E.G.S. PILLAY ENGINEERING COLLEGE,

(Autonomous)

NAGAPATTINAM – 611002

Approved by AICTE, New Delhi

Affiliated to Anna University, Chennai | Accredited byNAAC with 'A++ 'Grade

Accredited by NBA(B.Tech-IT, B.E-CSE and ECE)(Tier-1)

Approved by AICTE, New Delhi

B. Tech – COMPUTER SCIENCE & BUSINESS SYSTEMS R-2023

COURSE CODE	COURSE NAME	CATEGORY	L	T	P	C	MAX. MARKS		
							CA	ES	TOTAL
Theory Courses									
2302BS401	Operating Systems + Lab	PCC	3	0	2	4	50	50	100
2302BS402	Design And Analysis of Algorithms	PCC	3	0	0	3	40	60	100
2302BS403	Software Engineering	PCC	3	0	0	3	40	60	100
2302BS404	Introduction to Innovation, IP Management & Entrepreneurship	PCC	3	0	0	3	40	60	100
2302BS405	Design Thinking +Lab	PCC	3	0	2	3	50	50	100
2302MA401	Operations Research	BSC	3	0	0	3	40	60	100
	Mandatory Course	MC	3	0	0	3	100	0	100
Laboratory Courses									
2302BS451	Software Engineering Lab	PCC	0	0	2	2	50	50	100
	Indian Constitution (Non Credit)								
TOTAL			**21**	**0**	**6**	**21**	**410**	**390**	**800**

2302BS401	OPERATING SYSTEMS	L	T	P	C
		3	0	2	3

PRE-REQUISITE:

	Data structures like stack, queue, linked list, tree, graph, hashing, file structures, any structured programming language (like C or python).

COURSE OBJECTIVES:

	1.To know the concept of Operating Systems and types of operating system
	2.To analyze the process management system with scheduling algorithms
	3. To process the communication between the processes and detect and recover the deadlocks.
	4. To manage the memory system to utilize the memory space.
	5. To manage the file and disk system to utilize the storage space.

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

CO1:	Infer the knowledge on evolution of operating systems from primitive batch systems to sophisticated multi-user systems and implement the usage of different system calls to manage the resources.
CO2:	Analyze the mechanism of threads with the process of scheduling algorithms used in a multi-programming environment.
CO3:	Outline the mechanism of inter process communication using shared memory, message passing and analyze the activities of process synchronization, deadlock to increase the system performance.
CO4:	Design the hardware component to implement the virtual memory environment with the base knowledge of memory management methodologies
CO5:	Prefer a most suitable file system and the ordered perspective module of disk management methods for computing and storage scenario.

COs Vs POs MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	1	-	-	-	-	-	1	1	3	-
CO2	3	3	3	-	-	-	-	-	3	3	3	-
CO3	3	3	3	-	-	-	-	-	3	3	3	-
CO4	2	2	1	-	-	-	-	-	3	1	3	-
CO5	1	1	2	-	-	-	-	-	-	-	3	-

COs Vs PSOs MAPPING:

COs	PSO1	PSO2	PSO3
CO1	3	2	-
CO2	3	2	-
CO3	2	2	-
CO4	1	2	-
CO5	1	2	-

COURSE CONTENTS:

MODULE I	INTRODUCTION	9 Hours

Concept of Operating Systems (OS), Generations of OS, Types of OS, OS Services, Interrupt handlingand System Calls, Basic architectural concepts of an OS, Concept of Virtual Machine, ResourceManager view, process view and hierarchical view of an OS.		
MODULE II	**PROCESS MANAGEMENT SYSTEM**	**9 Hours**
Definition, Process Relationship, Different states of a Process, Process State transitions, Process ControlBlock (PCB), Context switching, Threads: Definition, Various states, Benefits of threads, Types ofthreads, Concept of multi-threads, Process Scheduling: Foundation and Scheduling objectives, Types ofSchedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time,Response Time, Scheduling algorithms: Pre-emptive and non-pre-emptive, FCFS, SJF, RR;Multiprocessor scheduling: Real Time scheduling: RM and EDF.		
MODULE III	**IPC AND DEADLOCKS**	**9 Hours**
Concurrent processes, precedence graphs, Critical Section, Race Conditions, Mutual Exclusion, HardwareSolution, Semaphores, Strict Alternation, Peterson's Solution, The Producer/ Consumer Problem, EventCounters, Monitors, Message Passing, Classical IPC Problems: Reader's & Writer Problem, DiningPhilosopher Problem, Barber's shop problem, Deadlocks: Definition, Necessary and sufficient conditionsfor Deadlock, Deadlock Prevention, Deadlock Avoidance: Banker's algorithm, Deadlock detection andRecovery, Concurrent Programming: Critical region, conditional critical region, monitors, concurrentlanguages, communicating sequential process (CSP); Deadlocks - prevention, avoidance, detection andrecovery.		
MODULE IV	**MEMORY MANAGEMENT SYSTEM**	**9 Hours**
Memory Management: Basic concept, Logical and Physical address maps, Memory allocation:Contiguous Memory allocation – Fixed and variable partition–Internal and External fragmentation andCompaction, Virtual Memory: Basics of Virtual Memory – Hardware and control structures – Localityof reference, Page allocation, Partitioning, Paging, Page fault, Working Set, Segmentation, Demandpaging, Page Replacement algorithms: Optimal, First in First Out (FIFO), Second Chance (SC), Notrecently used (NRU) and Least Recently used (LRU), I/O Hardware: I/O devices, Device controllers,Direct Memory Access, Principles of I/O.		
MODULE V	**ARCHITECTURE DEPENDENT CODE IMPROVEMENT**	**9 Hours**
File Management: Concept of File, Access methods, File types, File operation, Directory structure, FileSystem structure, Allocation methods (contiguous, linked, indexed), Free-space management (bitvector, linked list, grouping), directory implementation (linear list, hash table), efficiency andperformance, Disk Management: Disk structure, Disk scheduling- FCFS, SSTF, SCAN, C-SCAN, Diskreliability, Disk formatting, Boot-block, Bad blocks.		
		TOTAL: 45 HOURS
LIST OF EXPERIMENTS:		
1. Analysis and Synthesis of Basic Linux Commands		
2. Programs using Shell Programming		
3. Implementation of Unix System Calls		
4. Simulation and Analysis of Non-pre-emptive and Pre-emptive CPU Scheduling Algorithms		
5. Simulation of Producer – Consumer Problem using Semaphores and Implementation		
of Dining Philosopher's Problem to demonstrate Process Synchronization		
6. Simulation of Banker's Algorithm for Deadlock Avoidance		
7. Analysis and Simulation of Memory Allocation and Management Techniques		
8. Implementation of Page Replacement Techniques		
9. Simulation of Disk Scheduling Algorithms		
10. Implementation of File organization Techniques.		
		TOTAL: 30 HOURS
REFERENCES:		
1. Operating System Concepts Essentials. Abraham Silber schatz, Peter Baer Galvin and Greg Gagne.		
2. Operating Systems: Internals and Design Principles. William Stallings.		
3. Operating System: A Design-oriented Approach. Charles Patrick Crowley.		
4. Operating Systems: A Modern Perspective. Gary J. Nutt.		
5. Design of the Unix Operating Systems. Maurice J. Bach.		
6. Understanding the Linux Kernel, Daniel Pierre Bovet, Marco Cesati.		
7. Charles Patrick Crowley, "Operating System: A Design-oriented Approach", 2001.		
8. Daniel Pierre Bovet, Marco Cesati, "Understanding the Linux Kernel", 2000.		

2302BS402	DESIGNANDANALYSISOFALGORITHMS	L	T	P	C
		3	0	0	3

PREREQUISITE:

DataStructuresandAlgorithms

COURSEOBJECTIVES:

1. Tounderstandthetechniquesforanalyzingthecomputeralgorithms.
2. Tolearntheparadigmsfordesigningthealgorithms.
3. Toanalyzetheefficiencyofvariousalgorithmdesigntechniques/paradigmsforthe same problem.
4. Tounderstandthelimitationsofalgorithmicpower.

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

CO1:	Infer the knowledge on evolution of operating systems from primitive batch systems to sophisticated multi-user systems and implement the usage of different system calls to manage the resources.
CO2:	Analyze the mechanism of threads with the process of scheduling algorithms used in a multi-programming environment.
CO3:	Outline the mechanism of inter process communication using shared memory, message passing and analyze the activities of process synchronization, deadlock to increase the system performance.
CO4:	Design the hardware component to implement the virtual memory environment with the base knowledge of memory management methodologies
CO5:	Prefer a most suitable file system and the ordered perspective module of disk management methods for computing and storage scenario.

COs Vs POs MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	1	-	-	-	-	-	1	1	3	-
CO2	3	3	3	-	-	-	-	-	3	3	3	-
CO3	3	3	3	-	-	-	-	-	3	3	3	-
CO4	2	2	1	-	-	-	-	-	3	1	3	-
CO5	1	1	2	-	-	-	-	-	-	-	3	-

COs Vs PSOs MAPPING:

COs	PSO1	PSO2	PSO3
CO1	3	2	-
CO2	3	2	-
CO3	2	2	-
CO4	1	2	-
CO5	1	2	-

COURSE CONTENTS:

ModuleI	**Introduction to Algorithms and Analysis**	**9Hours**
Characteristics of Algorithm. Analysis of Algorithm: Asymptotic analysis of Complexity Bounds – Best, Average andWorst-Casebehavior;PerformanceMeasurementsofAlgorithm,TimeandSpaceTrade-Offs,AnalysisofRecursive Algorithms through Recurrence Relations: Substitution Method, RecursionTree Method and Masters'Theorem.		
ModuleII	**ALGORITHMICSTRATEGIES**	**9Hours**
FundamentalAlgorithmicStrategies:Brute-Force – Exhaustive Search - Assignment Problem-Knapsackproblem - Dynamic Programming –Optimal Binary Search Tree andTravellingSalesmanProblem.		
ModuleIII	**GRAPHANDTREEALGORITHMS**	**9Hours**
Greedymethodologies -Traversalalgorithms:DepthFirstSearch(DFS)andBreadthFirstSearch(BFS)-Shortestpathalgorithms-Transitiveclosure-MinimumSpanningTree-Topologicalsorting-NetworkFlowAlgorithm.		
ModuleIV	**BACKTRACKING & BRANCHANDBOUND TECHNIQUES**	**9Hours**
Backtracking – n-Queens problem – Graph Coloring Problem-Hamiltonian Circuit Problem – Subset Sum Problem -BranchandBound -Assignment problem – Knapsack Problem – Traveling Salesman Problem		
ModuleV	**FEATUREDALGORITHMS**	**9Hours**
Approximationalgorithms,Randomizedalgorithms,ClassofproblemsbeyondNP–PSPACE,IntroductiontoQuantumAlgorithms.		
		TOTAL:45HOURS
ModeofAssessment:CAT/Assignment/Quiz/Seminar/Presentation/ESE		

CourseOutcomes:

1. Applythemathematicaltoolstoanalyzeandderivetherunningtimeofthealgorithms.
2. Demonstratethemajoralgorithmdesignparadigms.
3. Explainmajorgraphalgorithms,stringmatchingandgeometricalgorithmsalongwiththeiranalysis.
4. ArticulatingRandomizedAlgorithms.
5. Explainthehardnessofreal-worldproblemswithrespecttoalgorithmicefficiencyandlearningtocope withit

REFERENCES:

1.Aho, J.Hopcroft andJ.Ullman, ―The Designand Analysis ofComputerAlgorithms‖, 4th Edition, PearsonEducation,2009.

2.ThomasH.Cormen,CharlesE.Leiserson,R.L.Rivest,―IntroductiontoAlgorithms‖,PrenticeHallofIndiaPublications,3rdEdition,2009.

3.JonKleinbergandÉvaTardos,AlgorithmDesign,PearsonEducation,1stEdition,2014.

4.E. HorowitzandS. Sahni,-FundamentalofComputerAlgorithms‖,ComputerScience Press,Inc.1978.

5.RajeevMotwani,PrabhakarRaghavan;RandomizedAlgorithms,CambridgeUniversityPress,1995(OnlinePrint–2013)

6.RavindraK.Ahuja,ThomasL. Magnanti,andJamesB.Orlin,NetworkFlows:Theory, Algorithms,andApplications,1stEdition,PearsonEducation,2014.

7.https://nptel.ac.in

2302BS403	SOFTWARE ENGINEERING	L	T	P	C
		3	0	0	3

PREREQUISITE: Programming and Problem Solving, Engineering Exploration.

COURSE OBJECTIVES:

1. To understand the phases in a software project
2. To understand fundamental concepts of requirements engineering
3. To Understand Analysis Modeling.
4. To understand the various software design methodologies.
5. To learn various testing and maintenance measures.

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

CO1:	Identify the key activities in managing a software project, project schedule, estimate project cost and effort required.
CO2:	Compare different process models
CO3:	Concepts of requirements engineering and Analysis Modeling.
CO4:	Apply systematic procedure for software design and deployment.
CO5:	Compare and contrast the various testing and maintenance.

COs Vs POs MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	3	3	-	-	-	-	-	-	-	2
CO2	2	-	3	3	-	2	-	-	-	-	-	-
CO3	-	-	3	3	-	-	-	-	-	-	3	-
CO4	-	2	-	-	-	-	-	-	-	2	-	-
CO5	-	2	-	-	-	3	-	-	-	-	3	-

COs Vs PSOs MAPPING:

COs	PSO1	PSO2	PSO3
CO1	2		
CO2	2	2	
CO3	2	2	
CO4	2	2	
CO5	2	2	

COURSE CONTENTS:

MODULE I	**SOFTWARE PROCESS AND AGILE DEVELOPMENT**	**9 Hours**
Introduction to Software Engineering, Software Process, Perspective and Specialized Process Models – Introduction to Agility-Agile process-Extreme programming XP Process-Quality management-SQA-SQA plan		
MODULE II	**REQUIREMENTS ANALYSIS AND SPECIFICATION**	**9 Hours**
Software Requirements: Functional and Non-Functional, User requirements, System requirements, Software Requirements Document – Requirement Engineering Process: Feasibility Studies, Requirements elicitation and analysis, requirements validation, requirements management-Classical analysis: Structured system Analysis, Petri Nets- Data Dictionary.		
MODULE III	**SOFTWARE DESIGN**	**9 Hours**
Design process – Design Concepts-Design Model– Design Heuristic – Architectural Design - Architectural styles, Architectural Design, Architectural Mapping using Data Flow- User Interface Design: Interface analysis, Interface Design –Component level Design: Designing Class based components, traditional Components.		
MODULE IV	**TESTING AND MAINTENANCE**	**9 Hours**
Software testing fundamentals-Internal and external views of Testing-white box testing - basis path testing-control structure testing-black box testing- Regression Testing – Unit Testing – Integration Testing – Validation Testing – System Testing and Debugging –Software Implementation Techniques: Coding practices-Refactoring Maintenance and Reengineering-BPR model-Reengineering process model-Reverse and Forward Engineering.		
MODULE V	**PROJECT MANAGEMENT**	**9 Hours**
Software Project Management: Estimation – LOC, FP Based Estimation, Make/Buy Decision COCOMO I & II Model – Project Scheduling – Scheduling, Earned Value Analysis Planning – Project Plan, Planning Process, RFP Risk Management – Identification, Projection - Risk Management-Risk Identification-RMMM Plan-CASE TOOLS		
		TOTAL: 45 HOURS

REFERENCES:

1.Rajib Mall, ""Fundamentals of Software Engineering", Third Edition, PHI Learning Pvt Limited, 2009.

2.Pankaj Jalote, "Software Engineering, A Precise Approach", Wiley India, 2010

3.Kelkar S.A., "Software Engineering", Prentice Hall of India Pvt Ltd, 2007

4.Stephen R.Schach, "Software Engineering", Tata McGraw-Hill Publishing Company Limited,2007

5. https://onlinecourses.nptel.ac.in/noc20_cs68/preview

2302BS404	INTRODUCTION TO INNOVATION, IP MANAGEMENT & ENTREPRENEURSHIP	L	T	P	C
		3	0	0	3

Objectives:

	1. To study the fundamentals of technology innovation, intellectual property rights and entrepreneurship.
	2. To identify and discover market needs.
	3. To create, protect and assetize and commercialize intellectual property.
	4. To learn the opportunities and challenges for entrepreneurs.
	5. To learn the fundamentals of a business model based on technology innovation.

Course Outcomes:

Upon completion of the course, the students will be able to

CO1:	Understand the innovation life cycle and types of innovation.
CO2:	Gain knowledge on the importance of intellectual property rights and procedure of filing an IPR.
CO3:	Interpret the market needs and analyze the marketing strategy.
CO4:	Build a business model based on technology innovation
CO5:	Convert an innovative idea into a venture and protect it through intellectual property rights.

COs Vs POs MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	3	3	-	-	-	-	-	-	-	-
CO2	2	-	3	3	-	2	-	-	-	-	-	-
CO3	-	-	3	3	-	-	-	-	-	-	3	-
CO4	-	2	-	-	-	-	-	-	-	2	-	2
CO5	-	2	-	-	-	3	-	-	-	-	3	-

COs Vs PSOs MAPPING:

COs	PSO1	PSO2	PSO3
CO1	2		
CO2	2	2	
CO3	2	2	
CO4	2	2	
CO5	2	2	

COURSE CONTENTS:		
MODULE I	**INNOVATION**	**9**
A primer on Innovation, IP Rights and Entrepreneurship - Types of Innovation - incremental, disruptive, Lifecycle of Innovation - idea, literature survey, PoT, PoC, Challenges in Innovation - time, cost, data, infrastructure- Case study.		
MODULE II	**INTELLECTUAL PROPERTY RIGHT**	**9**
Types of IPR - patents, copyrights, trademarks, Geographical Indication, Lifecycle of IP -creation, protection, assetization, monetization, Balancing IP risks & rewards - Right Access and Right Use of Open Source and 3rd party products, technology transfer & licensing, IP valuation - methods, examples, limitations- Case study.		
MODULE III	**ENTREPRENEURSHIP**	**9**
Opportunity identification in technology entrepreneurship - customer pain points, competitive context, Market research, segmentation & sizing, Product positioning & pricing, go-to market strategy, Innovation assessment - examples, patentability analysis.		
MODULE IV	**BUSINESS MODELS**	**9**
Start-up business models - fund raising, market segments, channels, co-innovation and open innovation - academia, start- ups and corporates, Technology innovation – Case study.		
MODULE V	**INNOVATION, INCUBATION & ENTREPRENEURSHIP IN CORPORATE CONTEXT**	**9**
Innovation, Incubation & Entrepreneurship in Corporate Context, Technology-driven Social Innovation & Entrepreneurship, Manage innovation, IP and Entrepreneurship Programs- Processes, Governance and Tools		
Text Book(s):		
1. Tidd, John Bessant, Managing Innovation: Integrating Technological, Market and Organizational Change, Sixth Edition, John Wiley & Sons Limited, 2018.		
2. John Bessant and Joe Tidd, Innovation and Entrepreneurship, Third Edition, John Wiley & Sons Limited, 2015.		
3. Vivien Irish, Intellectual Property Rights for Engineers, Second Edition, The Institution of Engineering and Technology, 2015.		
Reference Book(s)/Web Links/Online Resources:		
www.lead-innovation.com		
www.tatainnovista.com		
Social Innovation: A Guide to Achieving Corporate and Societal Value (Insight Report, World Economic Forum, 2016)		
Valuation and Deal making of Technology-Based Intellectual Property: Principles, Methods and Tools, http://razgaitis.com/books/dealmaking/		
www.wipo.int		
Indian Patent Act, 1970		

Approved in 10 th Academic Council Meeting held on 03.06.2023

2302BS405	DESIGN THINKING	L	T	P	C
		3	0	2	3

PREREQUISITE:

The course assumes no prior skill or background in design, art or engineering. It is open to all undergraduates and graduate students with an interest in learning design thinking, and is especiallyrecommendedforthosestudentsplanningsocial-ventureandotherkindsofdesign Interventions.

COURSEOBJECTIVES:

1.Embracinghuman-centereddesignmeansbelievingthatallproblems,eventhe seeminglyintractableoneslikepoverty,genderequality,andcleanwater,are solvable.

2.Believingthatthepeoplewhofacethoseproblemseverydayaretheoneswho holdthe key totheir answer.

3. Offersproblemsolversofanystripeachancetodesignwithcommunities,todeeply understand thepeoplethey'relookingtoserve,todreamupscoresofideas,and tocreateinnovativenew solutionsrootedinpeople'sactual needs.

COURSE OUTCOMES:

Upon completion of the course, the students will be able to

CO1:	DescribeKeyConceptsandbasicsofDesignThinking Principles
CO2:	Design by better understanding people, observe their lives, hear their hopes and desires, and get smart on the design challenge.
CO3:	Generate ideas, identify opportunities for design, and test and refine solutions.
CO4:	Develop to bring the solution to life by figuring out how to get idea to market and to maximize its impact in the world.

COs Vs POs MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	1	-	-	-	-	-	1	1	3	-
CO2	3	3	3	-	-	-	-	-	3	3	3	-
CO3	3	3	3	-	-	-	-	-	3	3	3	-
CO4	2	2	1	-	-	-	-	-	3	1	3	-
CO5	1	1	2	-	-	-	-	-	-	-	3	-

COs Vs PSOs MAPPING:

COs	PSO1	PSO2	PSO3
CO1	2		
CO2	2	2	
CO3	2	2	
CO4	2	2	
CO5	2	2	

COURSE CONTENTS:

Module I	**Designthinking basics**	**09Hours**

Designthinkingprocess,Processmodules–Empathize,Define,Ideate,Prototype&Test,Interview Preparation, Journey Map, Powers of Ten, Point of View, How Might We Questions,Storytelling.

Module II	**InspirationPhase**	**12Hours**

Frame YourDesign Challenge, Create a ProjectPlan, Builda Team, Recruiting Tools, Secondary Research, Interview,GroupInterview,ExpertInterview,DefineYourAudience,ConversationStarters,Extremesand Mainstreams,Immersion,AnalogousInspiration,CardSort,PeersObservingPeers,Collage,GuidedTour, Draw It, Resource Flow, Case Study: Vroom		
Module III	**Ideation Phase**	**12Hours**
Download Your Learnings, Share Inspiring Stories, Top Five, Find Themes, Create Insight Statements, ExploreYourHunch,HowMightWe,CreateFrameworks,Brainstorm,BrainstormRules,BundleIdeas,Get Visual, Mash-Ups, Design Principles, Create a Concept, Co-Creation Session, Gut Check, Determine, What to Prototype, Storyboard, Role Playing, Rapid Prototyping, Business Model Canvas, Get Feedback, IntegrateFeedbackandIterate,CaseStudy:Asili		
Module IV	**ImplementationPhase**	**12Hours**
Live Prototyping, Roadmap, Resource Assessment, Build Partnerships, Ways to Grow Framework, Staff, YourProject,FundingStrategy,Pilot,Define Success,KeepIterating,CreateaPitch,SustainableRevenue, MonitorandEvaluate,KeepGettingFeedback,CaseStudy:Clean Team		
		TOTAL:45HOURS

LISTOF EXPERIMENTS[SUGGESSTED]
1.FrameaDesignChallenge
2.PlanResearch
3.BuildanInterview Guide
4.ConductResearch
5.PointofViewStatements
6.ClusterIntoThemes
7.CreateInsightStatements
8.Brainstorm
9.SelectBestIdeas
10.DescribetheIdeas
11.Createa Storyboard
12.DetermineWhattoPrototype
13.TestPrototype&GetFeedback
14.BusinessModelCanvas
15.CreateanAction Plan
16.ResourceAssessment
17.CreateaPitch
18.Reflect

FURTHER READING:

1. *Design forSocialImpact:HowtobyIDEO.org*
2. *DesignThinkingTool Kitby IDEO.org*
3. *The FieldguidetoHumanCentered DesignbyIDEO.org*

REFERENCES:

1.Creative Confidence: Unleashing the Creative Potential Within Us All Book by David M. Kelley and Tom Kelley, 2013

2.Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation Book by Tim Brown, 2009

3.The art of Innovation by Tom Kelly, 2011

4.DesignThinkingforStrategicInnovation:What TheyCan'tTeachYouatBusinessOrDesignSchoolBook byIdrisMootee,2013

5.TheDesignofEverydayThingsBookbyDonNorman,1988

Approved in 10 th Academic Council Meeting held on 03.06.2023

2302MA401	OPERATIONS RESEARCH	L	T	P	C
		3	0	0	3

PREREQUISITE:

Basic Mathematics

COURSEOBJECTIVES:

1. To understand optimization of LPP using simplex and other methods to be applied in the Industrial situations.
2. To develop formulation skills in transportation models and finding solutions
3. To know how project management techniques help in planning and scheduling a project
4. To understand queue discipline in different situations and simulation techniques.

COURSEOUTCOMES:

Onthesuccessful completionofthecourse,students willbeableto

CO1:	Solve linear programming problems using appropriate techniques and optimization solvers, interpret the results obtained.
CO2:	Interpret the transportation and assignment models' and infer solutions to the real-world problems
CO3:	Use CPM and PERT techniques to plan, schedule and control project activities.
CO4:	Derive the mathematical models of Markovian queues and compute various measures of performance in these models.
CO5:	Explain procedures, effectively communicate ideas, interpret results and solutions in simulation.

COsVsPOsMAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	1	-	-	-	-	-	1	1	3	-
CO2	3	3	3	-	-	-	-	-	3	3	3	-
CO3	3	3	3	-	-	-	-	-	3	3	3	-
CO4	2	2	1	-	-	-	-	-	3	1	3	-
CO5	1	1	2	-	-	-	-	-	-	-	3	-

COsVsPSOsMAPPING

COs	PSO1	PSO2	PSO3
CO1	2	2	
CO2	2	2	
CO3	2	2	
CO4	2	2	
CO5	2	2	

COURSECONTENTS:

MODULE I	**INTRODUCTION TO LINEAR PROGRAMMING**	**9 Hours**

Introduction to applications of operations research in functional areas of management. Linear Programming-formulation, solution by graphical and simplex methods (Primal - Penalty, Two Phase).

MODULE II	**TRANSPORTATION AND ASSIGNMENT PROBLEMS**	**9 Hours**

TP - Examples, Definitions – decision variables, supply & demand constraints, formulation, Balanced &unbalanced situations, Solution methods – NWCR, minimum cost and VAM, test for optimality (MODI method), degeneracy and its resolution. AP-Examples, Definitions–decision variables, constraints formulation,Balanced&unbalanced situations, Solution method–Hungarian, test for optimality (MODI method), degeneracy
and its resolution.

MODULE III	**NETWORK MODELS**	**9 Hours**

Project definition, Project scheduling techniques – Gantt chart, PERT & CPM, Determination of critical paths-Estimation of Project time and its variance in PERT using statistical principles.

MODULE IV	**QUEUING THEORY**	**9 Hours**

Definitions– queue (waiting line), waiting costs, characteristics (arrival, queue, service discipline) of queuing system, queue types (channel vs. phase). Kendall‟s notation, Little‟s law, steady state behaviour, Poisson Process & queue, Models with examples - M/M/1 and its performance measures; M/M/m and its performance measures.

MODULE V	**SIMULATION METHODOLOGY**	**9 Hours**

Definition and steps of simulation, random number, random number generator, Monte-Carlo Simulation -Application in Scheduling and Queuing systems.

TOTAL: 45HOURS

TEXT BOOKS:

1.Hamdy A. Taha, “Operation Research: An introduction”, 10th Edition, Pearson, 2017.

2. KantiSwarup, Gupta, P.K., & Man Mohan, “Operations Research”, Sultan Chand & Sons, New Delhi,16th edition, 2012.

3. Sharma, J. K. “Operations Research Theory and Applications”, Macmillan India .3rd edition 2009

4. Paneerselvam R., Operations Research, Prentice Hall of India, Fourth Print, 2008.

5. G. Srinivasan, Operations Research – Principles and Applications, PHI,2007.

6. Gupta P.K, Hira D.S, Problem in Operations Research, S.Chand and Co, 2007.

WEB REFERENCES:

https://freevideolectures.com/course/2678/advanced-operations-research

https://onlinecourses.swayam2.ac.in/cec21_ma09

Approved in 10 th Academic Council Meeting held on 03.06.2023

2301MC405	LEAN START-UP MANAGEMENT	L	T	P	C
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COURSE OBJECTIVES:

1.	The objective of the course is to make a student to create and commercialize the product

COURSE OUTCOMES:

Upon successful completion of the course, students will be able to

CO1:	Understand developing business models and growth drivers
CO2:	Use the business model canvas to map out key components of enterprise
CO3:	Analyse market size, cost structure, revenue streams, and value chain
CO4:	Understand build-measure-learn principles
CO5:	Foreseeing and quantifying business and financial risks

COsVsPOsMAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	1	-	-	-	-	-	1	1	3	-
CO2	3	3	3	-	-	-	-	-	3	3	3	-
CO3	3	3	3	-	-	-	-	-	3	3	3	-
CO4	2	2	1	-	-	-	-	-	3	1	3	-
CO5	1	1	2	-	-	-	-	-	-	-	3	-

COsVsPSOsMAPPING

COs	PSO1	PSO2	PSO3
CO1	2	2	
CO2	2	2	
CO3	2	2	
CO4	2	2	

CO5	2	2	

COURSE CONTENTS:

Module-I	**CREATIVITY AND DESIGN THINKING**	**9 Hours**
Identify the vertical for business opportunity, understand your customers, accurately assess market opportunity		
Module-II	**MINIMUM VIABLE PRODUCT**	**9 Hours**
Value Proposition, Customer Segments, Build-measure-learn process		
Module-III	**BUSINESS MODEL DEVELOPMENT**	**9 Hours**
Channels and Partners, Revenue Model and streams, Key Resources, Activities and Costs, Customer Relationships and Customer Development Processes, Business model canvas –the lean model-templates		
Module-IV	**BUSINESS PLAN AND ACCESS TO FUNDING**	**9 Hours**
Visioning your venture, taking the product/ service to market, Market plan including Digital & Viral Marketing, start-up finance - Costs/Profits & Losses/cash flow, Angel/VC,/Bank Loans and Key elements of raising money		
Module-V	**LEGAL & CONTEMPORARY DISCUSSIONS**	**9 Hours**
Legal, Regulatory, CSR, Standards, Taxes & Contemporary discussion		
		TOTAL: 45 HOURS

TEXTBOOKS:

1. Steve Blank, K & S Ranch (2012)The Startup Owner's Manual: The Step-By-Step Guide for Building a Great Company, 1st edition

2. Steve Blank (2013)The Four Steps to the Epiphany, K&S Ranch; 2nd edition

3. Eric Ries (2011) The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses, Crown Business

REFERENCES:

1. Steve Blank (2014) Holding a Cat by the Tail, , K&S Ranch Publishing LLC

2. Karal T Ulrich, Product Design and Development, SDEppinger, McGraw Hill

3. Peter Thiel, (2014) Zero to One: Notes on Startups, or How to Build the Future, Crown Business

4. Lean Analytics: Use Data to Build a Better Startup Faster(Lean Series), Alistair Croll& Benjamin Yoskovitz,O'Reilly Media; 1stEdition

5. Marty Cagan, (2008) Inspired: How To Create Products Customers Love, SVPG Press; 1stedition

Approved in 10 th Academic Council Meeting held on 03.06.2023

2302BS451	SOFTWARE ENGINERING LABORATORY	L	T	P	C
		0	0	2	2

PREREQUISITE: Programming and Problem Solving, Engineering Exploration.

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COURSE OBJECTIVES:

1. To understand the concepts of software engineering
2. To understand the effectiveness of software project management
3. To understand the metrics and models of software quality and reliability
4. To implement software requirement analysis, design and construction
5. To know the various software testing methods

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

CO1:	To utilize engineering approach to software development
CO2:	To practice various software life cycle models.
CO3:	To implement software quality models.
CO4:	To analyze the techniques of requirements gathering and modeling
CO5:	To implement class responsibility collaborator model.

COs Vs POs MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	-	-	-	-	1	-	3	2	1	-
CO2	2	3	1	1	-	1	-	-	-	-	-	-	-	-
CO3	2	2	2	1	2	-	-	-	-	-	-	-	1	1
CO4	-	3	2	1	2	-	-	-	2	1	-	1	2	1
CO5	2	3	-	1	-	1	-	-	-	-	-	-	2	-
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2

COs Vs PSOs MAPPING:

COs	PSO1	PSO2
CO1		2
CO2	2	2
CO3	2	2
CO4	2	2
CO5	2	2

LIST OF EXPERIMENTS:

1. Development of requirements specification.
2. Function oriented design using SA/SD
3. Object – oriented design using UML
4. Test Case design
5. Implementation of the designed software using C++ language
6. Perform testing using any tool or different strategies
7. Use of Case Tools and other tools such as configuration management tools
8. Program analysis tools in the software life cycle

TOTAL: 45 HOURS

REFERENCES:

1. *Rajib Mall, "Fundamentals of Software Engineering", Third Edition, PHILearning PrivateLimited, 2009.*
2. *PankajJalote, "Software Engineering, A Precise Approach", Wiley India,2010.*
3. *Stephen R.Schach, "Software Engineering", Tata McGraw-Hill PublishingCompany Limited, 2007.*