP optimisation models	L4	Analyze
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	To breaking down a large problem into smaller sub problems and solved recursively or iteratively using Dynamic Programming models.	L4	Analyze

Operations Research (RCP23XOE213)
Course Contents

Unit-I 12 Hrs.

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 Problem: Formulation, solution, unbalanced Transportation problem. Finding basic feasible solutions – Northwest 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

Text Books

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

Reference Books

1. Boucherie, R. J., Tijms, H. and Braaksma, "A Operations Research: Introduction to Models and Methods", 2021.

2. Hiller, F. S. and Liebermann, G. J, "Introduction to Operations Research", McGraw-Hill Higher Education, 2010.

3. Ravindran, A., Phillips, D. T. and Solberg, J. J, "Operations Research: Principles and Practice", Wiley India Pvt. Limited, 2009.

Program: Electrical Engineering	S. Y. B. Tech.	Semester: III
Personal Finance Management (RCP23XOE214)		

Course 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 familarise the students with microfinance for accelerating the expansion of local microbusinesses.

Course Outcomes

COs	Course Outcomes	Blooms Level	Blooms 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

Personal Finance Management (RCP23XOE214)
Course Contents

Unit-I 07 Hrs.

Overview of Indian Financial System: Characteristics, Components and Functions of Financial System. Financial Instruments and Financial Markets, Financial inclusion.

Introduction to Personal Finance: Person 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 Investing in 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 and 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 and 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: Micro-Finance: Definitions, Scope and Assumptions, Types of Micro-finance, Customers of Micro-finance, Credit Delivery Methodologies, SHG concept, origin, Formation and Operation of Self Help Groups (SHGs).

Models in Microfinance: Joint Liability Groups (JLG), SHG Bank Linkage Model and GRAMEEN Model: Achievements and Challenges

Institutional Mechanism: Current Challenges for Microfinance, Microfinance Institutions (MFIs): Constraints and Governance Issues, Institutional Structure of Microfinance in India: NGO-MFIs, NBFC-MFIs, Co-operatives, Banks, Microfinance Networks and Associations; Demand and Supply of Microfinance Services in India, Impact assessment and social assessments of MFIs.

Reference Books

1. Asha Singh, M. S. Gupta, "Banking and Financial Sector Reforms in India" , Serials Publication, 2010.
2. M.S. Gupta and J. B. Singh,"Indian Banking Sector: Essays and Issues", 1st Edition, Serials Publication, 2016.
3. K.M. Bhattacharya, O. P. Agarwal,"Basics of Banking and Finance", Himalaya Publishing House, 2018.
4. S. Subba Reddy , P. Raghu Ram, "Agricultural Finance and Management", Oxford and IBH Publishing, 2018.
5. Dr.Vasant Desai, "The Indian Financial System and Development", 4th Edition, Himalaya Publishing House, 2011.
6. Sanjay Kumar Satapathy, "Income Tax Management Simple Way of Tax Management, Tax Planning and Tax Saving", 2018.
7. Dr. R. K. Jain, "Direct Tax System Income Tax", SBPD Publications, 2020.
8. S K Mishra,"Simplified Approach to GST Goods and Services Tax", Educreation Publishing, 2018.
9. Todd A Watkins, "Introduction To Microfinance", World Scientific Publishing Company, 2020.

Program: Electrical Engineering	S. Y. B. Tech.	Semester: III
Public Systems and Policies (RCP23XOE215)		

Prerequisite: Basic Knowledge of Social science and Current affairs.

Course 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 the public policy on firms and economy at large.

Course Outcomes

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Understand the importance of public systems in a fast-changing environment in the global context.	L2	Understand
CO2	Analyze the transformations in public systems with emphasis on current initiatives and emerging challenges in the field.	L4	Analyze
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	Evaluate

Public Systems and Policies (RCP23XOE215)
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

Reference Books

1. Charles Wheelan, "Introduction to Public Policy", W. W. Norton and Company, New York, 2011.
2. Thomas R. Dye, "Understanding Public Policy", Prentice Hall India, 2008.
3. Anderson J. E.,"Public Policy-Making: An Introduction", Cengage Publication, 2011.
4. Avasthi and 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", 10^{th} Edition, McGraw-Hill Education, 2013.
8. Richard A. Musgrave and Peggy B. Musgrave, "Public Finance in Theory and Practice", 5^{th} Edition, McGraw Hill Book, 2017.

Program: Electrical Engineering	S. Y. B. Tech.	Semester: III
Fundamentals of Biomedical Instruments (RCP23XOE216)		

Prerequisite: Basic knowledge of Human Anatomy, Basic knowledge of Electronics.

Course 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

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Associate and describe the the different physiological processes taking place within the human body.	L2	Understand
CO2	Identify the use of biomaterials and apply principles of various transducers and 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

Fundamentals of Biomedical Instruments (RCP23XOE216) 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 and EMG.

Transducers and 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, Analysis of digital images.

Unit-V 08 Hrs.

Telemetry and Telemedicine: Introduction to Biotelemetry, Physiological parameters compliant to biotelemetry, Components of Biotelemetry system, Applications of telemetry in medical field (ECG, EEG and EMG).

Text Books

1. Leslie Cromwell, "Biomedical Instrumentation and Measurement", Prentice Hall of India, New Delhi, 2nd Edition, 2015.
2. M. Arumugam, "Bio-Medical Instrumentation", Anuradha Agencies, 2017.
3. Khandpur R.S, "Handbook of Biomedical Instrumentation", Tata McGraw-Hill, 3rd Edition, 2003.
4. John G. Webster, "Medical Instrumentation Application and Design", John Wiley and Sons, 1998.
5. B.D. Ratner, A.S. Hoffmann, F. J. Schoen, J. E. Lemons, "Biomaterials Science - An Introduction to Materials in Medicine", Academic Press, 1997.

Reference Books

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

Program: Electrical Engineering	S. Y. B. Tech.	Semester: III
IPR and Patenting (RCP23XOE217)		

Course Objectives

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

Course Outcomes

COs	Course Outcomes	Blooms Level	Blooms 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

IPR and Patenting (RCP23XOE217)
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:

- 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.

Text Books

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

Program: Electrical Engineering	S. Y. B. Tech.	Semester: III
Entrepreneurship and Startup Ecosystem (RCP23XOE218)		

Course Objectives

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

Course Outcomes

COs	Course Outcomes	Blooms Level	Blooms 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

Entrepreneurship and Startup Ecosystem (RCP23XOE218) Course Contents

Unit-I 06 Hrs.

Understanding the Entrepreneurial Ecosystem

- Introduction to Entrepreneurship and Startups
- Role of Entrepreneurship in 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

Reference Books

1. Alexander Osterwalder and Yves Pigneur, "Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers", John Wiley & Sons, Jul2010.
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. Christensen, Clayton M. "The Innovator's Dilemma: When New Technologies Cause Great Firms to Fail", Boston, MA: Harvard Business School Press, 1997.
5. Brad Feld and Jason Mendelson, "Venture Deals: Be Smarter Than Your Lawyer and Venture Capitalist", Wiley, 4^{th} Edition, 1 October 2019.

Program: Electrical Engineering	S. Y. B. Tech.	Semester: III
Semester Project -I (RCP23XSC201P)		

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

Course Outcomes

COs	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 there by improve the technical communication skill	L3	Apply
CO5	Demonstrate the ability to work in teams and manage the conduct of the research study.	L2	Understand

Semester Project -I (RCP23XSC201P)
Course Contents

Semester Project:

The purpose of introducing semester project at 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 in 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 semester project report which is being submitted in partial fulfilment 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 project approved by departmental committee approved by the Head of Department, a group of 03 to 05 students (max 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. Semester Project Title or Theme should be based on knowledge acquired during 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 appropriate project title based on acquired knowledge from current semester subjects.
- Maintain Log Book of weekly work done(please see attached log book format).
- Report weekly to the project guide along with log book.

Assessment Criteria:

- At the end of the semester, after conformation by the project guide, each project group will submit project completion report in 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:

Size of report shall be of minimum 25 pages. 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 Semester Exam:

Departmental committee (including project guide) will evaluate 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.

Table 1: Log Book Format

S. N.	Week (Start Date : End Date)	Work Done	Sign of Guide	Sign of Coordinator

Table 2: Continuous Assessment Sheet

S. N.	Exam Seat No	Name of Student	Student Attendance (5)	Log Book Maintain (5)	Literature Review (5)	Depth of Understanding (5)	Report (5)	Total (25)

Table 3: Evaluation Sheet

S. N.	Exam Seat No	Name of Student	Project Selection (5)	Design / Simulation / Logic (5)	PCB / Hardware / Programming (5)	Result Verification (5)	Presentation (5)	Total (25)

Program: Electrical Engineering	S. Y. B. Tech.	Semester: III
Universal Human Values (RCP23XHS232)		

Course Objectives

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

Course Outcomes

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

ELECTRICAL ENGINEERING DEPT. R.C.P.I.T. Office Seal SHIRPUR

Universal Human Values (RCP23XHS232)
Course Contents

Unit-I 07 Hrs.

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

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

Unit-II 08 Hrs.

Understanding Harmony in the Human Being - Harmony in Myself

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

Unit-III 12 Hrs.

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

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

Unit-IV 06 Hrs.

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

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

Unit-V 06 Hrs.

Implications of the above Holistic Understanding of Harmony on Professional Ethics:

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

Text Books

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

Reference Books

1. A Nagaraj, "Jeevan Vidya: EkParichaya", Jeevan Vidya Prakashan, Amarkantak, 1999.
2. A.N. Tripathi, "Human Values", New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. Mohandas Karamchand Gandhi,"The Story of My Experiments with Truth" .
5. E. F Schumacher, "Small is Beautiful".
6. Cecile Andrews, "Slow is Beautiful".
7. J C Kumarappa, "Economy of Permanence".
8. PanditSunderlal, "Bharat Mein Angreji Raj".
9. Dharampal, "Rediscovering India".
10. Mohandas K. Gandhi, "Hind Swaraj or Indian Home Rule".
11. Maulana Abdul Kalam Azad, "India Wins Freedom".
12. Romain Rolland , "Vivekananda".
13. Romain Rolland, "Gandhi".

Program: Electrical Engineering	S. Y. B. Tech.	Semester: III
Economics and Financial Management (RCP23XHS234)		

Prerequisite: Knowledge of Economics and Finance domain current affairs.

Course Objectives

1. To describe the relationships among variables to analyse 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

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

Economics and Financial Management (RCP23XHS234) Course Contents

Unit-I 06 Hrs.

Introduction to Economics: Fundamentals of Economics, Definition and scope of economics, the nature of the economic problem, finite resources and unlimited wants, definitions of the factors of production and their rewards, definition of opportunity cost, the influence of opportunity cost 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 and deflation, living standards, 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.

Text Books

1. Gaurav Datt and Biswajit Nag, "Datt and Sundharam's Indian Economy" S. Chand Publishing, 73^{rd} Edition, 2024.

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

Reference Books

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

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

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

4. C. Paramasivan, T. Subramanian, “Financial Management” New Age Publications, 2nd Edition, 2023.

5. Sandeep Goel, “Financial Management Practices in India”, Taylor and Francis Publications, 2016.

Program: Electrical Engineering	S. Y. B. Tech.	Semester: III
Community Engagement Service (RCP23XEL201L)		

Prerequisite: Fundamentals of core branch, Communication Skills.

Course Objectives

1. To sensitise the student / learner into recognising community level problems and challenges and give them an opportunity to engage in activities for solving the same.

Course Outcomes

COs	Course Outcomes	Blooms Level	Blooms 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 sense of belongingness and gratitude towards societal cause	L5	Evaluate
CO3	Witness diversity in communities and cultures and demonstrate change in approach / attitude as, an evidence of unconditional acceptance.	L3	Apply
CO4	Recognise, experience and value, effectiveness of working in a team, demonstrating co-existence of the roles - sincere worker and effective leader.	L5	Evaluate

Community Engagement Service (RCP23XEL201L)
Course Contents

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 child / 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

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 un-initiated 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 (AC)						
Security Systems						
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

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

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 redevelopment 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

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:

1. Food Safety and Standards Authority of India: goo.gl/Y8Lzbu
2. Ex. 1 Milk Adulteration: https://www.youtube.com/watch?v=pbnmeRUBxKk
3. Ex.2 Watermelon Adulteration: https://www.youtube.com/watch?v=yrLAj7oJies

Product	Adulterant	Testing Method	Result	Remarks

Certificates and Formats:

Activity Endorsement Certificate

Date:

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

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

Course outcomes:

1. 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.
2. Commitment for cause: Identify and experience commitment for community engagement activities that reinforce sense of belongingness and gratitude towards societal cause.
3. Diversity: Witness diversity in communities and cultures and demonstrate change in approach / attitude as an evidence of unconditional acceptance.
4. 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

Name of Department Head:

Disclaimer

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

Student Details	**Activity Details**
Name	
PRN	Date
Program	Time
Class/Div	Address

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

1. I accept and understand that the community activity identification and selection has been done willingly by me.
2. 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.
3. 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.
4. 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 and Signature: _____

Parent or Guardian's name and 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 following forms to respective supervisor after conducting both the activities,
  - Activity Conduction Report
  - Participant Feedback (online / offline)
  - Participant Attendance (online / offline)
  - Survey Report
  - Participation certification

Forms for Technical Activity:

1. Activity Conduction Report

Sr. No.	Name of the Activity	
1	Date of Activity	
2	Activity type Open / Technical	
3	Activity objectives	
4	Place of Activity	
5	PRN and Names of students	
6	Name of the Association	
7	Activity description	
8	No. of participants	
9	Photos (Geo tagged)	

2. Participant feedback (online / offline):

Sr. No.	Indicators	Scale: 1 (Lowest) to 5 (Highest)
1	The objectives of the training were clearly defined.	
2	The content was organized and easy to follow.	
3	This training experience will be useful to me.	
4	The trainer was knowledgeable about the training topics.	
5	The training objectives were met.	

Evaluation Scheme:

Continuous Assessment (A):

Term Work:- 25 marks, distribution as herewith:

1. **R**ubric for Open Ended Activity (10 marks)
    - Participation certificate/proof
2. **R**ubric for Technical Activity (15 marks)

Sr.No.	Performance Indicators (Maximum marks per indicator are given in bracket)	Marks
1	Pre-requisite documents (permission letter, presentation material etc.) [05 marks]	
2	Participant Feedback [05 marks]	
3	Participant attendance [05 marks]	
	TOTAL	

OR

3. Rubric for Field Survey Activity:

Sr.No.	Performance Indicators (Maximum 03 marks per indicator)	Marks
1	Topic selection	
2	Survey preparation	
3	Field work	
4	Analysis	
5	Report writing	
	TOTAL	

Reference Books

1. Raghu Ramkrishnan and Johannes Gehrke, “Database Management Systems", 2nd Edition, McGraw – Hill.
2. Dr. P.S. Deshpande, “SQL and PL/SQL for Oracle 10g", Black Book, Dreamtech Press, 2006.
3. Patrick Dalton, “Microsoft SQL Server Black Book", Coriolis Group, U.S., 1997.
4. Paulraj Ponniah, “Data Warehousing Fundamentals a Comprehensive Guide for It Professionals", John Wiley and Sons, Inc., 2004.
5. Jiawei Han, Micheline Kamber and Jian Pei, “Data Mining. Concepts and Techniques", Elsevier Inc., 2012.

Program: Electrical Engineering	S. Y. B. Tech.	Semester: IV
Power System-I (RCP23LPC251)		
Power System-I Laboratory (RCP23LPC251L)		

Prerequisite: Knowledge of Basic Electrical Energy, Knowledge of Electrical Energy Generation System, Present scenario of power

Course Objectives

1. To understand the different types of power generating stations.
2. To examine A.C. and D.C. distribution systems.
3. To understand and compare overhead line insulators and Insulated cables.
4. To illustrate the economic aspects of power generation and tariff methods.
5. To evaluate the transmission line parameters calculations

Course Outcomes

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Understanding the basics of power system generation, transmission, distribution system.	L2	Understand
CO2	Classification of overhead line insulators and evaluation of string efficiency.	L2, L4	Understand, Apply
CO3	Modeling, Design, and Evaluation of various parameters of transmission lines.	L2, L4	Understand, Apply
CO4	Acquire knowledge of underground cables: Construction and methods of laying.	L2, L4	Understand, Apply
CO5	To understand power Distribution System.	L4	Analyze

Power System-I (RCP23LPC251)
Course Contents

Unit-I 08 Hrs.

Generation of Electric Power: Introductions to Power Plant: Hydro station, Steam Power Plant, Nuclear Power Plant and Gas Turbine Plant. Ocean Energy, Tidal Energy, Wave Energy, wind Energy, Fuel Cells, and Solar Energy.

Unit-II 08 Hrs.

Transmission System: Electric supply system, A.C power supply scheme, D.C transmission scheme, Comparison of AC and DC transmission system, advantages of A.C. transmission system, Comparison of various transmission system (Two wire dc system, Single phase two wire A.C system, Single phase three wire system, three phase three wire system, Three phase four wire system), Economic choice of transmission voltage, requirements of satisfactory electric supply.

Unit-III 08 Hrs.

Mechanical Design of Overhead Transmission Line: Main components of overhead line, conductor materials, line supports, Type of insulators, Testing of Insulators, potential distribution over suspension insulator string, string efficiency, methods of improving string efficiency. Phenomenon of corona, factors affecting corona, advantages and disadvantages of corona, methods of reducing corona, Sag in overhead line, calculation of sag, Effects of wind and ice coating on transmission line.

Unit-IV 08 Hrs.

Transmission Line Parameters: Resistance, Inductance: Definition, Inductance due to internal flux of two wire single phase line of composite conductor line, GMD and GMR, Inductance and Capacitance of single and three phase line with equal and unequal spacing, Skin effect, Proximity Effect, Ferranti effect. Phenomenon of Corona, Corona loss, Factors affecting Corona.

Transmission Line Performance: Characteristics and performance of power transmission lines: Short, Medium, Long lines, Generalized constants, Power flow, regulation, Power circle diagrams, Series and shunt compensation, Surge impedance loading.

Unit-V 08 Hrs.

Distribution System and Underground Cables: Distribution System Classification and Requirements of distribution system, Types of distribution AC and DC, Voltage drop calculations in different distribution system, Tariff, desirable characteristics of tariff, types of tariff, Numericals on tariff.

Underground cable: Introductions, Classification, Types of Cables, Insulation resistance and Capacitance, Grading, Dielectric stress in cable, Heating, Current rating of cable, Numericals on insulation resistance and capacitance of cable.

Power System-I Laboratory (RCP23LPC251L)

List of Laboratory Experiments

Suggested Experiments: (Any 8)

1. Study of Hydro Power Plant layout and its components.
2. Study of Thermal Power Plant layout and its components.
3. Study of Nuclear Power Plant layout and its components.
4. Study of line conductors and insulators of OHT system
5. To Determine Regulation and Transmission Efficiency for Short and Medium transmission line.
6. To Determine ABCD parameters of short, medium and long transmission lines.
7. To study the Ferranti effect of Long Transmission Line
8. To Study Various Types of Distribution systems
9. To Design substation models.
10. Case study on different types of Tariff.
11. To Determine Voltage regulation, efficiency and Power factor of long transmission line by using MATLAB Software.
12. To Determine sag of transmission line by using MATLAB Software.
13. Measurement of Insulation Resistance of Power Cables.
14. To study control Panel and Metering Equipment of Industries

Any other experiment based on syllabus may be included which would help the learner to understand topic/concept.

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

Text Books

1. Mehta, V.K, "Electrical Power system", S. Chand and Co., New Delhi, 2011.
2. Ashfaq Hussain, "Electrical Power System", CBS Publishers and Distributors,2015
3. J.B. Gupta, "Electrical Power", SK Kataria and Sons 2012.
4. Debapriya Das, "Electrical Power Systems", New Age International Private Limited, 2016.

Reference Books

1. M. V. Deshpande, “Elements of Electrical Power, Transmission and Distribution”, Tata McGraw Hill, 2004

2. S. L. Uppal, “Electrical Power”, Khanna Publication, 2011.

3. Chetan S. Solanki, “Renewable Energy Technologies”, PHI Learning, 2008.

4. B. R. Gupta, “Generation of Electrical Energy”, S. Chand and Company, 7^{th} Edition, 2017.

5. C. L. Wadhwa, “Generation, Distribution and Utilization of Electrical Energy”, New Age International, 7^{th} Edition, 2016.

Program: Electrical Engineering	S. Y. B. Tech.	Semester: IV
Electrical Machine-I (RCP23LPC252)		
Electrical Machine-I Laboratory (RCP23LPC252L)		

Prerequisite: Magnetic circuit, mutually induced EMF, dynamically induced EMF, Direction of magnetic field in current carrying conductor, Flemings LHR and RHR, Electromechanical energy conversion.

Course Objectives

1. To understand energy conversion process.
2. To understand basic principles operation, performance and control of dc machine and transformer.
3. To understand selection of machines for specific applications.
4. To understand test and analysis the performance of machine.

Course Outcomes

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	To understand the basic knowledge of science, mathematics and engineering for understanding the concept of magnetic circuit, electrical machines and transformer.	L2	Understand
CO2	To Apply engineering concepts in working and characteristics of DC machines	L3	Apply
CO3	To Analyse the performance of DC machines.	L4	Analyze
CO4	To Apply engineering concepts in construction and working of Transformers.	L3	Apply
CO5	To understand selection of machines for specific applications	L4	Analyze

Electrical Machine-I (RCP23LPC252)
Course Contents

Unit-I 08 Hrs.

Electromechanical Energy Conversion Principle: Energy stored in the magnetic circuit, rotating magnetic field, field energy and mechanical force, energy in single and multiple excited magnetic systems, Physical concept of torque production, Concept of general terms pertaining to rotating machines, Dynamic equations of electromechanical systems and analytical techniques.

Unit-II 08 Hrs.

DC Generator: Construction, main parts, magnetic circuits, poles, yoke, field winding, armature core, Armature windings, Generating action, E.M.F equation, magnetization curve, armature reaction, characteristic of DC generator, demagnetizing and cross magnetizing, compensating winding, commutation process and methods to improve commutation. Losses, power flow diagram and efficiency of DC generator.

Unit-III 08 Hrs.

DC Motor: Type of DC motors, significance of back E.M.F, torque equation, power stages, losses and efficiency, characteristic of DC motors, speed control of DC motors, necessity and types of starters, solid state starters. Applications of various DC machines, troubleshooting of various DC machines, selection procedure, study of relevant Indian Standard Specifications.

Unit-IV 08 Hrs.

Transformers: Concept of ideal transformer., Cargo core and amorphous core transformers, Phasor diagram, equivalent circuit, voltage regulation, Losses in a transformer, their variation with load and efficiency, testing of transformer open circuit and short circuit tests, polarity test. Three phase transformer construction, vector groups, V-V connections, Scott connection, parallel operation and load sharing. Applications of various transformers, Distribution Transformer requirements as per Indian Standard.

Unit-V 08 Hrs.

Special Machines and Applications: Brushless DC Motor (BLDC): Constructional details, working principle, comparison of BLDC motor with conventional DC motor, characteristics and applications, advantages and disadvantages. Permanent Magnet DC Motor (PMDC): Constructional details, working principle, characteristics and applications, advantages and disadvantages. Stepper Motor: Constructional details, working principle, types, characteristics and applications, advantages and disadvantages. Universal Motor, Switched Reluctance Motor.

Electrical Machine-I Laboratory (RCP23LPC252L)

List of Laboratory Experiments

Suggested Experiments: (Any 8)

1. Familiarization of the electrical machine laboratory apparatus.
2. Speed Control of DC motor by field resistance control.
3. Speed Control of DC motor by Armature Resistance Control.
4. To study Magnetization Characteristics of D C generator.
5. To study External, Internal Characteristics of D C Generator.
6. Determination of performance characteristic of DC series motor by direct load.
7. Determination of Transformer equivalent circuit from Open Circuit and Short Circuit Test.
8. Determination of performance of single phase transformer by direct load test.
9. Polarity and Ratio test on single phase transformer.
10. Parallel operation of two single phase transformer.
11. Study of phasor and vector group of three phase transformer.
12. Scott connection of two single phase transformer.
13. To study DC Machine characteristics using MATLAB.
14. Load test on single phase transformer using MATLAB.
15. Speed control of BLDC motor using Ardiuno.
16. Direction control of stepper motor using Ardiuno.

Any other experiment based on syllabus may be included which would help the learner to understand topic/concept.

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

Text Books

1. Ashfaq Husain, "Electrical Machines", Dhanpat Rai and Sons, 2^{nd} Edition, 2018.
2. S. K. Bhattacharya, "Electrical Machine", Tata McGraw Hill, 4^{th} Edition, 2018.
3. D. P. Kothari and I. J. Nagrath, "Electrical Machines", Tata McGraw Hill, 5^{th} Edition, 2017.
4. Bhag S. Guru, Huseyin R. Hiziroglu, "Electrical Machines and Transformers", Oxford University Press, 3^{rd} Edition, 2000.

5. K. Krishna Reddy, “Electrical Machines-I and II”, SCITECH Publications, 2008.

Reference Books

1. A. E. Clayton and N. N. Hancock, “Performance and Design of Direct Current Machines”, CBS Publishers, 3rd Edition, 2004.

2. A. E. Fitzgerald, Charles Kingsley, Stephen D. Umans, “Electrical Machines”, Tata McGraw Hill, 7th Edition, 2020.

3. A. S. Langsdorf, “Theory and Performance of DC Machines”, Tata McGraw Hill.

4. M. G. Say, “Performance and Design of AC Machines”, CBS Publishers and Distributors, 2002.

5. Smarajit Ghosh, “Electrical Machines”, Pearson Education, 2007.

6. Charles I Hubert, “Electrical Machines Theory, Application, and Control”, Pearson Education, 7th Edition, 2001.

Program: Electrical Engineering	S. Y. B. Tech.	Semester: IV
Microcontroller and Applications (RCP23LPC253)		
Microcontroller and Applications Laboratory (RCP23LPC253L)		

Prerequisite: Basic Electrical Engineering and Digital Electronics.

Course Objectives

1. To study the Architecture of 8051 microcontroller.
2. To study the addressing modes and instruction set of 8051.
3. To introduce the need and use of Interrupt structure of 8051
4. To develop skill in simple applications development with programming 8051 and to study advanced microprocessor.
5. To develop background knowledge of Embedded Systems.

Course Outcomes

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	To describe the Embedded System characteristics, design metrics and development life cycle.	L1	Understand
CO2	To recall describe the architecture of various micro controller.	L1	Understand
CO3	To understand interpret program for 805l in assembly language and embedded C.	L3	Apply
CO4	To analyze to use the Timers, Interrupts with microcontroller.	L4	Analyze
CO5	To analyze the interfacing of various peripheral devices with microcontroller and outline architecture of advanced microprocessor.	L2	Remember

Microcontroller and Applications (RCP23LPC253)
Course Contents

Unit-I — 08 Hrs.

Introduction to Embedded System: Definition of Embedded System, Embedded Systems vs General Computing Systems, Classification, Major Application Areas, Characteristics and quality attributes (Design Metric) of embedded system. Real time system's requirements, real time issues, interrupt latency. Embedded Product development life cycle

Unit-II — 08 Hrs.

8051 Microcontroller Architecture and Programming: Microprocessor vs Microcontroller, Intel 8051 Functional block diagram, Functions of pins of 8051, memory organization of 8051, Stack and Operation of stack, Instruction set of 8051 microcontrollers, Assembly Language Programs based on instructions, Addressing modes of 8051

Unit-III — 08 Hrs.

8051 Timers and Programming: Data types in C, 8051 Programming in embedded C, 8051 ports and programming in embedded C. Time delay programming in embedded C. 8051 Timers and counters and its programming in embedded C

Unit-IV — 08 Hrs.

Interrupts Programming and Advanced Microprocessor: 8051 interrupts, Interrupts Programming in embedded C, 8051 Serial port Structure and its programming in embedded C. Introduction to Architecture of PIC Microcontroller, ARM Processor, ATMEGA Processor.

Unit-V — 08 Hrs.

8051 Interfacing: Interfacing of Switch, LED, with 8051 and its programming in embedded C, Interfacing and programming of LCD, ADC, DAC, Stepper motor and Relay with 8051 in embedded C.

Microcontroller and Applications Laboratory (RCP23LPC253L)

List of Laboratory Experiments

Suggested Experiments: (Any 8)

1. 1 Write an Assembly language program to perform 8 bit arithmetic operations Addition and Subtraction.
2. Write an Assembly language program to find larger number from given data bytes stored in memory locations.
3. Write an Assembly language program to find square of number using Look up table concept.
4. Write an Assembly language program to perform 8 bit logical AND, OR operations.
5. Write an Assembly language program to arrange an data in ascending or descending order.
6. Write an Assembly language program to transfer data from source to destination locations of memory.
7. Write a program blinking of LED using Proteus VSM simulation software.
8. Design of temperature meter using Arduino.
9. Design of DC voltmeter using Arduino.
10. Implementation of Serial Communication by using 8051 serial ports.
11. Write an embedded C program for interfacing of 8 bit ADC 0809 with 8051 Microcontroller.
12. Write an embedded C program for interfacing of 8 bit DAC 0808 with 8051 to generate various waveforms.
13. Write an embedded C program for stepper motor control by 8051 Microcontroller.
14. Write an embedded C program for interfacing of the relay with 8051.
15. Write an embedded C program for LCD interfacing with 8051 microcontroller.
16. Write a program for switch and LED interfacing using Proteus VSM simulation software.
17. Design of ultrasonic distance meter using Arduino.
18. Design of digital ohmmeter using Arduino.

Any other experiment based on syllabus may be included which would help the learner to understand topic/concept.

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

Text Books

1. Muhammad Ali Mazidi, Janice Gillispie Mazidi, Rolin McKinlay, "The 8051 Microcontroller and Embedded Systems", Pearsons Education, 2nd Edition, 2014.
2. V. Udayashankara and M. S. Mallikarjuna Swamy, "8051 Microcontroller, Hardware, Software and Applications", TATA McGraw Hill, 1st Edition, 2017.
3. R. Theagrajan,"Microprocessor and Microcontroller", BS Publication, 1st Edition, 2010.
4. K. J. Ayala, "The 8051 Microcontrollers- Architecture, Programming and Applications", Peram International Publications, 2nd Edition, 1998.
5. Subrata Ghoshal, "8051 Microcontroller", Pearsons Publishers, 2nd Edition, 2014.
6. Han-Way Huang,"Embedded System Design with C8051", Cengage Learning, 1st Edition, 2009.
7. A. K. Ray and K. M. Burchandi, "Advanced Microprocessor and Peripherals Architectures,Programming and Interfacing", 2nd Edition, Tata McGraw-Hill, 3rd Edition, 2017.
8. James A. Langbridge "Arduino Sketches: Tools and Techniques for Programming Wizardry", Wiley Publication, 1st Edition, 2015.
9. Frank Vahid and Tony Givargis, "Embedded System Design: A Unified Hardware / Software Introduction", 3rd Edition, Wiley Publication, 2006.
10. Raj Kamal, "Embedded Systems: Architecture, Programming and Design", 3rd Edition, Tata McGraw-Hill Publication, 2008.
11. Sriram Iyer and Pankaj Gupta, "Embedded Real-time Systems Programming", 1st Edition, Tata McGraw-Hill Publication, 2017.

Reference Books

1. Scott Mackenzie, "8051 Microcontroller", Pearson Education, 4th Edition, 2006.
2. Intel Microcontroller Data Book.
3. Intel Corporation 1990, "8 bit Embedded Controller Handbook".
4. David Simon, "An Embedded Software Primer", 1st Edn, Pearson Education Publication, 2002.
5. K. V. Shibu, "Introduction to Embedded Systems", 2nd Edition, McGraw Hill, 2017.
6. K. V. K. Prasad, "Embedded Systems / Real-Time Systems: Concepts, Design and Programming", 1st Edition, Dreamtech Press, 2003.

Program: Electrical Engineering	S. Y. B. Tech.	Semester: IV
Data Structures and Algorithms (RCP23LCMD401)		
Data Structures and Algorithms Laboratory (RCP23LLMD401)		

Course Objectives

1. To introduce the concept of data structures.
2. To design and implement various data structure through abstract data type.
3. To develop application using data structure algorithms.

Course Outcomes

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Implement linear data structures using array and linked list.	L4	Analyze
CO2	Solve problems using non-linear data structures.	L3	Apply
CO3	Analyze the performance of sorting and searching algorithms.	L2	Understand

Data Structures and Algorithms (RCP23LCMD401)
Course Contents

Unit-I — 04 Hrs.

Introduction to Data Structures: Introduction to Data structures, Types of Data structures: Linear and nonlinear data structures, Arrays, Stacks, Queue, Linked list Tree and Graph, Recursion, Introduction to Analysis, Algorithms, characteristics of an algorithms, Time and Space complexities, Order of growth functions, Asymptotic notations.

Unit-II — 05 Hrs.

Stack and Queue Data Structure: Introduction to Stack, Stack as ADT, Operations on Stack, Application of stack: – reversing string, Polish notations, Introduction to Queue, Queue as ADT, Operations on Queue, Linear representation of queue.

Unit-III — 05 Hrs.

Linked List Data Structure: Introduction to Linked List, Singly Linked list, Doubly Linked list, Operations on linked list, Linked representation of stack, Linked representation of Queue .

Unit-IV — 06 Hrs.

Sorting and Searching: Introduction to Sorting: Bubble Sort, Selection Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort. Analysis of Sorting Techniques. Comparison of sorting Techniques Introduction to Searching: Linear search, Binary search, Hashing Techniques, Different Hash functions, Collision and Collision resolution techniques, Analysis of searching Techniques.

Unit-V — 06 Hrs.

Tree: Introduction to Trees, Definitions and Tree terminologies, Binary tree representation, Operations on binary tree, Traversal of binary trees, Binary search tree Introduction to Graph, Introduction Graph Terminologies, Graph Representation, Type of graphs, Graph traversal: Depth first search (DFS) and Breadth First search (BFS), Minimum Spanning Tree: Prim's and Kruskal's Shortest Path Algorithm.

Data Structures and Algorithms Laboratory (RCP23LLMD401)

List of Laboratory Experiments

Suggested Experiments: (Any 8)

1. Inserting / Deleting elements into a 1D array.
2. Merging two 1D arrays.
3. Search an element in an array.
4. Insert new elements at the beginning/end/k-th position of a linked list.
5. Optimal insertion new elements at the end of a linked list.
6. Insert/Delete at end in Circular/Doubly Linked List.
7. Implement the functionality of a music player using doubly linked list.
8. Use arrays to implement a Stack - push, pop.
9. Use of other functions in stacks - Peek, isEmpty, isFull.
10. Implement Stack using Arrays.
11. Convert an integer from decimal to binary using the "divisor-remainder" method.
12. Determine if parentheses (and optionally other brackets like curly braces and square brackets) in an expression are properly balanced.
13. Transform the algebraic expression into RPN form.
14. Implement queue using an array - isEmpty, isFull, functions of Queue.
15. Use of Enqueue and Dequeue Functions.
16. Implement the adjacency matrix.
17. Implement Depth First Search.
18. Implement Breadth First Search.
19. Implement a binary tree.
20. Implement PostOrder/PreOrder Traversal.
21. Make a BST from an array of numbers given.
22. Given a binary search tree and an integer X, search if X exists in the BST or not.
23. Given a binary search tree, print its nodes in sorted order.
24. Write a program to search for a specific element in an array.
25. Write a program to find the smallest and largest elements in an array of integers.
26. To implement stack.
27. To implement parenthesis checker using stack.

28. To Implement Infix to Postfix conversion.
29. To evaluate prefix and postfix expression.
30. To implement Linear queue.
31. To implement various operations on linked list –copy, concatenate, split, reverse, count no. of nodes.
32. To implement various operations on doubly linked list.
33. To implement Stack using Linked List.
34. To implement Queue using Linked List.
35. To implement Sorting algorithms.
36. To implement Searching algorithms.
37. To create a binary tree and traverse it in Inorder, preorder and Postorder.
38. To implement binary search tree.
39. To implement DFS and BFS in graph theory

Any other experiment based on syllabus may be included which would help the learner to understand topic/concept.

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

Text Books

1. Tenenbaum, Langsam, Augenstein, "Data structures using C", 1st Edition,Pearson Education,2019.
2. Ellis Horowitz, Sartaj Sahni and Susan Anderson-Freed, "Fundamentals of Data Structures in C", 2nd Edition, W. H. Freeman and Company, 2008.
3. Reema Thareja, "Data Structures using C", 2nd Edition, Oxford, 2017.

Reference Books

1. Mark A. Weiss, "Data Structures and Algorithm Analysis in C", 4th Edition, Pearson Education, 2014.
2. M. T. Goodritch, R. Tamassia, D. Mount, "Data Structures and Algorithms in C++", 2nd Edition, Wiley, 2011.
3. Kruse, Leung, Tondo, "Data Structures and Program Design in C", 2nd Edition, Pearson Education, 2013.
4. Seymour Lipschutz, "Data Structures", Schaum's Outline Series, 1st Edition, Tata McGraw-Hill, 2014.

Program: Electrical Engineering	S. Y. B. Tech.	Semester: IV
Project Management (RCP23XOE261)		

Prerequisite: Basic concepts of Management.

Course Objectives

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

Course Outcomes

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

Project Management (RCP23XOE261)
Course Contents

Unit-I 07 Hrs.

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

Unit-II 08 Hrs.

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

Unit-III 08 Hrs.

Project Planning: Work Breakdown structure (WBS) and linear responsibility chart, Project cost estimation and budgeting, Top down and bottoms up budgeting, Networking and Scheduling techniques, PERT, CPM. Crashing project time and Resource loading and levelling (Only Theory), Project Stakeholders and Communication plan.

Risk Management in projects: Risk management planning, Risk identification and risk register, Qualitative and quantitative risk assessment, Probability, and impact matrix. Risk response strategies for positive and negative risks.

Unit-IV 08 Hrs.

Monitoring and Controlling Projects: Planning monitoring and controlling cycle, Information needs and reporting, engaging with all stakeholders of the projects, communication and project meetings. Earned Value Management techniques for measuring value of work completed, using milestones for measurement, change requests and scope creep, Project audit, Project Contracting: Project procurement management, contracting and outsourcing

Closing the Project: Customer acceptance, Reasons of project termination, Various types of project terminations (Extinction, Addition, Integration, Starvation), Process of project termination, completing a final report, doing a lessons learned analysis, acknowledging successes and failures.

Unit-V 08 Hrs.

Agile Project Management: Agile principle, Agile Manifesto, Agile process framework, Characteristics of Agile Approaches and Scrum, Benefits of Agile project management, Implementing Agile project management.

Agile Project Planning: Comparison of Agile Project Management with Traditional Waterfall Approach, Project Planning with Scrum, Scrum Artifacts Supporting Project Planning , Scrum Events for Project Planning. Scheduling with scrum, Techniques for scrum scheduling- Poker estimation. Agile Tools for Tracking Project Progress: Task Boards, Burnup and Burndown Charts.

Text Books

1. Jack Meredith and Samuel Mantel, "Project Management: A Managerial Approach", 11^{th} Edition, Wiley India.
2. Erik Larson, Clifford Gray, "Project Management: The Managerial Process", 8^{th} edition, McGraw Hill Education.
3. Jim Highsmith, "Agile Project Management", Pearson Education, Low Price Edition,

Reference Books

1. A Guide to the Project Management Body of Knowledge (PMBOK® Guide), 7^{th} Edition, Project Management Institute PA, USA.
2. Gido Clements, "Project Management", Cengage Learning.
3. Gopalan, "Project Management", Wiley India.
4. Dennis Lock, "Project Management", 9^{th} Edition, Gower Publishing England.
5. Kalpesh Ashar, "Agile Essentials You Always Wanted to Know", Vibrant Publishers U.S.A.

Program: Electrical Engineering	S. Y. B. Tech.	Semester: IV
Cyber Security, Policies and Laws (RCP23XOE262)		

Prerequisite: Fundamentals of Computers.

Course Objectives

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

Course Outcomes

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

Cyber Security, Policies and Laws (RCP23XOE262)
Course Contents

Unit-I 08 Hrs.

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

Unit-II 08 Hrs.

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

Unit-III 08 Hrs.

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

Unit-IV 07 Hrs

India's Digital Personal and Data Protection Act (2023): Preliminary, Obligations of Data Fiduciary, Rights and Duties of Data Principal, Special Provisions, Data Protection Board of India, Powers, Functions and Procedure to Be Followed by Board, Appeal and Alternate Dispute Resolution, Penalties and Adjudication.

Unit-V 08 Hrs.

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

Text Books

1. Nina Godbole, Sunit Belapur, "Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives" Wiley-2011.
2. Gurdip Kaur, "Understanding Cybersecurity Management in Decentralized Finance: Challenges, Strategies, and Trends" Springer-2023.

Reference Books

1. “The Information Technology Act”, Bare Act- Professional Book Publishers, New Delhi, 2000.
2. Izzat Alsmadi , “The NICE Cyber Security Framework: Cyber Security Intelligence and Analytics”, Springer-2023.

Web Resources

1. Digital Personal data Protection act 2023.pdf (meity.gov.in)
2. National cyber security (draft v1) (meity.gov.in)
3. CISCO roles responcibility.pdf
4. Standrads (bis.gov.in)
5. AI, Machine Learning and Big Data Laws and Regulations | India (globallegalinsights.com)

Program: Electrical Engineering	S. Y. B. Tech.	Semester: IV
Advanced Operations Research (RCP23XOE263)		

Prerequisite: Operation Research, Mathematics (Calculus).

Course Objectives

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

Course Outcomes

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

Advanced Operations Research (RCP23XOE263)
Course Contents

Unit-I 06 Hrs.

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

Unit-II 06 Hrs.

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

Unit-III 05 Hrs.

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

Unit-IV

11 Hrs

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

Unit-V 11 Hrs.

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

Text Books

1. Gupta, P. K. and D. S. Hira, "Operations Research", S. Chand Publications, 2014.
2. Srinivasan, G., "Operations research: Principles and applications", PHI, 2007.
3. Nita H. Shah, Poonam Prakash Mishra, "Non-Linear Programming-A Basic Introduction", CRC Press, 2020.

Reference Books

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

2. Ravindran, Philips and Soleberg, "Operations Research – Principle and Practice", 2nd Edition, John Wiley, and Sons, 2007.

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

4. Paul A. Jensen, Jonathan F. Bard, "Operations Research: Models and Methods", Wiley Publications, 2003

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

Program: Electrical Engineering	S. Y. B. Tech.	Semester: IV
Corporate Finance Management (RCP23XOE264)		

Course Objectives

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

Course Outcomes

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

Corporate Finance Management (RCP23XOE264)
Course Contents

Unit-I 08 Hrs.

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

Unit-II 08 Hrs.

Concepts of Returns and Risks: Measurement of Historical Returns and Expected Returns of a Single Security and a Two-security Portfolio; Measurement of Historical Risk and Expected Risk of a Single Security and a Two-security Portfolio.

Time Value of Money: Future Value of a Lump Sum, Ordinary Annuity, and Annuity Due; Present Value of a Lump Sum, Ordinary Annuity, and Annuity Due; Continuous compounding and Continuous Discounting.

Unit-III 07 Hrs.

Overview of Corporate Finance: Objectives of Corporate Finance; Functions of Corporate Finance-investment Decision, Financing Decision, and Dividend Decision.

Working Capital Management: Concepts of Meaning Working Capital; Importance of Working Capital Management; Factors Affecting an Entity's Working Capital Needs; Estimation of Working Capital Requirements; Management of Inventories; Management of Receivables; and Management of Cash and Marketable Securities.

Unit-IV 08 Hrs

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

Unit-V 08 Hrs.

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

Dividend Policy: Meaning and Importance of Dividend Policy; Factors Affecting an Entity's Dividend Decision; Overview of Dividend Policy Theories and Approaches — Gordon's Approach, Walter's Approach, and Modigliani-Miller Approach.

Text Books

1. Prasanna Chandra, "Financial Management, Theory and Practice", Tata McGraw Hill Education Private Limited, New Delhi, 8^{th} Edition, 2011.
2. M. Y. Khan, "Indian Financial System", McGraw Hill Education, New Delhi, 9^{th} Edition 2015.
3. I. M. Pandey, "Financial Management", S. Chand and Company Limited, New Delhi, 11^{th} Edition, 2015.

Reference Books

1. Eugene F. Brigham, and Joel F. Houston, "Fundamentals of Financial Management", Cengage Publications, New Delhi, 13^{th} Edition, 2015.
2. Robert C. Higgins, "Analysis for Financial Management", McGraw Hill Education, New Delhi, $l0^{th}$ Edition, 2013.

Program: Electrical Engineering	S. Y. B. Tech.	Semester: IV
Corporate Social Responsibility (RCP23XOE265)		

Course Objectives:

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

Course Outcomes

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

Corporate Social Responsibility (RCP23XOE265)
Course Contents

Unit-I 07 Hrs.

Introduction to Corporate Social Responsibility (CSR):

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

Unit-II 08 Hrs.

Ethical Foundations of CSR:

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

Unit-III 08 Hrs.

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

Unit-IV 08 Hrs

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

Unit-V 08 Hrs.

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

Text Books

1. Andrew Crane, Dirk Matten , "Corporate Social Responsibility: Definition, Core Issues, and Recent Developments", Oxford University Press.
2. IO. C. Ferrell, John Fraedrich, Linda Ferrell , "Business Ethics: Ethical Decision Making and Cases", Cengage Learning .
3. "Corporate Social Responsibility in India", Sanjay K Agarwal, Sage Publications, 2008.
4. "Corporate Social Responsibility in India", Bidyut Chakrabarty, Routledge, New Delhi, 2015.

Reference Books

1. Mark S. Schwartz, "Corporate Social Responsibility: An Ethical Approach", Broadview Press, 2011.
2. George Pohle and Jeff Hittner, "Attaining Sustainable Growth through Corporate Social Responsibility", IBA Global Business Services, 2008 .
3. William B. Werther Jr. and David Chandler, "Strategic Corporate Social Responsibility: Stakeholders in a Global Environment", Sage Publications, 2nd Edition, 2011 .

Program: Electrical Engineering	S. Y. B. Tech.	Semester: IV
Bioinformatics (RCP23XOE266)		

Course Objectives

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

Course Outcomes

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

Bioinformatics (RCP23XOE266)
Course Contents

Unit-I 08 Hrs.

Foundations of Molecular and Cellular Biology.

Introduction to molecular biology: DNA, RNA, proteins, and their roles in cellular processes

Cell structure and function: Organelles, membrane structure, and cellular transport

Cell cycle regulation: phases of the cell cycle, checkpoints, and cell cycle control mechanisms .

Unit-II 08 Hrs.

Genetics and Genomics

Mendelian genetics: Inheritance patterns, Punnett squares, and genetic crosses

Chromosome structure and organization: karyotyping, gene mapping, and genetic linkage

Introduction to genomics: genome structure, organization, and variation

Techniques in molecular genetics: PCR, DNA sequencing, and gene cloning.

Unit-III 08 Hrs.

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

Unit-IV 08 Hrs

Systems Biology.

Introduction to Systems Biology: Modeling biological systems and network analysis, Bioinformatics tools for systems biology and modeling complex biological processes.

Principles of molecular evolution: Mutation, Selection, and genetic drift.

Phylogenetic analysis: Tree construction, sequence alignment, and molecular clock.

Unit-V 07 Hrs.

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

Text Books

1. Jean-Michel Claverie and Cedric Notredame, “Bioinformatics“ 2019.
2. Phillip Compeau and Pavel Pevzner, “Bioinformatics Algorithms: An Active Learning Approach”, Active Learning Publishers, 2019.

Reference Books

1. Arthur Lesk,"Introduction to Bioinformatics", Biologist and Bioinformatics Expert, 2019 .
2. Robert Hoyt, "Introduction to Biomedical Data Science", Informatics Education, 2019
3. Martin Jones, "Python for Biologists: A Complete Programming Course for Beginners", Oxford University Press, 2013
4. Neil C. Jones, and Pavel A. Pevzne, "An Introduction to Bioinformatics Algorithms", MIT Press, 2004.
5. Caroline St. Clair, Jonathan E. Visick, Jones, "Exploring Bioinformatics: A Project-Based Approach", Bartlett Learning, 2014.

Program: Electrical Engineering	S. Y. B. Tech.	Semester: IV
Human Resource Management (RCP23XOE267)		

Course Objectives

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

Course Outcomes

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Understand the changing environment of the HRM and the role of the HR managers.	L2	Understand
CO2	Understand the recruitment process and the application of the IT.	L4	Analyze
CO3	Understand the importance of the training and development.	L4	Analyze
CO4	Understand about the pay plans, performance appraisal and compensation	L4	Analyze
CO5	Understand the importance of the labour relation, the employee security and collective bargaining.	L2	Understand

Human Resource Management (RCP23XOE267)
Course Contents

Unit-I 07 Hrs.

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

Unit-II 10 Hrs.

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

Unit-III . 08 Hrs.

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

Unit-IV 08 Hrs

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

Unit-V 06 Hrs.

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

Text Books

1. Pattanayak, Biswajeet, "Human Resource Management", 6th Ed,PHI Learning Pvt. Ltd., 1 Jul 2020
2. Gary Dessler, "Human Resource Management", 16th Ed, Pearson Publications, 2020

Reference Books

1. Stephen Robbins, "Organizational Behavior", Kogan Page,16th Edition, 2013
2. Aswathapa, "Human Resource Management: Text and Cases", McGraw Hill, 6th Edition, 2011.
3. C. B. Mamoria and S V Gankar, "Dynamics of Industrial Relations in India", Himalaya Publishing, 15th Edition, 2015.
4. P. Subba Rao, "Essentials of Human Resource Management and Industrial Relations", Himalaya Publishing, 5th Edition, 2013.
5. Laurie Mullins, "Management and Organizational Behavior", Pearson Publications, 2016.
6. Raymond J. Stone,Anne Cox, Mihajla Gavin, "Human Resource Management", 10th Ed, John Wiley and Sons, 14 Dec 2020.
7. V S P Rao, "Human Resource Management", Excel publishing, 3rd Edition, 2010.

Program: Electrical Engineering	S. Y. B. Tech.	Semester: IV
Digital Marketing Management (RCP23XOE268)		

Course Objectives

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

Course Outcomes

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Understand the digital marketing framework and model and consumer behaviour.	L2	Understand
CO2	Develop digital marketing strategy roadmap.	L6	Create
CO3	Explain the terminology and concepts for developing web-specific media plans.	L2	Understand
CO4	Understand concepts related to digital campaign management and revenue generation models.	L2	Understand
CO5	Get a perspective on global digital marketing technology/tools and future trends.	L3	Apply

Digital Marketing Management (RCP23XOE268)
Course Contents

Unit-I 06 Hrs.

Introduction to Digital Marketing: Emergence of Digital Marketing as a tool, media consumption drivers for new marketing environment, applications and benefits of digital marketing.

Digital Marketing Framework Delivering enhanced customer value, market opportunity analysis and digital services development, ASCOR framework

Digital Marketing Models Creation Factors impacting digital marketplace, value chain digitization, business models.

The Consumer for Digital Marketing Consumer behavior on the internet, evolution of consumer behavior models, managing consumer demand, integrated marketing communications (IMC)

Unit-II 12 Hrs.

Digital marketing Strategy Development: Elements of assessment phase, macro-micro environmental analysis, marketing situation analysis.

Digital Marketing Internal Assessment and Objectives Planning

Analyzing present offerings mix, marketing mix, core competencies analysis and internal resource mapping. Digital presence analysis, digital marketing objectives development and review.

Digital Marketing Strategy Definition Understanding digital business strategy and structures, consumer development strategy, offering mix for Digital, digital pricing models, managing promotional channels and developing the extended Ps- People, process, programs and performance.

Digital marketing Strategy Roadmap Developing digital marketing strategy roadmap, the 6s digital marketing implementation strategy, marketing across the product life cycle.

Unit-III 08 Hrs.

Digital Marketing Planning and Setup: Understanding digital media planning terminology and stages, steps to creating marketing communications strategy, introduction to search marketing, display marketing, social media marketing.

Digital Marketing Operations Setup Basics of lead generation and conversion marketing, website content development and management, elements of user experience, web usability and evaluation.

Unit-IV 08 Hrs

Digital marketing Execution: Basic elements of digital campaign management, search execution, display execution, social media execution, content marketing.

Digital marketing Execution Elements Digital revenue generation models, managing service delivery and payments, managing digital implementation challenges like e commerce, internal and external and consumer specific challenges.

Unit-V 05 Hrs.

Digital Business – Present and Future: Digital Marketing – Global Landscape, digital marketing overview – global spend, advertising spend, and technology/tools landscape.

Data technologies (Big data and IOT) impacting marketing, segment based digital marketing and SoLoMo – the next level of hyperlocal marketing.

Text Books

1. Puneet Singh Bhatia, "Fundamentals of Digital Marketing", Pearson Education Limited, 2017
2. Seema Gupta, "Digital Marketing", McGraw Hill Education, 2022.

Reference Books

1. Dave Chaffey and P. R. Smith, "Digital Marketing Excellence: Planning, Optimizing and Integrating Online Marketing", 5^{th} Edition, Taylor and Francis, 2017.
2. Dave Chaffey Fiona Ellis-Chadwick, "Digital Marketing: Strategy, Implementation and Practice", Pearson Education Limited, 6^{th} Edition, 2019
3. Digital marketing by Vandana Ahuja, Oxford University Press, 2015.
4. Ian Dodson, "The Art of Digital Marketing", John Wiley and Sons, 2016.

Program: Electrical Engineering	S. Y. B. Tech.	Semester: IV
Logistics and Supply Chain Management (RCP23XOE269)		

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

Course Objectives

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

Course Outcomes

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

Logistics and Supply Chain Management (RCP23XOE269) Course Contents

Unit-I 05 Hrs.

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

Unit-II 06 Hrs.

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

Unit-III 08 Hrs.

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

Unit-IV 08 Hrs.

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

Unit-V 06 Hrs.

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

Unit-VI 06 Hrs.

Technology Standards: Introduction, IT Standards, Information Technology Infrastructure Inter-

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

Text Books

1. Sunil Chopra, Peter Meindl “Supply Chain Management-Strategy, Planning, and Operation”, Pearson Publications 2016
2. David Simchi-Levi, Philip Kaminsky, Edith Simchi-Levi, “Designing and Managing the Supply Chain-Concepts, Strategies, and Case Studies”, McGraw-Hill/Irwin 2008

Reference Books

1. Ian Sadler, “Logistics and Supply Chain Integration”, SAGE Publications, 2007
2. Donald Waters, “Supply Chain Management - An Introduction to Logistics”, Bloomsbury Publishing, 2019
3. Dimitris Folinas, “E-Logistics and E-Supply Chain Management-Applications for Evolving Business” , IGI Global Publications, 2013
4. Martin Christopher, “Logistics and Supply Chain Management”, Pearson Education Publications, 2016.

Program: Electrical Engineering	S. Y. B. Tech.	Semester: IV
Semester Project -II (RCP23XSC251P)		

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

Course Outcomes

COs	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 there by improve the technical communication skill	L3	Apply
CO5	Demonstrate the ability to work in teams and manage the conduct of the research study.	L2	Understand

Semester Project -II (RCP23XSC251P)
Course Contents

Semester Project:

The purpose of introducing semester project at 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 in 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 semester project report which is being submitted in partial fulfilment 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 project approved by departmental committee approved by the Head of Department, a group of 03 to 05 students (max 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. Semester Project Title or Theme should be based on knowledge acquired during 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 appropriate project title based on acquired knowledge from current semester subjects.
- Maintain Log Book of weekly work done(please see attached log book format).
- Report weekly to the project guide along with log book.

Assessment Criteria:

- At the end of the semester, after conformation by the project guide, each project group will submit project completion report in 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:

Size of report shall be of minimum 25 pages. 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 Semester Exam:

Departmental committee (including project guide) will evaluate 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.

Table 1: Log Book Format

S. N.	Week (Start Date : End Date)	Work Done	Sign of Guide	Sign of Coordinator

Table 2: Continuous Assessment Sheet

S. N.	Exam Seat No	Name of Student	Student Attendance (5)	Log Book Maintain (5)	Literature Review (5)	Depth of Understanding (5)	Report (5)	Total (25)

Table 3: Evaluation Sheet

S. N.	Exam Seat No	Name of Student	Project Selection (5)	Design / Simulation / Logic (5)	PCB / Hardware / Programming (5)	Result Verification (5)	Presentation (5)	Total (25)

Program: Electrical Engineering	S. Y. B. Tech.	Semester: IV
Professional and Business Communication Tutorial (RCP23XHS281T)		

Prerequisite: Basic concepts of Management.

Course Objectives

1. To inculcate professional and ethical attitude at 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

COs	Course Outcomes	Blooms Level	Blooms 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

Professional and Business Communication Tutorial (RCP23XHS281T) Course Contents

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 Assignment -02

Interpersonal Skills

- Team Building: Difference between group and team, importance of teamwork, strategies to be a good team player
- **Activity:** The 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 writeup.
- Leadership: Types of leadership, leadership styles, case studies.
- **Activity:** Each student will submit a writeup involving a leader they admire, analysing various aspects of his leadership style.
- Time Management: Importance of time management, cultural views of time, 80/20 rule, time wasters, setting priorities and goal.
- **Activity:** Each student will submit a writeup about a case involving time management.

Reference Books

1. Fred Luthans, "Organizational Behavior", 12th Edition, McGraw Hill, 2010.
2. Lesika and Pettit, "Report Writing for Business", 9th Edition, McGraw Hill, 1994.
3. Huckin and Olsen, "Technical Writing and Professional Communication", 2nd Edition, McGraw Hill, 1991.
4. Wallace and Masters, "Personal Development for Life and Work", 12th Edition, Thomson Learning, 2010.
5. Herta Murphy, "Effective Business Communication", 7th Edition, McGraw Hill, 2017.
6. R. C. Sharma and Krishna Mohan, "Business Correspondence and Report Writing", 5th Edition, Tata McGraw-Hill Education, 2017.
7. B. N. Ghosh, "Managing Soft Skills for Personality Development", Tata McGraw Hill, 2017.
8. Bell, Smith, "Management Communication", 3rd Edition, Wiley India Edition, 2014.

9. Dr. Alex, K., “Soft Skills”, 3rd Edition, S. Chand and Company, 2009.

10. Subramanian R., “Professional Ethics”, 2nd Edition, Oxford University Press, 2017.

11. Sandeep Das, “How Business Story Telling Works: Increase Your Influence and Impact”, Penguin Random House., 2023.

Program: Electrical Engineering	S. Y. B. Tech.	Semester: IV
Design Thinking Laboratory (RCP23XHS283L)		

Prerequisite:

1. Understanding of product / process / software / service development life cycle.
2. Knowledge of agile frameworks (or any similar iterative framework) would be added advantage but will not be mandatory.

Course Objectives

1. To instill an innovative mindset in students to solve the digital-age business, societal and wicked type of problems using design thinking methods and tools, and its application.
2. To equip students with techniques to empathize with users, and ideate innovative and sustainable solutions for real-world problems through an iterative approach to design.

Course Outcomes

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Understand the importance of a Human-Centric design approach for developing a solution.	L2	Understand
CO2	Generate innovative ideas to design sustainable solutions for real world problems.	L3	Apply
CO3	Apply design thinking principles to solve the real-world problems.	L3	Apply

Design Thinking Laboratory (RCP23XHS283L)
Course Contents

Unit-I 06 Hrs.

Introduction to Design Thinking :

- Understanding the fundamentals of design thinking.
- Exploring the history and evolution of design thinking.
- The importance of empathy in the design thinking process.
- Conduct market and industry research by observing and contextualizing various macro and micro trends.
- Case Study - conduct their research on how Design Thinking helped solve some of the biggest and most critical problems of our time.

Unit-II 04 Hrs.

Empathize Phase:

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

Unit-III 04 Hrs.

Define Phase:

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

Unit-IV 04 Hrs.

Ideate Phase:

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

Unit-V 06 Hrs.

Prototype and Validation:

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

Unit-VI 02 Hrs.

Design Thinking for Strategic Innovation:

- Types of innovations, strategic innovation.
- Features of strategic innovation.
- Design thinking and strategic innovation.
- Practices of integrating design thinking in strategic innovation.

List of Laboratory Experiments

Suggested Experiments: (Any 8)

Below is a list of assignments / activities / experiments that would be carried out by students as a mini project in groups consisting of 3-4 students.

Problem statement for these assignments / activities / experiments will be provided by facilitator/ instructor/ faculty to the groups/ teams/ batches within each class.

This list of experiments will help students learn various design thinking methods and practice the corresponding tools available.

1. To conduct market and industry research and analyze case studies demonstrating the application of design thinking. (Increased understanding of how design thinking has been applied to solve critical problems in various contexts.)
2. To exercise empathizing techniques to understand the needs and pain points of a target audience.
3. Developing empathy maps and customer journey maps based on collected insights.
4. To exercise different tools and techniques (such as affinity diagrams, journey mapping, and user story mapping) for synthesizing research findings.
5. Develop user personas to represent different user archetypes and their needs concerning the problem at hand.
6. To practice SCAMPRE technique, Brainstorming and brain writing as a collaborative ideation technique to create multiple creative ideas / solution for the problem at hand.
7. Create a mind map to generate a wide range of solutions to a problem at hand.
8. To explore different prototyping tools and platforms, such as Adobe XD, Figma, Sketch, and InVision.
9. To Conduct rapid prototyping sessions to build low fidelity / High fidelity prototype based on the ideas generated in Ideation phase and iterate based on feedback received.
10. Develop a plan for implementing the final solution, considering factors like scalability and feasibility.
11. - Conduct usability testing to gather feedback on prototypes.
    - Use A/B testing to compare different versions of a solution and determine which performs better.

Any other experiment based on syllabus may be included which would help the learner to understand topic/concept.

The Oral/Practical examination will be based on the entire syllabus, including the experiments performed during laboratory sessions.

Text Books

1. I. Mootee, "Design Thinking for Strategic Innovation: What They Can't Teach You at Business or Design School", Wiley, 2013.
2. M. Lewrick, P. Link, and L. Leifer, "The Design Thinking Playbook: Mindful Digital Transformation of Teams, Products, Services, Businesses and Ecosystems", Wiley, 2018.
3. T. Lockwood, "Design Thinking: Integrating Innovation, Customer Experience, and Brand Value", Allworth Press, 2010.
4. K. T. Ulrich and S. D. Eppinger, "Product Design and Development", McGraw-Hill Hill Education, 6^{th} Edition, 2016.
5. C. J. Meadows and C. Parikh, "The Design Thinking Workbook: Essential Skills for Creativity and Business Growth", Emerald Publishing, 2022.

Reference Books

1. T. Kelley and D. Kelley, "Creative Confidence: Unleashing the Creative Potential Within Us All", HarperCollins Publisher, 2013.
2. T. Brown, "Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation", HarperCollins, 2013.
3. J. Knapp, J. Zeratsky, and B. Kowitz, "Sprint: How to Solve Big Problems and Test New Ideas in Just Five Days", Simon and Schuster, 2016.
4. A. Chakrabarti, "Engineering Design Synthesis: Understanding, Approaches and Tools", Springer, 2002.
5. K. Otto, and K. Wood, "Product Design", Prentice Hall, 2000.