III, V, VII Sem. July-Dec. 2024

(8)

MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE,
GWALIOR (M.P.), INDIA

Deemed to be University

(Declared under Distinct Category by Ministry of Education, Government of India)

NAAC ACCREDITED WITH A++ GRADE

Minutes of Meeting Board of Studies

Department of Engineering Mathematics and Computing

(Conducted online on date, *30 May 2024*)

MADHAVINSTITUTE OF TECHNOLOGY & SCIENCE,

GWALIOR–474005

The minutes of the BOS meeting are following:

1. The minutes of the previous BOS meeting held on 29.11.2023 have been confirmed.
2. The courses of Engineering Mathematics-I, II and III do not have any changes.
3. The course outcomes attainments have been analyzed with identified Gap thereof action taken report (ATR) has been prepared according to respective courses.
4. The course outcomes of all courses have been discussed in detail.
5. The list of various subjects is proposed for Departmental electives, Minor and Honors specialization have been prepared.
6. In the course of Optimization Techniques one unit of PERT/CPM is changed by Information theory because of this unit is already included in the Mandatory Audit Course of Project Management and financing.
7. Expert members suggested that the on-line references should also incorporated along with recommended books.

Total No of courses	Total number of COs	Number of COs not attained	Percentage of COs not attained	Page No.
17	85	09	10.58	Item No. 21 (pp. 8)

Dr. S. K. Bharadwaj (Member)

Prof. Ashish Shukla (Member)

Dr. D. K. Mishra (Member)

Dr. Atul Ku. Ray (Member)

Dr. Minakshi (Member)

Dr. Divya Chatuervedi (Member)

Dr. D. K. Jain (Member)

Dr. J. K. Muthele (Member)

Prof. Prabhakar Sharma (Member)

present-online
Dr. Badam Singh Kushvah (Subject Expert)

Absent
Dr. Madhu Jain (Subject Expert)

Absent
Dr. Aparna Mehra (Subject Expert)

Absent
Dr. D.P. Agrawal Alumnus

Absent
Mr. Ankit Mundra Industry Expert

Dr. V.P. Shinde (Professor & Head)

Agenda of the BoS Meeting

(BoS Meeting Scheduled to be held up to 30th May 2024)

Instructions for preparing BoS Proceedings

{All information is to be uploaded on the webpage under suitable heading (such as Board of Studies) and separate links to be provided for each category mentioned below}

Minutes should have a summary/cover page mentioning all the significant changes made in the following Given format

Courses where revision was carried out*

(Course/subject name)	Course Code	Year/Date of introduction	Year/Date of revision	Percentage of content added or replaced	Agenda Item No.	Page No.	Link of relevant documents/minutes
Optimization Techniques & review few topics from different unit of different courses	**250505**	**28.11.20**	**30.05.24**	**1%**	Item 9	**07**	https://web.mitsgwalior.in/images/Departments/engineering_mathematics/BOS/BoS%2030.05.2024/Courses%20Revision%20%20MAC%20%20V%20sem%20point-1.3.pdf

Courses focusing on employability/entrepreneurship/ skill development*

	(Course/subject name)	Course Code	Activities/contents which have a bearing on increasing skill and employability	Agenda Item No.	Page No.	Link of relevant documents/minutes
1.	Stochastic Process and Financial Mathematics	**3250321**	Stochastic Process and Financial Mathematics gave the wide knowledge about the random process as well as the minimum mathematical requirements to study mathematical finance or more precisely the pricing of financial derivatives etc.	14	**2**	https://web.mitsgwalior.in/images/Departments/engineering_mathematics/BOS/BoS%2030.05.2024/Point-%201%20MAC-%20iii%20Sem.pdf
	Discrete Mathematical Structures	**3250322**	This course builds the mathematical foundation of computer science. It introduces the elements of mathematics like sets, functions, relations, groups, graph theory that form the basics of almost the entirety of computer science. It gives a clear understanding about the formal statements and their proofs and the counting techniques. The course develops the concept of algebraic structures and how they are used in defining mathematical applications.		**3**	
	Operating System Concepts	**3250223**	Operating System is computer software that manages the hardware components. It acts as an intermediary between the users and the hardware. It is responsible for managing the system resources and providing a smooth working environment for the users. The management includes the following - process management, processor management, memory management, storage management, user		**4**	

		management, protection and security. As a subject, it is an amalgamation of the fields like computer architecture, algorithms, data structure and so on. A course on fundamentals of operating systems is essential to equip the students for taking up the challenges in understanding and designing of computer systems.			
Data Structures and Algorithms	**3250324**	This subject develops the problem-solving ability and analytical skills of students. Questions based on Data Structures and Algorithms are scaled up or down according to the knowledge level of the candidate. All recruiting companies test the knowledge of data structures by asking concepts of stack, queue, linked list, tree, graph, searching, sorting etc.		**5**	
Numerical Techniques	**3250225**	Numerical Techniques contains solution of system of linear equations, roots of non-linear equations, interpolation, numerical differentiation and integration, solution of ODE and PDE. It plays an important role for solving various engineering sciences problems. Therefore, it has tremendous applications in diverse fields in engineering sciences.		**6**	
Computer Networks	**250501**	Computer network widely used in daily life such as Marketing and sales, financial services, Manufacturing, Information services without it internet cannot be perform on the system.	9	**2**	https://web.mitsgwalior.in/images/Departments/engineering_mathematics/BOS/BoS%2030.05.2024/Item%20-9%20Syllabus%20MAC-%20V%20Sem.%202022-23.pdf
Software Engineering	**250503**	All engineering branches use software extensively as well as in real life. Engineers use custom software tools to design, analyze, and simulate their own projects, like bridges and power lines. The concept of software engineering help to analyze, design, implementation, and testing phase indeed its enhance the skill of software development.		**4**	
Data Science using Python	**250504**	With the increased use of computers for day-to-day business and personal operations, there is a demand for intelligent machines that can learn human behaviour and work patterns. This brings Data science and big data analytics to the forefront. Students are trained to effectively tackle many real-world problems in various domains like banking and finance, communication, education, etc. by giving projects using Python.		**5**	
Optimization Techniques	**250505**	This paper provide the information of various tools of optimization techniques which widely used in GPS systems, by shipping companies delivering packages to our homes, by financial companies, airline reservations systems, etc.		**6**	
Java Technologies	**250506**	Java is very popular in software industry in almost all domains. Students are given medium level projects for creating Web apps, Android apps, and software development tools such as IntelliJ IDEA, Eclipse, Net Beans IDE, and others. Java applications have now grown to include Data Science, Machine Learning, and even the Internet of Things.	10	**2**	https://web.mitsgwalior.in/images/Departments/engineering_mathematics/BOS/BoS%2030.05.2024/Item%20-9%20Syllabus%20MAC-%20V%20Sem.%202022-23.pdf

New Courses added*					
(Course/subject name)	Course Code	Activities/contents which have a bearing on increasing skill and employability	Agenda Item No.	Page No.	Link of relevant documents/minutes
Ethical Hacking	250761	Ethical hacking is a subject that has become very important in present-day context, and can help individuals and organizations to adopt safe practices and usage of their IT infrastructure. Starting from the basic topics like networking, network security and cryptography, the course will cover various attacks and vulnerabilities and ways to secure them.	**Item 3**	**1**	https://web.mitsgwalior.in/images/Departments/engineering_mathematics/BOS/BoS%2030.05.2024/New%20Course%20Point-%201.1.pdf
Computational Complexity	250762	This subject deals with different models of computations and computational complexity classes. The computational models measure various different aspects of computation, like time, space, randomness, number of gates, amount of communication etc. The complexity classes classify different computational problems depending on their easiness or hardness as per these different models.	**Item 3**	**2**	
Approximation Algorithm	250763	In this course, we will study various techniques to design efficient algorithms to compute an approximately optimal solution. Many real-world problems are NP-complete. Hence, they are unlikely to admit a polynomial-time algorithm.	**Item 3**	**3**	
Deep Learning for Computer Vision	250764	The automatic analysis and understanding of images and videos, a field called Computer Vision, occupies significant importance in applications including security, healthcare, entertainment, mobility, etc. The recent success of deep learning methods has revolutionized the field of computer vision, making new developments increasingly closer to deployment that benefits end users. This course will introduce the students to traditional computer vision topics, before presenting deep learning methods for computer vision.	**Item 3**	**4**	
Cloud Computing	250766	Cloud computing is a scalable services consumption and	**Item 3**	**5**	

		delivery platform that provides on-demand computing service for shared pool of resources, namely servers, storage, networking, software, database, applications etc., over the Internet. It is a model for enabling ubiquitous, on-demand access to a shared pool of configurable computing resources, which can be rapidly provisioned and released with minimal management effort.			
Advanced Distributed System	250767	This course starts with epidemic and gossip-based algorithms and then move on to peer-to-peer networks. The core focus in this part will be on distributed hash tables (DHTs). Thereafter this focus on theoretical aspects such as vector clocks, distributed leader election, the FLP result, and the CAP theorem. In the last practical technologies such as the Paxos and RAFT consensus protocols, commit protocols, Bitcoin and blockchains, distributed file systems, and distributed programming languages.	**Item 3**	**6**	

Feedback on curriculum received from stakeholders: Analysis& ATR*

Stakeholder	Student	Faculty	Alumni	Employer
No. of responses	**1350**	**10**	NA	NA
Link of Analysis	https://web.mitsgwalior.in/images/Departments/engineering_mathematics/Curriculum%20Feedback%20by%20F%20%20S/Point%20-1%20Curriculum%20FB%20%20BY%20S%20%20July-%20Dec.%20-2023.pdf	https://web.mitsgwalior.in/images/Departments/engineering_mathematics/Curriculum%20Feedback%20by%20F%20%20S/Point-%201.1%20Curriculum%20FB%20%20BY%20F%20July-%20Dec.%20-2023.pdf	NA	NA
ATR Link	https://web.mitsgwalior.in/images/Departments/engineering_mathematics/Curriculum%20Feedback%20by%20F%20%20S/Point-%201.3%20ATR%20%20Curriculum%20FB%20by%20%20S%20%20F%20%20July-%20Dec.%202023.pdf		NA	NA
Link showing Excel sheet of Google Form details of stakeholders	https://web.mitsgwalior.in/images/Departments/engineering_mathematics/Curriculum%20Feedback%20by%20F%20%20S/S%20Curriculum%20feedback_Student%20J%20July-%20Dec.%20-2021%20F.xlsx	https://web.mitsgwalior.in/images/Departments/engineering_mathematics/Curriculum%20Feedback%20by%20F%20%20S/F%20Curriculum%20feedback_Faculty%20July-Dec%202020.xlsx	NA	NA

Separate page(s) for each of the above four points; Agenda point wise minutes to be appended with each point and a separate link to be given in the appropriate column for each point

2. The BoS minutes along with the cover/summary page (under point number 1, above) must be uploaded on the departmental web page and link for the same must be shared with the office of the Dean Academics.
3. Stakeholder feedback analysis must also contain an action taken report (ATR).
   The details/data of the stakeholder responded through GOOGLE form (such as Name, organization, mail id, phone no if available) must also be shared along with the feedback for the alumni/employer.
4. The following must be uploaded on the departmental web page and link for the same must be shared with the office of the Dean Academics.
   (i) The Stakeholder feedback collected & analyzed to find the index out of five
   (ii) Action taken report
   (iii) Google form showing responses from alumni, employer, student, faculty etc.

5.	Minutes should have a footer with department name, page number, month of meeting.
6.	Each page should be signed by all faculty, scanned and then submitted to the Dean Academics office.

BoS Agenda Items

Item 1	To confirm the minutes of previous BoS meeting held on the month of November 2023
Item 2	To review and finalize the **scheme structure of B.Tech. VII Semester** with the provision of *Three (03) Departmental Electives (DEs) and Open Category (OC) Course*. **(Out of which One (01) Elective and o1 Open category course is to be offered in traditional mode** and **remaining Two (02) Departmental Electives are to be offered in online mode** with credit transfer **for the batch admitted in 2021-22**. **Annexure-I**
Item 3	To propose the list of courses which the students can opt from SWAYAM/NPTEL/MOOC based Platforms, to be offered in **online modeforTwo (02) Departmental Electives** (DE) Course, with credit transfer in the B.Tech. VII Semester under the flexible curriculum (Batch admitted in 2021-22) **Annexure-II**
Item 4	To prepare and finalize the syllabus of courses to be offered ***(for batch admitted in 2021-22)*** under ***Departmental Elective (DE) Course***(in traditional mode) for B. Tech. ***VII Semester*** along with their COs **Annexure-III**
Item 5	To prepare and finalize the syllabus of courses to be offered (**for batch admitted in 2021-22**) under the **Open Category (OC) Courses** (in traditional mode) for B.Tech. VII semester students of other departments along with their Cos **Annexure-IV**
Item 6	To review and finalize the Experiment list/ Lab manual for Departmental Laboratory Course (DLC) to be offered in B. Tech. VII semester ***(for batches admitted in 2021-22)*** **Annexure-V**
Item 7	To propose the list of "Additional Courses" which can be opted for getting an ***(i) Honours (for students of the host department)*** ***(ii) Minor Specialization (for students of other departments)***

List of SWAYAM/NPTEL Courses for B. Tech. VII Sem.
Honors Specialization

S. No.	Subject Code	Subject name	Time Duration (Weeks)	Mentor Name and Affiliation
1	H250701	Machine Learning and Deep Learning - Fundamentals and Applications	12	*Prof. M. K. Bhuyan , IIT Guwahati*
2	H250701	Getting Started with Competitive Programming	12	*Prof. Neeldhara Misra , IIT Gandhinagar*
3	H250701	Computer Vision	12	*Prof. Jayanta Mukhopadhyay, IIT Kharagpur*

*These will be offered through **SWAYAM/NPTEL/MOOC** based Platforms for the* B.Tech. ***VII semester students*** *(for the batch admitted in 2021-22) and for* B.Tech. ***V semester****(for the batch admitted in 2022-23)*

S. No.	Subject Code	Subject name	Time Duration (Weeks)	Mentor Name and Affiliation
1	M250701	Introduction To Methods of Applied Mathematics	12	**Prof. Mani Mehra, Prof. Vivek K. Aggarwal, IIT Delhi, DTU Delhi**
2	M250701	Mathematical Methods and its Applications	12	**Prof. P. N. Agarwal, Prof. S. K. Gupta, IIT Roorkee**
3	M250701	Matrix Computation and its Applications	12	**Prof. Mani Mehra, Prof. Vivek K. Agarwal , IIT Delhi, DTU Delhi**

List of SWAYAM/NPTEL Courses for B. Tech. V Sem.	
Minor Programme	1. Ordinary Differential Equations 2. Partial Differential Equations 3. Linear Algebra
Honors Programme	1. Artificial Intelligence : Search Methods For Problem solving 2. Applied Accelerated Artificial Intelligence 3. Introduction to Machine Learning

Item 8 To review and finalize the ***scheme structure of B.Tech. V Semester under*** the flexible curriculum (***Batch admitted in 2022-23***)

Annexure-VI

Item 9 To review and finalize the syllabi for all ***Departmental Core (DC) Courses*** of B. Tech. ***V Semester (for batch admitted in 2022-23)*** under the flexible curriculum along with their CO's.

Annexure-VII

Item 10 To review and recommend the Experiment list/ Lab manual for all the Laboratory Courses to be offered in B. Tech. ***V Semester (for batch admitted in 2022-23)***

Annexure-VIII

Item 11 To review and recommend the list of projects which can be assigned under the 'Skill based mini-project' category in various laboratory components-based courses to be offered in B.Tech. **V Semester** ***(for the batch admitted in 2022-23)***.

Annexure-IX

Item 12 To propose the list of courses from SWAYAM/NPTEL/MOOC Platforms to be offered ***(for batch admitted in 2022-23)*** in online mode under ***Self-Learning/ Presentation***, in the B.Tech. **V Semester**

List of SWAYAM/NPTEL Courses for B. Tech. V Sem.	
Minor Programme	1. Ordinary Differential Equations 2. Partial Differential Equations 3. Linear Algebra
Honors Programme	1. Artificial Intelligence: Search Methods for Problem solving 2. Applied Accelerated Artificial Intelligence 3. Introduction to Machine Learning

Item 13	To review and finalize the ***scheme structure of B.Tech. III Semester under*** the flexible curriculum (***Batch admitted in 2023-24***) **Annexure-X**
Item 14	To review and finalize the syllabi for all Departmental Core (DC) Courses of ***B. Tech. III Semester*** (for **batch admitted in 2023-24**) under the flexible curriculum along with their CO's. **Annexure-XI**
Item 15	To review and recommend the list of experiments and skill-based mini projects of ***B.Tech. III semester*** (for **batch admitted in 2023-24)** **Annexure-XII** https://drive.google.com/file/d/1VSxiG1OnzlUkv-7MMlDAK97emA6sU9jB/view?usp=drive_link
Item 16	To propose the list of courses from SWAYAM/NPTEL/MOOC Platforms to be offered in the ***B.Tech. III Semester (for batches admitted in 2023-24)*** in online mode under ***Self-Learning/ Presentation***.
Item 19	To review and recommend the ***Scheme structure &Syllabi*** of **PG Programme** (M.E./M.Tech./MCA/MBA) along with their Course Outcomes (COs) **NA**
Item 20	To review and recommend the ***Scheme structure and Syllabus*** of **Ph.D. Course Work** (specific to Doctoral Research Scholars, if any) **Annexure-XIII**
Item 21	To review the CO attainments, to identify gaps and to suggest corrective measures for the improvement in the CO attainment levels for all the courses taught during **July-Dec 2023 session** **Annexure-XIV**
Item 22	To review the PO attainments levels and suggest the actions to be taken for improvement in PO attainment **NA**
Item 23	To review and finalize the CO-PO mapping matrix for all the courses to be taught in July-Dec 2024. NA
Item 23	To review curricula feedback from various stakeholders, its analysis and impact **Annexure-XV**
Item 23	Any other matter
	**********

List of NPTEL Courses for B. Tech. III Sem.	
Under Self- Learning	1. Computer Graphics 2. Computational Number Theory and Algebra 3. Computational Commutative Algebra 4. Ethics in Engineering Practice 5. Introduction to Quantum Computing: Quantum Algorithms and Qiskit

B.Tech. Offered by Department of Engineering Mathematics and Computing

Annexure-I

VII Semester *for batches admitted in academic session 2021-22*

Subject Code	Category Code	Subject Name	Maximum Marks Allotted									Total Marks	Contact Hours per week			Total Credits	Mode of Teaching (Online, Offline, Blended)	$^{\$\$}$Mode of Exam.
			Theory Slot				Practical Slot			MOOCs			L	T	P			
			End Term Evaluation		Continuous Evaluation		End Sem. Exam.	Continuous Evaluation		Assignment	Exam							
			End Sem. Exam.	$^{\$}$Proficiency in subject /course	Mid Sem. Exam	Quiz/ Assignment		Lab work & Sessional	Skill Based Mini Project									
2507XX	DE	Departmental Elective* (DE-II)	50	10	20	20	-	-	-	-	-	100	3	-	-	3	Offline	PP
2507XX	DE	Departmental Elective* (DE-III)	-	-	-	-	-	-	-	25	75	100	3	-	-	3	Online	MCQ
2507XX	DE	Departmental Elective* (DE-IV)	-	-	-	-	-	-	-	25	75	100	3	-	-	3	Online	MCQ
910XXX	OC	Open Category (OC-2)	50	10	20	20	-	-	-	-	-	100	3	-	-	3	Offline	PP
250704	DLC	Departmental Lab	-	-	-	-	60	20	20	-	-	100	-	-	4	2	Offline	SO
250705	DLC	Creative Problem Solving (Evaluation)	-	-	-	-	25	25	-	-	-	50	-	-	2	1	Blended	SO
250706	DLC	Summer Internship Project-III (04 weeks) (Evaluation)	-	-	-	-	60	-	-	-	-	60	-	-	4	2	Offline	SO
Total			**100**	**20**	**40**	**40**	**145**	**45**	**20**	**50**	**150**	**610**	**12**	**-**	**10**	**17**	-	-
1000008	MAC	Universal Human Values & Professional Ethics(UHVPE)	50	10	20	20	-	-	-	-	-	100	2	-	-	GRADE	Blended	MCQ
Additional Course for Honours or minor Specialization			**Permitted to opt for maximum two additional courses for the award of Honours or Minor specialization**															

$^{\$}$ proficiency in course/subject-includes the weightage towards ability/skill/competence/knowledge level/ expertise attained etc. in that particular course/subject.

MCQ: Multiple Choice Question $^{\$\$}$AO: Assignment + Oral $^{\$\$}$PP: Pen Paper $^{\$\$}$SO: Submission + Oral

Course run through SWAYAM/NPTEL/ MOOC Learning Based Platform with Credit Transfer

Mode of Teaching						Mode of Examination					Total Credits
Theory				Lab	NEC	Theory			Lab	NEC	
Offline	Online	Blended		Offline	Interactive	PP	A+O	MCQ	SO	SO	
		Offline	Online								
5	2	-	-			2		2	3		17
71.42%	28.57%	-	-			28.57%		28.57%	42.85%		

Department of Engineering Mathematics and Computing **Annexure-II**

List of Departmental Electives (DE) Course

	S. No.	Subject Name	Week	Name of Mentors
DE-3 (VII SEM)	1	Ethical Hacking	12	Prof.IndranilSengupta from IIT Kharagpur
	2	Computational Complexity	12	Prof.SubrahmanyamKalyanasundaram from IIT Hyderabad
	3	Approximation Algorithm	12	Prof.Palash Day from IIT Kharagpur
DE-4 (VII SEM)	1	Deep Learning	12	Prof. SudarshanIyengar from IIT Ropar
	2	Digital Image Processing	12	Prof. Prabir Kumar Biswash from IIT Kharagpu
	3	Advance Distributed System	12	Prof.SmrutiRanjan Sarangi, form IIT Delhi

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Annexure-III

Department of Engineering Mathematics and Computing

B. Tech. (Seventh Semester)
Engineering Reliability
(DE –II) MAC -250731

Course Objectives:

- To understand the concept of Reliability.
- To evaluate measures of reliability
- To determine the maintainability and availability
- To explore Software reliability growth model

Unit-I

Introduction to reliability, define failure/ hazard rate, network modelling and reliability evaluation basic concepts, evaluation of network liability systems, parallel systems, series parallel systems, partially redundant systems, k- out- of-m systems, types of redundancies, evaluation of network reliability using conditional probability method, paths based and cut set based approach, complete event tree and reduced event tree methods.

Unit-II

Time dependent probability basic concepts, reliability functions f(t), F(t), R(t), h(t) relationship between this functions bath tubs curve, exponential, Gama Weibull's and Rayleigh's failure density and distribution functions expected value and standard deviation of distribution, measures of reliability MTTF and MTTR,MTBF, MTTF for series and parallel systems

Unit-III

Discrete Markov chains and continuous Markov processes, basic concepts of stochastic transitional probability Matrix, time dependent probability evaluation, limiting state probability evaluation, Markov processes- modelling concepts state space diagrams, time dependent reliability evaluation of single component repairable model evaluation of limiting state, probability of one & two component repairable models.

Unit - IV

Concept of maintainability, availability, availability function, type of system availability, economies of reliability engineering, replacement of items, standby system maintenance costing and budgeting preventive maintenance.

Unit - V

Software reliability growth model, Classification of Software Reliability Models, Analytical Model, Dynamic or Probabilistic Model- Discrete Time Models and Continuous Time Models and their testing.

Course Outcomes

After completing this course, the students will be able to:

CO's	Description of CO's
CO1	Determine the reliability of system
CO2	Evaluation of measure for system reliability
CO3	Apply Markov process to carried out system reliability
CO4	Acquire the knowledge of maintainability and availability of system
CO5	Describe Software reliability growth model

Text Books:

1. Mathematical Statistics by C.E.Weatherbum.
2. Fundamentals of Mathematical Statistics by S C Gupta and V K Kapoor- S.Chand& Sons, New Delhi.
3. Fundamentals of Applied Statistics by S C Gupta and V K Kapoor, S Chand & Sons, New Delhi.

Reference Books:

1. An outline of Statistical Theory by Goon, Gupta and Dasgupta.
2. Fundamentals of Statistics by Goon, Gupta and Dasgupta

Course Articulation Matrix

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

1 - Slightly; 2 - Moderately; 3 – Substantially

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Department of Engineering Mathematics and Computing

B. Tech. (Seventh Semester)

Distributed Computing

(DE- II) MAC-250732

COURSE OBJECTIVES

To provide students contemporary knowledge of distributed systems.
To equip students with skills to analyze and design distributed applications.
To gain experience in the design and testing of a large software system, and to be able to communicate that design to others.

Unit - I

Introduction to Distributed Systems: Architecture for Distributed System, Goals of Distributed System, Hardware and Software Concepts, Distributed Computing Model, Advantages & Disadvantage Distributed System, Issues in Designing Distributed System.

Unit -II

Distributed Share Memory: Basic Concept of Distributed Share Memory (DSM), DSM Architecture & Its Types, Design & Implementations Issues in DSM System, Structure of Share Memory Space, Consistency Model and Thrashing.

Unit - III

Distributed File System: Desirable Features of Good Distributed File System, File Model, File Service Architecture, File Accessing Model, File Sharing Semantics, File Catching Scheme, File Application & Fault Tolerance.

Unit - IV

Inter Process Communication and Synchronization: Data Representation & Marshaling, Group Communication, Client Server Communication, RPC Implementing, RPC Mechanism, Stub Generation, RPC Messages. Synchronization: - Clock Synchronization, Mutual Exclusion, Election Algorithms - Bully & Ring Algorithms.

Unit - V

Distributed Scheduling and Deadlock Distributed Scheduling- Issues in Load Distributing, Components for Load Distributing Algorithms, Different Types of Loads Distributing Algorithms, Task Migration and its issues. Deadlock- Issues in deadlock detection & Resolutions, Deadlock Handling Strategy, Distributed Deadlock Algorithms. Case Study of Distributed System: Amoeba, Mach, Chorus.

COURSE OUTCOMES

After completion of this course, the students would be able to:

CO's	Description of CO's
CO1	Tell the basic elements and concepts related to distributed system technologies
CO2	Demonstrate knowledge of the core architectural aspects of distributed systems
CO3	Identify how the resources in a distributed system are managed by algorithm
CO4	Examine the concept of distributed file system and distributed shared memory
CO5	Compare various distributed system algorithms for solving real world problems

RECOMMENDED BOOKS:

1. Distributed Operating System Concept & Design, Sinha, PHI
2. Distributed System Concepts and Design, Coulouris & Dollimore, Pearson Publication
3. Distributed Operating System, Andrew S. Tanenbaum, Pearson.

Course Articulation Matrix

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

1 - Slightly; 2 - Moderately; 3 – Substantially

Annexure-IV

Department of Engineering Mathematics and Computing

B. Tech. (Seventh Semester)

Discrete Structure

(OC-II) MAC- 910213

Objective of Course

- To have knowledge of basic algebra and discrete numeric function.
- To describe function and its relation
- To familiarize propositional logic
- To know about the graph theory and its application in computer
- To familiarize the discrete numeric function and generating function

UNIT 1:

Sets, Subsets, Power sets, Complement, Union and Intersection, Demorgan's law Cartesian products, Relations, relational matrices, properties of relations, equivalence relation, functions, Injection, Surjection and Bijective mapping, Composition of functions, Permutations, the characteristic functions and Mathematical induction.

UNIT 2:

Partial order set, Hasse diagrams, upper bounds, lower bounds, Maximal and minimal element, first and last element, Lattices, sub lattices, Isotonicity, distributive inequality, Lattice homomorphism, lattice isomorphism, completelattice, complemented lattice distribution lattice.

UNIT 3:

Group axioms, permutation group, sub group, co-sets, normal subgroup, semi group, Lagrange theorem, fields, minimal polynomials, reducible polynomials, primitive polynomial, polynomial roots, applications.

UNIT 4:

Finite graphs, incidence and degree, isomorphism, sub graphs and union of graphs, connectedness, walk, paths and circuits, Eulerian and Hamiltonian graphs. Trees: properties of trees, pendant vertices in tree, Center of tree, spanning trees and cut vertices, binary tree, matrix representation of graph, incidence and adjacency matrix and their properties, applications of graphs in computer science.

UNIT 5:

Introduction to discrete numeric functions and generating functions, introduction to recurrence relations and recursive algorithms, linear recurrence relations with constant coefficients, homogeneous solutions, particular solutions and total solutions

Course Outcomes

After completing this course, the students will be able to:

CO's	Description of CO's
CO1	Acquire Knowledge of set theory
CO2	Analyze the concept of Lattices
CO3	Identify the concept of Group Theory
CO4	Derive the Inferences from Graph theory
CO5	Illustrate the Discrete numeric function and recursive relation

Recommended Books:

1. J.P Tremblay and Manohar: Discrete Mathematical Structures with Application to Computer science, McGraw-Hill, 1st Edition 2017.
2. NarsinghDeo: Graph Theory, PHI Learning, 2014.
3. C.L Liu: Discrete Mathematics.4th Edition 2012.
4. Rosen: Discrete Mathematics and its Applications, McGraw Higher Ed, 7th Edition 2008.
5. N. Herstein: Topics in Algebra, Wiley, 2nd Edition 2006.

Course Articulation Matrix

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

1 - Slightly; 2 - Moderately; 3 – Substantially

MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE,
GWALIOR (M.P.), INDIA

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NAAC ACCREDITED WITH A++ GRADE

Department of Engineering Mathematics and Computing

B. Tech. (Seventh Semester)

Optimization Techniques

(OC-II) MAC-910214

Objective of Course

- To know how to formulate and solve Linear Programming problem and Non-Linear Programming problems
- To familiarize with Information Techniques
- To explore the Game Theory
- To make the student acquire sound knowledge of inventory models

UNIT 1:

Linear Programming Problem (LPP):Historical development, models and modeling, classification, general methods for solving OR models, Formulation of LPP, Graphical method, Simplex method, Duality theory in linear programming and applications, Dual simplex method, Transportation and Assignment problems.

UNIT 2:

Non-Linear Programming Problems (NLPP): Introduction of NLPP, constraints problems of maxima and minima, constraints in the form of equations (Lagrangian method), constraints in the form of inequalities. Dynamic Programming: Basic concepts, Bellman's optimality principle, dynamic programming approach in decision making problems, optimal subdivision problems.

UNIT 3:

Introduction, Communication Process, A Measure of Information, Measures of Other Information Quantities, Channel Capacity, Efficiency and Redundancy, Encoding, Shannon-Fano Encoding Procedure, Necessary and Sufficient Condition For Noiseless Encoding.

UNIT 4:

Introduction to game theory, competitive games, finite and infinite games, two persons zero sum game, pure and mixed strategies, saddle point, maxmin and minimax principle, solution of a rectangular game in terms of mixed strategies, Graphical method of (2xm) and (nx2) games.

UNIT 5:

Introduction to inventory problems, deterministic models, classical EOQ (Economic Order Quantity) models, inventory models with deterministic demand (No shortage and shortage allowed), Multi item deterministic models, Price break models, and Inventory models with probabilistic demand.

Course Outcomes

After completing of this course, the students will beable to:

CO's	Description of CO's
CO1	Determine the solution of Linear Programming Problem
CO2	Express the solution of Non Linear Programming Problem
CO3	Find the use and application of Information coding
CO4	Acquire the knowledge of Game theory.
CO5	Evaluate the different models of inventory.

Recommended Books:

1. B. E. Gillet: Introduction to Operation Research, Computer Oriented Algorithmic Approach, McGraw Higher Ed, 1st Edition 1984.
2. Ravindran and J. J. Solberg: Operations Research Principles, Wiley, 2nd Edition 1987.
3. P. R. Thie and G. E. Keough: An Introduction to Linear Programming & Game Theory, Wiley, 3rd Edition 2008.
4. H. A. Taha: Operations Research an Introduction, Pearson, 9th Edition 2014.
5. Griva, S. G. Nash and A. Sofer: Linear and Non Linear Optimization, Taylor & Francis Group, 2014

Course Articulation Matrix

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

1 - Slightly; 2 - Moderately; 3 – Substantially

Annexure-IV

Department of Engineering Mathematics and Computing

B. Tech. (Seventh Semester)
Number Theory &Cryptography
(OC-II) MAC- 910215

Course Objective

- To Understand the Crypto graphical techniques to converting some secret information to not readable texts
- Explore the Crypto graphical techniques in various applications such as include military information transmission, computer passwords, electronic commerce, and others.
- Introduce the idea of encryption and public key cryptosystem in the context of algebra and elementary number theory.

Unit 1:
Number theory, Divisibility theory, Modular Arithmetic, primes and their distribution, theory of congruence and its application in security, Congruence: basic definitions and properties, complete and reduced residue systems.

Unit 2:
Integer representations (binary and base expansions, base conversion algorithm), Fermat's Little Theorem and Euler's Theorem, primitive roots, quadratic reciprocity, and Divisibility: basic definition, properties, prime numbers, some results on distribution of primes.

Unit 3:
Arithmetical functions: examples, with some properties and their rate of growth; Continued fractions, and their connections with Diophantine approximations, applications to linear and Pell's equations; Binary quadratic forms; Partition: basic properties and results; Diophatine equations: linear and quadratic, some general equations.

Unit 4:
Overview of cryptography, Encryption, Symmetric Encryption, Plain text, cipher text, Historical Ciphers, Shift Cipher, Substitution Cipher, Vigen'ere Cipher, Permutation Cipher, Symmetric Ciphers, Stream Cipher, Block Ciphers. Symmetric Key Distribution, key management, secret key distribution, public and private key cryptography.

Unit 5:
RSA cryptosystem, Primality Testing and Factoring, Key Exchange and Signature Schemes Diffie–Hellman Key Exchange, Digital Signature Schemes, Cryptographic hash functions, Authentication, Digital Signatures, Identification, certification, Discrete logarithm problem in general and on finite fields. Polynomials on finite fields, irreducibility and their applications to coding theory.

Course Outcomes
After completing this course, student will be able to:

CO's	Description of CO's
CO1	Acquire the knowledge of number theory and transcendental numbers
CO2	Describe the divisibility and related algorithms, factorization and quadratic sieve, efficiency of other factoring algorithms.
CO3	Evaluate arithmetical functions, Distribution of primes and Diophantine equations
CO4	Apply cryptography tools in various applications
CO5	Examine the Public key cryptosystems

Recommended Books:

1. Nigel Smart : Cryptography : An Introduction, CRC Press,3rd edition, 2013
2. Neal Koblitz : A course in number theory and cryptography, Springer-Varlag, 2nd edition, 1994.
3. W. Stein: Elementary Number Theory: Primes, Congruences and Secrets, OPAQUE, 2017
4. Burton, David M. Elementary Number Theory, 7th ed., 2011, McGraw-Hill, Inc.
5. Koshy, Thomas. Elementary Number Theory With Applications, 2nd ed., 2007. Elsevier, Inc

Course Articulation Matrix

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

1 - Slightly; 2 - Moderately; 3 – Substantially

Annexure-V

Department of Engineering Mathematics and Computing

B. Tech. (Seventh Semester)

Analytics Using R Programming

LIST OF PROGRAMS:

1. Download and install R-Programming environment and install basic packages using install. Packages () command in R.
2. Learn all the basics of R-Programming (Data types, Variables, Operators etc.)
3. Implement R-Loops with different examples.
4. Learn the basics of functions in R and implement with examples.
5. Implement data frames in R. Write a program to join columns and rows in a data frame using c bind () and r bind () in R.
6. Implement different String Manipulation functions in R.
7. Implement different data structures in R(Vectors,Lists,Data Frames)
8. Write a program to read acsv file and analyze the data in the file in R
9. Create pie charts and bar charts using R.
10. Create a data set and do statistical analysis on the data using R.
11. Write R program to find Correlation and Covariance
12. Write R program for Regression Modeling
13. Write R program to build classification model using KNN algorithm
14. Write R program to build clustering model using K-mean algorithm

Annexure-VI

Scheme of Examination
Department of Engineering Mathematics and Computing
B. Tech. (Admitted batch 2022)
V Semester

Sl. No.	Subject Code	Category Code	Subject Name	Maximum Marks Allotted							Total Marks	Contact Hours per week			Total Credits	Mode of Teaching (Offline/ Online)	Mode of Exam.
				Theory Slot				Practical Slot				L	T	P			
				End Sem.		Continuous Evaluation		End Sem.	Continuous Evaluation								
				End Term Evaluation	$Proficiency in subject /course	Mid Sem. Exam	Quiz/ Assignment		Lab Work & Sessional	Skill Based Mini Project							
	2250521	DC	Computer Networks	50	10	20	20	-	-	-	100	3	-	-	3	Offline	PP
	2250522	DC	Real and Complex Analysis	50	10	20	20	-	-		100	3	1	-	4	Offline	PP
	2250523	DC	Software Engineering	50	10	20	20				100	3	-	-	3	Offline	MCQ
	2250524	MC	Data Science using Python	50	10	20	20	60	20	20	200	2	1	2	4	Offline	MCQ
	2250525	DC	Optimization Techniques	50	10	20	20	-	-	-	100	3	1	-	4	Offline	PP
	2250526	DLC	Minor Project-I	-	-	-	-	60	40	-	100	-	-	4	2	Offline	SO
	2250527	DLC	Self-learning/Presentation#(NPTEL/SWAYAM/MOOC)	-	-	-	-	-	40	-	40	-	-	2	1	Blended	SO
	2200xxx	CLC	Novel Engaging Course (Informal Learning)	-	-	-	-	50	-	-	50	-		2	1	Interactive	SO
	2250528	DLC	Summer Internship Project -II	-	-	-	-	60	-		60	-	-	4	2	Offline	SO
al				250	50	100	100	230	100	20	850	14	3	14	24		
	1000006	MAC	Disaster Management	50	10	20	20	-	-	-	100	2	-	-	Grade	Blended	MCQ

$proficiency in course/subject-includes the weightage towards ability/skill/competence/knowledge level/ expertise attained etc. in that particular course/subject.

$$MCQ: Multiple Choice Question $$AO: Assignment + Oral $$PP: Pen Paper $$SO: Submission + Oral

** The Minor Project-I may be evaluated by an internal committee for awarding sessional marks.

Compulsory registration for one online course using SWAYAM/NPTEL/MOOC, evaluation through attendance, assignments and presentation

Mode of Teaching						Mode of Examination					Total Credits
Theory				Lab	NEC	Theory			Lab	NEC	
Offline	Online	Blended		Offline	Interactive	PP	A+O	MCQ	SO	SO	
		Offline	Online								
7	-	-	1	1	-	3	-	2	4	-	24
77%	-	-	11%	11%	-	33%	-	22%	44%	-	

Annexure-VII

Department of Engineering Mathematics and Computing

B. Tech. (Fifth Semester)

Computer Networks

(MAC-2250521)

COURSE OBJECTIVES

- To understand the architecture of networks.
- To understand the issues and solution to access shared medium.
- To understand the existing protocols at network and transport layer for design and implementation of computer network.
- To understand the reliability & efficiency related issue in a packet switched networks.

UNIT 1:

Introduction to computer networks & their uses, Different topologies, ISO-OSI model: Layered Architecture, Peer-to-Peer processes and encapsulation, Function and Services of OSI layers; The Physical layer: Digital Signals, Transmission Impairments and Maximum data rate of a channel, Shennons theorem, Nyquist theorem. Transmission media: Guided and Unguided medias, Circuit, Packet and Message switching, virtual Circuit, Introductionto ISDN & its components.

UNIT 2:

The data link layer: Design issues & function, Error detection & correction, Forward error correction Versus Retransmission, Hamming code & CRC codes, Framing: Fixed size and Variable size Frame, Bit stuffing and Byte stuffing. Data link layer protocols: Simplest, Stop and Wait, Sliding window protocols, PPP, SLIP, HDLC, The medium access sub layer: Static and Dynamic Channel Allocation, Protocols: ALOHA Protocol, CSMA (CSMA/CD, CSMA/CA), Collision Free Protocol- Bit Map.

UNIT 3:

IEEE 802 standards for LANs (IEEE 802.3, IEEE 802.4, IEEE 802.5), LAN Devices: HUB, Switches- Learning, Cut-Through and store and forward switches, Bridges: IEEE 802.x to IEEE 802.y, Spanning Tree, Remote Bridge. Internetworking Devices: Routers & gateways. The network layer: Design issues and functions, internal organization (Virtual Circuit & Datagrams).

UNIT 4:

Routing algorithms: Shortest path routing, Flooding, LSR, Distance Vector Routing, Hierarchical Routing. Introduction to TCP/IP Protocol stack: Protocol Architecture, Classful IP addressing, ARP, RARP, IP Datagrams with options and its delivery, ICMP.

UNIT 5:

Subnet, Supernet, CIDR Transport Layer: Congestion control, Load Shedding, Jitter control, addressing and multiplexing, Connection establishment and connection release, flow control. Application layer: Introduction to DNS and Email.

Course Outcomes

After completing of this course, the students will be able to:

CO's	Description of CO's
CO1	Analyze the requirements for a given organizational structure and select the appropriate networking architecture and technologies
CO2	Acquire the knowledge of network layers
CO3	Specify and identify deficiencies in existing protocols, and then go onto formulate new and better protocols
CO4	Analyze, specify and design the topological and routing strategies for an IP based networking infrastructure
CO5	Know the issues and solution to access shared medium

RECOMMENDED BOOKS:

1. Tanenbaum A. S., "Computer Networks", Pearson Education, 5th edition, 2011.
2. Behrouz A Forouzan, "Data communication and networking", 4th edition, McGraw- Hill Education, 2017.
3. Comer, "Internetworking with TCP/ IP Vol-1", Pearson education, 6th Edition, 2015.
4. Peterson & Davie, "Computer Networks", 5th Edition, Morgan Kaufmann, 2011.
5. W. Richard Stevens, "TCP/IP Illustrated Vol-1", 2nd Edition, Addison-Wesley, 2011.

Course Articulation Matrix

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

1 - Slightly; 2 - Moderately; 3 – Substantially

MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR (M.P.), INDIA

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NAAC ACCREDITED WITH A++ GRADE

Department of Engineering Mathematics and Computing

B. Tech. (Fifth Semester)

Real and Complex Analysis

(MAC- 2250522)

Course Objectives:

- To develop understanding of real analysis and to introduce the classical results of complex variable analysis.
- Acquire knowledge about continuity and differentiability of function
- To explain basic concept of Riemann integrals
- Develop the skills to apply complex variable functions in real world problems
- Evaluation of definite integrals by using contour integration techniques.

UNIT 1:

Real System: Introduction, Ordered Sets, Real system and Real Field, Archimedean property of the real-number system, Cauchy-Schwarz inequality, Finite, Countable, and Uncountable Sets, Compact Sets, Heine Borel Theorem, Perfect Sets, Connected Sets, Bolzano-Weierstrass theorem.

UNIT 2:

Continuity and Differentiability: Limits of Functions, Continuous Functions, Continuity and Discontinuities, Limits at Infinity, Continuity of Derivatives, Cauchy Criterion for finite limits, Continuity at point and in an interval, Theorems in Continuity, Function continuous on closed interval, Uniform continuity, Theorems on Uniform continuity.

UNIT 3:

Riemann and Riemann-Stieltjes Integral: Definition and existence of the integral, Refinement of Partitions, Darboux theorem, Condition of Integrability, Properties of Reimann Integral, Reimann Sums, Integrability of continuous and monotonic function, Definition, Partitions, Sufficient and existence conditions for existence of Riemann-Stieltjes integrals, Upper and lower bounds, Upper and Lower integrals, fundamental theorems of calculus, Mean Value Theorems for Riemann-Stieltjes integrals.

UNIT4:

Functions of Complex Variables, Limits, Continuity and differentiability of functions of a complex variable, Analytic functions, necessary and sufficient condition for function to be analytic, Cauchy-Reimann equations, Harmonic functions, Milne-Thomson method to find conjugate function, Conformal Mappings, Bilinear Transformation: magnification and rotation, inversion and reflection.

UNIT5:

Integration in a complex plane along a contour, integration of regular function, Cauchy's theorem, Cauchy's integral formula, Morera's theorem, Liouville Theorem, Taylor's and Laurents series, Isolated and non-isolated singularity, poles, residues, Cauchy's residue theorem and its applications.

Course Outcomes

After successful completion of this course, students will be able to:

CO's	Description of CO's
CO1	Grasp basic concept of real number system and their applications in engineering problems
CO2	Analyze various properties of continuity and uniform continuity and compare them
CO3	Apply concepts of Riemann Integral to solve engineering problems
CO4	Recognize and Analyze the applications of complex valued function in real world engineering problems.
CO5	Classify various forms of singularities of complex valued functions and their expansion in valid region of convergence.

Recommended Books:

1. Walter Rudin, Principles of Mathematical Analysis 3rd ed. McGraw-Hill, 1976.
2. S C Malik and Savita Arora, Mathematical Analysis, 4th Edition, New Age International Publishers, 2010.
3. S. Ponnusamy, Foundation of Complex Analysis, Narosa Publishing House, 1997.
4. J. W. Brown and R. V. Churchill, Complex variables and applications, MC Graw Hill Higher Education, Eighth Edition 2009.

Course Articulation Matrix

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

1 - Slightly; 2 - Moderately; 3 – Substantially

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NAAC ACCREDITED WITH A++ GRADE

Department of Engineering Mathematics and Computing

B. Tech. (Fifth Semester)

Software Engineering

(MAC-2250523)

COURSE OBJECTIVES

- To understand the nature of software development and software life cycle process models, agile software development, SCRUM and other agile practices.
- To understand project management and risk management associated with various types of projects.
- To know basics of testing and understanding concept of software quality assurance and software configuration management process.

Unit:1

Introduction to Software Engineering: Definition, software engineering-layered Technology, Software Characteristics and Components, Software model: Software Development of Life Cycle Model (SDLC), The Waterfall Model, Iterative Waterfall Model, Prototyping Model, Spiral Model, RAD Model. Selection criteria of model: Characteristics of Requirements, Status of Development Team, Users participation, Type of Project and Associated Risk.

Unit: 2

Requirement Engineering: Definition, Requirement Engineering Activity, Types of Requirements- Functional and Non-functional Requirements, User and System Requirements, Requirement Elicitation Methods, Requirement Analysis Methods, Requirement Documentation (SRS), Requirement Validation, Requirement Management.

Unit: 3

Design Concept, Principle and Methods: Design Fundamentals, Design Principles, Effective Modular Design, Design Representations, Architectural design, Procedural design, data Directed design, Real Time Design, Object Oriented Design, Coupling and Cohesion.

Unit: 4

Software Metrics, Project Management and Estimation: Metrics in Process and Project domains, Software Measurement, Software Quality Metrics, Project Management- Basics-People, Product, Process, Project, Estimation- Software Project Estimation, Decomposition Techniques- Function Point Estimation, Line of Code (LOC) based estimation, Empirical Estimation, COCOMO Model, Project Scheduling Techniques.

Unit:5

Software Testing: Definitions, Software Testing Life Cycle (STLC), Test Case Design, Strategic Approach to Software Testing- Verification & Validation , Strategic issues, Criteria for completion of Testing, Unit Testing, Integration Testing, Validation Testing, System Testing, Black Box Testing Techniques, White Box Testing Techniques, Acceptance Testing.

Course Outcomes

After successful completion of this course, students will be able to:

CO's	Description of CO's
CO1	Explain the various fundamental concepts of software engineering
CO2	Develop the concepts related to software design & analysis.
CO3	Compare the techniques for software project management & estimation
CO4	Choose the appropriate model for real life software project.
CO5	Test the software through different approaches.

RECOMMENDED BOOKS:

1. Software Engineering: A Practitioner's Approach, Roger S. Pressman, McGraw Hill, 2001.
2. Software Engineering, K.K. Agrawal & Yogesh Singh, New Age Publication, 2007.
3. Fundamentals of Software Engineering, Rajib Mall, PHI, 2014.

Course Articulation Matrix

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

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NAAC ACCREDITED WITH A++ GRADE

Department of Engineering Mathematics and Computing

B. Tech. (Fifth Semester)

Data Science using Python

(MAC-2250524)

COURSE OBJECTIVES:

- To provide the fundamental knowledge of Data Science
- To present the basic representation and exploratory data analysis used in Data Science
- To understand the working of techniques used in Data Science

UNIT: 1

Introduction of basics python tool, setting working Directory, Creating and saving a script file, File execution, Clearing console, removing variables from environment, clearing environment, Commenting script files, Variable creation, Arithmetic and logical operators, Data types and associated operations

UNIT: 2

Sequence data types and associated operations Strings, Lists, Arrays, Tuples, Dictionary, Sets, Range, NumPy, Array

UNIT:3

Pandasdata frame and data frame related operations on different dataset, Reading files, exploratory data analysis, Data preparation and preprocessing

UNIT: 4

Linear regression, logistic regression, decision tree, tree creation with entropy and information gain, IDE3 algorithm, random forest, naïve bayes theorem, K-nearest neighbor and different ensemble methods for solving real world problems.

UNIT:5

Data visualization on different dataset using matplotlib and seaborn libraries, Scatter plot, Line plot, Bar plot, Histogram, Box plot. Pair plot, Control structures using different dataset, if-else family, for loop, for loop with if breaks, while loop, Functions

Course Outcomes

After completing the course, the student will be able to:

CO's	Description of CO's
CO1	Define different Data Science techniques.
CO2	Apply different TOOL used for Data Science technique
CO3	Analyze different data set and their operation
CO4	Build exploratory data analysis for Data Science methods
CO5	Build Data Science techniques for solving real world problems

RECOMMENDED BOOKS:

1. Mastering python for data science, Samir Madhavan
2. Python Data Science Handbook essential tools for working with data, Jake VanderPlas, 2nd edition
3. Data Analytics using Python Paperback, Bharti Motwani
4. Data Analytics Essentials, Bianca Szasz

Course Articulation Matrix

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

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NAAC ACCREDITED WITH A++ GRADE

Department of Engineering Mathematics and Computing

B. Tech. (Fifth Semester)

Optimization Techniques

(MAC-2250525)

COURSE OBJECTIVES:

- To know how to formulate and solve Linear Programming problem and Non Linear Programming problems
- To familiarize with Information Techniques
- To explore the Game Theory
- To make the student acquire sound knowledge of inventory models

UNIT: 1

Linear Programming Problem (LPP): Historical development, models and modeling, classification, general methods for solving OR models, Formulation of LPP, Graphical method, Simplex method, Duality theory in linear programming and applications, Dual simplex method, Transportation and Assignment problems.

UNIT: 2

Non Linear Programming Problems (NLPP): Introduction of NLPP, constraints problems of maxima and minima, constraints in the form of equations (Lagrangian method), constraints in the form of inequalities. Dynamic Programming: Basic concepts, Bellman's optimality principle, dynamic programming approach in decision making problems, optimal subdivision problems.

UNIT: 3

Introduction, Communication Process, A Measure Of Information, Measures Of Other Information Quantities, Channel Capacity, Efficiency, And Redundancy, Encoding, Shannon-Fano Encoding Procedure, Necessary And Sufficient Condition For Noiseless Encoding.

UNIT: 4

Introduction to game theory, competitive games, finite and infinite games, two persons zero sum game, pure and mixed strategies, saddle point, maxmin and minimax principle, solution of a rectangular game in terms of mixed strategies, Graphical method of (2xm) and (nx2) games.

UNIT: 5

Introduction to inventory problems, deterministic models, classical EOQ (Economic Order Quantity) models, inventory models with deterministic demand (No shortage and shortage allowed), Multi item deterministic models, Price break models, and Inventory models with probabilistic demand.

Course Outcomes

After completing of this course, the students will be able to:

CO's	Description of CO's
CO1	Determine the solution of Linear Programming Problem
CO2	Express the solution of Non Linear Programming Problem
CO3	Find the use and application of Information coding
CO4	Acquire the knowledge of Game theory
CO5	Evaluate the different models of inventory.

Recommended Books:

1. A. Ravindran and J. J. Solberg: Operations Research Principles, Wiley, 2nd Edition 1987.
2. P. R. Thie and G. E. Keough: An Introduction to Linear Programming & Game Theory, Wiley, 3rd Edition 2008.
3. H. A. Taha: Operations Research an Introduction, Pearson, 9th Edition 2014.
4. I. Griva, S. G. Nash and A. Sofer: Linear and Non Linear Optimization, Taylor & Francis Group, 2014.

Course Articulation Matrix

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

1 - Slightly; 2 - Moderately; 3 – Substantially

Annexure-VIII

Department of Engineering Mathematics and Computing
B. Tech. (Fifth Semester)
Java Programming
(MAC-2250526)

List of Experiments

1. JAVA program to create a class to read and add two distance.
2. JAVA program to create a class for student to get and print details of a student.
3. JAVA program to create a class for student to get and print details of N students.
4. JAVA program to demonstrate example of array of objects.
5. JAVA program to create class to read and add two times.
6. JAVA program to create class to read time in seconds and convert into time in (HH:MM:SS) format.
7. JAVA program to create class to read time in HH:MM:SS format and display into seconds.
8. JAVA program to demonstrate example of friend function with class.
9. Count the created objects using static member function in JAVA.
10. Create an object of a class inside another class declaration in JAVA.
11. Example of private member function in JAVA.
12. Local Class with Example in JAVA.
13. Structure with private members in JAVA.
14. Member Functions in JAVA.
15. Demonstrate Example of public data members in JAVA.
16. Create a class Point having X and Y Axis with getter and setter functions in JAVA.
17. Passing an object to a Non-Member function in JAVA.
18. Access the reference of an object using 'this' in JAVA.
19. Create a class with public data members only in JAVA
20. JAVA program Input list of candidates and find winner of the Election based on received votes
21. JAVA program to design applets.
22. JAVA program to create a file.
23. JAVA program to read a text file.
24. JAVA program to write and read text in/from file.
25. JAVA program to write and read values using variables in/from file.
26. JAVA program to write and read object using read and write function.

Annexure-IX

Department of Engineering Mathematics and Computing
B. Tech. (Fifth Semester)

List of Skill Based Project

1. Building Chatbots
2. Credit card fraud detection
3. Fake news detection
4. Forest fire prediction
5. Classifying breast cancer
6. Airline reservation system
7. Course management system
8. Data visualization software
9. Electricity billing system
10. e-Healthcare management system
11. Email client software
12. Library management system
13. Online bank management system
14. Online medical management system
15. Online quiz management system
16. Online Survey System
17. Smart city project
18. Stock management system
19. Driver drowsiness detection
20. Recommender systems
21. Sentiment Analysis
22. Exploratory data analysis
23. Gender detection and age detection
24. Recognizing speech emotion
25. Customer segmentation

Annexure-X

Department of Engineering Mathematics and Computing
B. Tech. (Admitted batch 2023)
Scheme of Examination
III Semester

Subject Code	Category Code	Subject Name	Maximum Marks Allotted							Total Marks	Contact Hours per week			Total Credits	Mode of Teaching	Mode of Exam
			Theory Slot				Practical Slot									
			End Sem.		Mid Sem. Exam.	Quiz/ Assignment	End Sem.	Lab Work & Sessional	Skill Based Mini Project		L	T	P			
			End Term Evaluation	$Proficiency in subject /course												
3250321	DC	Stochastic Process and Financial Mathematics	50	10	20	20	-	-	-	100	2	1	-	3	Offline	PP
3250322	BSC	Discrete Mathematical Structures	50	10	20	20	-	-	-	100	3	1	-	4	Offline	PP
3250323	DC	Operating System Concepts	50	10	20	20	-	-	-	100	2	1	-	3	Offline	MCQ
3250324	DC	Data Structures and Algorithms	50	10	20	20	40	30	30	200	3	-	2	4	Offline	A+O
3250325	DC	Numerical Techniques	50	10	20	20	-	-	-	100	3	1	-	4	Offline	PP
3250326	DLC	Computing Lab	-	-	-	-	40	30	30	100	-	-	2	1	Offline	A+O
3250327	DLC	Self-learning/Presentation#	-	-	-	-	-	40	-	40	-	-	2	1	Blended +Mentoring	SO
2000xxx	CLC	Novel Engaging Course	-	-	-	-	50	-	-	50	-	-	2	1	Interactive	SO
3250328	DLC	Skill Internship Project–I (Institute Level Evaluation)	-	-	-	-	60	-	-	60	-	-	4	2	Offline	SO
			250	**50**	**100**	**100**	**230**	**80**	**40**	**850**	**13**	**4**	**12**	**23**		
3000001	Natural Sciences & Skills	Engineering Physics	50	10	20	20	-	40	10	150	2	-	-	Grade	Blended	MCQ
1000001	MAC	Indian Constitution and Traditional Knowledge	50	10	20	20	-	-	-	100	2	-	-	Grade	Blended	MCQ

$Proficiency in course/subject – includes the weight age towards ability/ skill/ competence /knowledge level /expertise attained /attendance etc. in that particular course/subject
#compulsory registration for one online course using SWAYAM/NPTEL/ MOOC, evaluation through attendance, assignments and presentation

Mode of Teaching						Mode of Examination					
Theory				Lab	NEC	Theory			Lab	SIP/ SLP/ NEC	Total Credits
Offline	Online	Blended		Offline	Interactive	PP	A+O	MCQ	SO	-	
		Offline	Online								
7	-	-	1	1	-	3	2	1	3	-	23
77 %	-	-	11 %	11%	-	33%	22%	11%	33%	-	Credits %

MCQ: Multiple Choice Question, **AO:** Assignment + Oral, **OB:** Open Book, **PP:** Pen Paper, **SO:** Submission and Oral

Annexure-XI

Department of Engineering Mathematics and Computing
B. Tech. (Third Semester)
Stochastic Process and Financial Mathematics
(MAC-3250321)

Objective of Course

- To perceive the mathematical techniques in financial sector
- To explore the concept of free and risky assets
- To understand mathematical models and risk management
- To know stochastic differential and integral equations

Unit: 1

Basic Notions and Assumptions, No-Arbitrage Principle, One-Step Binomial Model, Risk and Return, Forward Contracts, Call and Put Options, Growth and decay curves, Managing Risk with Options, Credit and loan, Cost of credit and amortization.

Unit: 2

Time Value of Money, Simple Interest, Periodic Compounding, Streams of Payments, Discrete and Continuous Compounding, how to Compare Compounding Methods, Money Market, Discrete Time Model: Stock and Money Market Models, Investment Strategies, The Principle of No Arbitrage, Fundamental Theorem of Asset Pricing.

Unit: 3

Dynamics of Stock Prices, Expected Return, Binomial Tree Model, Risk-Neutral Probability, Martingale Property, Numerical Techniques in Finance: Continuous-Time Limit, Monte-Carlo methods, Lattice Method.

Unit: 4

Portfolio Management: Risk and Expected Return on a Portfolio, Numerical and Combinatorial Optimization: Dynamic programming and allocating investments MarKov chains and sequential decision making, Linear programming and the simple method, The theory of games.

UNIT: 5

Random Walks and Brownian Motion, Concept of Stochastic Differential Equations (SDEs) - drift, diffusion, Ito calculus: Ito's Lemma, Ito Integral and Ito Isometry.

Course Outcomes

CO's	Description of CO's
CO1	Define and describe market models, growth and decay curve
CO2	Analyze free risk assets in financial sector
CO3	Deal with the market risk measurement and management
CO4	Employ discrete market models and able to manage portfolio.
CO5	Explore stochastic differential equations

After successfully completing this course, the students will have skill and knowledge to:

Recommended Books:

1. Marek Capinski and Tomasz Zastawniak, "Mathematics for Finance", Springer (2011).
2. Kannoo Ravindran, The Mathematics of Financial Models: Solving Real-World Problems with Quantitative Methods, Wiley Finance, (2014)
3. Ambad NazriWahidudin, "Financial Mathematics and its Applications", Ventus Publishing ApS (2011).
4. Ales Cerny: "Mathematical techniques in Finance: Tools for incomplete markets", Princeton University Press (2011).

Course Articulation Matrix

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

1 - Slightly; 2 - Moderately; 3 – Substantially

Department of Engineering Mathematics and Computing
B. Tech. (Third Semester)
Discrete Mathematical Structures
(MAC – 3250322)

Objective of Course

- To have knowledge of basic algebra and discrete numeric function.
- To describe function and its relation
- To familiarize propositional logic
- To know about the graph theory and its application in computer
- To familiarize the discrete numeric function and generating function

UNIT: 1

Sets, Subsets, Power sets, Complement, Union and Intersection, Demorgan's law Cartesian products, Relations, relational matrices, properties of relations, equivalence relation, functions, Injection, Surjection and Bijective mapping, Composition of functions, Permutations, the characteristic functions and Mathematical induction.

UNIT: 2

Partial order set, Hasse diagrams, upper bounds, lower bounds, Maximal and minimal element, first and last element, Lattices, sub lattices, Isotonicity, distributive inequality, Lattice homomorphism, lattice isomorphism,complete lattice, complemented lattice, and distribution lattice.

UNIT: 3

Group axioms, permutation group, sub group, co-sets, normal subgroup, semi group, Lagrange theorem, fields, minimal polynomials, reducible polynomials, primitive polynomial, polynomial roots, applications.

UNIT: 4

Finite graphs, incidence and degree, isomorphism, sub graphs and union of graphs, connectedness, walk, paths and circuits, Eulerian and Hamiltonian graphs. Trees: properties of trees, pendant vertices in tree, Center of tree, spanning trees and cut vertices, binary tree,matrix representation of graph, incidence and adjacency matrix and their properties, applications of graphs in computer science.

UNIT: 5

Introduction to discrete numeric functions and generating functions, introduction to recurrence relations and recursive algorithms, linear recurrence relations with constant coefficients, homogeneous solutions, particular solutions and total solutions

Course Outcomes

After completing this course, the students will be able to:

CO's	Description of CO's
CO1	Acquire Knowledge of set theory
CO2	Analyse the concept of Lattices
CO3	Identify the concept of Group Theory
CO4	Derive the Inferences from Graph theory
CO5	Illustrate the Discrete numeric function and recursive relation

Recommended Books:

1. J.P Tremblay and Manohar: Discrete Mathematical Structures with Application to Computer science, McGraw-Hill, 1st Edition 2017.
2. NersinghDeo: Graph Theory, PHI Learning, 2014.
3. C.L Liu: Discrete Mathematics.4th Edition 2012.
4. Rosen: Discrete Mathematics and its Applications, McGraw Higher Ed, 7th Edition 2008.
5. N. Herstein: Topics in Algebra, Wiley, 2nd Edition 2006.

Course Articulation Matrix

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

1 - Slightly; 2 - Moderately; 3 – Substantially

Department of Engineering Mathematics and Computing

B. Tech. (Third Semester)

Operating System Concepts

(MAC - 3250323)

Course Objectives

- Recognize the concepts and principles of operating systems.
- Provide comprehensive introduction to understand the underlying principles, techniques and approaches which constitute a coherent body of knowledge in operating systems.
- To teach understanding how the various elements that underlie operating system interact and provides services for execution of application software.

Unit 1: Introduction: Evolution of operating systems, Types of operating systems, Different views of operating system, operating system concepts and structure.

Processes: The process concept, systems programmer's view of processes, operating system services for processes management, scheduling algorithms, Performance evaluation.

Unit 2: Memory Management: Memory management without swapping or paging, swapping, virtual memory, page replacement algorithms, modelling paging algorithms, design issues for paging system, segmentation, Thrashing.

Unit 3: Interprocess communication and synchronization: The need for interprocess synchronization, mutual exclusion, semaphores, hardware support for mutual exclusion, queuing implementation of semaphores, classical problems in concurrent programming, critical region and conditional critical region, monitors messages.Deadlocks:Deadlock prevention, deadlock avoidance.

Unit 4: Mass Storage system – Overview of Mass Storage Structure, Disk Structure, Disk Scheduling and Management, swap space management; File-System Interface – File concept, Access methods, Directory Structure, Directory organization, File system mounting, File Sharing and Protection; FileSystem Implementation-File System Structure, Directory implementation, Allocation Methods,Free Space Management, Efficiency and Performance, Recovery.

Unit 5: Performance measurement: Monitoring and evaluation introduction, important trends affecting performance issues, why performance monitoring and evaluation are needed, performance measures, evaluation techniques, bottlenecks and saturation, feedback loops, raid model.

Case study: Unix Operating System.

Course Outcomes

After completion of this course, the students would be able to:

CO's	Description of CO's
CO1	Outline the basic concept of operating systems
CO2	Analyze the working of operating system
CO3	Examine the working of various scheduling/allocation approaches
CO4	Measure the performance of various scheduling/allocation approaches
CO5	Compare the various operating system problems/issues

Recommended Books:

1. Silberschatz, Galvin: Operating System Concepts, Wiley, 9/E, 2013.
2. Stalling William: Operating Systems, Pearson Education, 5/E, 2006.
3. Andrew S. Tanenbaum: Modern Operating Systems, 3/E, PHI, 2006.
4. J. Bach Maurice: The Design of Unix Operating System, Pearson ,First Edition, 2015.
5. Bovet & Cesati: Understanding the Linux Kernel, O' Reily, 3/E, 2005.
6. Peter Norton: Complete Guide to Windows XP, SAMS, 2002.

Course Articulation Matrix

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

1 - Slightly; 2 - Moderately; 3 – Substantially

MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR (M.P.), INDIA

Deemed to be University

(Declared under Distinct Category by Ministry of Education, Government of India)

NAAC ACCREDITED WITH A++ GRADE

Department of Engineering Mathematics and Computing

B. Tech. (Third Semester)

Data Structures and Algorithms

(MAC - 3250324)

Course Objectives

- To be familiar with the use of data structures as the foundational base for computer solutions to problems.
- To understand various techniques of searching and sorting.
- To understand basic concepts about stacks, queues, lists, trees and graphs.

Unit: 1

Prerequisites: Array, Structure, pointers, pointer to structure, functions, parameter passing, recursion.
Stack and Queue: Contiguous implementations of stack, various operations on stack, various polish notations-infix, prefix, postfix, conversion from one to another-using stack; evaluation of post and prefix expressions. Contiguous implementation of queue: Linear queue, its drawback; circular queue; various operations on queue.

Unit: 2

General List: list and it's contiguous implementation, it's drawback; singly linked list-operations on it; doubly linked list-operations on it; circular linked list; linked list using arrays. Linked implementation of stack and queue,various applications of Linked List, like polynomial representation, Josephus Problem.

Unit: 3

Trees: Definitions-height, depth, order, degree, parent and children relationship etc;Binary Trees- various theorems, complete binary tree, almost complete binary tree;Tree traversals-preorder, pre order and post order traversals, their recursive and non-recursive implementations; expression tree- evaluation; Linked representation of binary tree-operations. Threaded binary trees; forests, conversion of forest into tree. Heap-definition.AVL tree- definition, insertion & deletion operations; Basic idea of B tree and B+ Tree: definition, order, degree, operations and comparison.

Unit: 4

Searching, Hashing and Sorting: Requirements of a search algorithm; sequential search, binary search, indexed sequential search, interpolation search; hashing-basics, methods, collision, resolution of collision, chaining; Internal sorting- Bubble sort, selection sort, insertion sort, quick sort, merge sort on linked and contiguous list, shell sort, heap sort, tree sort.

Unit: 5

Graphs: Related definitions: Graph representations- adjacency matrix, adjacency lists, adjacency multi-list; traversal schemes- Depth first search, Breadth first search; Minimum spanning tree; Shortest path algorithm; Prim's,Kruskal&Dijkstra algorithm. Sparse Matrix.

Course Outcomes

After completion of this course, the students would be able to:

CO's	Description of CO's
CO1	Outline the basics of Algorithms and their performance criteria's.
CO2	Explain the working of linear/Non Linear data structures.
CO3	Identify the appropriate data structure to solve specific problems
CO4	Analyze the performance of various data structures & their applications
CO5	Evaluate the time/space complexities of various data structures & their applications.

Recommended Books:

1. AM Tanenbaum, Y Langsam & MJ Augustein: Data structure using C, PHI, 2007.
2. Robert Kruse, Bruse Leung: Data structures & Program Design in C, Pearson Education, 2007.
3. Richard, Gilberg Behrouz, Forouzan: Data structure – A Pseudo code Approach with C, Thomson press, 2005.
4. Jean – Paul Trembly, Paul Sorenson: An Introduction to Structure with application, TMH, 2007.
5. N. Wirth: Algorithms + Data Structure = Programs, Prentice Hall, 1978.
6. Sartaj Sahni : Data Structures, Algorithms and Applications in C++, Universities Press, 2014.

Course Articulation Matrix

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

1 - Slightly; 2 - Moderately; 3 – Substantially

Department of Engineering Mathematics and Computing
B. Tech. (Third Semester)
Numerical Techniques
(MAC – 3250325)

Course Objective

- To perceive the Errors, Algebraic & Transcendental
- To expose the concept of Interpolation, Extrapolation, Numerical differential and Integration
- To understand Numerical solution of Ordinary Differential Equation
- To explore the Finite Difference Methods

Unit 1:

Problem solving on computer, Algorithms and flow charts, Introduction to numerical computing, approximations and errors in numerical computations. Useful rules for estimating Errors, Truncation and round off errors, propagation of errors, Error in the Approximation of function, Error in Approximation

Bisection method, RegulaFalsi method, Iteration method, Newton Raphson method, Secant method, convergence of iterative methods.

Unit 2:

Matrix algebra, Solution of simultaneous linear algebraic equations: Gauss elimination, Gauss Jordan method, LU decomposition, Jacobi method, Gauss Seidel method, SOR method, Ill and well condition of equations, Condition of a system and stability issues., Finite Differences, forward, backward and central operators, Shifting operators, Averaging Operators, Differences of a polynomial, Factorial Notation, Relation between operators.

Unit 3:

Newton's forward and backward interpolation formula, Lagrange interpolation formula, Divided differences and Newton's divided difference formula, Inverse Interpolation, Numerical differentiation, Numerical integration: Newton-Cotes integration formulas, Trapezoidal, Simpson's rules (1/3 & 3/8)and Weddle rules.

Unit 4:

Taylor series method, Picard's method, Euler's method, Modified Euler's method, RungeKutta methods fourth order. Multistep methods: Milne's Predictor corrector method, Numerical solution of the simultaneous linear differential equation, Second order differential equation.

Unit 5:

Classification of partial differential equation, Finite difference method, Numerical solution of Partial Differential equations, five-point formula, Laplace and Poisson equation.

Course Outcomes

After completing this course, the students will be able to:

CO's	Description of CO's
CO1	Identify the concepts Algebraic & Transcendental Equations
CO2	Acquire the knowledge of finite difference
CO3	Describe numerical integration and differentiation
CO4	Illustrate the problems of ordinary differential equation
CO5	Analyze the Partial differential equations

Recommended Books:

1. B. S. Grewal: Higher Engineering Mathematics, Khanna Publisher, 43rd Edition, 2015.
2. B.V. Ramanna: Higher Engineering Mathematics, McGraw Hill,1st Edition, 2017.
3. S.S. Sastry: Introductory Methods of Numerical Analysis, PHI Learning Private Limited, 4th edition, 2007.
4. J. H. Mathews and K. D. Fink: Numerical Methods using MATLAB, PHI, 4th edition, 2007.
5. C.F. Gerald and P.O. Wheatley: Applied Numerical Analysis, Pearson Education, 6th edition, 2006.
6. H. K. Dass: Advance Engineering Mathematics, S. Chand& Company, Publisher, 2018.

Course Articulation Matrix

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

1 - Slightly; 2 - Moderately; 3 – Substantially

Department of Engineering Mathematics and Computing
B. Tech. (Third Semester)
Indian Constitution and Traditional Knowledge
(MAC – 1000001)

Course Objectives:

- The course aims to provide students with the continuous, comprehensive and cumulative understanding of Indian Knowledge Tradition (Philosophy, Language, Art) and its modern interpretation and analysis.
- It intends to connect the students' modern advanced knowledge system with the roots. ofIndianKnowledgeTraditionfortheirdevelopmentandbetterunderstandingoftheessentialsof thought process, intellection and inference.
- To impart the knowledge of the Yogic Science and an insight into Sanskrit Literature this will promote interest among students in discerning the significance of health and wisdom with an Indian perspective.
- The objective of the syllabus is to familiarize students with the essential features and basic principles of the constitution of India.

Unit-1

Introduction to Basic Structure of Indian Knowledge System, Homogeneity of modern science and Indian Knowledge Tradition, Yoga: Promoting positive health and personality, Case Studies

Unit-2

Indian Philosophy or Dracaenas: Jainism, Buddhism, Yoga, Saliva and Vedanta, Indian Linguistic Tradition: Panini's Aashaadha, Indian Art: Maryannart, Buddhist art Guptaart, Muslim Art & Culture, Contemporary art, Case Studies

Unit3

Nature and sociopolitical science, Definition, elements and theories of origin of State (Social Contract and Evolutionary), Meaning and features of Civil Society, Indian Political Thought: Raja Ram Mohan Roy, Swami Vivekananda, Gandhi, Ambedkar

Unit4

Government: Definition and its characteristics, Types and meaning of Legislature: Composition, Function and Role of the Parliament (Lok Sabha and Rajya Sabha), The Powers, Position and Role of the President, Prime Minister and the Cabinet, ThePowers,PositionandRoleoftheGovernorandtheChiefMinister;Compositionandtherole of Supreme Court, Judicial Review and Judicial Activism.

Unit5

Preamble, Conventions, Sovereignty of the Constitution and the Rule of Law, Parliamentary Democracy, Federalism, Secularism and Socialism, Fundamental Rights, Directive Principles of State Policies and Fundamental Duties, Election Commission and Electoral Reforms.

Course Outcomes

After completing this course, the students will be able to:

CO's	Description of CO's
CO1	Know the rich Indian traditions and the Indian constitution
CO2	Appraisetheutilityandsignificanceoftraditionanditsapplicabilityinpresenttimes.
CO3	Employtheknowledgeoftheconstitutionalnormsaslaidintheconstitutionandabidebythepracticesstatedtherein.
CO4	Recognizethebasicconceptsofethicsandmoralitypertainingto Indiancultureandtradition.
CO5	Connect traditional Indian philosophy with the in everyday conduct and practices.

Recommended Books:

1. O.P.Gauba,*PoliticalTheory*,Macmillan,(latestedition).
2. D.D.Basu,*IntroductiontotheConstitutionofIndia*,(LatestEdition).
3. N.G.Jayal&PratapBhanuMehta,*theOxfordCompanionof PoliticsinIndia*,2000.
4. W.H.Morris-Jones, *theGovernmentandPoliticsofIndia*
5. SwamiJitamanand,HolisticScienceandVedam, BhartiyaVidyabhawan
6. V. Shivramakrishnan (Ed.), Cultural Heritage of India, BhartiyaVidyabhawan, Mumbai Fifth Edition,2014.
7. YogasutraofPatanjali,RamakrishnanMission,Kolkata.
8. PaniniShiksha,MotilalBanarsidas
9. VNJh, Language, ThoughtandReality
10. KrishnaChaitanya,ArtsofIndia, AbhinavPublications, 1987.

Annexure-XII

Department of Engineering Mathematics and Computing
List of skill-based mini projects
Data Structures and Algorithms
(MAC-3250324)

Implement the following in C/C++

1. Linked List Insertion
2. Linked List Deletion (Deleting a given key)
3. Linked List Deletion (Deleting a key at given position)
4. A Programmer's approach of looking at Array vs. Linked List
5. Find Length of a Linked List (Iterative and Recursive)
6. How to write C functions that modify head pointer of a Linked List?
7. Swap nodes in a linked list without swapping data
8. Reverse a linked list
9. Merge two sorted linked lists
10. Merge Sort for Linked Lists
11. Reverse a Linked List in groups of given size
12. Detect and Remove Loop in a Linked List
13. Add two numbers represented by linked lists | Set 1
14. Rotate a Linked List
15. Circular Linked List Introduction and Applications,
16. Circular Singly Linked List Insertion<
17. Circular Linked List Traversal
18. Split a Circular Linked List into two halves
19. Sorted insert for circular linked list
20. Doubly Linked List Introduction and Insertion
21. Delete a node in a Doubly Linked List
22. Reverse a Doubly Linked List
23. Quick sort on Doubly Linked List
24. Merge Sort for Doubly Linked List
25. Introduction to Stack
26. Infix to Postfix Conversion using Stack
27. Evaluation of Postfix Expression
28. Reverse a String using Stack
29. Implement two stacks in an array
30. Check for balanced parentheses in an expression
31. Next Greater Element
32. Reverse a stack using recursion
33. Sort a stack using recursion
34. Design and Implement Special Stack Data Structure
35. Implement Stack using Queues
36. Design a stack with operations on middle element37.How to efficiently implement k stacks in a single array?
38. Sort a stack using recursion
39. Queue Introduction and Array Implementation
40. Linked List Implementation of Queue
41. Applications of Queue Data Structure
42. Priority Queue Introduction

43. Deque (Introduction and Applications)
44. Implementation of Deque using circular array
45. Implement Queue using Stacks
46. LinearSearch,BinarySearch,JumpSearch,InterpolationSearch,ExponentialSearch
47. SelectionSort,BubbleSort,InsertionSort,MergeSort,HeapSort,Quicksort,RadixSort,CountingSort,BucketSort,ShellSort.
48. Tree Traversals
49. BFS vs DFS for Binary Tree
50. Level Order Tree Traversal
51. Diameter of a Binary Tree
52. Inorder Tree Traversal without Recursion
53. Inorder Tree Traversal without recursion and without stack!
54. Threaded Binary Tree
55. Maximum Depth or Height of a Tree
56. If you are given two traversal sequences, can you construct the binary tree?
57. Clone a Binary Tree with Random Pointers
58. Construct Tree from given inorder and Preorder traversals
59. Maximum width of a binary tree
60. Print nodes at k distance from root
61. Print Ancestors of a given node in Binary Tree
62. Check if a binary tree is sub tree of another binary tree
63. Connect nodes at same level
64. Search and insert in BST
65. Deletion from BST
66. Minimum value in a Binary Search Tree
67. Inorder predecessor and successor for a given key in BST
68. Check if a binary tree is BST or not
69. Lowest Common Ancestor in a Binary Search Tree.
70. Inorder Successor in Binary Search Tree
71. Binomial Heap
72. Fibonacci Heap
73. Heap Sort
74. Separate Chaining for Collision Handling
75. Open Addressing for Collision Handling
76. Breadth First Traversal for a Graph
77. Depth First Traversal for a Graph
78. Applications of Depth First Search
79. Applications of Breadth First Traversal
80. Detect Cycle in a Directed Graph
81. Detect Cycle in an Undirected Graph
82. Detect cycle in an undirected graph

Department of Engineering Mathematics and Computing
Computing Lab

(MAC-3250326)

Numerical Techniques Using MATLAB List of Topics in Experiments

1. Introduction to MATLAB and Simple Calculations with MATLAB.
2. Creating Arrays and Mathematical Operations in MATLAB.
3. Two Dimensional Plots in MATLAB.
4. User Define function and function file.
5. Loops and Conditional Statements in MATLAB.
6. Polynomial and Interpolation.
7. Application on Numerical Methods:
    a. Solving Algebraic Equations of one variable
    b. Finding Maxima & Minima
    c. Numerical Integration.
    d. Ordinary Differential Equation.
8. Three dimensional Plots.

List of Experiments

1.If X=[1 4; 8 3], Find

a) the inverse matrix of X.
b) the diagonal of X.
c) the sum of each column and the sum of whole matrix X.
d) the transpose of X.

2. Plot Sinc function in MATLAB, where Sinc (x) = sin(x) / x, and $-2\pi \le x \le 2\pi$
3. 3-D Plot of function: y=xcos(x); z=exp(x/5)cos(x)+1 for $0 \le x \le 6\pi$.
4. Root Finding
    a) Program for roots of f(x)=0 by Newton Raphson method
    b) Program for roots of f(x)=0 by Bisection method
    c) Program for roots of f(x)=0 by Regula-Falsi method.
5. Solution of a system of simultaneous algebraic equations using the Gaussian Elimination procedure.
6. Determination of Eigen-values and Eigenvectors of a square matrix.
7. Solution of a system of simultaneous algebraic equations using the Gauss-Seidel iterative method.
8. Program for solving tointegral of a given function using Trapezoidal Rule
9. Program for solving numerical integration by Simpson's 1/3 rule. 10.Program for solving numerical integration by Simpson's 3/8 rule.
11. Program for solving numerical solution of an ordinary differential equation using the Euler's method.
12. Program for solving numerical solution of an ordinary differential equation using the Runge-Kutta -4th order method.

Annexure-XIV

Department of Engineering Mathematics and Computing
Course Outcomes (CO's) Attainment
(July- Dec. 2023)

Course Outcomes (CO's)

B. Tech. (III, V & VII Sem.) July- Dec. -2023

Subject & Code/ CO's	CO's	Description of CO's
Stochastic Process & Mathematics Finance (2250321)	CO1	Define and describe market models, growth and decay curve
	CO2	Analyze free risk assets in financial sector
	CO3	Deal with the market risk measurement and management
	CO4	Employ discrete market models and able to manage portfolio.
	CO5	Explore stochastic differential equations
Discrete Mathematical Structure (2250322)	CO1	Acquire Knowledge of set theory
	CO2	Analyse the concept of Lattices
	CO3	Identify the concept of Group Theory
	CO4	Derive the Inferences from Graph theory
	CO5	Illustrate the Discrete numeric function and recursive relation
Operating System Concepts (2250323)	CO1	Outline the basic concept of operating systems
	CO2	Analyze the working of operating system
	CO3	Examine the working of various scheduling/allocation approaches
	CO4	Measure the performance of various scheduling/allocation approaches
	CO5	Compare the various operating system problems/issues
Data Structure & Algorithm (2250324)	CO1	Outline the basics of Algorithms and their performance criteria's.
	CO2	Explain the working of linear/Non Linear data structures.
	CO3	Identify the appropriate data structure to solve specific problems
	CO4	Analyze the performance of various data structures & their applications
	CO5	Evaluate the time/space complexities of various data structures & their applications.

Numerical Technique (2250325)	**CO1**	Identify the concepts Algebraic & Transcendental Equations
	CO2	Acquire the knowledge of finite difference
	CO3	Describe numerical integration and differentiation
	CO4	Illustrate the numerical solution of ordinary differential equation
	CO5	Apply finite difference methods to solve Partial differential equations
Computer Networks (250501)	**CO1**	Analyze the requirements for a given organizational structure and select the most appropriate networking architecture and technologies.
	CO2	Acquire the knowledge of network layers.
	CO3	Specify and identify deficiencies in existing protocols, and then go onto formulate new and better protocols
	CO4	Analyze, specify and design the topological and routing strategies for an IP based networking infrastructure
	CO5	Know the issues and solution to access shared medium
Real and Complex Analysis (250502)	**CO1**	Grasp basic concept of real number system and their applications in engineering problems.
	CO2	Analyse various properties of continuity and uniform continuity and compare them.
	CO3	Apply concepts of Riemann Integral to solve engineering problems.
	CO4	Recognize and Analyse the applications of complex valued function in real world engineering problems.
	CO5	Classify various forms of singularities of complex valued functions and their expansion in valid region of convergence.
Data Science using Python (250504)	**CO1**	Define different Data Science techniques.
	CO2	Apply different TOOL used for Data Science technique.
	CO3	Apply data visualization techniques to solve real world problems.
	CO4	Build exploratory data analysis for Data Science methods.
	CO5	Build Data Science techniques for solving real world problems.
Optimization Techniques (250505)	**CO1**	Determine the solution of Linear Programming Problem
	CO2	Express the solution of Non Linear Programming Problem
	CO3	Find the Optimal solution using PERT/CPM
	CO4	Acquire the knowledge of Game theory.
	CO5	Evaluate the different models of inventory.
UHPVE (1000008)	**CO1**	to become more aware of their surroundings, society, social problems and their sustainable solutions.
	CO2	to become sensitive to their commitment towards what they believe in (humane values. humane relationships and humane society).
	CO3	to apply what they have learnt to their own self in different day-to-day settings in real life.
	CO4	to sustain human relationships and human nature in mind.
	CO5	to have better critical ability.
	CO6	to negotiate living in harmony with self and others.
Engineering Reliability (250731)	**CO1**	Determine the reliability of system
	CO2	Evaluation of measure for system reliability

	CO3	Apply Markov process to carried out system reliability
	CO4	Acquire the knowledge of maintainability and availability of system
	CO5	Describe Software reliability growth model
Distributed Computing (250732)	CO1	Tell the basic elements and concepts related to distributed system technologies
	CO2	Demonstrate knowledge of the core architectural aspects of distributed systems
	CO3	Identify how the resources in a distributed system are managed by algorithm
	CO4	Examine the concept of distributed file system and distributed shared memory
	CO5	Compare various distributed system algorithms for solving real world problems
Mathematics - II 2100025	CO1	Apply the Fourier series and Laplace Transform for solving engineering Problems.
	CO2	Solve Ordinary Differential Equation of Second Order.
	CO3	Solve Partial Differential equations application for various engineering problems.
	CO4	Solve problems of Vector Calculus.
	CO5	Apply probability theory with distributions for statistically analysis of given data.
Mathematics - I 2100011	CO1	Apply differential Calculus in basic engineering problems
	CO2	Use integration techniques to determine the solution of various complex problems
	CO3	Solve the differential equations by various methods
	CO4	Solve the problem of matrix.
	CO5	Concept of Boolean algebra and graph theory.
Foundation Computational Science (680111)	CO1	Acquire Knowledge of set theory
	CO2	Analyse the concept of Lattices
	CO3	Identify the concept of Group Theory
	CO4	Derive the Inferences from Graph theory
	CO5	Illustrate the Discrete numeric function and recursive relation
Probability and Random Process (2250106)	CO1	Interpreting the theory of Probability and its distributions
	CO2	Evaluating the Skewness, Kurtosis, curve fitting, correlation and regression.
	CO3	Applying the various test to validate the hypothesis
	CO4	Explaining the knowledge of random variables.
	CO5	Judging the various random process
Linear Algebra (2250100)	CO1	Determine the solution of Matrix
	CO2	Find the analytical solution of algebraic structures'
	CO3	Express the vector space
	CO4	Acquire the knowledge of Linear transformation
	CO5	Illustrate the concept of Inner product spaces

Department of Engineering Mathematics & Computing
Action Taken Report Based on Course Outcomes (CO's)

(MAC- III, V & VII Sem.)

July- Dec. -2023

- More numerical questions should be solved in tutorial classes
- More tutorial classes should be conducted for doubt clarification
- If necessary, additional classes to be conducted other than remedial classes
- Emphasis on rigorous exercises through assignments
- Provide various numerical problems in tutorial sheet
- Tutorials should include real world application and problems
- Creating interest of students for solving practical problems
- More lab session will be planned for slow learner
- Explain various aspect of analytical and numerical problems of different courses
- Discuss various analytical and logical problems for enhancing their knowledge
- Extra time will be given for slow learner
- Quiz contain vast variety of problems including numerical, analytical and logical problems
- Focus on slow students for improving their knowledge
- Motivate the students by regular interaction with related topics

Co Attainment & Gap Analysis

B. Tech. (III, V & VII Sem.) July- Dec. -2023 MAC-III Sem.

MAC- III Sem.

Name of Faculty	Course Name & Code	Course Outcomes	CO Attainment %			CO Attainment %					Result		CO Attainment	
			I- Mid Term	II- Mid Term	End Sem. Exam	Direct	In-Direct	Overall	Target	Gap in Attainment %	Registered Students	PASS	Status	Action Taken
Dr. S. K. Bharadwaj	Stochastic Process & Mathematics Famnace	CO-1	73.06		91.38	82.22	69.00	79.57	60.00	-14.57	80	75	Attained	
		CO-2	66.72		90.22	78.47	67.00	76.18	60.00	-11.18			Attained	
		CO-3		62.38	77.84	65.11	61.00	63.49	60.00	-6.51			Attained	
		CO-4		65.69	74.22	69.96	66.00	69.17	60.00	-4.17			Attained	
		CO-5		62.70	86.71	74.70	64.00	72.56	60.00	-7.56			Attained	
Dr. D.K. Jain	Discrete Mathematical Structure (250322)	CO-1	67.06		91.38	79.22	62.00	75.77	60.00	-15.77	80	74	Attained	
		CO-2	55.31		90.22	72.76	65.00	71.21	60.00	-11.21			Attained	
		CO-3		51.39	77.84	64.62	55.00	62.69	60.00	-2.69			Attained	
		CO-4		71.94	74.22	73.08	60.00	70.47	60.00	-10.47			Attained	
		CO-5		79.86	86.71	83.28	61.00	78.83	60.00	-18.83			Attained	
Prof. P. Sharma	Data Structure and Algorithm (250324)	CO-1	71.00		84.76	77.88	84.76	79.26	60.00	-19.26	80	77	Attained	
		CO-2	63.59		92.06	77.83	92.06	80.67	60.00	-20.67			Attained	
		CO-3		68.40	75.90	72.15	75.90	72.90	60.00	-12.90			Attained	
		CO-4		63.82	70.83	67.32	70.83	68.02	60.00	-8.02			Attained	
		CO-5		66.39	83.37	74.88	83.37	76.58	60.00	-16.58			Attained	
Dr. J.K. Muthele	Numerical Technique (250325)	CO-1	72.53		91.38	81.95	76.00	80.76	60.00	-20.76	80	75	Attained	
		CO-2	74.00		90.22	82.11	74.00	80.49	60.00	-20.49			Attained	
		CO-3		76.67	77.84	77.26	69.00	75.60	60.00	-15.60			Attained	
		CO-4		71.43	74.22	72.82	68.00	71.86	60.00	-11.86			Attained	
		CO-5		75.00	86.71	80.85	61.00	76.88	60.00	-16.88			Attained	

MAC V SEM

Name of Faculty	Course Name & Code	Course Outcomes	CO Attainment %			CO Attainment %					Result		CO Attainment	
			I- Mid Term	II- Mid Term	End Sem Exam	Direct	InDirect	Overall	Target	Gap in Attainment %	Registered Students	PASS	Status	Action Taken
Prof Vivek Sharma	Computer Networks (250501)	CO-1	49.22		91.38	70.30	70.00	70.24	60.00	-10.24	68	64	Attained	
		CO-2	54.00		90.22	72.11	71.00	71.89	60.00	-11.89			Attained	
		CO-3		77.93	77.84	77.89	59.00	74.11	60.00	-14.11			Attained	
		CO-4		83.19	74.22	78.71	59.00	74.77	60.00	-14.77			Attained	
		CO-5		71.67	86.71	79.19	64.00	76.15	60.00	-16.15			Attained	
Dr. Divya Charturvedi	Real and Complex Analysis (250502)	CO-1	69.44		91.38	80.41	59.00	76.13	60.00	-16.13	68	63	Attained	
		CO-2	68.44		90.22	79.33	60.00	75.46	60.00	-15.46			Attained	
		CO-3		65.63	77.84	71.73	61.00	69.59	60.00	-9.59			Attained	
		CO-4		69.69	74.22	71.96	62.00	69.96	60.00	-9.96			Attained	
Dr. Atul K Ray	Data Science using Python (250504)	CO-5		71.94	86.71	79.33	61.00	75.66	60.00	-15.66			Attained	
		CO-1	73.03		91.38	82.20	64.00	78.56	60.00	-13.56	68	66	Attained	
		CO-2	74.22		90.22	82.22	69.00	79.58	60.00	-14.58			Attained	
		CO-3		73.96	77.84	75.90	54.00	71.52	60.00	-6.52			Attained	
		CO-4		68.55	74.22	71.39	63.00	69.71	60.00	-4.71			Attained	
		CO-5		77.64	86.71	82.17	61.00	77.94	60.00	-12.94			Attained	
Dr. V.P.Shinde	Optimization Techniques (250505)	CO-1	74.75		82.66	78.71	71.00	77.17	60.00	-22.17	68	60	Attained	
		CO-2	65.86		92.39	79.12	73.00	77.90	60.00	-22.90			Attained	
		CO-3		71.88	74.29	73.08	74.00	73.27	60.00	-18.27			Attained	
		CO-4		65.63	79.87	72.75	65.00	71.20	60.00	-16.20			Attained	
		CO-5		89.17	83.37	86.27	62.00	81.41	60.00	-26.41			Attained	

MAC- VII Sem.

Name of Faculty	Course Name & Code	Course Outcomes	CO Attainment %			CO Attainment %					Result		CO Attainment	
			I- Mid Term	II- Mid Term	End Sem. Exam	Direct	In-Direct	Overall	Target	Gap in Attainment %	Registered Students	PASS	Status	Action Taken
Dr. V.P.Shinde	Engineering Reliability (MAC-250731)	CO-1	61.25		91.38	76.32	84	77.85	65	-7.85	130	124	Attained	
		CO-2	61.92		90.22	76.07	73	75.45	65	-5.45			Attained	
		CO-3		74.86	77.84	76.35	74	75.88	65	-5.88			Attained	
		CO-4		72.83	75.22	66.53	65	71.02	65	-5.02			Attained	
		CO-5		77.22	86.71	81.97	62	77.97	65	-7.97			Attained	
Prof. Ram Naresh Sharma	Distributed Computing (MAC-250732)	CO-1	61.33		91.38	76.36	61	73.29	65	-8.29	135	125	Attained	
		CO-2	60.08		90.22	75.15	59	71.92	65	-6.92			Attained	
		CO-3		59.79	77.84	68.82	57	66.45	65	-1.45			Attained	
		CO-4		62.92	74.22	68.57	63	67.45	65	-2.45			Attained	
		CO-5		64.38	86.71	75.54	60	72.43	65	-7.43			Attained	
Dr. S Khama	UHPVE (1000008)	CO-1	63.03		91.38	77.2	70	75.76	65	-5.76	134	129	Attained	
		CO-2	75		90.22	82.61	65	79.09	65	-9.09			Attained	
		CO-3		69.1	77.84	73.47	60	70.78	65	-0.78			Attained	
		CO-4		65.5	74.22	68.36	68	67.49	65	-3.51			Attained	
		CO-5		61.18	86.71	73.94	65	72.16	65	-2.16			Attained	

Engineering Mathematics- (2100011)

Name of Faculty	Course Name & Code	Course Outcomes	CO Attainment %			CO Attainment %					Result		CO Attainment	
			I- Mid Term	II- Mid Term	End Sem Exam	Direct	InDirect	Overall	Target	Gap in Attainment %	Registered Students	PASS	Status	Action Taken
Prof. A. Shukla	Engg Mathematics-I (ME-2100011)	CO-1	65.62		79.12	70.37	71	70.5	70	-4.5	287	254	Attained	
		CO-2	87.5		91.33	89.41	73	86.13	70	11.13			Attained	
		CO-3		77.08	74.78	75.93	74	75.55	70	-0.55			Attained	
		CO-4		76.04	64.28	70.16	65	69.13	70	5.87			Not Attained	To Organize t Classes .Give Assignments
		CO-5		88.89	83.97	86.43	62	81.54	70	-6.54			Attained	
Dr. Rachana Gupta	Engg. Mathematics-I (EE-2100011)	CO-1	81		78.5	79.75	71	78	70	-8	168	151	Attained	
		CO-2	72.81		93.24	83.02	73	81.02	70	-11.02			Attained	
		CO-3		76.75	76.86	76.8	74	76.24	70	-6.24			Attained	
		CO-4		77.93	81.84	79.88	65	76.91	70	-6.91			Attained	
		CO-5		83.19	84.38	83.79	62	79.43	70	-9.43			Attained	
Prof. Mukesh Kumar	Engg. Mathematics-II (CE-2100011)	CO-1	63.62		83.26	73.44	71	72.95	70	-2.95	176	168	Attained	
		CO-2	65.47		94.38	47.19	73	52.35	70	17.65			Not Attained	Doubt Clearing S arranged in Extra H
		CO-3		79.17	71.62	75.4	74	75.12	70	-5.12			Attained	
		CO-4		81.25	64.18	72.71	65	71.17	70	-1.17			Attained	
		CO-5		89.17	74.71	81.94	62	77.95	70	-7.95			Attained	
Dr. SK Bhardwaj	Engg. Mathematics-I (CSE-2100011)	CO-1	81		78.5	79.75	71	78	70	-8	168	151	Attained	
		CO-2	72.81		93.24	83.02	73	81.02	70	11.02			Attained	
		CO-3		76.75	76.86	76.8	74	76.24	70	-6.24			Attained	
		CO-4		77.93	81.84	79.88	65	76.91	70	-6.91			Attained	
		CO-5		83.19	84.38	83.79	62	79.43	70	-9.43			Attained	

MCA- I Sem.

Name of Faculty	Course Name & Code	Course Outcomes	CO Attainment %			CO Attainment %					Result		CO Attainment	
			I- Mid Term	II- Mid Term	End Sem Exam	Direct	InDirect	Overall	Target	Gap in Attainment %	Registered Students	PASS	Status	Action Taken
Prof. D.K. Mishra	MCA650111	CO 1	81.00		78.50	79.75	71.00	78.00	70.00	-8.00	59	58	Attained	
		CO-2	72.81		93.24	83.02	73.00	81.02	70.00	-11.02			Attained	
		CO-3		76.75	76.86	76.80	74.00	76.24	70.00	-6.24			Attained	
		CO-4		77.93	81.84	79.88	65.00	76.91	70.00	-6.91			Attained	
		CO-5		83.19	84.38	83.79	62.00	79.43	70.00	-9.43			Attained	

Engineering Mathematics- II (2100025) Sem. –III

Name of Faculty	Course Name & Code	Course Outcomes	CO Attainment %			CO Attainment %					Result		CO Attainment	
			I- Mid Term	II- Mid Term	End Sem Exam	Direct	InDirect	Overall	Target	Gap in Attainment %	Registered Students	PASS	Status	Action Taken
Dr. J. K. Muthele	Mathematics- II (IT-100025)	CO-1	81.00		78.50	79.75	71.00	78.00	70.00	-8.00	87	73	Attained	
		CO-2	72.81		93.24	83.02	73.00	81.02	70.00	-11.02			Attained	
		CO-3		76.75	76.86	76.80	74.00	76.24	70.00	-6.24			Attained	
		CO-4		77.93	81.84	79.88	65.00	76.91	70.00	-6.91			Attained	
		CO-5		83.19	84.38	83.79	62.00	79.43	70.00	-9.43			Attained	
Prof. A. Shukla	Mathematics- I (ET-100025)	CO-1	63.62		83.26	73.44	71.00	72.95	70.00	-2.95	74	68	Attained	
		CO-2	77.91		94.38	47.19	73.00	52.35	70.00	-6.25			Attained	
		CO-3		79.17	71.62	75.40	74.00	75.12	70.00	-5.12			Attained	
		CO-4		81.25	64.18	72.71	65.00	71.17	70.00	-1.17			Attained	
		CO-5		89.17	74.71	81.94	62.00	77.95	70.00	-7.95			Attained	

Prof. A. Shukla	Mathematics- II (EE-100025)	CO-1	61.62		79.12	70.37	71.00	70.50	70.00	4.50	172	164	Not Attained	Doubt Clearing Session to be arranged in Extra Hours Remedial Classes.
		CO-2	87.50		91.33	89.41	73.00	86.13	70.00	-11.13			Attained	
		CO-3		77.08	74.78	75.93	74.00	75.55	70.00	-0.55			Attained	
		CO-4		76.04	64.28	70.16	65.00	69.13	70.00	5.87			Not Attained	To Organize the Remedial Classes. Give Assignments.
		CO-5		88.89	83.97	86.43	62.00	81.54	70.00	-6.54			Attained	
Prof. A. Shukla	Mathematics- II (ME-100025)	CO-1	81.00		78.50	79.75	71.00	78.00	70.00	-8.00	182	174	Attained	
		CO-2	72.81		93.24	83.02	73.00	81.02	70.00	-11.02			Attained	
		CO-3		76.75	76.86	76.80	74.00	76.24	70.00	-6.24			Attained	
		CO-4		77.93	81.84	79.88	65.00	76.91	70.00	-6.91			Attained	
		CO-5		83.19	84.38	83.79	62.00	79.43	70.00	-9.43			Attained	
Prof. A. Shukla	Mathematics- II (CE-100025)	CO-1	63.62		83.26	73.44	71.00	72.95	70.00	-2.95	174	162	Attained	
		CO-2	64.28		94.38	47.19	73.00	52.35	70.00	-5.24			Attained	
		CO-3		79.17	71.62	75.40	74.00	75.12	70.00	-5.12			Attained	
		CO-4		81.25	64.18	72.71	65.00	71.17	70.00	-1.17			Attained	
		CO-5		89.17	74.71	81.94	62.00	77.95	70.00	-7.95			Attained	
Dr. D. K. Mishra	Discrete Structure (CSE-150416)	CO-1	88.62		83.97	86.43	62.00	81.54	70.00	-6.54	305	298	Attained	
		CO-2	87.50		91.33	89.41	73.00	86.13	70.00	-11.13			Attained	
		CO-3		77.08	74.78	75.93	74.00	75.55	70.00	-0.55			Attained	
		CO-4		76.04	64.28	70.16	65.00	69.13	70.00	-5.87			Attained	
		CO-5		88.89	83.97	86.43	62.00	81.54	70.00	-6.54			Attained	
Dr. SK Bhardawaj	Mathematics- II (EC-100025)	CO-1	81.00		78.50	79.75	71.00	78.00	70.00	-8.00	182	174	Attained	
		CO-2	72.81		93.24	83.02	73.00	81.02	70.00	-11.02			Attained	
		CO-3		76.75	76.86	76.80	74.00	76.24	70.00	-6.24			Attained	
		CO-4		77.93	81.84	79.88	65.00	76.91	70.00	-6.91			Attained	
		CO-5		83.19	84.38	83.79	62.00	79.43	70.00	-9.43			Attained	

Probability & Random Process (2250106) for B. Tech. (I- Sem.)

Name of Faculty	Course Name & Code	Course Outcomes	CO Attainment %			CO Attainment %					Result		CO Attainment	
			I- Mid Term	II- Mid Term	End Sem. Exam	Direct	In-Direct	Overall	Target	Gap in Attainment %	Registered Students	PASS	Status	Action Taken
Dr. A K Ray	Probability & Random Process (AIR 2250106)	CO-1	61.33		91.38	76.36	61.00	73.29	65.00	-8.29	66	64	Attained	
		CO-2	60.08		90.22	75.15	59.00	71.92	65.00	-6.92			Attained	
		CO-3		59.79	77.84	68.82	57.00	66.45	65.00	-1.45			Attained	
		CO-4		62.92	74.22	68.57	63.00	67.45	65.00	-2.45			Attained	
		CO-5		64.38	86.71	75.54	60.00	72.43	65.00	-7.43			Attained	
Dr. Divya Charturvedi	Probability & Random Process (IT-IoT- 2250106)	CO-1	63.03		91.38	77.20	70.00	75.76	65.00	-5.76	67	64	Attained	
		CO-2	75.00		90.22	82.61	65.00	79.09	65.00	-9.09			Attained	
		CO-3		69.10	77.84	73.47	60.00	70.78	65.00	-0.78			Attained	
		CO-4		65.50	74.22	68.36	64.00	67.49	65.00	-2.51			Attained	
		CO-5		61.18	86.71	73.94	65.00	72.16	65.00	-2.16			Attained	

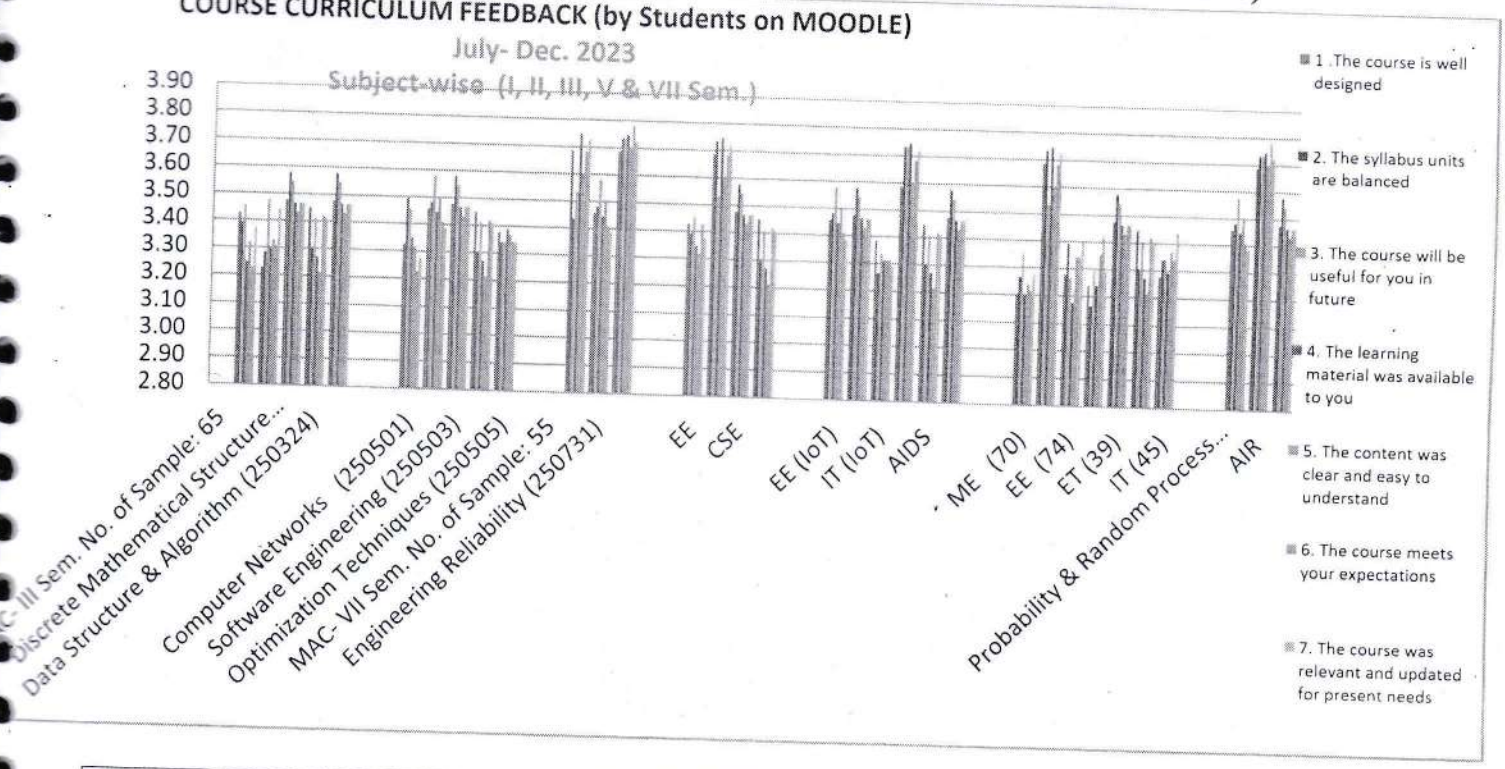
Linear Algebra (250100) MAC-I Sem.

Name of Faculty	Course Name & Code	Course Outcomes	CO Attainment %			CO Attainment %					Result		CO Attainment	
			I- Mid Term	II- Mid Term	End Sem. Exam	Direct	In-Direct	Overall	Target	Gap in Attainment %	Registered Students	PASS	Status	Action Taken
Dr. Divya Charturvedi	Linear Algebra- AIDS-250100)	CO-1	61.25		91.38	76.32	84	77.85	65	-7.85	130	124	Attained	
		CO-2	61.92		90.22	76.07	73	75.45	65	-5.45			Attained	
		CO 3		71.86	77.84	76.35	71	75.88	65	5.88			Attained	
		CO-4		68.83	65.22	66.53	65	71.02	65	1.02			Not Attained	To Organize the Remedial Classes, Give Assignments
		CO-5		77.22	86.71	81.97	62	77.97	65	-7.97			Attained	

Dr. AK Ray	Linear Algebra-(EE-IoT-250100)	CO-1	61.33		91.38	76.36	61	73.29	65	-8.29	135	125	Attained	
		CO-2	60.08		90.22	75.15	59	71.92	65	-6.92			Attained	
		CO-3		59.79	77.84	68.82	57	66.45	65	-1.45			Attained	
		CO-4		62.92	74.22	68.57	63	67.45	65	-2.45			Attained	
		CO-5		64.38	86.71	75.54	60	72.43	65	-7.43			Attained	
Dr. Atul K. Ray	Linear Algebra- CSD-250100)	CO-1	63.03		91.38	77.2	70	75.76	65	-5.76	134	129	Attained	
		CO-2	75		90.22	82.61	65	79.09	65	-9.09			Attained	
		CO-3		69.1	77.84	73.47	60	70.78	65	-0.78			Attained	
		CO-4		62.5	74.22	68.36	64	67.49	65	2.51			Not Attained	Doubt Clearing Session to be arranged To Organize the Remedial Classes, Give Assignments
		CO-5		61.18	86.71	73.94	65	72.16	65	-2.16			Attained	
Dr. Rachana Gupta	Linear Algebra- AIML-250100)	CO-1	61.25		91.38	76.32	84	77.85	65	7.85	130	124	Not Attained	To Organize the Remedial Classes, Give Assignments
		CO-2	61.92		90.22	76.07	73	75.45	65	-5.45			Attained	
		CO-3		74.86	77.84	76.35	74	75.88	65	-5.88			Attained	
		CO-4		68.83	65.22	66.53	65	71.02	65	1.02			Not Attained	To Organize the Remedial Classes, Give Assignments
		CO-5		77.22	86.71	81.97	62	77.97	65	-7.97			Attained	
Prof. S. Sharma	Linear Algebra-(AIR-250100)	CO-1	61.33		91.38	76.36	61	73.29	65	-8.29	135	125	Attained	
		CO-2	60.08		90.22	75.15	59	71.92	65	-6.92			Attained	
		CO-3		59.79	77.84	68.82	57	66.45	65	-1.45			Attained	
		CO-4		62.92	74.22	68.57	63	67.45	65	-2.45			Attained	
		CO-5		64.38	86.71	75.54	60	72.43	65	-7.43			Attained	
Dr. Atul K. Ray	Linear Algebra- (IT-IoT-250100)	CO-1	63.03		91.38	77.2	70	75.76	65	-5.76	134	129	Attained	
		CO-2	75		70.22	62.61	65	79.09	65	9.09			Not Attained	Doubt Clearing Session to be arranged To Organize the Remedial Classes, Give Assignments
		CO-3		69.1	77.84	73.47	60	70.78	65	-0.78			Attained	
		CO-4		62.5	74.22	68.36	64	67.49	65	2.51			Attained	
		CO-5		61.18	86.71	73.94	65	72.16	65	-2.16			Attained	

MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR (M.P.), INDIA
Deemed to be University
(Declared under Distinct Category by Ministry of Education, Government of India)
NAAC ACCREDITED WITH A++ GRADE

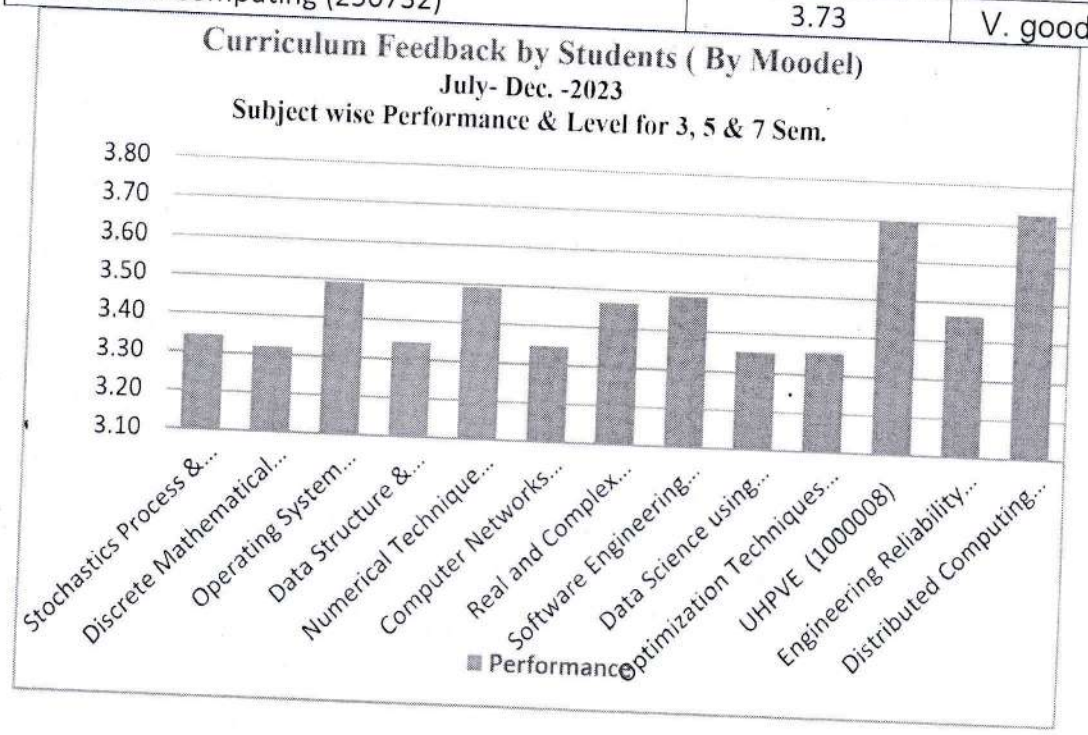
Course Curriculum Feedback by Student (July- Dec. -2023)



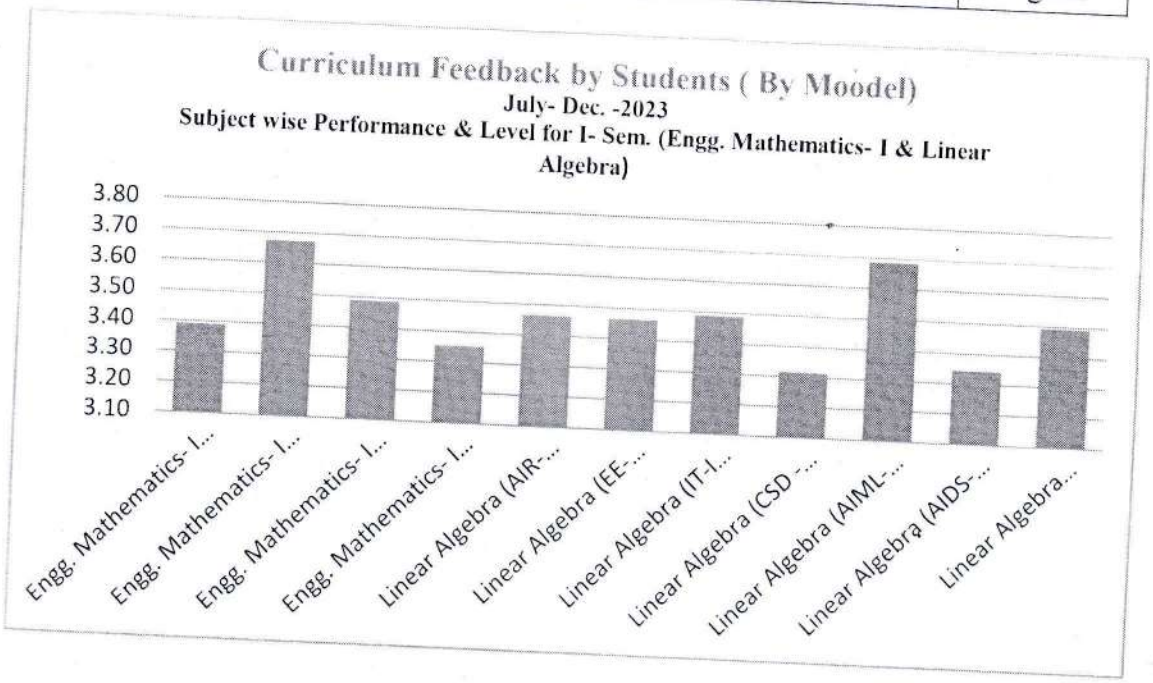
Subject & Code	Parameters of Curriculum
Stochastic Process & Mathematics Finance (250321)	1. The course is well designed. 2. The syllabus units are balanced. 3. The course will be useful for you in future. 4. The learning material was available to you. 5. The content was clear and easy to understand. 6. The course meets your expectations. 7. The course was relevant and updated for present needs
Discrete Mathematical Structure (250322)	
Operating System Concepts (250323)	
Data Structure & Algorithm (250324)	
Numerical Technique (250325)	
Computer Networks (250501)	
Real and Complex Analysis (250502)	
Software Engineering (250503)	
Data Science using Python (250504)	
Optimization Techniques (250505)	
UHPVE (1000008)	
Engineering Reliability (250731)	
Distributed Computing (250732)	
Engg. Mathematics- I (3100011)	
Linear Algebra (250100)	
Mathematics- II (2100025)	
Probability & Random Process (250300)	

Course Curriculum Feedback Performance & Level:

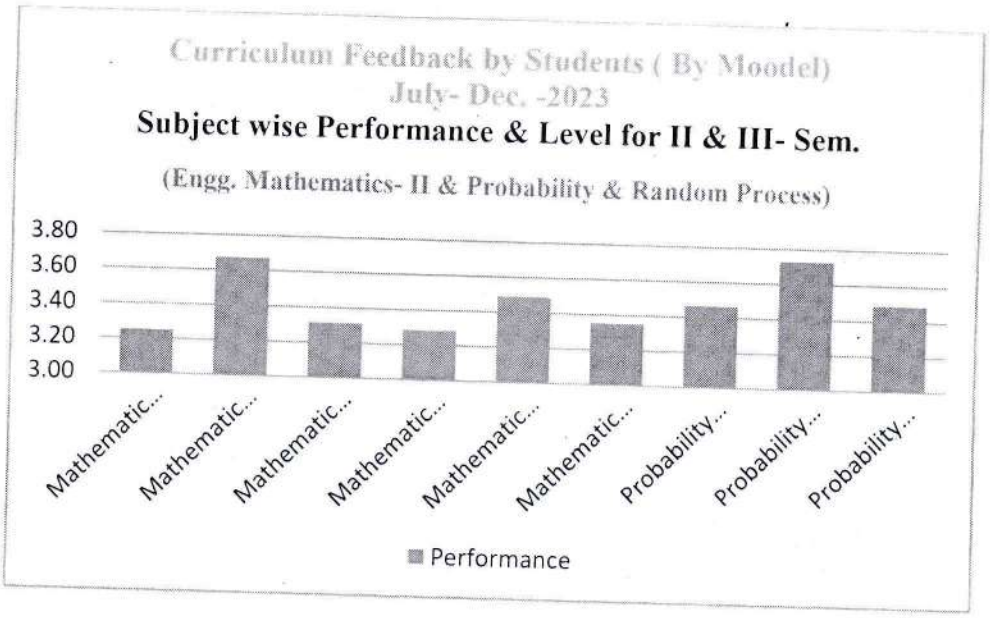
Subject & Code	Performance	Level
Stochastic Process & Mathematics Fanniace (250321)	3.34	good
Discrete Mathematical Structure (250322)	3.32	good
Operating System Concepts (250323)	3.49	V. good
Data Structure & Algorithm (250324)	3.35	good
Numerical Technique (250325)	3.49	V. good
Computer Networks (250501)	3.35	good
Real and Complex Analysis (250502)	3.47	good
Software Engineering (250503)	3.49	V. good
Data Science using Python (250504)	3.35	good
Optimization Techniques (250505)	3.36	good
UHPVE (1000008)	3.70	V. good
Engineering Reliability (250731)	3.47	good
Distributed Computing (250732)	3.73	V. good



Subject & Code	Performance	Level
Engg. Mathematics- I (CE-100011)	3.39	good
Engg. Mathematics- I (ME-100011)	3.67	V. good
Engg. Mathematics- I (EE-100011)	3.49	good
Engg. Mathematics- I (CSE- 100011)	3.35	good
Linear Algebra (AIR-250100)	3.47	V. good
Linear Algebra (EE-IoT 250100)	3.47	good
Linear Algebra (IT-I OT 250100)	3.49	good
Linear Algebra (CSD -250100)	3.32	V. good
Linear Algebra (AIML-250100)	3.69	good
Linear Algebra (AIDS-250100)	3.35	good
Linear Algebra (250100)	3.49	V. good



Subject & Code	Performance	Level
Mathematics- II (ME- 100025)	3.25	good
Mathematics- II (CE-100025)	3.67	V. good
Mathematics- II (EE- 100025)	3.31	good
Mathematics- II (EL-100025)	3.29	good
Mathematics- II (ET-100025)	3.49	V. good
Mathematics- II (CSE-100025)	3.35	good
Probability & Random Process (EE-IoT 250300)	3.47	good
Probability & Random Process (AIR 250300)	3.73	V. good
Probability & Random Process (IT-IoT 250300)	3.49	good



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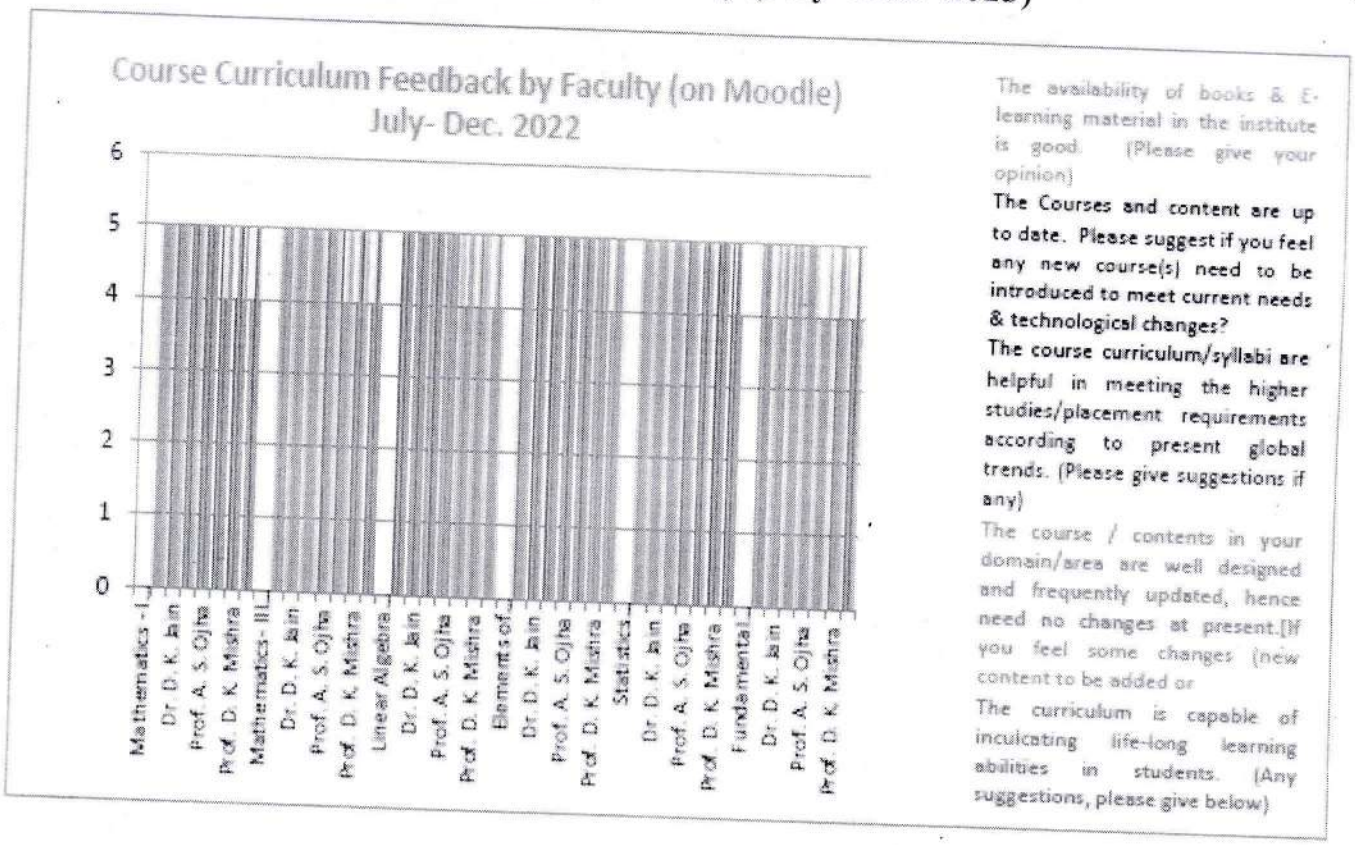
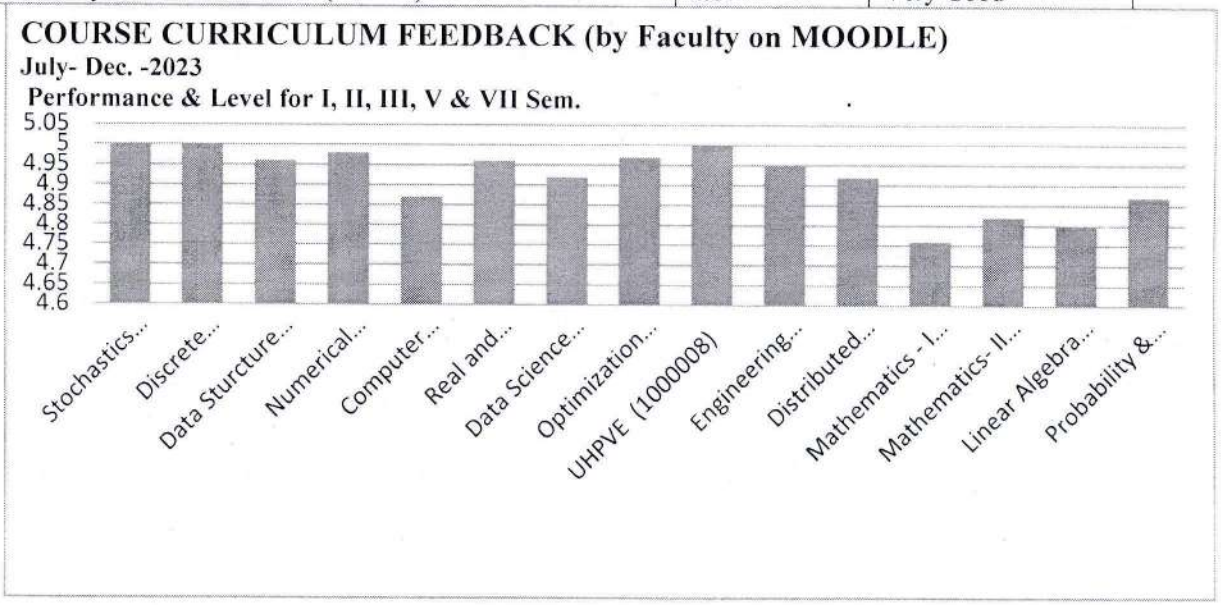
Course Curriculum Feedback by Faculty (July- Dec. -2023)



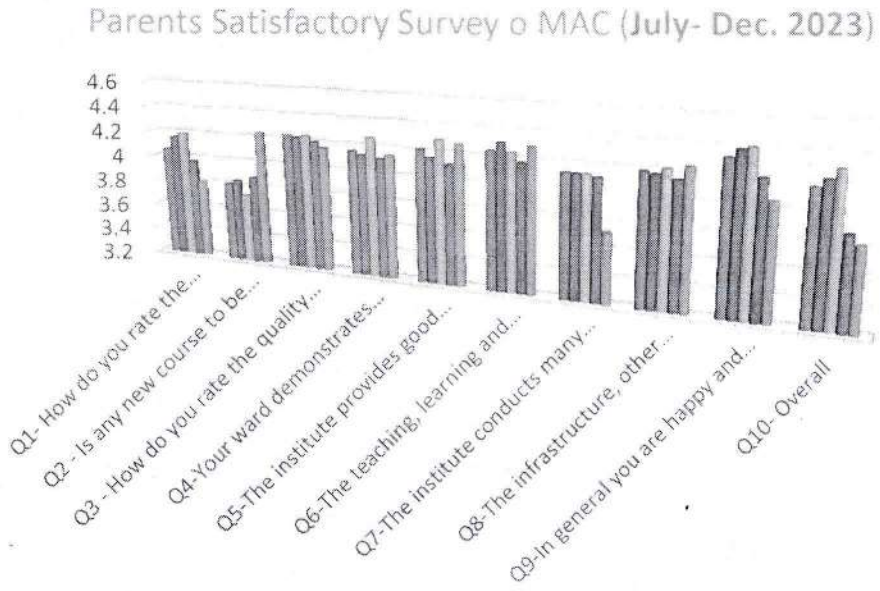
Subject & Code	Parameters of Curriculum
Stochastic Process & Mathematics Fanniace (250321)	Q1. The availability of books & E-learning material in the institute is good. (Please give your opinion). Q2. The Courses and content are up to date. Please suggest if you feel any new course(s) need to be introduced to meet current needs & technological changes? . Q3. The course curriculum/syllabi are helpful in meeting the higher studies/placement requirements according to present global trends. (Please give suggestions if any) . Q4. The course / contents in your domain/area are well designed and frequently updated, hence need no changes at present.[If you feel some changes (new content to be added or Q5. The curriculum is capable of inculcating life-long learning abilities in students. (Any suggestions, please give below).
Discrete Mathematical Structure (250322)	
Data Structure and Algorithm (250324)	
Numerical Technique (250325)	
Computer Networks (250501)	
Real and Complex (250502)	
Data Science using Python (250504)	
Optimization Techniques (250505)	
UHPVE (1000008)	
Engineering Reliability (250731)	
Distributed Computing (250732)	
Mathematics - I (3100011)	
Mathematics- II (100025)	
Linear Algebra (250100)	
Probability & Random Process (250300)	

Course Curriculum Feedback Performance & Level:

Subject & Code	Performance	Level
Stochastic Process & Mathematics Fanniace (250321)	5	Excellent
Discrete Mathematical Structure (250322)	5	Excellent
Data Structure and Algorithm (250324)	4.96	Very Good
Numerical Technique (250325)	4.98	Very Good
Computer Networks (250501)	4.87	Very Good
Real and Complex (250502)	4.96	Very Good
Data Science using Python (250504)	4.92	Very Good
Optimization Techniques (250505)	4.97	Very Good
UHPVE (1000008)	5.00	Excellent
Engineering Reliability (250731)	4.95	Very Good
Distributed Computing (250732)	4.92	Very Good
Mathematics - I (3100011)	4.76	Very Good
Mathematics- II (100025)	4.82	Very Good
Linear Algebra (250100)	4.80	Very Good
Probability & Random Process (250300)	4.87	Very Good



Parents Satisfactory Survey



Feedback Points and Satisfactory Index with Level

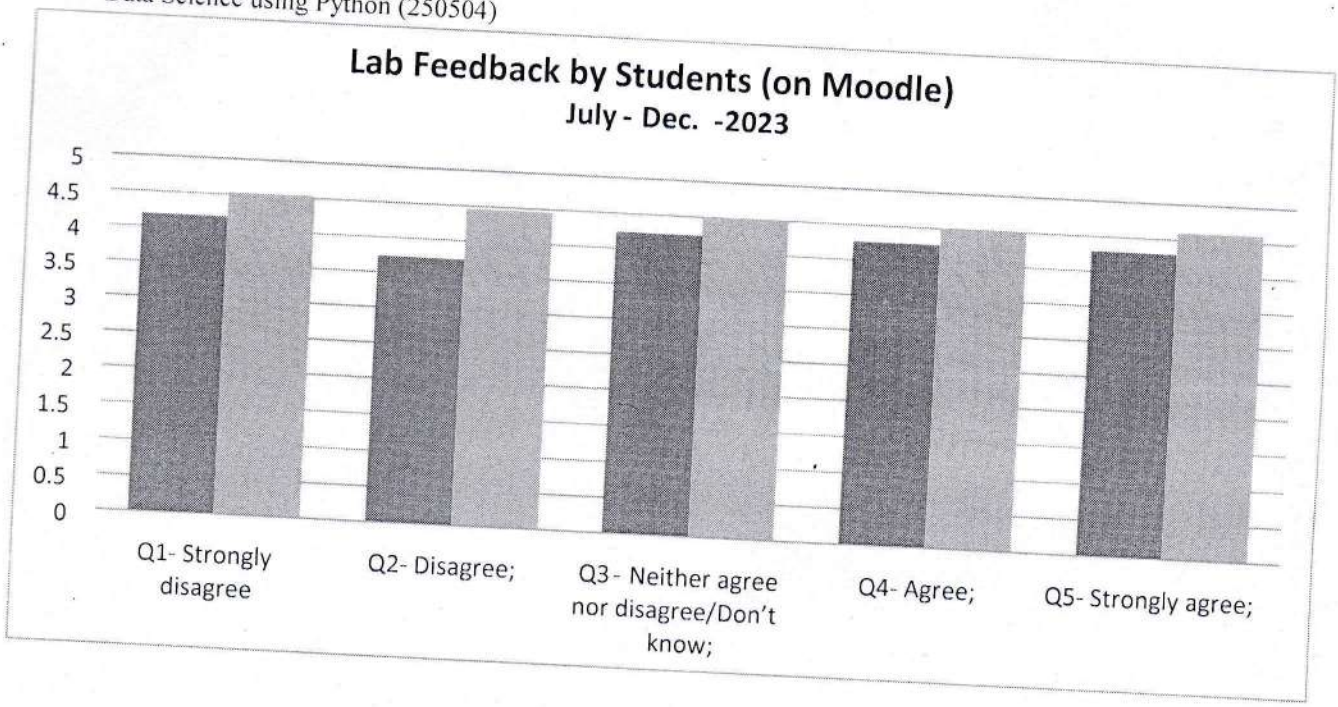
- **Strongly disagree (दृढ़तापूर्वकअसहमत)**
- **Disagree (असहमत)**
- **Neither agree nor disagree (नतोइसबातसेसहमतहैऔरनहीअसहमत)**
- **Agree (सहमत)**
- **Strongly agree (दृढ़तापूर्वकसहमत)**

Parent Satisfaction Index & Level

4.0358	3.9024	4.217	4.1664	4.211	4.2534	4.0506	4.1936	4.2748	4.0802
V. Good	Good	V. Good	V. Good	V. Good	V. Good	V. Good	V. Good	V. Good	V. Good

Lab Feedback by Students (on Moodle)

- Data Structure and Algorithm (250324)
- Data Science using Python (250504)



Feedback Points and Satisfactory Index with Level

- **Strongly disagree (दृढ़तापूर्वकअसहमत)**
- **Disagree (असहमत)**
- **Neither agree nor disagree (नतोइसबातसेसहमतहैऔरनहीअसहमत)**
- **Agree (सहमत)**
- **Strongly agree (दृढ़तापूर्वकसहमत)**

Parent Satisfaction Index & Level

4.364	4.096	4.3715	4.385	4.456
V. Good	V. Good	V. Good	V. Good	V. Good