

2.6: Student Performance and Learning

2.6.2: Attainment of POs and COs are evaluated

CO-PO & PSO Mapping

Sample File – CS-303 (Data Structure) July-Dec 2020

The provided document titled "CO-PO & PSO Mapping of Data Structure Course (July-Dec 2020)" outlines the mapping between Course Outcomes (COs), Program Outcomes (POs), and Program Specific Outcomes (PSOs) for the Data Structure course (Subject Code: CS-303) in the Department of Computer Science & Engineering at ITM Gwalior. This mapping helps to evaluate how the course contributes to broader educational objectives by aligning specific learning outcomes with the goals of the program.

On the basis of this mapping, faculties map their mid-term questions and activity-based questions with specific performance indicators, ensuring that each assessment is aligned with the program's educational objectives.



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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

CO-PO & PSO Mapping

Course: Data Structure

Subject Code: CS-303

Session: July-Dec 2020


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"THINK BIG... THINK BEYOND"

Name of the (University/College): ITM Gwalior		Name of the Program: (B.Tech(CSE))	
Name of the Course:- Data Structure (CS-303)		Name of the faculty: Ms. Rakhi Arora	
Course Outcomes(Cos)	Semester: IIIrd	Credits: 3:1:2 (Total 4)	Bloom Level
CO1	Ability to Define, understand concepts of different categories of data Structures .		L1,L2
CO2	Identify different parameters to analyze the performance of an algorithm.		L2,L4
CO3	Design algorithms to perform operations with Linear and Nonlinear data structures		L5
CO4	Compare and contrast different implementations of data structures.		L4
CO5	Apply appropriate data structure to solve and implement various real time problems		L3

List of PSO:	1=Low	2=Medium	3=High
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PSO1	The ability to understand the principles of computer hardware and software to analyze, design and develop algorithms for complex and logical problems.
PSO2:	Enhance programming concepts and professional competencies of students by exercising principles of software engineering to fix various computational problems.
PSO 3	To implement emerging technologies such as internet of things, cloud computing, artificial intelligence, machine learning etc. to serve the society.

List of POs												
Engg. Knowledge	Problem Analysis	Design Development of Solutions	Conduct Investigation of Complex Problem.	Modern Tool Usage	Engineer and Society	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Management & Finance	Life long learning	
PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	


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DATA STRUCTURE									
Program Outcomes	C.No.	Competencies	PI No.	Performance Indicators	CO1	CO2	CO3	CO4	CO5
PO1: Engineering Knowledge: apply knowledge of mathematics, science, engineering fundamentals and engineering specialization in the solution of complex engineering problems.	1.1	Demonstrate competence in mathematical modelling	1.1.1	Apply the knowledge of discrete structures, linear algebra, statistics and numerical techniques to solve problems	YES				
			1.1.2	Apply the concepts of probability, statistics and queueing theory in modeling of computer-based system, data and network protocols.					
	1.2	Demonstrate competence in basic sciences	1.2.1	Apply laws of natural science to an engineering problem					
	1.3	Demonstrate competence in engineering fundamentals	1.3.1	Apply engineering fundamentals	YES	YES	YES	YES	YES
	1.4	Demonstrate competence in specialized engineering knowledge to the program	1.4.1	Apply theory and principles of computer science and engineering to solve an engineering problem	YES	YES	YES	YES	YES
PO2: Problem Analysis: identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	2.1	Demonstrate an ability to identify and formulate complex engineering problem	2.1.1	Evaluate problem statements and identifies objectives.					
			2.1.2	Identify processes/modules/algorithms of a computer-based system and parameters to solve a problem	YES	YES	YES	YES	YES
			2.1.3	Identify mathematical algorithmic knowledge that applies to a given problem					
	2.2	Demonstrate an ability to formulate a solution plan and methodology for an engineering problem	2.2.1	Reframe the computer-based system into interconnected subsystems					
			2.2.2	Identify functionalities and computing resources.					
			2.2.3	Identify existing solution/methods to solve the problem, including forming justified approximations and assumptions			YES		
			2.2.4	Compare and contrast alternative solution/methods to select the best methods					
			2.2.5	Compare and contrast alternative solution processes to select the best process					
	2.3	Demonstrate an ability to formulate and interpret a model	2.3.1	Apply computer engineering principles to formulate modules of a system with required applicability and performance.					
			2.3.2	Identify design constraints for required performance criteria.					
	2.4	Demonstrate an ability to execute a solution process and analyze results	2.4.1	Applies engineering mathematics to implement the solution.					
			2.4.2	Analyze and interpret the results using contemporary tools.					
			2.4.3	Identify the limitations of the solution and sources/causes.					
			2.4.4	Arrive at conclusions with respect to the objectives			YES	YES	

	CO1	CO2	CO3	CO4	CO5
PO1	3	2	2	2	2
PO2	1	1	3	2	1
PO3	0	0	0	0	1
PO4	2	1	1	1	2
PO5	1	1	1	1	1
PO6	0	0	0	0	0
PO7	0	0	0	0	0
PO8	0	0	0	1	0
PO9	0	0	0	0	0
PO10	0	0	0	1	2
PO11	0	0	0	0	0
PO12	0	0	0	0	0
PSO1	0	1	1	0	0
PSO2	0	1	1	2	2
PSO3	0	0	0	0	0

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PO3: Design & Development of Solutions: design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	3.1	Demonstrate an ability to define a complex/ open-ended problem in engineering terms	3.1.1	Able to define a precise problem statement with objectives and scope.					
			3.1.2	Able to identify and document system requirements from stakeholders.					
			3.1.3	Able to review state-of-the-art literature to synthesize system requirements.					
			3.1.4	Able to choose appropriate quality attributes as defined by ISO/IEC/JECC standard.					
			3.1.5	Explore and synthesize system requirements from larger social and professional concerns.					
			3.1.6	Able to develop software requirement specifications(SRS).					
	3.2	Demonstrate an ability to generate a diverse set of alternative design solutions	3.2.1	Able to explore design alternatives					
			3.2.2	Able to produce a variety of potential design solutions suited to meet functional requirements.					
			3.2.3	Identify suitable non-functional requirements for evaluation of alternate design solutions.					
	3.3	Demonstrate an ability to select optimal design scheme for further development	3.3.1	Able to perform systematic evaluation of the degree to which several design concepts meet the criteria.					
			3.3.2	Consult with domain experts and stakeholders to select candidate engineering design solution for further development					
	3.4	Demonstrate an ability to advance an engineering design to defined end state	3.4.1	Able to refine architecture design into a detailed design within the existing constraints.					YES
			3.4.2	Able to implement and integrate the modules.					
			3.4.3	Able to verify the functionalities and validate the design.					
PO4: Conduct investigation of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions.	4.1	Demonstrate an ability to conduct investigations of technical issues consistent with their level of knowledge and understanding	4.1.1	Define a problem for purposes of investigation, its scope and importance	YES				
			4.1.2	Able to choose appropriate procedure/algorithm, dataset and test cases.	YES	YES	YES	YES	YES
			4.1.3	Able to choose appropriate hardware/software tools to conduct the experiment.					
	4.2	Demonstrate an ability to design experiments to solve open-ended problems	4.2.1	Design and develop appropriate procedures/methodologies based on the study objectives					YES
	4.3	4.6 Demonstrate an ability to analyze data and reach a valid conclusion	4.3.1	Use appropriate procedures, tools and techniques to collect and analyze data					
			4.3.2	Critically analyze data for trends and correlations, stating possible errors and limitations					
			4.3.3	Represent data (in tabular and/or graphical forms) so as to facilitate analysis and explanation of the data, and drawing of conclusions					
			4.3.4	Synthesize information and knowledge about the problem from the raw data to reach appropriate conclusions					

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PO5: Modern Tools Usage: create, select and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.	5.1	Demonstrate an ability to identify/create modern engineering tools, techniques and resources	5.1.1	Identify modern engineering tools, techniques and resources for engineering activities					
			5.1.2	Create/adapt/modify/extend tools and techniques to solve engineering problems	YES	YES	YES	YES	YES
	5.2	Demonstrate an ability to select and apply discipline specific tools, techniques and resources	5.2.1	Identify the strengths and limitations of tools for (i) acquiring information, (ii) modeling and simulating, (iii) monitoring system performance, and (iv) creating engineering designs.					
			5.2.2	Demonstrate proficiency in using discipline-specific tools					
	5.3	Demonstrate an ability to evaluate the suitability and limitations of tools used to solve an engineering problem	5.3.1	Discuss limitations and validate tools, techniques and resources					
			5.3.2	Verify the credibility of results from tool use with reference to the accuracy and limitations, and the assumptions inherent in their use.					
PO6: The Engineer and Society: apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.	6.1	Demonstrate an ability to describe engineering roles in a broader context, e.g. pertaining to the environment, health, safety, legal and public welfare	6.1.1	Identify and describe various engineering roles; particularly as pertains to protection of the public and public interest at the global, regional and local level					
	6.2	Demonstrate an understanding of professional engineering regulations, legislation and standards	6.2.1	Interpret legislation, regulations, codes, and standards relevant to your discipline and explain its contribution to the protection of the public.					
PO7: Environment & Sustainability: understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.	7.1	Demonstrate an understanding of the impact of engineering and industrial practices on social, environmental and in economic contexts	7.1.1	Identify risks/impacts in the life-cycle of an engineering product or activity					
			7.1.2	Understand the relationship between the technical, socio-economic and environmental dimensions of sustainability					
	7.2	Demonstrate an ability to apply principles of sustainable design and development	7.2.1	Describe management techniques for sustainable development					
			7.2.2	Apply principles of preventive engineering and sustainable development to an engineering activity or product relevant to the discipline					
PO8: Ethics: apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice.	8.1	Demonstrate an ability to recognize ethical dilemmas	8.1.1	Identify situations of unethical professional conduct and propose ethical alternatives					
	8.2	Demonstrate an ability to apply the Code of Ethics	8.2.1	Identify tenets of the ASME professional code of ethics					
			8.2.2	Examine and apply moral & ethical principles to known case studies				YES	
PO9: Individual & Team work: function effectively as an individual and as a member or leader in diverse teams, and in multidisciplinary settings.	9.1	Demonstrate an ability to form a team and define a role for each member	9.1.1	Recognize a variety of working and learning preferences; appreciate the value of diversity on a team					
			9.1.2	Implement the norms of practice (e.g. rules, roles, charters, agendas, etc.) of effective team work, to accomplish a goal.					
	9.2	Demonstrate effective individual and team operations-- communication, problem solving, conflict resolution and leadership skills	9.2.1	Demonstrate effective communication, problem-solving, conflict resolution and leadership skills					
			9.2.2	Treat other team members respectfully					
			9.2.3	Listen to other members					
	9.3	Demonstrate success in a team-based project	9.3.1	Maintain composure in difficult situations					
				Present results as a team, with smooth integration of contributions from all individuals/efforts					

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PO10: Communication: communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	10.1	Demonstrate an ability to comprehend technical literature and document project work	10.1.1	Read, understand and interpret technical and non-technical information					
			10.1.2	Produce clear, well-constructed, and well-supported written engineering documents					
			10.1.3	Create flow in a document or presentation logical progression of ideas so that the main point is clear					YES
	10.2	Demonstrate competence in listening, speaking, and presentation	10.2.1	Listen to and comprehend information, instructions, and viewpoints of others					
			10.2.2	Deliver effective oral presentations to technical and non-technical audiences			YES		YES
	10.3	Demonstrate the ability to integrate different modes of communication	10.3.1	Create engineering-standard figures, reports and drawings to complement writing and presentations					
			10.3.2	Use a variety of media effectively to convey a message in a document or a presentation.					
PO11: Project management & Finance: demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.	11.1	Demonstrate an ability to evaluate the economic and financial performance of an engineering activity	11.1.1	Describe various economic and financial costs/benefits of an engineering activity					
			11.1.2	Analyze different forms of financial statements to evaluate the financial status of an engineering project.					
	11.2	Demonstrate an ability to compare and contrast the costs/benefits of alternate proposals for an engineering activity	11.1.3	Analyze and select the most appropriate proposal based on economic and financial considerations.					
	11.3	Demonstrate an ability to plan/manage an engineering activity within time and budget constraints	11.3.1	Identify the tasks required to complete an engineering activity, and the resources required to complete the tasks					
			11.3.2	Use project management tools to schedule an engineering project, so it is completed on time and on budget					
	PO12: Life-long Learning: recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	12.1	Demonstrate an ability to identify gaps in knowledge and a strategy to close these gaps	12.1.1	Describe the rationale for the requirement for continuing professional development				
12.1.2				Identify deficiencies or gaps in knowledge and demonstrate an ability to source information to close this gap					
12.2		Demonstrate an ability to identify changing trends in engineering knowledge and practice	12.2.1	Identify historic points of technological advance in engineering that required practitioners to seek education in order to stay current					
			12.2.2	Recognize the need and be able to clearly explain why it is vitally important to keep current regarding new developments in our field					
12.3		Demonstrate an ability to identify and access sources for new information	12.3.1	Source and comprehend technical literature and other credible sources of information					
			12.3.2	Analyze sourced technical and popular information for feasibility, viability, sustainability, etc.					
PSO1	The ability to understand the principles of computer hardware and software to analyze, design and develop algorithms for complex and logical problems.								
PSO2	Enhance programming concepts and professional competencies of students by exercising principles of software engineering to fix various computational problems.								
PSO3	To implement emerging technologies such as internet of things, cloud computing, artificial intelligence, machine learning etc. to serve the society.								

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Course Outcomes	Program Outcomes																														PSOs								
	PO1			PO2			PO3			PO4			PO5			PO6			PO7			PO8			PO9			PO10			PO11			PO12			PSO1	PSO2	PSO3
	TP%	M.P%	MG	TP%	M.P%	MG	TP%	M.P%	MG	TP%	M.P%	MG	TP%	M.P%	MG	TP%	M.P%	MG	TP%	M.P%	MG	TP%	M.P%	MG	TP%	M.P%	MG	TP%	M.P%	MG	TP%	M.P%	MG	TP%	M.P%	MG			
CO1	5	3	2	14	1	1	14	0	0	8	2	1	6	1	1	2	0	0	4	0	0	3	0	0	7	0	0	7	0	0	5	0	0	6	0	0	0	0	0
CO2	5	2	2	14	1	1	14	0	0	8	1	1	6	1	1	2	0	0	4	0	0	3	0	0	7	0	0	7	0	0	5	0	0	6	0	0	1	1	0
CO3	5	2	2	14	3	1	14	0	0	8	1	1	6	1	1	2	0	0	4	0	0	3	0	0	7	0	0	7	0	0	5	0	0	6	0	0	1	1	0
CO4	5	2	2	14	2	1	14	0	0	8	1	1	6	1	1	2	0	0	4	0	0	3	1	1	7	0	0	7	1	1	5	0	0	6	0	0	0	2	0
CO5	5	2	2	14	1	1	14	1	1	8	2	1	6	1	1	2	0	0	4	0	0	3	0	0	7	0	0	7	2	1	5	0	0	6	0	0	0	2	0

TP%	Total Perf. Indicators
MP%	Mapped Per. Indicators
MG	Mapping Grade

Threshold Level
3 67
2 34
1 0

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Course	Course Outcomes	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PSO1	PSO2	PSO3
CS303.1	Ability to Define, understand concepts of different categories of data Structures to analyze the data.	2	1	0	1	1	0	0	0	0	0	0	0	0	0	0
CS303.2	Identify different parameters to analyze the performance of an algorithm.	2	1	0	1	1	0	0	0	0	0	0	0	1	1	0
CS303.3	Design algorithms to perform operations with Linear and Nonlinear data structures	2	1	0	1	1	0	0	0	0	0	0	0	1	1	0
CS303.4	Compare and contrast different implementations of data structures.	2	1	0	1	1	0	0	1	0	1	0	0	0	2	0
CS303.5	Apply appropriate data structure to solve and implement various real time problems	2	1	1	1	1	0	0	0	0	1	0	0	0	2	0
Average		2.00	1.00	0.20	1.00	1.00	0.00	0.00	0.20	0.00	0.40	0.00	0.00	0.40	1.20	0.00

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