

Structure of Curriculum for Bachelor of Technology (B.Tech.) in Information Technology Programme

**Syllabus Aligned with the National Education Policy (NEP) 2020
Effective from Academic Year 2025–2026**



(For Affiliated Colleges)

**Department of Information
Technology**

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Abbreviations

Abbreviation	Definition
BSC	Basic Science Course
PCC	Programme Core Course
PEC	Programme Elective Course
MDM	Multidisciplinary Minor
OE	Open Electives
HSSM	Humanities, Social Science, and Management Course
VEC	Value Education Courses
VSEC	Vocational and Skill Enhancement Courses
CEP	Community Engagement Project
FP	Field Project
OJT	On Job Training
HON	Honor Course
DM	Double Minor
RM	Research Methodology
HR	Honor with Research
L	Lecture
P	Practical
T	Tutorial
CA	Continuous Assessment
MSE	Mid Semester Exam
ESE	End Semester Exam
CR	Credits

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B.Tech. in Information Technology with Multidisciplinary Minor

Vision

To be a center of excellence in Information Technology education, research, and innovation, nurturing globally competent professionals with ethical values and social responsibility.

Mission

M1:	To impart strong theoretical and practical knowledge in emerging areas of Information Technology.
M2:	To promote interdisciplinary learning, innovation, and research culture.
M3:	To inculcate ethical values, leadership skills, and societal responsibility.
M4:	To develop industry-ready professionals with lifelong learning capabilities.

Programme Educational Objectives (PEOs)

PEO1:	Apply engineering principles, computing knowledge, and modern tools to solve real-world problems in industry, academia, and entrepreneurship.
PEO2:	Engage in innovation, research, or higher studies to advance in their professional careers.
PEO3:	Demonstrate ethical behavior, leadership, teamwork, and communication skills in multidisciplinary environments.
PEO4:	Contribute to society by developing sustainable, inclusive, and technology-driven solutions.
PEO5:	Pursue continuous learning and adapt to technological advancements throughout their professional journey.

Programme Outcomes (POs)

PO1:	Engineering Knowledge: Apply knowledge of mathematics, science, engineering fundamentals and Information Technology specialization to solve complex problems.
PO2:	Problem Analysis: Identify, formulate, research literature, and analyze complex engineering problems to reach substantiated conclusions.
PO3:	Design/Development of Solutions: Design IT solutions and systems to meet desired needs with consideration for public health, safety, culture, society, and environment.
PO4:	Conduct Investigations of Complex Problems: Use research-based knowledge and methods to analyze and interpret data and provide valid conclusions.
PO5:	Modern Tool Usage: Create, select and apply appropriate techniques, resources, and modern IT tools for complex engineering activities.
PO6:	The Engineer and Society: Apply contextual knowledge to assess societal, legal, and cultural issues relevant to professional practice.
PO7:	Environment and Sustainability: Understand the impact of IT solutions in societal and environmental contexts and demonstrate sustainable development.
PO8:	Ethics: Apply ethical principles and commit to professional ethics and responsibilities.
PO9:	Individual and Team Work: Function effectively as an individual and as a member or leader in diverse teams and multidisciplinary settings.
PO10:	Communication: Communicate effectively with engineering communities and society at large, and write effective reports and documentation.
PO11:	Project Management and Finance: Demonstrate knowledge of project management and financial principles to manage projects in a multidisciplinary environment.
PO12:	Lifelong Learning: Recognize the need for lifelong learning in the context of technological change.

Programme Specific Outcomes (PSOs)

PSO1:	Apply the principles and practices of computing and software engineering to develop real-world IT solutions in domains like Web, Data Analytics, Networks, and Cybersecurity.
PSO2:	Demonstrate proficiency in using modern tools, programming languages, and platforms for effective problem-solving and project implementation.
PSO3:	Exhibit leadership, innovation, and ethical responsibility in IT practices, with effective teamwork and communication.

PEO–PO–PSO Correlation Matrix

PEOs \ POs/PSOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PSO 3
PEO1	3	3	3	2	3	2	2	2	2	2	2	2	3	3	2
PEO2	2	3	2	3	3	1	1	2	2	2	2	3	2	3	2
PEO3	1	2	2	1	2	3	2	3	3	3	2	2	1	2	3
PEO4	2	2	3	2	2	3	3	3	2	2	2	2	3	2	3
PEO5	2	2	2	2	2	2	2	2	2	2	2	3	2	2	2

Note: Values in the matrix represent the level of correlation between PEOs and POs/ PSOs: **1**– Low, **2**– Medium, **3**–High.

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Curriculum Structure for Second Year B. Tech (Information Technology)

Semester – III										
Sr. No.	Course Type	Course code	Course Name	Hours		Examination Scheme				Credits
				L	P	CA	MSE	E S E	Total Marks	Total
1	BSC	25AF1000BS301	Engineering Mathematics III	3	-	20	20	60	100	3
2	PCC	25AF1246PC302	Data Structures	3	-	20	20	60	100	3
3	PCC Lab	25AF1246PCL303	Data Structures Lab	-	2	60	-	40*	100	1
4	PCC	25AF1246PC304	Object Oriented Programming using Java	3	-	20	20	60	100	3
5	PCC Lab	25AF1246PCL305	Object Oriented Programming using Java Lab	-	2	60	-	40*	100	1
6	MDM	25AF1246MD306	Multidisciplinary Minor-1	2	-	20	20	60	100	2
7	OE	25AF1246OE307	Open Elective – 1 (any course from University OE Basket)	3	-	20	20	60	100	3
8	AEC	25AF1246AEL308A	Modern Indian Languages (any one) A) Marathi (मराठी) B) Hindi (हिंदी) C) Sanskrit (संस्कृत)	-	2	60	-	40†	100	1
		25AF1246AEL308B								
		25AF1246AEL308C								
9	HSSM	25AF1246HM309	ITPM	2	-	20	20	60	100	2
10	VEC1	25AF1000VE310A	Life of Chhatrapati Shivaji Maharaj	1	-	60	-	40†	100	1
11	CEP / FP	25AF 1246CP311	Community Engagement Project /field Project	-	4	60	-	40*	100	2
Total				17	10	420	120	560	1100	22

*Practical/Oral evaluation of 40 marks at the end of the semester.

†Presentation/Oral evaluation of 40 marks at the end of the semester.

Semester – IV										
Sr. No.	Course Type	Course code	Course Name	Hours		Examination Scheme				Credits
				L	P	CA	MSE	ESE	Total Marks	Total
1	PCC	25AF1246PC401	Analysis of Algorithms	3	-	20	20	60	100	3
2	PCC Lab	25AF1246PCL402	Analysis of Algorithms Lab	-	2	60	-	40*	100	1
3	PCC	25AF1246PC403	Computer Organization and Architecture	3	-	20	20	60	100	3
4	PCC	25AF1246PC404	Discrete Mathematics	3	-	20	20	60	100	3
5	MDM	25AF1246MD405	Multidisciplinary Minor-2	3	-	20	20	60	100	3
6	OE	25AF1246OE406	Open Elective – 2 (any course from University OE Basket)	2	-	20	20	60	100	2
7	VSEC	25AF1246VSL407	Web Technology	1	2	60	-	40*	100	2
8	HSSM	25AF1246HM408	Innovation and Entrepreneurship	2	-	60	-	40†	100	2
9	VEC2	25AF1000VE409B	Life of Bharat Ratna Dr Babasaheb Ambedkar	1	-	60	-	40†	100	1
10	VEC3	25AF1000VE410C	UHV-II	2	-	20	20	60	100	2
Total				20	4	360	120	520	1000	22

*Practical/Oral evaluation of 40 marks at the end of the semester.

†Presentation/Oral evaluation of 40 marks at the end of the semester.

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List of Multidisciplinary Minor (MDM) Courses offered by Department of Information Technology

Multidisciplinary Minor (MDM) Courses

Sr. No.	Course Type	Semester	Course code	Course Name	Hours		Examination Scheme				Credits
					L	P	CA	MSE	ESE	Total Mark	Total
1	MDM	Sem-III	25AF1246MD306	Data Structures	2	-	20	20	60	100	2
2	MDM	Sem-IV	25AF1246MD405	Computer Organization and Architecture	3	-	20	20	60	100	3
3	MDM	Sem-V	25AF1246MD508	Machine learning	3	-	20	20	60	100	3
4	MDM	Sem-VI	25AF1246MD609	Cloud Computing	3	-	20	20	60	100	3
5	MDM	Sem-VIII	25AF1246MD809	Artificial Intelligence	3	-	20	20	60	100	3
Total					14	0	100	100	300	500	14

Note: *Information Technology department Students will choose a Multidisciplinary Minor (MDM) Bucket (a Set of Courses to be learnt from 2nd Year to Third/Final Year) offered by the other departments.*

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List of Open Elective (OE) Courses offered by University

Faculty-wise baskets of OE are prepared by University which are chosen from faculty **other than** that of the Major Faculty i.e. in this case **Major Faculty is Faculty of Engineering**. Other Faculties considered are as follows:

1. Faculty of Management and Commerce
2. Faculty of Law
3. Faculty of Humanities and Arts
4. Faculty of Architecture and Planning
5. Faculty of Health Sciences
6. Faculty of Science

Students need to take up **three or four courses of 08 credits** over semesters **III to V**

Open Elective (OE) Courses										
Sr. No.	Course Type	Semester	University OE Courses link	Hours		Examination Scheme				Credits
				L	P	CA	MSE	ESE	Total Mark	Total
1	OE	Sem-III	https://dbatu.ac.in/wp-content/uploads/2024/08/Open-Electives-Buckets-for-University-Campus-2024-25.pdf	3	-	20	20	60	100	3
2	OE	Sem-IV		2	-	20	20	60	100	2
3	OE	Sem-V		3	-	20	20	60	100	3
Total				8	0	60	60	180	300	8

Note:** It is essential for students to choose these courses from disciplines **other than their major programme (i.e. engineering)** for which they initially **enrolled in during their first year (ex.B. Tech. IT).

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List of Honor Courses offered by Department of Information Technology

Honor (HON) Courses											
Sr. No.	Course Type	Semester	Course code	Course Name	Hours		Examination Scheme				Credits
					L	P	CA	MSE	ESE	Total Marks	Total
1	HON	Sem-III	25AF1246HON301	Optimization Techniques	3	-	20	20	60	100	3
2	HON	Sem-IV	25AF1246HON402	Advanced Algorithms and Data Structures	3	-	20	20	60	100	3
3	HON	Sem-V	25AF1246HON503	Advanced Computer Architecture	3	-	20	20	60	100	3
4	HON	Sem-VI	25AF1246HON604	Mobile Computing	3	-	20	20	60	100	3
5	HON	Sem-VII	25AF1246HON705	Robotics and Embedded Systems	3	-	20	20	60	100	3
6	HON	Sem-VIII	25AF1246HON806	Artificial Neural Networks	3	-	20	20	60	100	3
Total					18	0	120	120	360	600	18

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***Note:** Students with a CGPA ≥ 7.5 after the first year are **eligible** to opt for 6 additional courses (18–20 credits) from their **parent (major) department**.*

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List of Double Minor (DM) Courses offered by Department of Information Technology

Double Minor (DM) Courses

Sr. No.	Course Type	Semester	Course code	Course Name	Hours		Examination Scheme				Credits
					L	P	CA	MSE	ESE	Total Marks	Total
1	DM	Sem-III	25AF1246DM301	Computer Networks Fundamentals	3	-	20	20	60	100	3
2	DM	Sem-IV	25AF1246DM402	Data science and visualization	3	-	20	20	60	100	3
3	DM	Sem-V	25AF1246DM503	IT Service Management (ITSM)	3	-	20	20	60	100	3
4	DM	Sem-VI	25AF1246DM604	DevOps (Development and operations)	3	-	20	20	60	100	3
5	DM	Sem-VII	25AF1246DM705	UI/UX Design	3	-	20	20	60	100	3
6	DM	Sem-VIII	25AF1246DM806	Data Security	3	-	20	20	60	100	3
Total					18	0	120	120	360	600	18

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Note: Student are required to select a double minor program from a department **other than their major programme** (Students who enrolled in their first year of engineering is the major programme **B. Tech. IT**) and it **must different** from the **Multidisciplinary Minor programme**.

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List of Honor with Research Courses in Semester –VII and Semester -VIII offered by Department of Information Technology

Honor with Research (HR) Courses

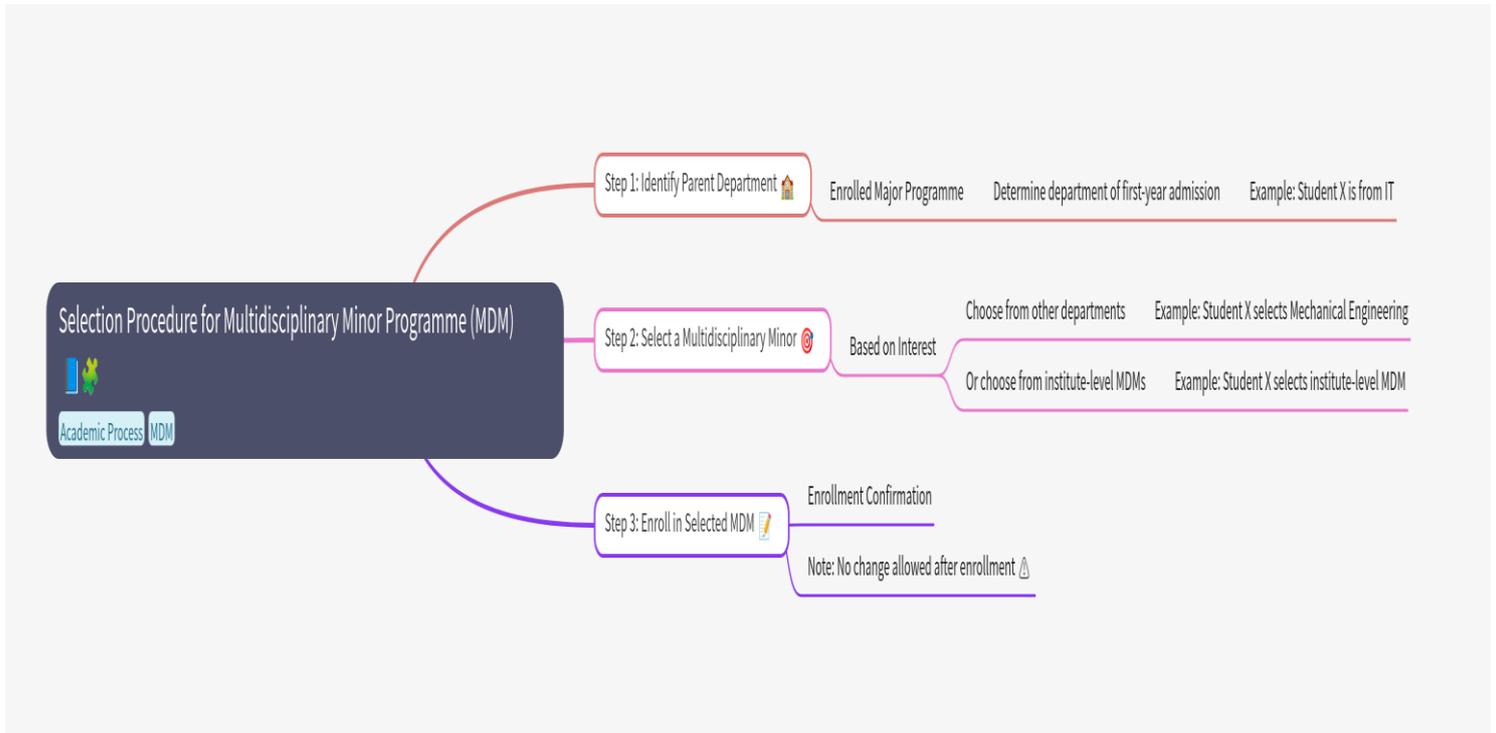
Sr. No.	Course Type	Semester	Course code	Course Name	Hours		Examination Scheme				Credits
					L	P	CA	MSE	ESE	Total Mark	Total
1	HR	Sem-VII	25AF1246HRL701	Research Orientation, Literature Review & Proposal Approval <i>(Includes: problem identification, research gap analysis, and proposal defense)</i>	-	6	60	-	40	100	3
2	HR	Sem-VII	25AF1246HRL702	Project Implementation – Phase I & IPR Awareness <i>(Initial design, development, and Intellectual Property Rights & Research Ethics training)</i>	-	6	60	-	40	100	3
3	HR	Sem-VIII	25AF1246HRL803	Project Implementation – Phase II & Documentation <i>(Final implementation, validation, and thesis preparation)</i>	-	6	60	-	40	100	3
4	HR	Sem-VIII	25AF1246HRL804	Research Paper Writing & Publication <i>(Target: Scopus/Web of Science/IEEE/UGC-CARE journals or reputed conferences)</i>	-	6	60	-	40	100	3
5	HR	Sem-VIII	25AF1246HRL805	Final Viva / Project Defense <i>(Internal & External evaluation, defense of research work)</i>	-	12	100		100	200	6
Total					-	36	340	-	260	600	18

Note: Students with a CGPA \geq 7.5 or 75% after the 6th semester are eligible for the UG Research degree and must complete an additional 18-credit research project/dissertation in the 4th year within their major discipline.

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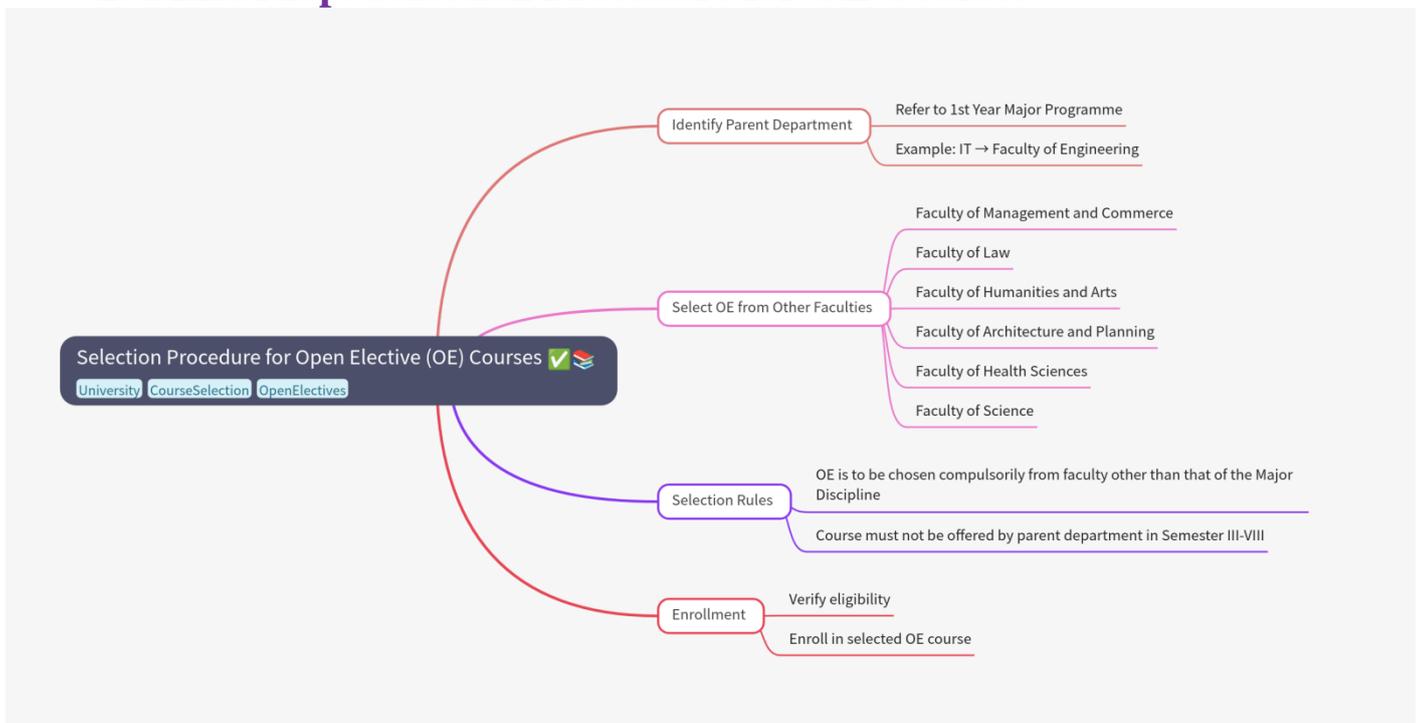
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1. Mind Map: Selection Procedure for MDM Courses



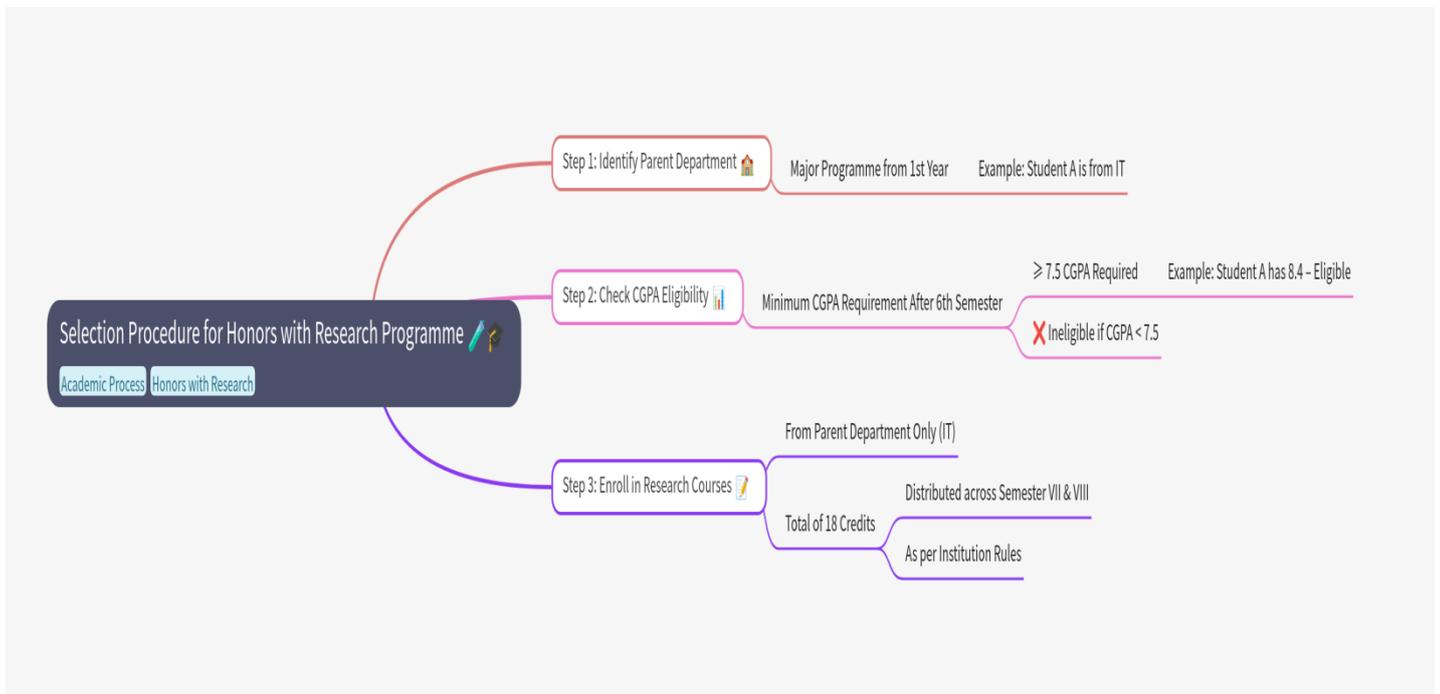
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2. Mind Map: Selection Procedure for OE Courses



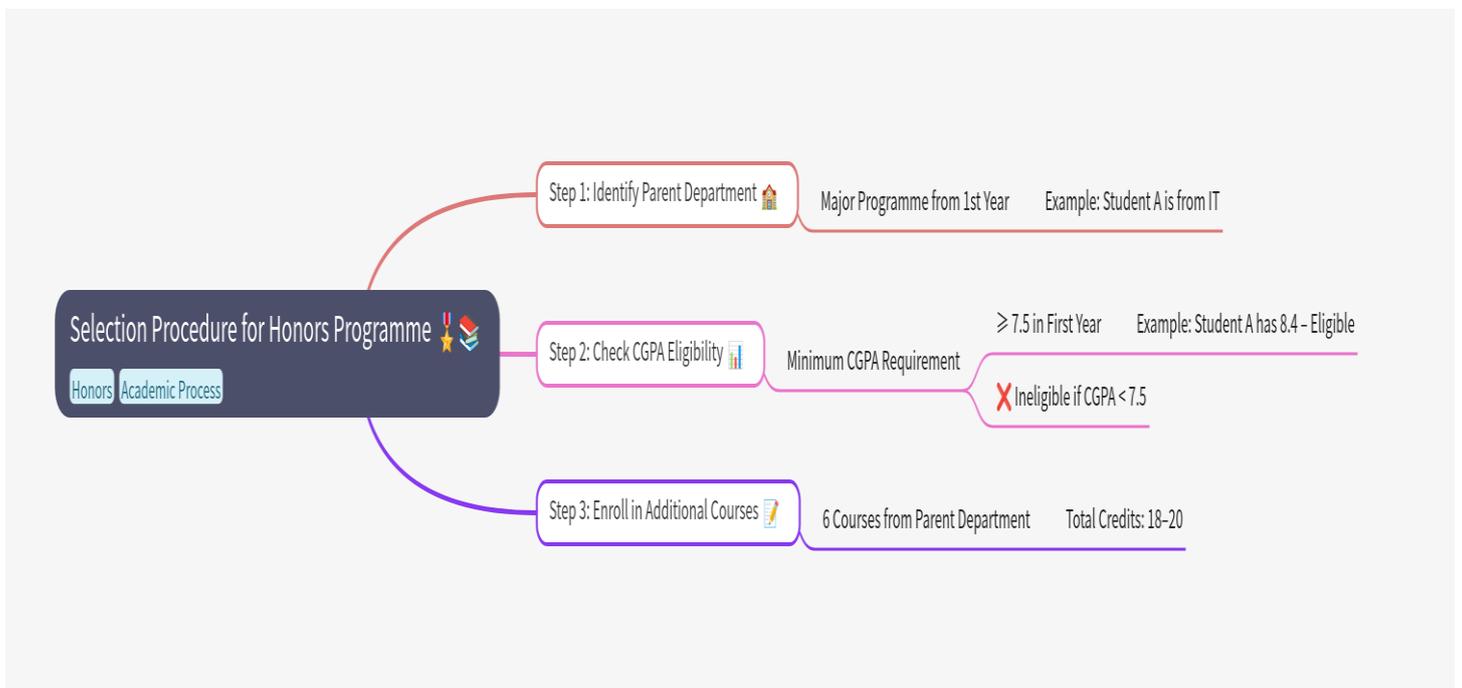
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3. Mind Map: Selection Procedure for Honors with Research Programme



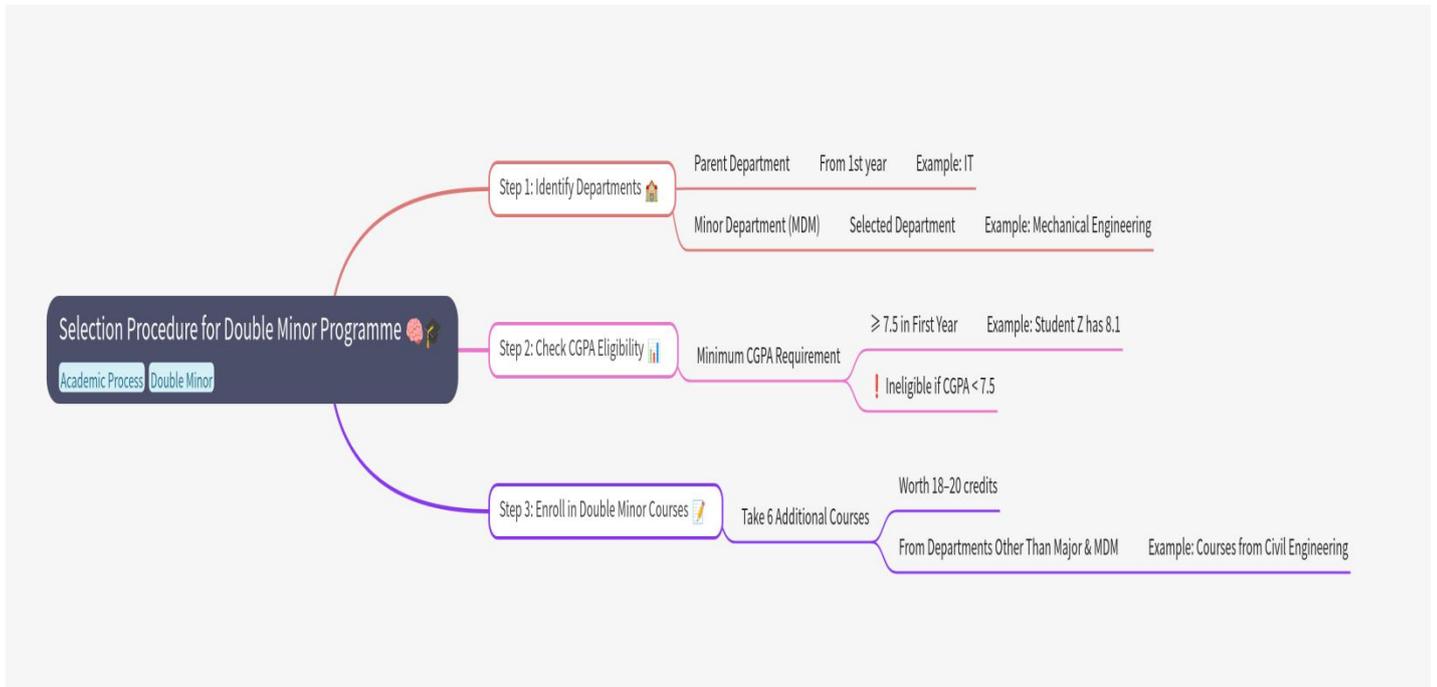
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4. Mind Map: Selection Procedure for Honors Programme



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5. Mind Map: Selection Procedure for Double Minor Courses Programme



Note: The example provided in the above mind map is for better understanding for students and faculty. **It is not compulsory to choose the specific example courses mentioned.**

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Credit Distribution:

1. B.Tech. degree with a multidisciplinary minor:

SEM- I	SEM -II	SEM-III	SEM-IV	SEM-V	SEM-VI	SEM-VII	SEM –VIII	TOTA L
21	23	22	22	21	23	22	18	172 (160-176)

2. B.Tech. honour with multidisciplinary minor:

SEM- I	SEM -II	SEM-III	SEM-IV	SEM-V	SEM-VI	SEM-VII	SEM –VIII	TOTA L
21	23	22+3	22+3	21+3	23+3	22+3	18+3	172+18 =190 (180-194)

3. B.Tech. honour with Research and multidisciplinary minor:

SEM- I	SEM -II	SEM-III	SEM-IV	SEM-V	SEM-VI	SEM-VII	SEM –VIII	TOTA L
21	23	22	22	21	23	22+6	18+12	172+18 =190 (180-194)

4. B.Tech. degree with Double Minors (Multidisciplinary and Specialization Minors) :

SEM- I	SEM -II	SEM-III	SEM-IV	SEM-V	SEM-VI	SEM-VII	SEM –VIII	TOTA L
21	23	22+3	22+3	21+3	23+3	22+3	18+3	172+18 =190 (180-194)

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List of Exit Options after Second Year, B.Tech to Qualify for Diploma in Information Technology

Sr. No.	Course Code	Semester	Name of the course	Credits		
				Theory	Practical	Total
1	25AF1246EX401	Sem-IV	Mobile App Development	120Hr		8
Total				120	8	

OR

Sr. No.	Course Code	Semester	Name of the course	Credits		
				Theory	Practical	Total
1	25AF1246EX402	Sem-IV	Office Assistance	120Hr		8
Total				120	8	

Important criteria for the Exit Option after Second Year

Total Additional Credits Required	08
Certificate Awarded	Diploma in IT
Requirement	Completion of any one Skill-Based Course listed in the Exit Option Structure
Duration	Summer Vacation
Important Guidelines	
1. Option Registration	Must be registered with the Parent Department & Exam Section
2. Prerequisite	Clearing of all course work till the End of Second Year as a Regular Student.
3. Minimum Credits Earned	80
4. Evaluation	Conducted by the Department for the award of the said certification.
5. Document Submission	Original Course/Internship Certificates required at the time of evaluation

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Criteria for Re-entry or Lateral Entry under NEP 2020

Sr.No.	Re-entry or Lateral Entry (NEP 2020)
1.	Re-entry Option: Students exiting at any level can rejoin the same or another institution within 4 years to complete their degree.
2.	Maximum Duration: The entire degree must be completed within 8 years from the date of first admission.
3.	Based on Credits: Re-entry or lateral entry is allowed based on valid earned credits stored in the Academic Bank of Credits (ABC) .
4.	Multiple Entry Paths: Students can re-enter into UG Diploma, B.Voc, UG Degree (Single/Double Minor), Honours, or Research programs.
5.	Subject to Availability: Admission depends on intake capacity and validation of prior learning outcomes .

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Syllabus of SEMESTER-III Courses

Teaching Scheme		Engineering Mathematics – III Course code: 25AF1000BS301	Examination Scheme	
TH	3	Prerequisite Courses: 1. Engineering Mathematics – I and II Course Objectives: 1. Linear differential equations of higher order using analytical methods and numerical methods applicable to Control systems and Network analysis. 2. Transforms such as Fourier transform, Laplace transform and applications to Communication systems and Signal processing. 3. Vector differentiation and integration required in Electro-magnetics and Wave theory. 4. Complex functions, conformal mappings, contour integration applicable to Electrostatics, Digital filters, Signal and Image processing. Course Outcomes (COs): <i>At the end of Course Students will be able.</i> CO1: Solve higher order linear differential equation using appropriate techniques for modelling and analyzing electrical circuits. CO2: Solve problems related to Fourier transform, Laplace transform and applications to Communication systems and Signal processing. CO3: Obtain Interpolating polynomials, numerically differentiate and integrate functions, numerical solutions of differential equations using single step and multi-step iterative methods used in modern scientific computing. CO4: Perform vector differentiation and integration, analyze the vector fields and apply to Electromagnetic fields. CO5: Analyze conformal mappings, transformations and perform contour integration of complex functions in the study of electrostatics and signal processing.	CA	20
PR	-		MSE	20
CR	3		ESE	60
			TOTAL	100

CO-PO Mapping:

COs \ POs / PSOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PSO 3
CO1	3	3	2	2	2	1	1	1	1	1	1	2	2	1	1
CO2	3	2	2	2	2	1	1	1	1	1	1	2	2	1	1
CO3	3	3	2	3	3	1	1	1	2	1	1	2	3	2	1
CO4	3	2	2	2	1	1	1	1	1	1	1	1	2	1	1
CO5	3	2	2	2	2	1	1	1	1	1	1	1	2	1	1

Note: Values in the matrix represent the level of correlation between COs and POs/ PSOs: **1**–Low, **2**– Medium, **3**–High.

COURSE CONTENTS

Unit No.	Unit Details	Hours
1	Laplace Transform : Definition – conditions for existence ; Transforms of elementary functions ; Properties of Laplace transforms - Linearity property, first shifting property, second shifting property, transforms of functions multiplied by tn , scale change property, transforms of functions divided by t , transforms of integral of functions, transforms of derivatives ; Evaluation of integrals by using Laplace transform ; Transforms of some special functions- periodic function, Heaviside-unit step function, Dirac delta function.	8 Hrs
2	Inverse Laplace Transform : Introductory remarks ; Inverse transforms of some elementary functions ; General methods of finding inverse transforms ; Partial fraction method and Convolution Theorem for finding inverse Laplace transforms ; Applications to find the solutions of linear differential equations and simultaneous linear differential equations with constant coefficients.	8 Hrs
3	Fourier Transform :Definitions – integral transforms ; Fourier integral theorem (without proof) ; Fourier sine and cosine integrals ; Complex form of Fourier integrals ; Fourier sine and cosine transforms ; Properties of Fourier transforms ; Parseval’s identity for Fourier Transforms.	8 Hrs
4	Partial Differential Equations and Their Applications : Formation of Partial differential equations by eliminating arbitrary constants and functions; Equations solvable by direct integration; Linear equations of first order (Lagrange’s linear equations); Method of separation of variables – applications to find solutions of one dimensional heat flow equation ($\nabla^2 u = 0$), and one dimensional wave equation.	8 Hrs
5	Functions of Complex Variables : Analytic functions; Cauchy- Riemann equations in Cartesian and polar forms; Harmonic functions in Cartesian form; Cauchy’s integral theorem; Cauchy’s integral formula; Residues; Cauchy’s residue theorem (All theorems without proofs).	8 Hrs
	<p>Textbooks:</p> <ol style="list-style-type: none"> Grewal, B. S., <i>Higher Engineering Mathematics</i>. Khanna Publishers, New Delhi. Das, H. K., and Verma, Er. Rajnish, <i>Higher Engineering Mathematics</i>. S. Chand & Co. Pvt. Ltd., New Delhi. Singh, B. B., <i>A Course in Engineering Mathematics (Vol. III)</i>. Synergy Knowledgeware, Mumbai. Ramana, B. V., <i>Higher Engineering Mathematics</i>. Tata McGraw-Hill Publications, New Delhi. <p>Reference Books:</p> <ol style="list-style-type: none"> Kreyszig, Erwin, <i>Advanced Engineering Mathematics</i>. John Wiley & Sons, New York. O’Neil, Peter, <i>A Textbook of Engineering Mathematics</i>. Thomson Asia Pte Ltd., Singapore. Wylie, C. R., and Barrett, L. C., <i>Advanced Engineering Mathematics</i>. Tata McGraw-Hill Publishing Company Ltd., New Delhi. Singh, B. B., <i>Integral Transforms and Their Engineering Applications</i>. Synergy Knowledgeware, Mumbai. Sneddon, I. N., <i>Integral Transforms</i>. Tata McGraw-Hill, New York. 	

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Teaching Scheme		Data Structures Course code: 25AF1246PC302	Examination Scheme	
TH	3	Prerequisite Courses: 1. Programming and Problem Solving 2. Fundamentals of C Programming Languages Course Objectives: 1. To understand importance of data structures in context of writing efficient programs. 2. To be able to implement linear and non-linear data. Course Outcomes (COs): <i>Upon successful completion of this course, students will be able to:</i> CO1: Understand and Analyze various types of data structures and algorithms CO2: Apply various sorting algorithms for given problem. CO3: Make Use of Stacks and Queues to solve the given problem. CO4: Understand the Linked List data structure. CO5: Demonstrate basic operations on trees and graph.	CA	20
PR	1		MSE	20
CR	4		ESE	60
			TOTAL	100

CO-PO Mapping:

COs \ POs / PSOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PSO 3
CO1	1	2	1	1	1	-	-	-	-	-	-	-	2	3	3
CO2	3	2	3	1	1	1	-	-	-	-	-	-	3	2	3
CO3	3	3	3	2	1	1	1	1	-	1	-	-	2	3	2
CO4	3	3	3	2	1	1	2	1	-	2	-	-	3	3	3
CO5	3	3	3	3	-	1	1	-	-	-	-	-	2	3	3

Note: Values in the matrix represent the level of correlation between COs and POs/ PSOs: **1**–Low, **2**–Medium, **3**–High.

COURSE CONTENT

Unit No.	Topic	Hours
1	Introduction to Data Structures: Abstract Data Types (ADT), Types of Data Structure: Linear and Non-linear. Concept of Recursion: Definition, Example (Tower of Hanoi). Static and Dynamic data structure.	05 Hrs
2	Stack: Definition, Representation techniques: Static and Dynamic, Operations (Algorithm): PUSH, POP, DISPLAY. Application of Stack: Converting the expressions like Infix, Postfix, Evaluating the expression. Queue: Definition, Representation techniques: Static and Dynamic, Operations (Algorithm): INSERT, DELETE, DISPLAY. Types of Queue: Circular, Double Ended, Priority. Application of Queue.	07 Hrs
3	Linked List: Definition, Representation techniques: Static and Dynamic, Types of Linked list: Singly, Doubly, Circular. Operations (Algorithm): Insertion and Deletion: At BEGINNING, SPECIFIC, END for Singly linked list and Doubly linked List. Application of Linked List.	07 Hrs
4	Tree: Definition, Basic concept, Terminology, Types of Tree: Binary tree, Binary Search tree, AVL tree. Operation (Algorithm): INSERT, DELETE, and SEARCH for binary tree. Binary Tree traversals. Application of tree.	07 Hrs
5	Graph: Definition, Types of graph, Representation techniques: Adjacency matrix, Adjacency list. Traversals: Depth first and Breadth first, Application of graph: Minimum Spanning Tree. Searching and Sorting: Various searching methods: Linear Search, Binary search. Various sorting methods: Insertion, Selection, Merge, Quick.	09 Hrs
	<p>Text Books:</p> <ol style="list-style-type: none"> Horowitz, E., Mehta, D., & Sahni, S. (2008). <i>Fundamentals of Data Structures in C++</i> (2nd ed.). Silicon Press. Lipschutz, S. (2010). <i>Data Structures with C</i> (1st ed.). Tata McGraw-Hill. Bichkar, R. S. (2014). <i>Programming with C and Data Structures</i> (1st ed.). Universities Press. <p>Reference Books:</p> <ol style="list-style-type: none"> Goodrich, M. T., & Tamassia, R. (2014). <i>Data Structures and Algorithms in Java</i> (6th ed.). Wiley. Cormen, T. H., Leiserson, C. E., Rivest, R. L., & Stein, C. (2009). <i>Introduction to Algorithms</i> (3rd ed.). MIT Press. Goyal, V., Goyal, L., & Kumar, P. (2014). <i>A Simplified Approach to Data Structures</i> (1st ed.). Shroff Publishers. 	

Alternative NPTEL/SWAYAM Digital Reference				
Sr.No	NPTEL/SWAYAM Courses Name	Instructor	Host Institute	Links
01	Data Structure using C Programming	Dr. Dipti Verma and Mr. Aditya Tiwari	Chhattisgarh Swami Vivekanand Technical University, Bhilai	https://onlinecourses.swayam2.ac.in/nou25_cs06/preview
02	Data Structures and Algorithms Design	Prof. Nitin Saxena	IIT Kanpur	https://onlinecourses.nptel.ac.in/noc25_cs81/preview

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Teaching Scheme	Data Structures Lab Course code: 25AF1246PCL303	Examination Scheme	
2 Hrs / Week = Credit 1	Course Outcomes (COs): <i>Upon successful completion of this course, students will be able to:</i> CO1: Implement recursive solutions like Tower of Hanoi and understand the concept of recursion. CO2: Apply operations on linear data structures such as Stack and Queue using C. CO3: Create and manipulate various types of linked lists through different operations. CO4: Implement non-linear data structures like Binary Trees and perform various tree traversals. CO5: Demonstrate searching and sorting techniques with real-time programming applications.	CA	60
		ESE	40
		TOTAL	100

CO-PO Mapping:

COs \ POs / PSOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PSO 3
CO1	3	2	2	2	3	-	-	-	-	-	-	1	2	3	2
CO2	3	3	2	2	3	-	-	-	-	-	-	1	2	3	2
CO3	-	3	3	3	2	3	-	-	-	2	1	-	1	2	3
CO4	3	3	3	3	3	-	-	-	-	1	-	1	3	3	2
CO5	-	3	3	3	2	3	-	-	-	-	-	-	1	3	3

Note: Values in the matrix represent the level of correlation between COs and POs/ PSOs: **1**–Low, **2**–Medium, **3**–High.

List of Experiments:

1. Write a program for implementing recursion by Tower of Hanoi.
2. Write a menu driven program for implementation of stack by using following methods: PUSH, POP and DISPLAY.
3. Write a menu driven program for implementation of queue by using following methods: INSERT, DELETE and DISPLAY.
4. Write a menu driven program for implementation of singly linked list by using following methods: Insert a node at beginning, deleting a node from beginning and display singly linked list after any operation.
5. Write a menu driven program for implementation of singly linked list by using following methods: Insert a node at specific, deleting a node from specific and display singly linked list a after any operation.
6. Write a menu driven program for implementation of singly linked list by using following methods: Insert a node at end, deleting a node from end and display singly linked list a after any operation.
7. Write a menu driven program for implementation of Binary tree by using following methods: Insert, Delete, Search, and Display.
8. Write a menu driven program for implementation of Binary tree traversal by using following methods: Pre-Order, In-Order and Post-Order.
9. Write a program for Searching an element: Linear, Binary
10. Write a program for sorting an array: Merge, Quick.

Note:

1. The above list is for illustration purposes only. The course coordinator may update or change the list as needed,
2. At least **8** to**10** experiments should be performed.
3. Students should be encouraged to design and perform new experiments, subject to prior approval from the respective subject authority.

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Teaching Scheme		Object Oriented Programming using Java Course code: 25AF1246PC304	Examination Scheme	
TH	3	Prerequisite Courses: 1. Programming for Problem Solving Course Objectives: 1. To understand the Fundamentals of Java Programming. 2. To develop Logical Thinking Using Control Structures and Methods. 3. To implement and Manipulate Arrays and Object-Oriented Features. 4. To handle Exceptions and Multithreading. Course Outcomes (COs): <i>At the end of Course Students will be able.</i> CO1: To describe the structure of Java programs, core concepts of memory, arithmetic operations, and the role of Java Class Libraries in application development. CO2: To develop Java programs using object-oriented principles including classes, objects, constructors, methods, and instance variables. CO3: To apply control structures and modular programming concepts such as static methods, method overloading, and logical operators to solve real-world problems. CO4: Implement arrays, inheritance, polymorphism, and interfaces to build scalable and reusable Java applications. Analyse the concept of small and micro enterprise. CO5: Demonstrate exception handling mechanisms in Java and multithreading.	CA	20
PR	-		MSE	20
CR	3		ESE	60
			TOTAL	100

CO-PO Mapping:

COs \ POs / PSOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PSO 3
CO1	3	2	1	-	2	-	-	-	-	-	-	2	2	-	-
CO2	3	2	2	-	3	-	-	-	-	-	-	3	3	-	-
CO3	3	2	1	-	2	-	-	-	-	-	-	2	2	-	-
CO4	3	3	3	-	3	-	-	-	-	-	-	3	3	-	-
CO5	3	3	3	-	3	-	-	-	-	-	-	3	3	-	-

Note: Values in the matrix represent the level of correlation between COs and POs/ PSOs: **1**–Low, **2**–Medium, **3**–High.

COURSE CONTENT

Unit No.	Topic	Hours
1	Introduction to Java Applications: Introduction, Java Class Libraries, Typical Java Development Environment, Memory Concepts, Arithmetic. Introduction to Classes and Objects: Introduction, Classes, Objects, Methods and Instance Variables, Declaring a Class with a Method and Instantiating an Object of a Class, Declaring a Method, Instance variables, set Methods and get Methods, Primitive Types vs. Reference type double Types ,Initializing Objects with Constructors, floating point numbers.	07 Hrs
2	Control Statements: Control structures if single-selection statement, if...else double-selection statement, while repetition statement, do...while repetition statement, switch multi-selection statement, break and continue statements, logical operators. Methods :Introduction, Program modules in Java, static methods, static Fields and Class Math, declaring methods with multiple parameters, scope of declaration, method overloading and Java API packages.	07 Hrs
3	Arrays: Arrays, declaring and creating arrays in java, examples using arrays, passing arrays to methods, multidimensional arrays, variable-length argument lists, using command-line arguments.	07 Hrs
4	Inheritance and Polymorphism in Java: Inheritance: Super classes and Subclasses, protected members, relationship between super classes and subclasses, constructors in subclasses, object class. Polymorphism: Abstract classes and methods, final methods and classes, polymorphism examples and Interfaces.	07 Hrs
5	Exception-handling and multithreading: Exception-handling overview, handling Arithmetic Exceptions and Input Mismatch Exceptions, when to use exception handling, java exception hierarchy, finally block. Multithreading: Creating threads, Extending thread class, Stopping and Blocking a thread, Life cycle of a thread, Using thread method, Thread exceptions, Implementing the Runnable interface, Inter thread communication.	07 Hrs
	<p>Text Book:</p> <ol style="list-style-type: none"> 1. Paul Deitel and Harvey Deitel, <i>Java: How to Program</i>, Pearson's Publication, 9th Edition. <p>Reference Books:</p> <ol style="list-style-type: none"> 1. Joel Murach and Michael Urban, <i>Murach's Beginning Java with Eclipse</i>, Murach's Publication, 1st Edition, 2016. 2. Doug Lowe, <i>Java All-in-One For Dummies</i>, Wiley Publication, 4th Edition, 2014. 3. Herbert Schildt, <i>Java: The Complete Reference</i>, McGraw-Hill Publication, 	

	9th Edition. 4. Patrick Niemeyer and Daniel Leuck, <i>Learning Java</i> , O'Reilly Media, 4th Edition, 2013. 5. Douglas Crockford, <i>JavaScript: The Good Parts</i> , O'Reilly, ISBN: 9782744055973. 6. <i>Microsoft® .NET: Architecting Applications for the Enterprise</i> , Microsoft Press, 1st Edition, ISBN: 978-0735626096.	
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Alternative NPTEL/SWAYAM Digital Reference

Sr.No.	NPTEL/SWAYAM Courses Name	Instructor	Host Institute	Links
01	Programming in Java	Debasis Samanta	IIT Kharagpur	https://nptel.ac.in/courses/106105191

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Teaching Scheme		Object Oriented Programming using Java Lab Course code: 25AF1246PCL305	Examination Scheme	
TH	-	Course Objectives: 1. Develop foundational programming skills using Java language constructs, including operators, method calling 2. Explore object-oriented programming concepts in Java 3. Apply modular programming techniques using functions and packages 4. Implement exception handling and error management in Java programs Course Outcomes (COs): <i>At the end of Course Students will be able.</i> CO1: Apply Java programming concepts such as operators, methods, classes, constructors, arrays, inheritance, and exception handling to develop structured and object-oriented applications. CO2: Demonstrate modular programming and code reuse in Java through the use of packages, interfaces, access modifiers, and binding techniques. CO3: Apply and understand basics of exception handling and use of multithreading.	CA	60
PR	2		MSE	-
CR	1		ESE	40
			TOTAL	100

CO-PO Mapping:

COs \ POs / PSOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PSO 3
CO1	2	1	1	-	-	1	-	-	2	2	-	-	3	2	1
CO2	2	-	1	2	-	-	-	-	2	2	1	-	2	2	-
CO3	2	-	3	1	1	1	-	-	2	-	-	-	-	2	1

Note: Values in the matrix represent the level of correlation between COs and POs/ PSOs: **1**–Low, **2**–Medium, **3**–High.

List of Experiments:

1. Programs on Operators, Arithmetic Promotion, Method Calling.
2. Programs on Classes: String and Math.
3. Write a program to demonstrate following Function concepts
 - i. Function overloading
 - ii. Constructors of all types
 - iii. Default parameters, returning by reference
4. Programs on dealing with Arrays.
5. Programs on Classes: String and Math.
6. Programs on Inheritance and Polymorphism.
7. Programs on Garbage collection, packaging, access Modifiers, as well as static and abstract modifiers.
8. Programs on Interfaces, block initializers, final Modifier, as well as static and dynamic binding.
9. Programs on Exception Handling.
10. Write a Java program that illustrates the following
 - i. Creation of simple package.
 - ii. Accessing a package.
 - iii. Implementing interfaces.
11. Program to create thread by Thread class and Runnable interface.
12. Program to show the use of Synchronized keywords using threads.

Note:

1. The above list is for illustration purposes only. The course coordinator may update or change the list as needed,
2. At least **8 to 10** experiments should be performed.
3. Students should be encouraged to design and perform new experiments, subject to prior approval from the respective subject authority.

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Teaching Scheme		Modern Indian Languages Marathi (मराठी) Course code: 25AF1246AEL308A	Examination Scheme	
TH	-	<p>पाठ्यक्रम उद्दिष्टे (Course Objectives):</p> <ol style="list-style-type: none"> 1. आधुनिक मराठी भाषेचे व्याकरण, संवादकौशल्य आणि साहित्यिक संकल्पना आत्मसात करणे. 2. मराठी भाषेच्या विकासामध्ये सामाजिक, सांस्कृतिक व पाश्चिमात्य प्रभावांचा अभ्यास करणे. 3. शैक्षणिक व व्यावसायिक लेखन कौशल्य विकसित करणे. 4. मराठी व इंग्रजी भाषांतरासंबंधी कौशल्य प्राप्त करणे. 5. भाषेच्या माध्यमातून सामाजिक आणि सांस्कृतिक जाणीव विकसित करणे. <p>अभ्यासक्रम पूर्ण केल्यावर विद्यार्थ्यांना येणारी कौशल्ये (Course Outcomes - COs):</p> <p>CO1: मराठी भाषेची मूलभूत माहिती, लिपी आणि व्याकरण आत्मसात करणे.</p> <p>CO2: मराठी संवादकौशल्य, लेखन व वाचन प्रावीण्य प्राप्त करणे.</p> <p>CO3: मराठी साहित्याचा अभ्यास करून सांस्कृतिक जाणिवा विकसित करणे.</p> <p>CO4: भाषांतर व व्यावसायिक संवादाचे कौशल्य प्राप्त करणे.</p>	CA	60
PR	2		ESE	40
CR	1		TOTAL	100

CO-PO Mapping:

COs \ POs / PSOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PSO 3
CO1	2	-	-	-	1	-	-	-	-	2	-	2	-	1	-
CO2	-	-	1	-	2	-	-	-	2	3	-	2	-	2	2
CO3	-	-	-	-	-	2	2	2	1	2	-	2	1	-	2
CO4	1	-	2	-	2	2	-	2	2	3	-	2	2	2	3

Note: Values in the matrix represent the level of correlation between COs and POs/ PSOs: **1**–Low, **2**–Medium, **3**–High.

प्रयोग अभ्यासक्रम

आठवडा	प्रयोगात्मक कार्य	
१	मराठी लिपी आणि उच्चारांचा सराव, भाषेचा इतिहास	
२	साधी, संयुक्त व मिश्र वाक्यरचना, संवाद व अभिव्यक्ती	
३	इंग्रजी ते मराठी भाषांतर (सोप्या वाक्यांवर आधारित)	
४	मराठी ते इंग्रजी भाषांतर (लघुपरिच्छेदांवर आधारित)	
५	औपचारिक पत्रलेखन (रजा अर्ज, विनंती पत्र इ.)	
६	अनौपचारिक पत्रलेखन (व्यक्तिगत पत्रे)	
७	परिच्छेद / सारांश लेखन (१००-१५० शब्द)	
८	वृत्तलेखन - कार्यक्रम / बातमी यावर आधारित	
९	संवाद लेखन - परिस्थितीनुसार संवाद	
१०	वाचन सराव - उच्चार व शब्दसंग्रह वृद्धी	
११	संभाषण सराव - मुलाखत / भूमिकानिर्मिती (role-play)	
१२	अंतिम प्रयोगात्मक परीक्षा व तोंडी परीक्षा (Internal Test + Viva)	
	<p>पाठ्यपुस्तके:</p> <ol style="list-style-type: none"> मराठी भाषेचे मूळ - लेखक: वि. ना. खरें मराठी भाषेचा इतिहास - लेखक: गं. ना. जोगळेकर मराठी भाषा: उगम व विकास - लेखक: कृ. पा. कुलकर्णी साहित्याची भाषा - लेखक: डॉ. भालचंद्र नेमाडे <p>संदर्भ ग्रंथ:</p> <ol style="list-style-type: none"> सुगम मराठी व्याकरण व लेखन - लेखक: मो. रा. वाळंबे अनुवाद: तत्त्वज्ञान आणि प्रयोग - लेखक: डॉ. भालचंद्र नेमाडे प्रशासकीय लेखन - प्रकाशक: भाषा संचालनालय, महाराष्ट्र शासन मराठी भाषा आणि साहित्याचा इतिहास - लेखक: व. का. राजवाडे बनगरवाडी - लेखक: व. पु. माडगुळकर ढग - लेखिका: उषा शेळके बटाट्याची चाळ - लेखक: पु. ल. देशपांडे NPTel/SWAYAM Digital Reference : https://onlinecourses.swayam2.ac.in/nou25_lg30/preview 	

Teaching Scheme		Modern Indian Languages Hindi (हिंदी) Course code: 25AF1246AEL308B	Examination Scheme	
TH	-	पाठ्यक्रम उद्देश्य (Course Objectives): 1. हिंदी भाषा के उद्भव, विकास और ऐतिहासिक प्रवृत्तियों का ज्ञान कराना। 2. हिंदी व्याकरण, लिपि तथा लेखन कौशल में प्रवीणता प्रदान करना। 3. प्रशासनिक, शैक्षणिक एवं संवादात्मक दृष्टिकोण से हिंदी के व्यावहारिक प्रयोग को समझाना। 4. अनुवाद कौशल विकसित कर तकनीकी तथा व्यवसायिक संवाद को सरल बनाना। अपेक्षित पाठ्यपरिणाम (Course Outcomes - COs): CO1: हिंदी भाषा के ऐतिहासिक विकास, लिपि और व्याकरण की मूलभूत जानकारी प्राप्त करना। CO2: हिंदी संवाद कौशल, लेखन और वाचन में दक्षता प्राप्त करना। CO3: साहित्य और सामाजिक संदर्भों से भाषा की सांस्कृतिक समझ विकसित करना। CO4: हिंदी और अंग्रेजी अनुवाद कौशल अर्जित कर व्यावसायिक संवाद स्थापित करना।	CA	60
PR	2		ESE	40
CR	1		TOTAL	100

CO-PO Mapping:

COs \ POs / PSOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PSO 3
CO1	2	-	-	-	1	-	-	-	-	2	-	2	-	1	-
CO2	-	-	1	-	2	-	-	-	2	3	-	2	-	2	2
CO3	-	-	-	-	-	2	2	2	1	2	-	2	1	-	2
CO4	1	-	2	-	2	2	-	2	2	3	-	2	2	2	3

Note: Values in the matrix represent the level of correlation between COs and POs/ PSOs: **1**–Low, **2**–Medium, **3**–High.

प्रायोगिक अभ्यासक्रम

सप्ताह	प्रयोगात्मक अभ्यास	
१	हिंदी लिपि और उच्चारण का अभ्यास, भाषा का ऐतिहासिक विकास एवं स्रोतों की जानकारी	
२	सरल, संयुक्त और मिश्र वाक्य रचना का अध्ययन एवं संवाद अभ्यास	
३	अंग्रेज़ी से हिंदी में अनुवाद – सरल वाक्यों पर आधारित	
४	हिंदी से अंग्रेज़ी में अनुवाद – लघु अनुच्छेदों पर आधारित	
५	औपचारिक पत्र लेखन – अवकाश आवेदन, निवेदन पत्र आदि	
६	अनौपचारिक पत्र लेखन – मित्र, परिवार आदि को पत्र	
७	अनुच्छेद लेखन) सार लेखन /100-150 शब्दों में(
८	रिपोर्ट लेखन – कार्यक्रम, समाचार अथवा गतिविधि पर आधारित	
९	संवाद लेखन – विभिन्न सामाजिक अथवा व्यावसायिक परिस्थितियों पर आधारित	
१०	वाचन अभ्यास – शुद्ध उच्चारण, विराम चिन्हों का प्रयोग, शब्द संग्रह का विस्तार	
११	संभाषण) निर्माण-भूमिका /Role-play) – साक्षात्कार, संवाद, समूह चर्चा आदि	
१२	अंतिम प्रयोगात्मक परीक्षा – आंतरिक मूल्यांकन) मौखिक परीक्षा + Viva Voce)	
	<p>संदर्भ ग्रंथ (Reference Books):</p> <ol style="list-style-type: none"> 1. हिंदी भाषा का उद्भव और विकास – डॉ. हरीशचंद्र वर्मा 2. हिंदी भाषा का इतिहास – डॉ. रामविलास शर्मा 3. भारत में राजभाषा हिंदी – डॉ. विश्वनाथ प्रसाद 4. हिंदी व्याकरण और रचना – डॉ. हरीशचंद्र वर्मा 5. हिंदी लेखन कौशल – डॉ. रमेश गुप्ता 6. अनुवाद विज्ञान और सिद्धांत – डॉ. ओमप्रकाश 	

Teaching Scheme		Modern Indian Languages Sanskrit (संस्कृत) Course code: 25AF1246AEL308C	Examination Scheme	
TH	-	पाठ्यक्रम उद्देश्य (Course Objectives): 1. संस्कृत भाषा के ऐतिहासिक प्रवास की समझ देना। 2. संस्कृत लेखन के नियम एवं व्याकरण का अभ्यास कराना। 3. दैनिक संवाद हेतु आवश्यक शब्दों का अध्ययन कराना। अपेक्षित पाठ्यपरिणाम (Course Outcomes - COs): CO1: विद्यार्थी संस्कृत भाषा के ऐतिहासिक प्रवास को समझेंगे एवं उसके विकास के चरणों को स्पष्ट कर सकेंगे। CO2: शुद्ध और प्रमाणबद्ध संस्कृत लेखन करने की क्षमता प्राप्त करेंगे। CO3: विभिन्न लेखन शैलियों को आत्मसात कर लेखन कर सकेंगे। CO4: स्पष्ट और सटीक भाषा में संस्कृत से अन्य भाषाओं में तथा अन्य भाषाओं से संस्कृत में प्रभावी अनुवाद कर सकेंगे।	CA	60
PR	2		ESE	40
CR	1		TOTAL	100

CO-PO Mapping:

COs \ POs / PSOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PSO 3
CO1	2	-	-	-	-	2	-	-	-	2	-	2	-	-	1
CO2	2	-	1	-	1	-	-	-	1	2	-	2	-	1	1
CO3	-	-	1	-	2	-	-	-	2	2	-	2	-	1	2
CO4	1	-	2	-	2	2	-	2	2	3	-	2	1	2	3

Note: Values in the matrix represent the level of correlation between COs and POs/ PSOs: **1**–Low, **2**–Medium, **3**–High.

प्रयोग अभ्यासक्रम

सप्ताह	प्रयोगात्मक अभ्यास	
१	संस्कृत भाषा का परिचय, इतिहास एवं महत्व	
२	वर्णमाला – स्वर, व्यंजन, उच्चारण एवं लिपि	
३	संज्ञा, सर्वनाम, लिंग, वचन, पुरुष का अभ्यास	
४	क्रिया, काल, संधि और कारक का परिचय	
५	विभक्ति प्रयोग एवं वाक्य निर्माण	
६	शब्द संग्रह – परिवार, प्रकृति, पशु, वस्तुएँ	
७	अभिवादन एवं सामान्य संवाद वाक्य	
८	सरल वाक्य निर्माण का अभ्यास	
९	संस्कृत श्लोकों / सुभाषितों का पाठ एवं अर्थ	
१०	पंचतंत्र, हितोपदेश, गीता से चयनित श्लोक अभ्यास	
११	संस्कृत अनुच्छेद लेखन एवं पाठ अभ्यास	
१२	अंतिम प्रयोगात्मक परीक्षा + मौखिक परीक्षा	
	संदर्भ ग्रंथ (Reference Books): 1. संस्कृत व्याकरण सारांश – वासुदेव द्विवेदी 2. भाषा विज्ञान और संस्कृत भाषा – डॉ. सत्यव्रत शर्मा 3. संस्कृत संवाद कौशल – डॉ. मीरा त्रिपाठी 4. हितोपदेश, पंचतंत्र, श्रीमद्भगवद्गीता – चयनित श्लोक 5. संस्कृत सुभाषित संग्रह – भारती साहित्य. 7. NPTEL/SWAYAM Digital Reference : https://onlinecourses.nptel.ac.in/noc21_hs03/preview	

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Teaching Scheme		IT Project Management (ITPM) Course code: 25AF1246HM309	Examination Scheme	
TH	2	Prerequisite Courses: 1. Design Thinking Course Objectives: 1. To understand the fundamentals of IT project management, including the project life cycle, business case development, and project selection methods. 2. To develop skills in project scope definition, scheduling, budgeting, and risk management. 3. To learn effective communication planning, procurement processes, and outsourcing strategies in IT projects. 4. To explore leadership qualities, ethical practices, and implementation strategies for successful project closure. Course Outcome : <i>After successful completion of the course, students will be able to:</i> CO1: Explain the IT project life cycle, business case preparation, and project selection techniques. CO2: Analyze and prepare a project scope, schedule, and budget with appropriate risk management strategies. CO3: Develop project communication and procurement plans, and evaluate outsourcing strategies. CO4: Demonstrate leadership, teamwork, and ethical behavior in managing multicultural and IT project teams. CO5: Apply concepts of project execution, monitoring, and closure with appropriate evaluation methods.	CA	20
PR	-		MSE	20
CR	2		ESE	60
			TOTAL	100

CO-PO Mapping:

COs \ POs / PSOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PSO 3
CO1	2	2	1	-	-	-	-	-	2	2	-	2	-	-	-
CO2	3	3	2	2	2	-	-	-	1	3	-	3	2	-	-
CO3	-	1	2	2	-	2	2	-	1	2	3	-	2	2	2
CO4	-	-	-	-	-	2	3	3	2	-	-	-	-	3	-
CO5	2	2	2	2	2	-	-	-	2	3	2	2	2	2	2

Note: Values in the matrix represent the level of correlation between COs and POs/ PSOs: **1**–Low, **2**–Medium, **3**–High.

COURSE CONTENT

Unit No.	Topic	Hours		
1	An overview of IT project management: Introduction, The state of IT project management, The context of project management, Project Life Cycle and IT Development. The Business Case: Introduction, an ITPM , Business case, Project selection and Approval.	06 Hrs		
2	The Project Team: Introduction, Organization and Project Planning, The project team, The project Evaluation. The scope management plan: Introduction, Scope planning, Project scope definition, Project scope verification.	06 Hrs		
3	The Project's Schedule and Budget: Developing the project's Schedule, Developing Project Budget, Finalizing the project schedule and budget. The Risk management Plan: IT project Risk management Planning Process, Identifying IT Project Risk, Risk analysis and assessment.	06 Hrs		
4	The Project communication plan: Monitoring and controlling the project, The Project communication plan, Project Metrics, Managing Project procurement and Outsourcing: Project procurement management.	06 Hrs		
5	Project Leadership and Ethics: Project Leadership, Ethics in Projects, Multicultural Projects. The implementation Plan and Project closure: Project Implementation, Administrative Closure, Project Evaluation.	06 Hrs		
	Text Book: 1. Jack T. Marchewka, <i>Information Technology Project Management</i> , 5th Edition, Wiley India. ISBN: 9788126557873. Reference Books: 1. Kathy Schwalbe, <i>Information Technology Project Management</i> , 7th Edition, Cengage Learning. ISBN: 9788131520972. 2. Wade Golden, <i>Project Management</i> , Bravex Publications, January 2020. ISBN 978-1647482602.			
Alternative NPTEL/SWAYAM Digital Reference				
Sr.No.	NPTEL/SWAYAM Courses Name	Instructor	Host Institute	Links
01	Software Project Management	Prof. Rajib Mall, Prof. Durga Prasad Mohapatra	IIT Kharagpur, NIT Rourkela	https://onlinecourses.nptel.ac.in/noc22_cs107/preview

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Teaching Scheme		Life of Chhatrapati Shivaji Maharaj Course code: 25AF1000VE310A	Examination Scheme	
TH	1	Course Objective: 1. Analyze Chhatrapati Shivaji Maharaj's leadership qualities, strategic thinking, and management skills. 2. Develop critical thinking and problem-solving skills through case studies and discussions. 3. Recognize the relevance of the Chhatrapati's principles and values in modern times. Course Outcomes: <i>After successful completion of this course the student will be able:</i> CO1: Explain Chhatrapati Shivaji Maharaj's military strategies, conquests, and establishment of the Maratha Empire. CO2: Evaluate the Chhatrapati's leadership qualities, such as courage, vision, human values and adaptability. CO3: Apply the Chhatrapati's principles, such as decentralization and social welfare, to modern engineering challenges.	CA	60
PR	-		ESE	40
CR	1		TOTAL	100

CO-PO Mapping:

COs \ POs / PSOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PSO 3
CO1	2	-	-	-	-	3	2	-	2	2	-	2	-	-	2
CO2	1	-	-	-	-	2	1	3	3	2	-	2	-	-	3
CO3	2	-	-	-	-	3	3	3	3	2	-	3	-	-	3

Note: Values in the matrix represent the level of correlation between COs and POs/ PSOs: **1**–Low, **2**–Medium, **3**–High.

COURSE CONTENT

Unit No.	Topic	Hours
1	Shivaji Maharaj as a Great Conqueror: Master Strategist and innovator in Military Tactics, Guerrilla Warfare (Ganimi Kava), Fortress Strategy, Avoidance of Direct Confrontation, Diplomacy and Alliances, Naval Power.	5 Hrs
2	Shivaji Maharaj's Management and leadership strategies: Architecture and metallurgy of Raigad Fort, Use of Light Cavalry, Intelligence Network, Asymmetric Warfare, Logistics and Supply Chains, Fortifications and Military Architecture.	5 Hrs
3	Shivaji Maharaj's views on Democracy and Nationalism: Shivaji Maharaj's views about Women's rights, their dignity and religious views, His views on Democracy & Nationalism.	5 Hrs
	Textbooks: <ol style="list-style-type: none">1. Desai, Ranjit, <i>Shriman Yogi</i>, Mehta Publishing House, 2018.2. Kurundkar, Narhar, <i>Chatrapati Shivaji Maharaj Jeevan Rahasya</i>, Deshmukh and Company, 2024.3. Sarkar, Jadunath, <i>Shivaji and His Times</i>, Nandy Books, 2024. Reference Books: <ol style="list-style-type: none">1. Keluskar, Krushnaji Arjun, <i>Chhatrapati Shivaji Maharaj</i>, Sudhir Prakashan, 2020.2. Bedekar, Ninad, <i>Kalatil Vyavsthapan Tatve</i>, 2015.	

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Teaching Scheme	Community Engagement Project/Field Project Course code: 25AF 1246CP311	Examination Scheme	
4 Hrs / Week = Credit 2	Prerequisite Courses: 1. Fundamentals of Communication Skills 2. Design Thinking / Problem Solving Techniques Course Objective: 1. To provide students with experiential learning opportunities through community-based field projects. 2. To develop an understanding of socio-economic challenges faced by local communities. 3. To encourage students to apply their technical knowledge to real-world community issues. 4. To promote a sense of civic responsibility and ethical engagement in students. 5. To enhance students' problem-solving, teamwork, communication, and leadership skills through active participation in community work. Course Outcomes: <i>After successful completion of this course the student will be able:</i> CO1: Identify and analyze real-life socio-economic issues through field-based learning experiences. CO2: Apply knowledge from core courses to propose context-specific and sustainable solutions to community problems. CO3: Work effectively in teams to plan, implement, and evaluate a community engagement project under faculty supervision. CO4: Demonstrate social responsibility, ethical behavior, and empathy while working with diverse community stakeholders. CO5: Communicate project goals, processes, and outcomes clearly through presentations, reports, and community interactions.	CA	40
		ESE	60
		TOTAL	100

CO-PO Mapping:

COs \ POs / PSOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PSO 3
CO1	2	3	2	2	1	3	2	2	2	2	1	2	2	1	2
CO2	3	3	3	2	2	3	3	2	2	2	1	2	3	2	2
CO3	2	2	3	1	2	2	2	2	3	2	2	2	2	2	3
CO4	1	1	2	1	1	3	3	3	2	2	1	2	2	1	3
CO5	1	1	2	1	1	2	2	2	2	3	1	2	1	1	3

Note: Values in the matrix represent the level of correlation between COs and POs/ PSOs: **1**–Low, **2**–Medium, **3**–High.

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Syllabus of SEMESTER-IV Courses

Teaching Scheme		Analysis of Algorithms Course code: 25AF1246PC401	Examination Scheme	
TH	3	Prerequisite Courses: 1. Data Structures 2. Programming for Problem Solving Course Objectives: 1. The principle objective of this course is to build solid foundation in algorithms and their applications. 2. To implement various divide and conquer techniques examples. 3. To implement various Greedy techniques examples. ∞ To implement various Dynamic Programming techniques examples. 4. To provide a practical exposure of all algorithms. 5. To understand the importance of algorithm and its complexities. Course Outcomes (COs): <i>Course Outcomes: Upon successful completion of this course, students will be able to:</i> CO1: Students will be able to calculate the time complexity of algorithm. CO2: Students will be able to sort the given numbers using various sorting algorithms. CO3: Students will be able to write programs for the problems using Divide and Conquer. CO4: Students will be able to write programs for the problems using Greedy Method. CO5: Students will be able to write programs for the problems using Dynamic programming and backtracking.	CA	20
PR	1		MSE	20
CR	4		ESE	60
			TOTAL	100

CO-PO Mapping:

COs \ POs / PSOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PSO 3
CO1	3	3	3	3	1	2	1	1	2	1	-	1	1	2	-
CO2	3	2	2	3	2	1	2	1	1	-	-	-	2	2	-
CO3	3	3	2	3	3	1	1	1	-	-	-	-	1	3	1
CO4	3	3	2	3	2	1	2	1	-	-	-	-	1	3	1
CO5	3	3	3	3	3	2	3	1	-	-	-	-	3	3	1

Note: Values in the matrix represent the level of correlation between COs and POs/ PSOs: 1–Low, 2–Medium, 3–High.

COURSE CONTENT

Unit No.	Topic	Hours
1	Introduction: Instruction counts, Growth functions, Necessity of time and space analysis of algorithms, Order notations (O , Θ , Ω notations), Different types of method for solving recurrence relations: Substitution method, Master theorem method, Recurrence tree method.	07 Hrs
2	Divide and Conquer: Binary search, Finding maximum and minimum, Merge sort, Quick sort, Strassen's matrix multiplication. Greedy Algorithms: Knapsack problem, Job sequencing with deadlines, Optimal storage on tapes, Optimal merge pattern, Single source shortest paths.	07 Hrs
3	Dynamic Programming: Multistage graphs, All pair's shortest paths, Knapsack problem, Travelling Salesperson Problem, Longest Common Subsequence.	07 Hrs
4	Graph Theory: Elementary Algorithms: DFS, BFS And Topological Sort, Minimum spanning trees (Kruskal's and Prim's algorithms).	07 Hrs
5	Introduction to Backtracking and Branch and bound strategy: N-queen problem, Sum of Subsets, Graph Coloring. NP theory: Basic concepts, Reduction process, Relation of P, NP Hard and NP complete problems.	07 Hrs
Text Books: <ol style="list-style-type: none"> 1. Thomas Cormen, Charles Leiserson, Ronald Rivest, and Clifford Stein, <i>Introduction to Algorithms</i>, MIT Press, 3rd Edition, 2010. 2. E. Horowitz, S. Sahni, and S. Rajsekar, <i>Computer Algorithms</i>, Silicon Press, 2nd Edition, 2008. Reference Books: <ol style="list-style-type: none"> 1. B. K. Joshi, <i>Data Structures and Algorithms in C++</i>, Tata McGraw Hill Education, 2010. 2. G. T. Heineman, Gary Pollice, Stanley Selkow, <i>Algorithms in a Nutshell</i>, Shroff Publication, 2nd Edition, 2016. 3. Kyle Loudon, <i>Mastering Algorithms with C</i>, O'Reilly Publication, 1st Edition, 2009. 4. S. K. Basu, <i>Design Methods and Analysis of Algorithm</i>, PHI. 		

Alternative NPTEL/SWAYAM Digital Reference				
Sr.No.	NPTEL/SWAYAM Courses Name	Instructor	Host Institute	Links
01	Design and Analysis of Algorithms	Prof. Abhiram G Ranade, Prof. Ajit A Diwan, Prof. Sundar Viswanathan	IIT Bombay	https://nptel.ac.in/courses/106101059
02	Design and Analysis of Algorithms	Prof. Madhavan Mukund	Chennai Mathematical Institute	https://nptel.ac.in/courses/106106131
03	Design and Analysis of Algorithms	Dr Akshay Kumar	Indira Gandhi National Open University, New Delhi	https://onlinecourses.swayam2.ac.in/nou25_cs31/preview

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Teaching Scheme	Analysis of Algorithms Lab Course code: 25AF1246PCL402	Examination Scheme	
2 Hrs / Week = Credit 1	Course Outcomes (COs): <i>After pursuing the course, the students will be able to:</i> CO1: Implement searching and sorting algorithms using Divide and Conquer approach and analyze their time complexity. CO2: Apply Greedy strategy to solve optimization problems like the Knapsack problem. CO3: Design solutions using Dynamic Programming for complex problems including cost optimization and Knapsack. CO4: Solve problems using Graph algorithms such as Topological Sort and understand their applications. CO5: Apply Backtracking to solve constraint satisfaction problems like the N-Queen problem and analyze algorithm behavior.	CA	60
		ESE	40
		TOTAL	100

CO-PO Mapping:

COs \ POs / PSOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PSO 3
CO1	3	2	2	2	3	-	-	-	-	-	-	1	3	3	-
CO2	3	3	2	2	3	-	-	-	-	-	-	1	3	3	-
CO3	3	3	3	2	3	-	-	-	-	-	-	1	3	3	-
CO4	3	3	2	3	3	-	-	-	1	-	-	1	3	3	-
CO5	3	3	3	3	3	-	-	-	-	-	-	1	3	3	-

Note: Values in the matrix represent the level of correlation between COs and POs/ PSOs: **1**–Low, **2**–Medium, **3**–High.

	<p>List of Experiments:</p> <ol style="list-style-type: none"> 1. Write a program for searching an element from the given sorted array of size ‘n’ by using binary search algorithm and apply divide and conquer approach. 2. Write a program for sorting an unsorted array with size as ‘n’ by using Merge Sort algorithm and also analyse the time complexity in worst case, average case and best case. 3. Write a program for sorting an unsorted array with size as ‘n’ by using Quick Sort algorithm and also analyse the time complexity in worst case, average case and best case. 4. Write a program for finding the maximum and minimum 	
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	<p>elements from the given array of size 'n'.</p> <ol style="list-style-type: none">5. Write a program to implement the Knapsack problem using Greedy method and earn the maximum profit.6. Write a program to implement the Knapsack problem using Dynamic Programming method and earn the maximum profit.7. Write a program to implement the Knapsack problem using Dynamic Programming method and earn the maximum profit by generating the cost.8. Write a program for Topological Sort for getting the ordering of given graph.9. Write a program for different sorting algorithm.10. Write a program for N queen problem and demonstrate its illustration.	
	<p>Note:</p> <ol style="list-style-type: none">1. The above list is for illustration purposes only. The course coordinator may update or change the list as needed,2. At least 8 to 10 experiments should be performed.3. Students should be encouraged to design and perform new experiments, subject to prior approval from the respective subject authority.	

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Teaching Scheme		Computer Organization and Architecture Course code: 25AF1246PC403	Examination Scheme	
TH	3	Prerequisite Courses: 1. Digital Logic Design 2. Fundamentals of Computer Programming Course Objectives: 1. To understand the structure, function & characteristics of computer systems. 2. To understand the design of the various functional units and components of digital computers 3. To study hierarchical memory system including cache memories and virtual memory. 4. To understand instruction level parallelism & parallel organization of multi-processor & multi core systems Course Outcomes (COs): <i>At the end of Course Students will be able.</i> CO1: Explain processor structure & its functions. CO2: Solve problems based on computer arithmetic. CO3: Understand concepts related to memory & IO organization. CO4: Obtain knowledge about micro-programming of a processor. CO5: Acquire knowledge about instruction level parallelism & parallel organization of multiprocessors & multi core systems.	CA	20
PR	-		MSE	20
CR	3		ESE	60
			TOTAL	100

CO-PO Mapping:

COs \ POs / PSOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PSO 3
CO1	3	2	-	-	2	-	-	-	-	-	-	1	3	2	-
CO2	3	3	2	-	-	-	-	-	-	-	-	1	3	3	-
CO3	3	2	-	-	3	-	-	-	-	-	-	1	3	3	-
CO4	3	2	2	-	3	-	-	-	-	-	-	1	2	3	-
CO5	3	2	2	-	3	-	-	-	-	-	-	2	2	3	2

Note: Values in the matrix represent the level of correlation between COs and POs/ PSOs: **1**–Low, **2**–Medium, **3**–High.

COURSE CONTENT

Unit No.	Topic	Hours
1	Introduction: Concept of computer organization and architecture, Fundamental unit, Computer function and interconnection, CPU structure and function.	07 Hrs.
2	Instruction Sets: Characteristics, Types of operands, Types of operations, Assembly language, Addressing modes, Instruction format, Types of instruction, Instruction execution, Structure of program, Introduction to RISC and CISC architecture. Computer Arithmetic: The arithmetic and logic Unit, Integer representation, Integer arithmetic, Floating point representation, Floating point arithmetic.	08 Hrs.
3	Memory Organization: Internal Memory: Semiconductor main memory, Error detection & correction, Advanced DRAM organization, Virtual memory systems and cache memory systems, External Memory: Organization and characteristics of magnetic disk, Magnetic tape, Optical memory, RAID.	07Hrs
4	Control Unit: Control unit operation: Micro-operations, Control of the processor, Hardwired implementation Control Unit, Micro-programmed Control Unit.	07Hrs
5	Input/ Output Organization: External devices, I/O module, Programmed I/O, Interrupt driven I/O, Direct memory access. Instruction pipe-lining: Concepts, Parallel processing: Multiple processor organization, Symmetric multiprocessor, Cache coherence and the MESI protocol.	08 Hrs.
	<p>Text Books:</p> <ol style="list-style-type: none"> 1. William Stalling, <i>Computer Organization and Architecture: Designing for Performance</i>, Prentice Hall Publication, 8th Edition, 2009. 2. Hayes, <i>Computer Architecture and Organization</i>, McGraw-Hill Publication, 3rd Edition, 2012. 3. Zaky, <i>Computer Organization</i>, McGraw-Hill Publication, 5th Edition, 2011. <p>Reference Books:</p> <ol style="list-style-type: none"> 1. Morgan, Hennessy, Patterson, <i>Computer Architecture: A Quantitative Approach</i>, Kaufman Publication, 4th Edition, 2007. 2. Morris Mano, <i>Computer System Architecture</i>, Pearson Education India, 3rd Edition, 2007. 3. Mostafa Abd-El-Barr, Hesham El-Rewini, <i>Fundamentals of Computer Organization and Architecture</i>, Wiley Publication, 1st Edition, 2004. 	

4. Miles J. Murdocca, Vincent P. Heuring, <i>Computer Architecture and Organization: An Integrated Approach</i> , Wiley Publication, 1st Edition, 2007.				
Alternative NPTEL/SWAYAM Digital Reference				
Sr.No.	NPTEL/SWAYAM Courses Name	Instructor	Host Institute	Links
01	Computer Organization and Architecture	Prof. V. Kamakoti	IIT Madras	https://nptel.ac.in/courses/106106166
02	Computer Organization and Architecture	Prof. Jatindra Kumar Deka	IIT Guwahati	https://nptel.ac.in/courses/106103068

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Teaching Scheme		Discrete Mathematics Course code: 25AF1246PC404	Examination Scheme	
TH	3	Prerequisite Courses: 1. Fundamentals of Mathematics 2. Introduction to Computer Programming Course Objectives: 1. Understand basic discrete structures like sets, functions, and relations. 2. Apply logic and proof techniques to solve mathematical and computational problems. 3. Use counting principles and recurrence to handle combinatorial problems. 4. Explore algebraic structures and graph theory for real-world IT applications. 5. Develop logical reasoning and problem-solving skills for advanced computing. Course Outcomes (COs): <i>At the end of Course Students will be able.</i> CO1: Apply set theory and logic to real-world computing problems. CO2: Use induction and recursion in algorithmic problem solving. CO3: Apply counting techniques and solve recurrence relations. CO4: Analyze and apply relations and algebraic structures in computation. CO5: Utilize graph theory concepts in modeling and solving IT-based problems.	CA	20
PR	-		MSE	20
CR	3		ESE	60
			TOTAL	100

CO-PO Mapping:

COs \ POs / PSOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PSO 3
CO1	3	2	2	1	2	-	-	-	-	1	-	2	3	2	-
CO2	3	3	2	2	2	-	-	-	-	-	-	2	3	2	-
CO3	3	3	3	2	2	-	-	-	-	-	-	2	3	3	-
CO4	3	2	2	1	2	1	-	1	-	-	-	2	3	2	2
CO5	3	3	3	2	3	-	1	-	1	1	1	3	3	3	2

Note: Values in the matrix represent the level of correlation between COs and POs/ PSOs: **1**–Low, **2**–Medium, **3**–High.

COURSE CONTENT

Unit No.	Topic	Hours
1	Sets and Logic: Set operations, power sets, partitions, cardinality, Inclusion-exclusion principle and applications. Propositional and predicate logic, logical operations, quantifiers. Rules of inference, proof strategies, applications in web search & bitwise operations.	07 Hrs
2	Induction, Recursion, and Functions : Mathematical & strong induction, Recursive definitions and algorithms. Types of functions: injective, surjective, bijective. Composition, identity, inverse, and recursive functions. Application: job scheduling.	07 Hrs
3	Counting and Recurrence : Permutations, combinations (with/without repetition). Binomial coefficients and pigeonhole principle. Generating permutations, solving recurrence relations. Applications: basic combinatorics and enumeration.	07 Hrs
4	Relations and Algebraic Structures : Binary relations, closures, equivalence & partial orders. Warshall's algorithm, N-ary relations and their applications, Databases and relations.. Algebraic systems: groups, monoids, rings, fields. Codes, Homomorphism, Fermat's theorem, polynomial rings, Applications of groups, Ring, Field.	07 Hrs
5	Graph Theory : Graphs: types, paths, circuits, Euler & Hamiltonian paths. Graph coloring, independent sets, planar graphs, Trees, spanning trees, cut sets, MST algorithms: Kruskal's and Prim's, Applications: TSP, shortest path algorithms.	07 Hrs
	<p>Text Books:</p> <ol style="list-style-type: none"> Rosen, K. H., "<i>Discrete Mathematics and Its Applications</i>", 8th Edition, Tata McGraw Hill Publication, 2018. Tremblay, J. P., and Manohar, R., "<i>Discrete Mathematical Structures with Applications to Computer Science</i>", 1st Edition, McGraw Hill Publication, 2001. Liu, C. L., "<i>Elements of Discrete Mathematics</i>", 3rd Edition, McGraw-Hill Publication, 2008. <p>Reference Books:</p> <ol style="list-style-type: none"> Kolman, B., Busby, R., and Ross, S., "<i>Discrete Mathematical Structures</i>", 6th Edition, Pearson Education, 2009. Bisht, R. K., and Dhami, H. S., "<i>Discrete Mathematics</i>", Oxford University Press, 2015. 	

Alternative NPTEL/SWAYAM Digital Reference				
Sr.No	NPTEL Courses Name	Instructor	Host Institute	Links
01	Discrete Mathematics	Prof. Ashish Choudhury	IIT Bangalore	https://onlinecourses.nptel.ac.in/noc25_cs127/preview
02	Discrete Mathematics	Prof Sudarshan Iyer	IIT Ropar,	https://onlinecourses.nptel.ac.in/noc25_cs105/preview

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Teaching Scheme		Web Technology Course code: 25AF1246VSL407	Examination Scheme	
TH	1	Prerequisite Courses: 1. Computer Fundamentals 2. Programming for Problem Solving Course Objectives: 1. To provide an introduction to the concepts of web development using HTML, CSS, and PHP. 2. To develop the ability to design and structure web pages using HTML and styling with CSS. 3. To implement server-side scripting using basic PHP. 4. To build dynamic web pages through form processing and session handling. 5. To introduce the concept of website hosting and deployment. Course Outcomes (COs): <i>At the end of Course Students will be able.</i> CO1. Design static web pages using HTML. CO2. Apply CSS to enhance the design and responsiveness of web pages CO3. Develop simple dynamic web pages using PHP. CO4. Implement form data handling and validations using PHP. CO5. Deploy websites using basic hosting techniques and tools.	CA	60
PR	1		MSE	-
CR	2		ESE	40
			TOTAL	100

CO-PO Mapping:

COs \ POs / PSOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PSO 3
CO1	1	2	2	1	2	1	1	1	1	1	2	1	1	2	1
CO2	2	1	3	1	3	1	1	1	1	2	1	1	3	3	1
CO3	3	2	3	2	3	1	1	1	1	2	2	1	3	3	2
CO4	2	2	3	2	2	2	1	1	1	2	2	1	3	3	3
CO5	3	2	2	1	3	2	2	2	1	2	1	2	3	3	3

Note: Values in the matrix represent the level of correlation between COs and POs/ PSOs: 1–Low, 2–Medium, 3–High.

COURSE CONTENT

Unit No.	Topic	Hours
1	Web Basics and HTML :Web Fundamentals: WWW, HTTP, URL, Web Client and Server, Basic HTML: HTML Structure, Headings, Paragraphs, Lists, Tables, Hyperlinks, Forms Basics: Input types (text, radio, checkbox), Labels, Buttons.	04 Hrs
2	Advanced HTML & CSS : HTML Advanced Elements: Select, Textarea, File upload, HTML5 Semantic Tags: <section>, <article>, <nav>, <aside>, Multimedia Embedding: Audio, Video, iFrames, Introduction to CSS: Syntax, Selectors, Types (Inline, Internal, External), Styling Basics: Colors, Fonts, Backgrounds, Box Model, Layout Techniques: Float, Basic Flexbox	05 Hrs
3	PHP & Website Hosting : PHP Basics: Syntax, Variables, Data Types, Operators, Conditional Statements, Loops, Form Handling: \$_GET, \$_POST methods, Connection with database, CRUD Operation in PHP , basic file operations, Introduction to Sessions and Cookies, Website Hosting: Overview of domain and hosting, deploying using free platforms (e.g., GitHub Pages, 000WebHost)	06 Hrs
	<p>Text Books</p> <ol style="list-style-type: none"> 1. Jon Duckett, <i>HTML & CSS: Design and Build Websites</i>. John Wiley & Sons, 2011. ISBN: 978-1-118-00818-8. 2. Larry Ullman, <i>PHP for the Web: Visual QuickStart Guide</i>, 5th Edition. Peachpit Press, 2016. ISBN: 978-0-13-429125-3. <p>Reference Books</p> <ol style="list-style-type: none"> 1. Robin Nixon, <i>Learning PHP, MySQL & JavaScript: With jQuery, CSS & HTML5</i>, 5th Edition. O'Reilly Media, 2018. ISBN: 978-1-492-04114-8. 2. Uttam K. Roy, <i>Web Technologies: HTML, JavaScript, PHP, Java, JSP, XML and AJAX, Black Book</i>. Oxford University Press, 2010. ISBN: 978-0-19-806622-1. <p>List of Experiments:</p> <ol style="list-style-type: none"> 1. Create a simple HTML page with headings, paragraphs, and line breaks. 2. Design a student registration form using HTML elements. 3. Create a web page using HTML tables for timetable display. 4. Develop a web page with navigation links and embedded video. 5. Apply internal and external CSS to a web page. 6. Create a responsive page using Flexbox or Grid. 7. Write a PHP script to demonstrate arithmetic and logical operators. 8. Create a PHP program to handle form data and display submitted input 9. Perform crud operation using PHP and MySQL. 10. Develop a login form using HTML and validate using PHP. 11. Perform file handling operations in PHP. 12. Host a sample static website using GitHub Pages or free web hosting tool. <p>Note:</p> <ol style="list-style-type: none"> 1. The above list is for illustration purposes only. The course coordinator may update or change the list as needed, 2. At least 8 to10 experiments should be performed. 3. Students should be encouraged to design and perform new experiments, subject to prior approval from the respective subject authority. 	

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Teaching Scheme		Innovation and Entrepreneurship Course code: 25AF1246HM408	Examination Scheme	
TH	2	Prerequisite Courses: 1. Design Thinking / Creative Problem-Solving 2. Communication Skills Course Objectives: 1. To study and understand the key concepts of innovation and entrepreneurship principles and the role of innovation in business success. 2. To cultivate the ability to generate and evaluate innovative ideas through creative thinking techniques and design thinking methodologies. 3. To learn to design viable business models and value propositions those effectively address market needs and customer problems. 4. To acquire practical skills in opportunity recognition, risk assessment, resource mobilization, and lean start-up methodologies for launching and managing new ventures. Course Outcomes (COs): <i>At the end of Course Students will be able.</i> CO1. Outline the concepts of Entrepreneurship. CO2. Create the awareness on creativity and innovation. CO3. Adapt the Entrepreneurship development program. CO4. Evaluate the project planning and feasibility studies. CO5. Analyze the concept of small and micro enterprise.	CA	60
PR	-		MSE	-
CR	2		ESE	40
			TOTAL	100

CO-PO Mapping:

COs \ POs / PSOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PSO 3
CO1	1	1	-	-	-	2	-	-	-	-	2	2	2	2	2
CO2	1	1	-	-	-	2	-	-	-	-	2	2	2	2	2
CO3	2	2	-	-	-	2	-	-	-	-	2	2	2	2	2
CO4	2	2	-	-	-	2	-	-	-	-	3	3	3	2	2
CO5	2	2	-	-	-	2	-	-	-	-	3	3	3	2	2

Note: Values in the matrix represent the level of correlation between COs and POs/ PSOs:1–Low, 2–Medium, 3–High.

COURSE CONTENT

Unit No.	Topic	Hours
1	Introduction to Innovation and Entrepreneurship: Defining innovation, Types of innovation: incremental, radical, disruptive, The innovation process, Factors that drive innovation, Defining entrepreneurship, The entrepreneurial process, Characteristics of successful entrepreneurs, Brainstorming, Design thinking process.	07 Hrs
2	Opportunity identification and Idea Generation: Techniques for Identifying Business Opportunities, Creativity and Innovation in Entrepreneurship, Evaluating Feasibility and Potential of Business Ideas, Tools for Idea Generation: Customer value propositions- Business models.	07 Hrs
3	Business Planning and Strategy Development: Importance of a Business Plan, Components of a Business Plan: Executive Summary, Market Research, Marketing Strategy, Operational Plan, Developing Financial Projections (Revenue, Cost, Profit), Strategic Planning and Goal Setting, Business Model Design (e.g., B2B, B2C, SaaS).	07 Hrs
4	Business Organization and Venture Establishment: Forms of business organization, techno- economic feasibility assessment, financial feasibility, Market feasibility, preparation of business plan, business canvas & lean canvas, challenges and pitfalls in selecting new venture.	07 Hrs
5	Promoting and managing innovation: Sources of finance: crowdfunding, venture capital, equity funds, angel investing; various forms of IPR: patent, copyright, trademark, geographical indications, industrial design; Enhancing innovation potential & formulating strategies for innovation.	07 Hrs
	<p>Text Books:</p> <ol style="list-style-type: none"> Charanthimath, Poornima M., <i>Entrepreneurship Development and Small Business Enterprises</i>, Pearson Education, 2016 . Pavan Soni, <i>Design Your Thinking – The Mindsets, Toolsets and Skill Sets For Creative Problem Solving</i>, Penguin Random House India Pvt. Ltd., 2020. ISBN: 9780670094097. <p>Reference Books:</p> <ol style="list-style-type: none"> Pearson Education, <i>Entrepreneurship and Small Business Management</i>, 2nd Edition. Pearson, July 14, 2021. ISBN-13: 978-0137612468. Hatten, T. S., <i>Small Business Management: Entrepreneurship and Beyond</i>, 5th Edition, Cengage Learning, 2012. Hisrich, R. D., Peters, M. P., & Shepherd, D. A., <i>Entrepreneurship</i>, 10th Edition, McGraw-Hill Education, 2017. Drucker, P. F., <i>Innovation and Entrepreneurship</i>, Routledge, 2014. ISBN: 9781138019195. McGrath, R. G., & MacMillan, I. C., <i>The Entrepreneurial Mindset: Strategies for Continuously Creating Opportunity in an Age of Uncertainty</i>, Harvard Business School Press, 2000. ISBN: 9780875848341. 	

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Teaching Scheme		Life of Bharat Ratna Dr Babasaheb Ambedkar Course code: 25AF1000VE409B	Examination Scheme	
TH	1	Course Objective: <ol style="list-style-type: none"> To analyze Dr. Ambedkar's role in shaping India's constitution and social justice movements. To recognize the relevance of his principles in contemporary engineering and societal contexts. To develop critical thinking and problem-solving skills through case studies and discussions. Course Outcomes: <i>After successful completion of this course the student will be able:</i> CO1: To explain Dr. Ambedkar's key contributions to the Constitution of India, establishment of human values and social reform. CO2: To identify and analyze his leadership qualities and strategic thinking. CO3: To evaluate the impact of his legacy on Maharashtra's culture, politics, and economy.	CA	60
PR	-		ESE	40
CR	1		TOTAL	100

CO-PO Mapping:

COs \ POs / PSOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PSO 3
CO1	1	2	-	-	-	3	-	2	-	-	-	-	-	-	2
CO2	-	2	2	-	-	3	-	2	2	2	-	-	-	-	-
CO3	-	2	-	-	-	-	-	2	-	-	-	-	-	-	2

Note: Values in the matrix represent the level of correlation between COs and POs/ PSOs: **1**–Low, **2**–Medium, **3**–High.

COURSE CONTENT

Unit No.	Topic	Hours
1	Introductio: Introduction to the Socio-political Context of Dr. Babasaheb Ambedkar's Era, British Colonialism, Indian National Movement, Caste Hierarchy, Untouchability, Social Reform Movements, Role in the Indian freedom struggle.	5 Hrs
2	The Contribution of Dr. Babasaheb Ambedkar: Contributions to the Constitution of India, Vision for Social Justice and Empowerment.	5 Hrs
3	Legacy and Relevance Today: Dr. Ambedkar and Marxism: An Exploration of his Thoughts on Marxism, Common Ground with Marxism, Focus on Class Struggle, Caste Vs Caste, Primacy of Caste in Indian Society, Economic Ideas and Policies.	5 Hrs
	Textbooks: 1. Keer, Dhananjay, <i>Dr. Babasaheb Ambedkar: Life and Mission</i> , Popular Prakashan, 1954. 2. Ambedkar, B. R., <i>Annihilation of Caste</i> , Fingerprint Publishing, 2023. Reference Books: 1. Ambedkar, B. R., <i>Buddha or Karl Marx</i> , Infinite Words, 2024. 2. Ambedkar, B. R., <i>The Problem of Rupee: Its Origin and Its Solution</i> , Sudhir Prakashan, 2021.	

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Teaching Scheme		UHV-II Course code: 25AF1000VE410C	Examination Scheme	
TH	2	<p>Course Objectives:</p> <p>1. To help the students appreciate the essential complementarity between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity, the core aspirations of all human beings.</p> <p>2. To facilitate the development of a holistic perspective among students towards life and profession as well as happiness and prosperity, based on correct understanding of human reality and the rest of existence.</p> <p>3. To highlight implications of such a holistic understanding in terms of ethical human conduct, fulfilling human behavior, and enriching interaction with Nature.</p> <p>Course Outcomes (COs): <i>At the end of Course Students will be able.</i></p> <p>CO1: Become more aware of themselves, and their surroundings (family, society, nature).</p> <p>CO2: Act more responsibly in handling problems with sustainable solutions, considering human relationships and nature.</p> <p>CO3: Develop sensitivity and commitment toward human values, relationships, and society.</p> <p>CO4: Apply learned values in real-life scenarios and day-to-day decision-making.</p> <p>CO5: Exhibit professional ethics rooted in human values.</p> <p>CO6: Understand and advocate a holistic perception of harmony in nature and society.</p>	CA	20
PR	-		MSE	20
CR	2		ESE	60
			TOTAL	100

CO-PO Mapping:

COs \ POs / PSOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PSO 3
CO1	2	1	-	-	-	2	3	3	2	-	-	-	-	-	-
CO2	2	2	-	-	-	3	3	3	2	-	-	-	-	-	-
CO3	1	-	-	-	-	3	3	3	2	-	-	-	-	-	-
CO4	-	-	-	-	-	2	3	2	2	-	-	-	-	-	-
CO5	-	-	1	-	-	3	3	2	2	2	-	-	-	-	-
CO6	-	-	-	-	-	-	-	3	2	1	-	-	-	-	-

Note: Values in the matrix represent the level of correlation between COs and POs/ PSOs: **1**–Low, **2**–Medium, **3**–High.

COURSE CONTENT

Unit No.	Topic	Hours
1	Introduction to Value Education :Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, Right Understanding, Relationship and Physical Facility, Happiness and Prosperity – Current Scenario, Method to Fulfill the Basic Human Aspirations	06 Hrs
2	Harmony in the Human Being: Understanding Human being as the Co-existence of the Self and the Body, Distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self , Understanding Harmony in the Self , Harmony of the Self with the Body, Programme to Ensure self-regulation and Health.	06 Hrs
3	Harmony in the Family and Society: Harmony in the Family – the Basic Unit of Human Interaction, Values in Human-to-Human Relationship, Trust' – the Foundational Value in Relationship, 'Respect' – as the Right Evaluation, Understanding Harmony in the Society, Vision for the Universal Human Order	06 Hrs
4	Harmony in the Nature (Existence): Understanding Harmony in the Nature, Interconnectedness self-regulation and Mutual Fulfillments among the Four Orders of Nature ,Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence	06 Hrs
5	Implications of the Holistic Understanding – a Look at Professional Ethics: Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics, Holistic Technologies, Production Systems and Management Models – Typical Case Studies, Strategies for Transition towards Value-based Life and Profession	06 Hrs
	<p>Text Book and Teacher’s Manual:</p> <ol style="list-style-type: none"> 1. R. R. Gaur, R. Asthana, G. P. Bagaria, <i>A Foundation Course in Human Values and Professional Ethics</i>, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN: 978-93-87034-47-1. 2. R. R. Gaur, R. Asthana, G. P. Bagaria, <i>Teachers’ Manual for A Foundation Course in Human Values and Professional Ethics</i>, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN: 978-93-87034-53-2. 	

Reference Books:

1. A. Nagaraj, *Jeevan Vidya: Ek Parichaya*. Amarkantak, India: Jeevan Vidya Prakashan, 1999.
2. A. N. Tripathi, *Human Values*. New Delhi, India: New Age International Publishers, 2004.
3. A. Leonard, *The Story of Stuff: How Our Obsession with Stuff Is Trashing the Planet, Our Communities, and Our Health – and a Vision for Change*. New York, NY, USA: Simon & Schuster (Free Press), 2011.
4. M. K. Gandhi, *The Story of My Experiments with Truth*. Ahmedabad, India: Navajivan Publishing House, 1927.
5. E. F. Schumacher, *Small Is Beautiful: A Study of Economics as If People Mattered*. London, UK: Blond & Briggs, 1973.
6. C. Andrews, *Slow Is Beautiful: New Visions of Community, Leisure, and Joie de Vivre*. Gabriola Island, BC, Canada: New Society Publishers, 2006.
7. J. C. Kumarappa, *Economy of Permanence: A Quest for a Social Order Based on Non-violence*. Varanasi, India: Sarva Seva Sangh Prakashan, 1948.
8. P. Sunderlal, *Bharat Mein Angreji Raj*. [Place/publisher/year to be confirmed].
9. Dharampal, *Rediscovering India*. New Delhi, India: Penguin Books India, 1983.
10. M. K. Gandhi, *Hind Swaraj or Indian Home Rule*. Bombay, India: Navajivan Publishing House, 1909.
11. M. A. K. Azad, *India Wins Freedom*. New Delhi, India: Orient Longman, 1959.
12. R. Rolland, *Vivekananda*, Kolkata, India: Vedanta Press, 1953
13. R. Rolland, *Gandhi*, New York, NY, USA: The Century Co., 1924

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Syllabus of Minor (MDM) in IT Courses offered by Department of Information Technology at Second Year B.Tech Level

Teaching Scheme		Multidisciplinary Minor-1 Data Structures Course code: 25AF1246MD306	Examination Scheme	
TH	2	<p>Prerequisite Courses:</p> <p>1. Programming and Problem Solving</p> <p>2. Fundamentals of C Programming Languages</p> <p>Course Objectives:</p> <ol style="list-style-type: none"> 1. To teach efficient storage mechanisms of data for an easy access. 2. To design and implementation of various basic and advanced data structures. 3. To introduce various techniques for representation of the data in the real world. 4. To develop application using data structures. 5. To teach the concept of protection and management of data. <p>Course Outcomes (COs): <i>At the end of Course Students will be able To.</i></p> <p>CO1: Understand and apply efficient storage mechanisms for structured and unstructured data.</p> <p>CO2: Design and implement various basic and advanced data structures and hashing techniques.</p> <p>CO3: Analyze and select suitable data representation techniques for solving real-world computational problems.</p> <p>CO4: Implement applications using appropriate data structures to improve efficiency and scalability.</p> <p>CO5: Demonstrate knowledge of data protection, file organization, and effective data management strategies.</p>	CA	20
PR	-		MSE	20
CR	2		ESE	60
			TOTAL	100

CO-PO Mapping:

COs \ POs / PSOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PSO 3
CO1	3	2	2	2	2	1	1	1	1	1	1	2	3	3	2
CO2	3	3	2	3	3	1	1	1	2	1	1	2	3	3	2
CO3	3	3	3	3	2	1	1	1	2	2	1	2	3	2	2
CO4	2	2	3	2	3	1	1	1	3	2	2	2	3	3	3
CO5	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2

Note: Values in the matrix represent the level of correlation between COs and POs/ PSOs: 1–Low, 2–Medium, 3–High.

COURSE CONTENT

Unit No.	Topic	Hours		
1	Linear Data Structures: Introduction to List, Array and Linked List, Stack: Stack Implementation using Array and Linked List, Applications of Stack, Queue: Queue Implementation, Applications of Queue.	05 Hrs		
2	Non-Linear Data Structures: Trees: Trees and Terminologies, Tree Traversals (In-order, Pre-order, Post-order), Binary Search Tree (BST): In-order Traversal, Implementation of Search Algorithm, AVL Trees: Concept.	05 Hrs		
3	Graphs and Advanced Data Structures: Graph Representation, Shortest Path Algorithms, Minimum Spanning Tree: Prim's &Kruskal's Algorithm.	06 Hrs		
4	Sorting Algorithms & Techniques: Divide and Conquer Algorithms, Selection Sort, Bubble Sort, Insertion Sort, Merge Sort,Quick Sort and Applications.	06 Hrs		
5	File Organization and B+ Trees: Directories and Contiguous Allocation, B+ Trees: Construction of B-tree, B+ Tree Insertion and Deletion, B+ Tree Maintenance and Efficiency.	06 Hrs		
Text Books: <ol style="list-style-type: none"> 1. Weiss, M. A. (Year). <i>Data Structures and Algorithm Analysis in C++</i> (Edition, if any). Pearson Education. 2. Horowitz, E., Sahni, S., & Mehta, D. (Year). <i>Fundamentals of Data Structures in C++</i> (Edition, if any). Universities Press. 3. Cormen, T. H., Leiserson, C. E., Rivest, R. L., & Stein, C. (Year). <i>Introduction to Algorithms</i> (Edition, if any). MIT Press. Reference Books: <ol style="list-style-type: none"> 1. Aho, A. V., Hopcroft, J. E., & Ullman, J. D. (Year). <i>Data Structures and Algorithms</i> (Edition, if any). Addison-Wesley. 2. Thareja, R. (Year). <i>Data Structures</i>. Oxford University Press. 				
Alternative NPTEL/SWAYAM Digital Reference				
Sr.No.	NPTEL/SWAYAM Courses Name	Instructor	Host Institute	Links
01	Data Structures	Dr.S.Sasikala	University of Madras, Chennai, Tamil Nadu	https://onlinecourses.swayam2.a.c.in/cec19_cs04/preview

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Teaching Scheme		Multidisciplinary Minor-2 Computer Organization and Architecture Course code: 25AF1246MD405	Examination Scheme	
TH	3	Prerequisite Courses: 1. Digital Logic Design 2. Fundamentals of Computer Programming Course Objectives: 1. To understand the structure, function & characteristics of computer systems. 2. To understand the design of the various functional units and components of digital computers 3. To study hierarchical memory system including cache memories and virtual memory. 4. To understand instruction level parallelism & parallel organization of multi-processor & multi core systems Course Outcomes (COs): <i>At the end of Course Students will be able.</i> CO1. Explain processor structure & its functions. CO2. Solve problems based on computer arithmetic. CO3. Understand concepts related to memory & IO organization. CO4. Obtain knowledge about micro-programming of a processor. CO5. Acquire knowledge about instruction level parallelism & parallel organization of multiprocessors & multi core systems	CA	20
PR	-		MSE	20
CR	3		ESE	60
			TOTAL	100

CO-PO Mapping:

COs \ POs / PSOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PSO 3
CO1	3	2	-	1	2	-	-	-	-	-	-	1	-	-	-
CO2	3	3	-	2	2	-	-	-	-	-	-	1	-	-	-
CO3	3	2	-	1	2	-	-	-	-	-	-	1	-	-	-
CO4	3	2	2	2	2	-	-	1	-	-	-	1	-	-	-
CO5	3	3	2	2	3	-	1	-	-	-	1	2	-	-	-

Note: Values in the matrix represent the level of correlation between COs and POs/ PSOs: **1**–Low, **2**–Medium, **3**–High.

COURSE CONTENT

Unit No.	Topic	Hours
1	Introduction: Concept of computer organization and architecture, Fundamental unit, Computer function and interconnection, CPU structure and function.	07 Hrs
2	Instruction Sets: Characteristics, Types of operands, Types of operations, Assembly language, Addressing modes, Instruction format, Types of instruction, Instruction execution, Structure of program, Introduction to RISC and CISC architecture. Computer Arithmetic: The arithmetic and logic Unit, Integer representation, Integer arithmetic.	08 Hrs
3	Memory Organization: Internal Memory: Semiconductor main memory, Error detection & correction, Virtual memory systems and cache memory systems, External Memory: Organization and characteristics of magnetic disk, Optical memory, RAID.	08Hrs
4	Control Unit: Control unit operation: Micro-operations, Control of the processor, Hardwired implementation control unit, Micro-programmed Control Unit.	07Hrs
5	Input/ Output Organization: External devices, I/O module, Programmed I/O, Interrupt driven I/O, Direct memory access, Instruction pipe-lining: Concepts, Parallel processing: Multiple processor organization, Symmetric multiprocessor, Cache coherence and the MESI protocol.	07 Hrs.
	<p>Text Books:</p> <ol style="list-style-type: none"> 1. William Stalling, “<i>Computer Organization and Architecture: Designing for Performance</i>”, Prentice Hall Publication, 8th edition, 2009. 2. Hayes, “<i>Computer Architecture and Organization</i>”, McGraw-Hill Publication, 3rd edition, 2012. 3. Zaky, “<i>Computer Organization</i>”, McGraw-Hill Publication, 5th edition, 2011. <p>Reference Books:</p> <ol style="list-style-type: none"> 1. Morgan, Hennessy, Patterson, “<i>Computer Architecture: A Quantitative Approach</i>”, Kaufman Publication, 4th edition, 2007. 2. Morris Mano, “<i>Computer System Architecture</i>”, Pearson Education India, 3rd edition, 2007. 3. Mostafa Abd-El-Barr, Hesham El-Rewini, “<i>Fundamentals of Computer</i> 	

	<i>Organization and Architecture</i> ”, Wiley Publication, 1st edition, 2004.			
	4. Miles J. Murdocca, Vincent P. Heuring, “ <i>Computer Architecture and Organization: An Integrated Approach</i> ”, Wiley Publication, 1st edition, 2007.			
Alternative NPTEL/SWAYAM Digital Reference				
Sr.No.	NPTEL/SWAYAM Courses Name	Instructor	Host Institute	Links
01	Computer Organization and Architecture	Prof. Indrani Sen Gupta Prof. Kamalika Datta	IIT Kharagpur	https://nptel.ac.in/course/s/106105163 https://onlinecourses.nptel.ac.in/no_c25_cs154/preview

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Syllabus of Honor Courses (HON) offered by Information Technology at Second Year B.Tech Level

Teaching Scheme		Honor (HON) Courses Optimization Techniques Course code: 25AF1246HON301	Examination Scheme	
TH	3	Prerequisite Courses: 1. Engineering Mathematics – I & II 2. Discrete Mathematics 3. Data Structures and Algorithms Course Objectives: 1. Understand the fundamental concepts and need for optimization in engineering and IT domains. 2. Learn mathematical modeling techniques and classical methods for linear and non-linear optimization problems. 3. Apply optimization algorithms to real-world IT and computer science problems. 4. Explore modern optimization tools including evolutionary and nature-inspired algorithms. Course Outcomes (COs): <i>After completing the course, students will be able to:</i> CO1: Formulate and classify optimization problems relevant to information technology. CO2: Solve linear programming problems using graphical and simplex methods. CO3: Apply unconstrained and constrained nonlinear optimization techniques. CO4: Implement dynamic programming and integer programming approaches in problem-solving. CO5: Use modern heuristic and metaheuristic algorithms like Genetic Algorithms and Particle Swarm Optimization for solving complex IT-related problems.	CA	20
PR	-		MSE	20
CR	3		ESE	60
			TOTAL	100

CO-PO Mapping:

COs \ POs / PSOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PSO 3
CO1	3	3	2	2	2	-	-	-	-	-	-	1	3	2	-
CO2	3	3	2	2	3	-	-	-	-	-	-	1	3	3	-
CO3	3	3	2	2	3	-	-	-	-	-	-	1	3	3	-
CO4	3	3	3	2	3	-	-	-	-	-	-	1	3	3	-
CO5	3	2	3	2	3	-	1	-	1	2	1	2	3	3	2

Note: Values in the matrix represent the level of correlation between COs and POs/ PSOs: **1**–Low, **2**–Medium, **3**–High.

COURSE CONTENT

Unit No.	Topic	Hours		
1	Mathematical preliminaries: Linear algebra and matrices , Vector space, eigen analysis, Elements of probability theory ,Elementary multivariable calculus	07 Hrs		
2	Linear Programming: Introduction to linear programming model, Simplex method, Duality , Karmarkar's method	07 Hrs		
3	Unconstrained optimization: One-dimensional search methods, Gradient-based methods , Conjugate direction and quasi-Newton methods	07 Hrs		
4	Constrained Optimization: Lagrange theorem , FONC, SONC, and SOSC conditions	07 Hrs		
5	Non-linear problems: Non-linear constrained optimization models, KKT conditions ,Projection methods	07 Hrs.		
<p>Text Books:</p> <ol style="list-style-type: none"> 1. Rao, S. S., <i>“Engineering Optimization: Theory and Practice”</i>, 4th Edition, Wiley India. 2. Diwekar, Urmila, <i>“Introduction to Applied Optimization”</i>, 2nd Edition, Springer. 3. Antoniou, Andreas, and Lu, Wu-Sheng, <i>“Practical Optimization: Algorithms and Engineering Applications”</i>, Springer. <p>Reference Books:</p> <ol style="list-style-type: none"> 1. Rardin, Ronald L., <i>“Optimization in Operations Research”</i>, Pearson. 2. Cavazzuti, Marco, <i>“Optimization Methods: From Theory to Design”</i>, Springer. 3. Taha, H. A., <i>“Operations Research: An Introduction”</i>, 10th Edition, Pearson. 4. Talbi, El-Ghazali, <i>“Metaheuristics: From Design to Implementation”</i>, Wiley. 				
Alternative NPTEL/SWAYAM Digital Reference				
Sr.No.	NPTEL/ SWAYAM Courses Name	Instructor	Host Institute	Links
1.	Optimization from fundamentals	Prof. Ankur A. Kulkarni	IIT Bombay	https://nptel.ac.in/courses/112101298

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Teaching Scheme		Honor (HON) Courses Advanced Algorithms and Data Structures Course code: 25AF1246HON402	Examination Scheme	
TH	3	Prerequisite Courses: 1. Data Structures 2. Analysis of Algorithms. 3. Discrete Mathematics Course Objectives: 1. To analyze and apply advanced data structures for solving real-world computational problems. 2. To explore optimization-focused algorithmic techniques including randomization and approximation. 3. To understand computational geometry, string algorithms, and network flows in depth. 4. To solve problems using advanced algorithm paradigms beyond traditional divide & conquer or dynamic programming. 5. To implement complex algorithms using high-level languages and assess performance rigorously. Course Outcomes (COs): <i>At the end of Course Students will be able.</i> CO1: Understand and apply advanced data structures like Red-Black Trees, AVL Trees, and Hashing. CO2: Analyze and implement advanced graph algorithms including shortest paths and flows. CO3: Design algorithms using approximation, randomization, and online methods. CO4: Solve real-world problems using string algorithms and computational geometry techniques. CO5: Demonstrate proficiency in implementing complex algorithms and evaluating performance.	CA	20
PR	-		MSE	20
CR	3		ESE	60
			TOTAL	100

CO-PO Mapping:

COs \ POs / PSOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PSO 3
CO1	3	2	3	2	2	-	-	-	-	-	-	-	3	3	2
CO2	3	3	3	3	3	-	-	-	-	-	-	-	3	3	3
CO3	3	3	3	3	3	2	-	-	-	-	-	-	3	2	3
CO4	3	3	3	3	2	-	-	-	-	-	-	-	2	2	3
CO5	3	2	3	3	3	-	-	-	-	2	-	-	3	3	3

Note: Values in the matrix represent the level of correlation between COs and POs/ PSOs: **1**–Low, **2**–Medium, **3**–High.

COURSE CONTENT

Unit No.	Topic	Hours		
1	Advanced Trees and Hashing: AVL Trees, Red-Black Trees, Splay Trees, B-Trees, Cuckoo Hashing, Extendible Hashing, Bloom Filters.	07 Hrs		
2	Advanced Graph Algorithms: Bellman-Ford, Dijkstra's, Floyd-Warshall, Network Flows (Ford-Fulkerson, Edmonds-Karp), Topological Sort.	07 Hrs		
3	Approximation & Randomized Algorithms: Set Cover, Vertex Cover, Travelling Salesman Problem; Las Vegas vs. Monte Carlo, Hashing with Randomization.	07 Hrs		
4	String Algorithms and Computational Geometry: KMP, Rabin-Karp, Suffix Trees; Convex Hull (Graham Scan), Line Segment Intersection, Closest Pair.	07 Hrs		
5	Online Algorithms and Real-World Applications: Paging, k-Server Problem, Online Bipartite Matching; Applications in Networking, Bioinformatics, AI.	07 Hrs.		
<p>Text Books:</p> <ol style="list-style-type: none"> Cormen, T. H., et al., <i>“Introduction to Algorithms”</i>, MIT Press, 2022. Levitin, Anany, <i>“Introduction to Design and Analysis of Algorithms”</i>, Pearson, 2021. <p>Reference Books:</p> <ol style="list-style-type: none"> Horowitz, E., Sahni, S., and Rajasekaran, S., <i>“Fundamentals of Computer Algorithms”</i>, Galgotia, 2021. Mitzenmacher, Michael, and Upfal, Eli, <i>“Probability and Computing”</i>, Cambridge University Press. 				
Alternative NPTEL/SWAYAM Digital Reference				
Sr.No.	NPTEL/ SWAYAM Courses Name	Instructor	Host Institute	Links
1.	Data Structure and Algorithms Using Java	Prof. Debasis Samanta	IIT Kharagpur	https://nptel.ac.in/courses/106105225
2.	Introduction to Algorithms and Analysis	Prof. Sourav Mukhopadhyay	IIT Kharagpur	https://onlinecourses.nptel.ac.in/noc25_cs150/preview

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Syllabus of Double Minor Courses (DM) offered by Information Technology in at Second Year B.Tech Level

Teaching Scheme		Double Minor (DM) Courses Computer Networks Fundamentals Course code: 25AF1246DM301	Examination Scheme	
TH	3	Prerequisite Courses: 1. Basic Programming Concepts 2. Basics of Data Communication Course Objectives: 1. To introduce the fundamentals of computer networks and communication models. 2. To explain key networking concepts such as protocols, architecture, and addressing. 3. To provide insight into common networking devices and transmission media. 4. To familiarize students with layered architecture (OSI and TCP/IP) and data flow. Course Outcomes (COs): <i>At the end of Course Students will be able.</i> CO1: Describe basic concepts and terminology of computer networks. CO2: Explain the functions of various layers of the OSI and TCP/IP models. CO3: Identify networking devices, topologies, and transmission media. CO4: Understand addressing schemes like IP, MAC, and domain names. CO5: Summarize the role of protocols in enabling communication over networks.	CA	20
PR	-		MSE	20
CR	3		ESE	60
			TOTAL	100

CO-PO Mapping:

COs \ POs / PSOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PSO 3
CO1	3	2	-	-	-	-	-	-	-	1	-	-	3	-	-
CO2	3	3	2	-	-	-	-	-	-	-	1	-	3	3	-
CO3	2	2	-	-	2	1	-	-	-	-	-	-	3	2	-
CO4	3	2	-	-	2	-	-	-	-	-	-	-	3	2	-
CO5	3	2	-	-	2	-	-	1	-	1	-	1	3	2	2

Note: Values in the matrix represent the level of correlation between COs and POs/ PSOs: **1**–Low, **2**–Medium, **3**–High.

COURSE CONTENT

Unit No.	Topic	Hours		
1	Introduction to Computer Networks: Definition and Uses of Computer Networks, Types of Networks: LAN, MAN, WAN, Network Topologies and Transmission Media, Network Devices: Router, Switch, Hub, Modem	07 Hrs		
2	Network Models: OSI Reference Model: 7 Layers and Functions, TCP/IP Model and Comparison with OSI, Protocol Stack Overview	07 Hrs		
3	Physical and Data Link Layer: Transmission Modes: Simplex, Half-Duplex, Full-Duplex, Error Detection Techniques (Parity, CRC), MAC Address and ARP Protocol	07 Hrs		
4	Network and Transport Layer : IP Addressing (IPv4 & Introduction to IPv6) , Subnetting Basics, Routing Concepts and Protocols (Static, Dynamic) , TCP vs. UDP	08 Hrs		
5	Application Layer and Services : DNS, HTTP, FTP, Email (SMTP/POP3), Network Security Basics (Firewall, VPN, Encryption Overview) , Internet and Web Basics.	07 Hrs.		
Text Books: 1. Behrouz A. Forouzan, <i>Data Communications and Networking</i> , McGraw-Hill Education. Reference Books: 1. James F. Kurose and Keith W. Ross, <i>Computer Networking: A Top-Down Approach</i> , Pearson Education. 2. Andrew S. Tanenbaum, <i>Computer Networks</i> , Pearson Education.				
Alternative NPTEL/SWAYAM Digital Reference				
Sr.No.	NPTEL/ SWAYAM Courses Name	Instructor	Host Institute	Links
1.	Computer Networks	Dr. Karthik N	NIT, Puducherry	https://onlinecourses.swayam2.ac.in/ntr25_ed138/preview
2.	Computer Networks and Internet Protocol	Prof. Soumya Kanti Ghosh, Prof. Sandip Chakraborty	IIT Kharagpur	https://nptel.ac.in/courses/106105183

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Teaching Scheme		Double Minor (DM) Courses Data science and visualization Course code: 25AF1246DM402	Examination Scheme	
TH	3	Prerequisite Courses: 1. Programming Fundamentals 2. Fundamentals of Data Structures and Algorithms Course Objectives: 1. To introduce the basic concepts and techniques of data science. 2. To enable students to perform data preprocessing, exploration, and visualization. 3. To familiarize with tools and programming libraries used in data analysis and visualization. 4. To equip students with practical skills in interpreting and visualizing real-world datasets. Course Outcomes (COs): <i>At the end of Course Students will be able.</i> CO1: Understand the fundamental concepts of data science and analytics. CO2: Perform data preprocessing and cleaning using Python. CO3: Apply statistical techniques for data analysis. CO4: Use visualization tools (Matplotlib, Seaborn, Plotly) to interpret datasets. CO5: Build simple data-driven insights from real-world datasets.	CA	20
PR	-		MSE	20
CR	3		ESE	60
			TOTAL	100

CO-PO Mapping:

COs \ POs / PSOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PSO 3
CO1	3	2	-	-	2	-	-	-	-	-	-	2	3	2	-
CO2	3	3	2	2	3	-	-	-	-	-	-	2	3	3	-
CO3	3	3	2	3	2	-	-	-	-	-	-	2	3	3	-
CO4	2	3	3	2	3	-	-	-	-	2	-	2	3	3	2
CO5	3	3	3	3	3	-	2	2	2	3	2	3	3	3	3

Note: Values in the matrix represent the level of correlation between COs and POs/ PSOs: **1**–Low, **2**–Medium, **3**–High.

COURSE CONTENT

Unit No.	Topic	Hours		
1	Introduction to Data Science :Data Science process, lifecycle, and applications,Types of data: structured, semi-structured, and unstructured, Basics of statistics: mean, median, mode, standard deviation , Introduction to Python for Data Science.	07 Hrs		
2	Data Collection and Preprocessing :Data collection methods: web scraping, APIs, datasets, Data cleaning: handling missing data, outliers, duplicate data, Data transformation: normalization, encoding categorical data ,Introduction to pandas and NumPy.	07 Hrs		
3	Exploratory Data Analysis :Descriptive statistics and summary techniques, Correlation analysis and cross-tabulation, Grouping and aggregating data, Hands-on using pandas for EDA.	07 Hrs		
4	Data Visualization Techniques : Principles of effective visualization, Plotting using Matplotlib and Seaborn, Advanced charts: heatmaps, pair plots, histograms, box plots ,Introduction to interactive visualizations using Plotly.	08 Hrs		
5	Case Studies and Applications : Real-world applications of data science in various domains. Interpreting datasets from government, health, finance, and social media. Data storytelling and presentation best practices.	07 Hrs.		
Textbooks: <ol style="list-style-type: none"> Grus, J., <i>“Data Science from Scratch: First Principles with Python”</i>, O’Reilly Media. VanderPlas, J., <i>“Python Data Science Handbook”</i>, O’Reilly. Reference Books: <ol style="list-style-type: none"> McKinney, W., <i>“Python for Data Analysis”</i>, O’Reilly. Wickham, H., <i>“ggplot2: Elegant Graphics for Data Analysis”</i>, Springer. Yau, N., <i>“Data Points: Visualization That Means Something”</i>, Wiley. 				
Alternative NPTEL/SWAYAM Digital Reference				
Sr.No.	NPTEL/ SWAYAM Courses Name	Instructor	Host Institute	Links
1.	Data Science for Engineers	Prof. Shankar Narasimhan, Prof. Rangunathan Rengasamy	IIT Madras	https://nptel.ac.in/courses/106106179
2.	Data Science Using Python	Prof. Faisal Anwer, Prof. Mohammad Nadeem	Aligarh Muslim University	https://onlinecourses.swayam2.ac.in/ini25_cs04/previaw

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Syllabus of Exit options after Second Year, B.Tech to Qualify for Diploma

Teaching Scheme		Exit Course Mobile App Development Course code: 25AF1246EX401											Examination Scheme													
TH	120	Course Objectives: <ol style="list-style-type: none"> 1. To introduce learners to the fundamentals of Android operating system and mobile app development environments. 2. To develop programming skills in Java and Kotlin for building Android applications. 3. To enable learners to design effective user interfaces using Android UI components. 4. To train learners in implementing data storage, database connectivity, and backend integration. 5. To guide learners through the process of app deployment, publishing, and monetization. Course Outcomes (COs): <i>At the end of Course Students will be able.</i> CO1: Describe the structure and functioning of Android applications. CO2: Write efficient Java/Kotlin code for Android-based solutions. CO3: Design and implement user-friendly interfaces using Android components. CO4: Integrate storage solutions like SQLite and Firebase into mobile applications. CO5: Build, test, and deploy Android apps to the Google Play Store.											Original Course Certificates required at the time of evaluation													
PR																										
CR																8										
CO-PO Mapping:																										
COs \ POs / PSOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PSO 3											
CO1	3	2	-	-	2	-	-	-	-	-	-	2	3	2	-											
CO2	3	3	2	-	3	-	-	1	1	-	-	2	3	3	1											
CO3	2	2	3	1	3	-	1	-	2	2	-	2	3	3	2											
CO4	3	3	2	2	3	-	1	-	1	-	-	2	3	3	-											
CO5	2	2	3	2	3	1	1	1	3	3	2	3	3	3	3											
Note: Values in the matrix represent the level of correlation between COs and POs/ PSOs: 1 –Low, 2 –Medium, 3 –High.																										

COURSE CONTENT

Unit No.	Topic	Hours
1	Introduction to Mobile App Development and Android Basics <ul style="list-style-type: none"> • Overview of Mobile App Development • Introduction to Android OS and Android Studio • Creating First Android Project • Understanding Project Structure and Folder Layout • Activities and Activity Lifecycle • Views and ViewGroups (Layouts) • LinearLayout, RelativeLayout, ConstraintLayout 	20 Hrs
2	Java Programming for Android <ul style="list-style-type: none"> • Java Basics: Data Types, Variables, Operators • Control Structures: if, switch, loops • Object-Oriented Concepts: <ul style="list-style-type: none"> ◦ Class, Object, Inheritance, Polymorphism, Encapsulation • Exception Handling • Event Handling • Arrays and Strings • Introduction to Multithreading 	20 Hrs
3	Android User Interface Components <ul style="list-style-type: none"> • Buttons, TextView, EditText, CheckBox, RadioButton, ImageView • RecyclerView and ListView • Toast, Snackbar, Dialogs, Menus • Intents: Explicit and Implicit • Navigation between Activities • Fragments: Creation, Lifecycle, Fragment Transactions 	20 Hrs
4	Data Storage and Connectivity <ul style="list-style-type: none"> • SharedPreferences • Internal and External Storage • SQLite Database and CRUD Operations • WebView and JavaScript Integration • JSON Parsing • Firebase Integration (Realtime Database, Firestore) 	10 Hrs
5	Advanced App Features <ul style="list-style-type: none"> • Location and Maps (Google Maps API) • Services and Broadcast Receivers • Notifications • Introduction to Kotlin for Android • Integrating APIs (e.g., Weather API) • Working with Media: Audio, Video, Camera • Publishing an App: Generating Signed APK, Play Store Deployment • App Store Optimization (ASO) 	20 Hrs

6	Capstone Projects and Industry Applications <ul style="list-style-type: none">• Chat App using Firebase• Hotel Booking App• E-Commerce Shopping Cart App• YouTube Video Player App• Weather Forecast App using API• Calculator App• Tips for Interview Preparation• Freelancing and Monetization Opportunities• Mini Projects and Evaluation	30 Hrs
	References: https://klic.mkcl.org/klic-courses/mobile-app-development	

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Teaching Scheme		Exit Course Office Assistance Course code: 25AF1246EX402											Examination Scheme																																																																																															
TH	120 Hr	<p>Course Objectives:</p> <ol style="list-style-type: none"> 1. Providing an excellent and consistent level of administrative support to the customers 2. Scheduling executive meetings and travel plans 3. Maintaining various types of data required in business matters 4. Organizing various events and maintaining event expenses 5. Creating presentations required in business <p>Course Outcomes (COs): <i>At the end of Course Students will be able.</i></p> <p>CO1: Providing an excellent and consistent level of administrative support to the customers</p> <p>CO2: Scheduling executive meetings and travel plans</p> <p>CO3: Maintaining various types of data required in business matters</p> <p>CO4: Organizing various events and maintaining event expenses</p> <p>CO5: Creating presentations required in business</p>											<p>Original Course Certificates required at the time of evaluation</p>																																																																																															
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		<p>CO-PO Mapping:</p> <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr style="background-color: #d9ead3;"> <th style="text-align: left;">COs \ POs / PSOs</th> <th>PO 1</th> <th>PO 2</th> <th>PO 3</th> <th>PO 4</th> <th>PO 5</th> <th>PO 6</th> <th>PO 7</th> <th>PO 8</th> <th>PO 9</th> <th>PO 10</th> <th>PO 11</th> <th>PO 12</th> <th>PS O1</th> <th>PS O2</th> <th>PSO 3</th> </tr> </thead> <tbody> <tr> <td>CO1</td> <td>1</td> <td>1</td> <td>-</td> </tr> <tr> <td>CO2</td> <td>1</td> <td>1</td> <td>-</td> </tr> <tr> <td>CO3</td> <td>2</td> <td>2</td> <td>-</td> </tr> <tr> <td>CO4</td> <td>3</td> <td>3</td> <td>3</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>2</td> <td>3</td> <td>-</td> <td>-</td> </tr> <tr> <td>CO5</td> <td>3</td> <td>3</td> <td>3</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>2</td> <td>3</td> <td>-</td> <td>-</td> </tr> </tbody> </table> <p>Note: Values in the matrix represent the level of correlation between COs and POs/ PSOs: 1–Low, 2–Medium, 3–High.</p>											COs \ POs / PSOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PSO 3	CO1	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	CO2	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	CO3	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	CO4	3	3	3	-	-	-	-	-	-	-	-	2	3	-	-	CO5	3	3	3	-	-	-	-	-	-	-	-	2	3	-	-
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CO5	3	3	3	-	-	-	-	-	-	-	-	2	3	-	-																																																																																													

COURSE CONTENT

Unit No.	Topic	Hours
1	Word Processing : The Home Tab, The Insert Tab, The References Tab, The Mailings Tab, The Review Tab, The View Tab, Other Features, Using Automatic Features, Using the PDF Format, Using Forms and Creating Templates, Security, Word Processing in Other Languages, Case Studies	20 Hrs
2	Spreadsheet : The Home Tab, The Insert Tab, The Page Layout Tab, The Data Tab, The Review and View Tabs, Additional Excel Features, Security, Excel Extensions, Case Studies	20 Hrs
3	Presentation Graphics : The Home Tab, The Insert Tab, The Design Tab, The Transitions Tab, The Animations Tab, The Slide Show Tab, Other Features, Spellings, Views and Masters, Additional File Tab Options, PowerPoint Extensions, Case Studies	20 Hrs
4	Internet : Navigating the Web, Finding Information on the Web, Communication Using E-Mail, Internet Concepts, Unleashing the Power of Internet	10 Hrs
5	E-Mail : Configuring an E-mail Account, Composing and Sending Mail, Receiving, Replying To and Forwarding Mail, Organizing Mail.	20 Hrs
6	Case Studies and Live Project Work	30 Hrs
	References: https://klic.mkcl.org/klic-courses/office-assistance	

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