Minutes of Meeting

Board of Studies of Centre for Internet of Things

B.Tech Internet of Things(IoT)

30 May, 2024

MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR
(Deemed to be University
Declared Under Distinct Category by Ministry of Education, Government of India
Centre for Internet of Things

MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR
(Deemed to be University)
(Declared Under Distinct Category by Ministry of Education, Government of India)
NAAC Accredited with A++ Grade

Centre for Internet of Things

Date: 31-05-2024

Summary

(Approved by Academic Development Cell of the institute - BoS Meeting scheduled on 30th May 2024)

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
Data Sciences in IoT	2230522	2022/ 01.07.22	2024/ 30.05.24	5%	08		Click Here
Cloud Computing	2230525	2022/ 01.07.23	2024/ 30.05.24	10%	09		Click Here

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
Programming in Java	2230521	Java Programming essential coding skills for software development, enhancing employability in tech-driven industries.	08		Click Here
Data Sciences in IoT	2230522	Learn to analyze IoT-generated data, driving smart solutions and boosting career prospects in emerging technologies.	08		
Data Analytics for IoT	230731	Acquire expertise in extracting insights from IoT data, increasing employability in data-centric roles.	02		

Deep Learning- IIT Ropar	230763	Deep Learning has received a lot of attention over the past few years and has been employed successfully by companies like Google, Microsoft, IBM, Facebook, Twitter etc. to solve a wide range of problems in Computer Vision and Natural Language Processing	03		
The Joy of Computing using Python	230765	The course brings programming to your desk with anecdotes, analogies and illustrious examples	03		
Big Data Computing	230764	This course provides an in-depth understanding of terminologies and the core concepts behind big data problems, applications, systems and the techniques, that underlie today's big data computing technologies	03		
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**
Electronic Systems Thinking & Circuits	3230325	Develop skills in designing, analyzing, and troubleshooting electronic circuits. Engage in hands-on projects and simulations, enhancing problem-solving abilities and employability in electronics and engineering sectors.	13		Click Here
Data Analytics for IoT	230731	Learn to analyze IoT-generated data, driving smart solutions and boosting career prospects	02		

		in emerging technologies.			
Mobile Computing	230735	In this course, Student will learn android programming to create applications for smartphones. We will also learn integration of mobile applications with cloud services to create mobile cloud applications.	03		
Smart Energy Analytics	-	Develop technical skills in energy data analysis and practical experience with smart grid technologies, for in-demand roles in the evolving energy sector.	03		

Feedback on curriculum received from stakeholders: Analysis& ATR*

Stakeholder	Student	Faculty	Alumni	Employer
No. of Responses	1st Sem: 121 3rd Sem: 154 5th Sem: 226 7th Sem: 41	**14**	--	--
Link of Analysis	Click Here	Click Here	--	--
ATR Link	Click Here	Click Here	--	--
Link showing Excel sheet of Google Form details of stakeholder	Click Here	Click Here	--	--

Minutes of Meeting Board of Studies

Board of Studies (BoS) meeting of the Centre for Internet of Things was held in hybrid mode on **May 30th, 2024 at 03:30 PM** . The following external members were invited in addition to the faculty members of the department:

S.No.	Name of Expert	Designation and Organization
➢	Dr. Kaushlendra Sharma -1 ***(Vice-chancellor,Nominee)***	Professor, Department of Electrical Engineering, **DTU-Delhi**
➢	Mr. Mayank Soni, ***(Industry expert)***	**Manager**, Strategy & Consulting-Accenture
➢	Dr. Rimjhim Agrawal, **(Alumus)**	Engineers Control, **General Electric** Bangluru
➢	Dr. Anurag Singh, ***(Subject Expert)***	Associate Professor, **NIT-Delhi**
➢	Dr.Lokesh Chouhan,***(Subject Expert)***	Assistant Professor, DTU

Above mentioned External experts and the following Internal members attended the meeting:

1. **Dr. Praveen Bansal,** Assistant Professor & Coordinator, CoT
2. **Dr. Dhananjay Bisen,** Assistant Professor
3. **Dr. Aditya Dubey,** Assistant Professor
4. **Dr. Priyanka Garg**, Assistant Professor
5. **Dr. Yashwant Sawle**, Assistant Professor
6. **Dr. Nookala Venu**, Assistant Professor
7. **Dr. Saurabh Kumar Rajput**, Assistant Professor
8. **Dr. Bhavna Rathore**, Assistant Professor
9. **Dr. Kaushal Pratap Sengar**, Assistant Professor
10. **Dr. Murli Manohar,** Assistant Professor
11. **Dr. Gaurav Khare,** Assistant Professor

Agenda-wise Summary of BoS Meeting

Item CIoT1	**To confirm the minutes of previous BoS meeting held in the month of May-June 2024** ➢ *The minutes of the last BoS held on December 1st, 2023 at 03:30 PM were confirmed. The BoS Minutes were presented & approved in Academic Council Meeting held on 14th December 2023*
Item CIoT2	**To propose 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 One (01) Open category course is to be offered in traditional mode and the remaining Two (02) Departmental Electives are to be offered in online mode with credit transfer for the batch admitted in 2021-22. (The total credits from I-VIII semester should not be less than 160 for this batch).** ➢ *The scheme structure of B. Tech. VII Semester of Internet of Things for the batch admitted in 2021-22 is prepared and is annexed at **ANNEXURE-1***
Item CIoT3	**To propose the list of courses which the students can opt from SWAYAM/NPTEL/ other MOOC Platforms/ Institution (MITS) MOOC, to be offered in online mode under Departmental Elective (DE-4) and (DE-5) for credit transfer in the VII Semester under the flexible curriculum (Batch admitted in academic year 2021-22).** ➢ *List of offered DE and OC courses in online is annexed at **ANNEXURE-2***

Details of Departmental Elective (DE-4): SWAYAM/NPTEL/MOOC

Course Name	Code	Offered By	Duration of the course	Start date	End date	Exam date	Name of the Mentor faculty
Distributed Systems	230767	IIT Patna	8 Weeks	July 22, 2024	Sep 13, 2024	Sep 22, 2024	Dr. Adiya Dubey
Programming in Java	230768	IITKGP	12 Weeks	July 22, 2024	Oct 11, 2024	Oct 27, 2024	Dr.Dhanajay Bisen
Deep Learning-IIT Ropar	230769	IIT Ropar	12 Weeks	July 22, 2024	Oct 11, 2024	Oct 26, 2024	Dr.Nookala Venu

Details of Departmental Elective (DE-5): SWAYAM/NPTEL/MOOC

Course Name	Code	Offered By	Duration of the course	Start date	End date	Exam date	Name of the Mentor faculty
Big Data Computing	230770	IIT Patna	12 Weeks	Aug 19, 2024	Oct 11, 2024	Oct 26, 2024	Dr. Adiya Dube

	The Joy of Computing using Python	230771	IIT Ropar	12 weeks	July 22, 2024	Oct 11, 2024	Nov 02, 2024	Dr.Dhanajay Bisen
	Design & Implementation of Human-Computer Interfaces	230772	IIT Guwahati	8 Weeks	July 22, 2024	Oct 11, 2024	Nov 02, 2024	Dr.Nookala Venu

Item CIoT4

To propose the syllabus of courses to be offered (for batch admitted in 2021-22) under the Departmental Elective (DE) Course (in traditional mode) for B. Tech. VII Semester along with their COs.

- *The syllabus of B. Tech. VII Semester of Internet of Things for the batch admitted in 2021-22 is prepared and is annexed at **ANNEXURE-3***

Subject Code	Subject Name
230734	Data Analytics for IoT
230735	Mobile Computing

Item CIoT5

To propose 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.

- *The syllabus of B. Tech. VII Semester of Internet of Things for the batch admitted in 2021-22 is prepared and is annexed at **ANNEXURE-4***

Subject Code	Subject Name
910226	Smart Energy Analytics
910203	IoT and Its Applications

Item CIoT6

To review and finalize the Experiment list/ Lab manual for all the Laboratory Courses to be offered in B. Tech. VII Semester (for batch admitted in 2021-22).

- *The Experiment list/ Lab manual for various laboratory courses to be offered in along with the Course Outcomes of VII semester of the B.Tech Internet of Things students of 2021-22 admitted batch under the flexible curriculum is included at **ANNEXURE-5***
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Item CIoT7

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)

[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)]

- *The Details is also annexed as **ANNEXURE-6***

1. Following courses are identified & proposed for V Semester for their requirement towards getting Honors

S. No	Tracks	Course Name	Offered By	Duration of Course	Start Date	End Date	Exam Date	Name of Mentor faculty
	Artificial Intelligence and Machine	Introduction to Machine Learning	IITM	12 weeks	July 22, 2024	October 11, 2024	October 27, 2024	
		Responsible & Safe AI Systems	IIT Madras	12 Weeks	11 Oct 2024	16 Aug 2024	02 Nov 2024	
		Programming, Data Structures And Algorithms Using Python	CMI	8 weeks	July 22, 2024	September 13, 2024	September 22, 2024	
		Artificial Intelligence : Search Methods For Problem solving	IIT Madras	12 Weeks	July 22, 2024	October 11, 2024	October 26, 2024	
		Artificial Intelligence for Economics	IIT KGP	8 Weeks	July 22, 2024	September 13, 2024	September 22, 2024	
	Smart Computing & Algorithms	Design and analysis of algorithms	CMI	8 weeks	July 22, 2024	September 13, 2024	September 22, 2024	
		Programming, Data Structures And Algorithms Using Python	CMI	8 weeks	July 22, 2024	September 13, 2024	September 22, 2024	
		The Joy of Computing using Python	IIT Ropar	12 Weeks	July 22, 2024	October 11, 2024	November 2, 2024	
		Discrete Mathematics	IIT Ropar	12 Weeks	July 22, 2024	October 11, 2024	October 27, 2024	
		Data Structure and Algorithms using Java	IIT KGP	12 Weeks	July 22, 2024	October 11, 2024	October 26, 2024	
		Programming in Modern	IITK	12	July	October	November	

		C++	GP	Weeks	22, 2024	11, 2024	03, 2024	
	Embedded System Design	Electronic Systems Design: Hands-on Circuits and PCB Design with CAD Software	IIT Delhi	12 Weeks	July 22, 2024	October 11, 2024	October 27, 2024	
		Microelectronics: Devices to Circuits	IIT Roorkee	12 Weeks	July 22, 2024	October 11, 2024	October 27, 2024	
		Real-Time Digital Signal Processing	IISc Bangalore	12 Weeks	July 22, 2024	October 11, 2024	November 2, 2024	

ii. Following courses are identified & proposed for VII Semester for their requirement towards getting Honors

S. No	Tracks	Course Name	Offered By	Duration of Course	Start Date	End Date	Exam Date	Name of Mentor faculty
	Artificial Intelligence and Machine	Introduction to Machine Learning	IITM	12 weeks	July 22, 2024	October 11, 2024	October 27, 2024	
		Responsible & Safe AI Systems	IIIT Hyderabad & IIT Madras	12 Weeks	11 Oct 2024	16 Aug 2024	02 Nov 2024	
		Programming, Data Structures And Algorithms Using Python	CMI	8 weeks	July 22, 2024	September 13, 2024	September 22, 2024	
		Artificial Intelligence : Search Methods For Problem solving	IIT Madras	12 Weeks	July 22, 2024	October 11, 2024	October 26, 2024	
		Artificial Intelligence for Economics	IIT KGP	8 Weeks	July 22, 2024	September 13, 2024	September 22, 2024	
	Smart Computing &	Design and analysis of algorithms	CMI	8 weeks	July 22, 2024	September 13, 2024	September 22, 2024	

			Programming, Data Structures And Algorithms Using Python	CMI	8 weeks	July 22, 2024	September 13, 2024	September 22, 2024	
			The Joy of Computing using Python	IIT Ropar	12 Weeks	July 22, 2024	October 11, 2024	November 2, 2024	
			Discrete Mathematics	IIT Ropar	12 Weeks	July 22, 2024	October 11, 2024	October 27, 2024	
			Data Structure and Algorithms using Java	IIT KGP	12 Weeks	July 22, 2024	October 11, 2024	October 26, 2024	
			Programming in Modern C++	IITKGP	12 Weeks	July 22, 2024	October 11, 2024	November 03, 2024	
		Robotics	Industrial Robotics : Theories for Implementation	IIT Kharagpur	12 Weeks	July 22, 2024	October 11, 2024	November 2, 2024	
			Mechanism and Robot Kinematics	IIT Kharagpur	8 Weeks	August 19, 2024	October 11, 2024	November 3, 2024	
			Mechanics and Control of Robotic Manipulators	IIT Madras	8 Weeks	July 22, 2024	September 13, 2024	September 22, 2024	

*ii) **Minor Specialization (for students of other departments)***

Following courses are identified & proposed for their requirement towards getting Minor Speciation in Internet of Things:

Domain	Course Name	Offered By	Duration of course	Start date	End date	Exam date	Name of Mentor Faculty
Internet of Things	Introduction To Internet of Things	IITKGP	12 Weeks	July 22, 2024	October 11, 2024	November 02, 2024	
	Introduction To Industry 4.0 And Industrial Internet of	IITKGP	12 Weeks	July 22, 2024	October 11, 2024	October 26, 2024	

		Things							
		Cloud Computing	IITKGP	12 Weeks	July 22, 2024	October 11, 2024	November 03, 2024		

Item CIoT08	**To review and finalize the scheme structure of B.Tech V Semester under the flexible curriculum (Batch admitted in 2022-23)** ➢ *The Scheme structure of V semester of the B.Tech Internet of Things of 2022-23 admitted batch under the flexible curriculum is at **ANNEXURE -7***
Item CIoT09	**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 COs.** *The syllabus of B. Tech. V Semester of Internet of Things for the batch admitted in 2022-23 is prepared and is annexed at **ANNEXURE-8***
Item CIoT10	**To propose the Experiment list/ Lab manual for all the Laboratory Courses to be offered in B. Tech. V Semester (for batch admitted in 2022-23).** ➢ *The Experiment list/ Lab manual for various laboratory courses to be offered in along with the Course Outcomes of V semester of the B.Tech Internet of Things students of 2022-23 admitted batch under the flexible curriculum is included at **ANNEXURE-09***
Item CIoT11	**To review and finalize the Skill Based Mini Project for all the Laboratory Courses to be offered in B. Tech. V Semester (for batch admitted in 2022-23).** ➢ *The list of skilled based mini projects for various laboratory courses to be offered in along with the Course Outcomes of V semester of the B.Tech Internet of Things students of 2022-23 admitted batch under the flexible curriculum is included at **ANNEXURE-10***
Item CIoT12	**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.** ➢ *The List of Self Study and Seminar of B. Tech. V Semester of Internet of Things for the batch admitted in 2021-22 is prepared and is annexed at **ANNEXURE-11***
Item CIoT13	**To review and finalize the scheme structure of B.Tech III Semester under the flexible curriculum (Batch admitted in 2023-24)** ➢ *The Scheme structure of III semester of the B.Tech Internet of Things of 2023-24 admitted batch under the flexible curriculum is at **ANNEXURE -12***
Item CIoT14	**To propose 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 COs.** ➢ *The syllabus of B. Tech. III Semester of Internet of Things for the batch admitted in 2023-24 is prepared and is annexed at **ANNEXURE-13***
Item CIoT15	**To propose the Experiment list/ Lab manual and skill based mini project for all the Laboratory Courses to be offered in B. Tech. III Semester (for batch admitted in 2023-24).** ➢ *The Experiment list/ Lab manual for various laboratory courses to be offered in along with the Course Outcomes of III semester of the B.Tech Internet of Things students of 2023-24*

	*admitted batch under the flexible curriculum is included at **ANNEXURE-14***
Item CIoT16	**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.** ➢ *The List of Self Study and Seminar of B. Tech. V Semester of Internet of Things for the batch admitted in 2021-22 is prepared and is annexed at **ANNEXURE-15***
Item CIoT17	**To discuss and recommend the scheme structure & syllabi of PG Programme (M.E./M.Tech./MCA/MBA) along with their Course Outcomes (COs)** ***Not Applicable***
Item CIoT18	**To recommend the scheme structure and Syllabus of Ph.D. Course Work (specific to Doctoral Research Scholars, if any)** ***Not Applicable***
Item CIoT19	**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 2023session** ➢ *The CO attainments for each course was computed by the respective faculty are compiled for the November. The gap in attainment, if any, was identified and the corrective actions to be taken were proposed by the subject faculty is reviewed. The CO attainment level of the subject in the above duration is annexed at **ANNEXURE -16***
Item CIoT20	**To review the PO attainments levels and suggest the actions to be taken for improvement in PO attainment.** ➢ *The data is attached as **ANNEXURE-16***
Item CIoT21	**To review and finalize the CO-PO mapping matrix for all the courses to be taught in JulyDec 2024.** ➢ *The data is attached as **ANNEXURE-16***
Item CIoT22	**To review curricula feedback from various stakeholders, its analysis and impact.** ➢ *The Feedback on the curriculum is taken from the Stakeholder (Students, Faculty, Alumni, and Employer) in online mode using Moodle &Google Forms. The analysis is carried out on a scale of 1-5. Few suggestions were received from the alumni & employer. Some of them are already in place. The feedback analysis is annexed at **ANNEXURE -18***
Item CIoT23	**Any other matter.** ➢ **Discussion on Establishment of New Labs in the Centre for IoT**

Suggestion by Expert Members:

1. Assignments based on Realistic Problem solving will be given
2. MOOCs offered courses will be mentored
3. Labs on Wireless Embedded System will be introduced
4. Courses offered on Applications of IoT for Power Electronics will be offered
5. Students will be motivated to participated in the online coding competitions for enhancing the programming skills

The meetings ended with the vote of thanks by BoS Coordinator.

Dr. Gaurav Khare

Dr. Murli Manohar

Dr. Kaushal Pratap Sengar

Dr. Bhavna Rathore

Dr. Priyanka Garg

Dr. Saurabh Kumar Rajput

Dr. Yashwant Sawle

Dr. Nookala Venu

Dr. Aditya Dubey

Dr. Dhananjay Bisen

Present

Dr. Kaushlendra Sharma
Assistant Professor, Department of Computer Science and Engineering, IIIT-Nagpur

Absent

Dr. Anurag Singh
Department of CSE
Associate Professor, NIT-Delhi

Present

Dr.Lokesh Chouhan
Associate Professor, National Forensic Science University, Curti Podna, Goa

Present

Mr. Mayank Soni
Custom Software, Engineer
Senior Analyst- Accenture Pune

Present

Dr. Rimjhim Agrawal
Principal Data Scientist Utoipus Insights, Bangaluru

31/05/24

Dr. Praveen Bansal
Assistant Professor
Coordinator, Centre for Internet of Things

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Centre for Internet of Things

Scheme of Evaluation

B. Tech. III Semester *(Internet of Things (IoT)*

(for batch admitted in academic session 2023-24)

S. No.	Subject Code	Category Code	Subject Name	Maximum Marks Allotted							Total Marks	Contact Hours per week			Total Credits	Mode of Teaching	Mode of Exam.	Duration of Exam.
				Theory Slot				Practical Slot										
				End Term Evaluation		Continuous Evaluation		End Sem. Exam.	Continuous Evaluation			L	T	P				
				End Sem. Exam	$Proficiency in Subject/ Course	Mid Sem. Exam.	Quiz/ Assignment		Lab Work & Sessional	Skill Based Mini Project								
1.	3230321	DC	Discrete Structures	50	10	20	20	-	-	-	100	3	1	-	4	Offline	PP	2 Hrs
2.	3230322	DC	Computer Networks & Protocols	50	10	20	20	-	-	-	100	2	1	-	3	Blended	PP	2 Hrs
3.	3230323	DC	Design & Analysis of Algorithms	50	10	20	20	40	30	30	200	2	1	2	4	Blended	PP	2 Hrs
4.	3230324	DC	Database Management System	50	10	20	20	40	30	30	200	2	1	2	4	Blended	PP	2 Hrs
5.	3230325	DC	Electronic Systems Thinking & Circuits	50	10	20	20	40	30	30	200	2	1	2	4	Blended	PP	2 Hrs
7.	3230326	DLC	Self-learning/Presentation (SWAYAM/NPTEL/MOOC)	-	-	-	-	-	40	-	40	-	-	2	1	Online & Mentoring	SO	-
8.	200XXX	CLC	Novel Engaging Course (Informal Learning)	-	-	-	-	50	-	-	50	-	-	2	1	Interactive	SO	-
9.	3230327	DLC	Skill Internship Program (Institute Level Evaluation)	-	-	-	-	60	-	-	60	-	-	4	2	Offline	SO	-
Total				**250**	**50**	**100**	**100**	**230**	**130**	**90**	**950**	**11**	**05**	**14**	**23**	-	-	-
10.	3000005	Natural Sciences & Skills	Environmental Engineering	50	10	20	20	-	-	-	100	2	-	-	Grade	Blended	MCQ	1.5 Hrs
11.	1000001	MAC	Indian Constitution and Traditional Knowledge	50	10	20	20	-	-	-	100	2	-	-	Grade	Blended	MCQ	1.5 Hrs

$Proficiency in course/subject – includes the weightage towards ability/ skill/ competency /knowledge level /expertise attained etc. in that particular course/subject

Natural Sciences & Skills: Engineering Physics / Engineering Chemistry / Environmental Engineering / Language

Credits of Natural Sciences & Skills will be added in the VI Semester

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

Dean 16/7/24

Faculty of Engineering & Technology
MITS-DU

16/07/24

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Centre for Internet of Things

Scheme of Evaluation

B. Tech. V Semester - *Internet of Things (IoT)*

(for batch admitted in academic session 2022-23)

S. No.	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 Term Evaluation		Continuous Evaluation		End Sem. Exam.	Continuous Evaluation			L	T	P			
				End Sem. Exam.	$Proficiency in subject/ Course	Mid Sem. Exam.	Quiz/ Assignment		Lab work & Sessional	Skill Based Mini Project							
1	2230521	DC	Programming in Java	50	10	20	20	60	20	20	100	3	-	2	4	Blended	AO
2	2230522	DC	Data Sciences in IoT	50	10	20	20	60	20	20	200	3	-	2	4	Blended	MCQ
3	2230523	DC	Theory of Computation	50	10	20	20	-	-	-	200	3	-	-	3	Blended	PP
4	2230524	DC	Wireless Technologies for IoT	50	10	20	20	60	20	20	200	3	-	2	4	Blended	PP
5	2230525	DC	Cloud Computing	50	10	20	20	-	-	-	100	2	1	-	3	Blended	PP
6	2230526	DLC	Minor Project-I**	-	-	-	-	60	40	-	100	-	-	4	2	Offline	SO
7	2230527	Seminar/ Self-Study	Self-learning/Presentation (SWAYAM/NPTEL/ MOOC)#	-	-	-	-	-	40	-	40	-	-	2	1	Online and Mentoring	SO
8	200XXX	CLC	Novel Engaging Course (Informal Learning)	-	-	-	-	50	-	-	50	-	-	2	1	Interactive	SO
9	2230528	DLC	Summer Internship Project-II (Evaluation)	-	-	-	-	60	-	-	60	-	-	4	2	Offline	SO
Total				**250**	**50**	**100**	**100**	**350**	**140**	**60**	**1050**	**14**	**01**	**14**	**21**	-	-
10	1000006	MAC	Disaster Management	50	10	20	20	-	-	-	100	2	-	-	Grade	Online	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 course/subject.

MCQ: Mult ple 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.

17/07/24

Dean 16/7/24

Faculty of Engineering & Technology
MITS-DU

5[1]

Following courses are identified & proposed for V Semester for their requirement towards getting Honors

S. No	Tracks	Course Name	Offered By	Duration of Course	Start Date	End Date	Exam Date
1.	Artificial Intelligence and Machine Learning	Introduction to Machine Learning	IITM	12 weeks	July 22, 2024	October 11, 2024	October 27, 2024
2.		Responsible & Safe AI Systems	IIIT Hyderabad& IIT Madras	12 Weeks	11 Oct 2024	16 Aug 2024	02 Nov 2024
3.		Programming, Data Structures And Algorithms Using Python	CMI	8 weeks	July 22, 2024	September 13, 2024	September 22, 2024
4.		Artificial Intelligence : Search Methods For Problem solving	IIT Madras	12 Weeks	July 22, 2024	October 11, 2024	October 26, 2024
5.		Artificial Intelligence for Economics	IIT KGP	8 Weeks	July 22, 2024	September 13, 2024	September 22, 2024
6.	Smart Computing & Algorithms	Design and analysis of algorithms	CMI	8 weeks	July 22, 2024	September 13, 2024	September 22, 2024
7.		Programming, Data Structures And Algorithms Using Python	CMI	8 weeks	July 22, 2024	September 13, 2024	September 22, 2024
8.		The Joy of Computing using Python	IIT Ropar	12 Weeks	July 22, 2024	October 11, 2024	November 2, 2024
9.		Discrete Mathematics	IIT Ropar	12 Weeks	July 22, 2024	October 11, 2024	October 27, 2024
10.		Data Structure and Algorithms using Java	IIT KGP	12 Weeks	July 22, 2024	October 11, 2024	October 26, 2024
11.		Programming in Modern C++	IITKGP	12 Weeks	July 22, 2024	October 11, 2024	November 03, 2024
12.	Embedded System Design	Electronic Systems Design: Hands-on Circuits and PCB Design with CAD Software	IIT Delhi	12 Weeks	July 22, 2024	October 11, 2024	October 27, 2024
13.		Microelectronics: Devices to Circuits	IIT Roorkee	12 Weeks	July 22, 2024	October 11, 2024	October 27, 2024
14.		Real-Time Digital Signal Processing	IISc Bangalore	12 Weeks	July 22, 2024	October 11, 2024	November 2, 2024

ii) **Minor Specialization (for students of other departments)**

owing courses are identified & proposed for the requirement towards getting Minor Speciati in Internet of Things:

Domain	Course Name	Offered By	Duration of course	Exam date
Internet of Things	Introduction To Internet of Things	IITKGP	12 Weeks	October 26, 2024
	Introduction To Industry 4.0 And Industrial Internet of Things	IITKGP	12 Weeks	October 26, 2024
	Analog Electronic Circuit	IIT Delhi	12 Weeks	November 2, 2024
	Microelectronics: Devices to Circuits	IIT Roorkee	12 Weeks	November 2, 2024

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MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE GWALIOR
(Deemed to be University)
Declared Under Distinct Category by Ministry of Education, Government of India)

(NAAC Accredited with A++ Grade

Centre for Internet of Things
Scheme of Evaluation
B. Tech. VII Semester *(Internet of Things (IoT)*

(for batch admitted in academic session 2021-22)

S. No.	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			MOOCs								
				End Term Evaluation		Continuous Evaluation		End Sem. Exam.	Continuous Evaluation										
				End Sem. Exam.	$Proficiency in subject/ Course	Mid Sem. Exam.	Quiz/ Assignment		Lab work & Sessional	Skill Based Mini Project	Assignment	Exam		L	T	P			
1	DE	DE	Departmental Elective (DE-2)	50	10	20	20	50	-	-	-	-	100	3	-	-	3	Blended	PP
2	DE	DE	Departmental Elective* (DE-3)	-	-	-	-	-	-	-	25	75	100	3	-	-	3	Online	MCQ
3	DE	DE	Departmental Elective* (DE-4)	-	-	-	-	-	-	-	25	75	100	3	-	-	3	Online	MCQ
4	OC	OC	Open Category (OC-2)	50	10	20	20	50	-	-	-	-	100	3	-	-	3	Blended	PP
5	230701	DLC	Internet of Things Lab Advanced	-	-	-	-	60	20	20	-	-	100	-	-	4	2	Offline	SO
6	230702	DLC	Creative Problem Solving (Evaluation)	-	-	-	-	25	25	-	-	-	50	-	-	2	1	Offline	SO
7	230703	DLC	Summer Internship Project-III (04 weeks) (Evaluation)	-	-	-	-	60	-	-	-	-	60	-	-	4	2	Interactive	SO
			Total	**100**	**20**	**40**	**40**	**245**	**45**	**20**	**50**	**150**	**610**	**12**	**-**	**10**	**17**	**-**	**-**
8.	1000008	MAC	Universal Human Values & Professional Ethics (UHVPE)	50	10	20	20	-	-	-	-	-	100	2	-	-	Grade	Online	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

16/7/24
Dean
Faculty of Engineering & Technology
MITS-DU

26/7/24

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Centre for Internet of Things
Scheme of Evaluation
B. Tech. VII Semester *(Internet of Things (IoT)*

(for batch admitted in academic session 2021-22)

List of Offered Courses from SWAYAM(NPTEL)

DE -2 (Traditional Mode)		
S. No.	**Subject Code**	**Subject Name**
1.	**230734**	Data Analytics for IoT
2.	**230735**	Mobile Computing
OC-2 (Traditional Mode)		
S. No.	**Subject Code**	**Subject Name**
1.	**910203**	IoT and Its Applications
2.	910226	Smart Energy Analytics

DE-3*(SWAYAM/NPTEL/ MOOC platform)		
S. No.	**Subject Code**	**Subject Name**
1.	**230767**	Distributed Systems (8 Weeks)
2.	**230768**	Programming in Java (12 Weeks)
3.	**230769**	Deep Learning - IIT Ropar (12 Weeks)
DE-4* (SWAYAM/NPTEL/ MOOC platform)		
S. No.	**Subject Code**	**Subject Name**
1.	**230770**	Big Data Computing (8 Weeks)
2.	**230771**	The Joy of Computing using Python (12 Weeks)
3.	**230772**	Design & Implementation of Human-Computer Interfaces (8 Weeks)

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Courses are [illegible] proposed for VII Semester for their requirement towards getting Honors

Tracks for Honor Specialization

Internet of Things (IoT)

S. No	Tracks	Course Name	Offered By	Duration of Course	Start Date	End Date	Exam Date	Name of Mentor faculty
1.	Artificial Intelligence and Machine	Introduction to Machine Learning	IITM	12 weeks	July 22, 2024	October 11, 2024	October 27, 2024	
2.		Responsible & Safe AI Systems	IIIT Hyderabad& IIT Madras	12 Weeks	11 Oct 2024	16 Aug 2024	02 Nov 2024	
3.		Programming, Data Structures And Algorithms Using Python	CMI	8 weeks	July 22, 2024	September 13, 2024	September 22, 2024	
4.		Artificial Intelligence : Search Methods For Problem solving	IIT Madras	12 Weeks	July 22, 2024	October 11, 2024	October 26, 2024	
5.		Artificial Intelligence for Economics	IIT KGP	8 Weeks	July 22, 2024	September 13, 2024	September 22, 2024	
6.	Smart Computing & Algorithms	Design and analysis of algorithms	CMI	8 weeks	July 22, 2024	September 13, 2024	September 22, 2024	
7.		Programming, Data Structures And Algorithms Using Python	CMI	8 weeks	July 22, 2024	September 13, 2024	September 22, 2024	
8.		The Joy of Computing using Python	IIT Ropar	12 Weeks	July 22, 2024	October 11, 2024	November 2, 2024	
9.		Discrete Mathematics	IIT Ropar	12 Weeks	July 22, 2024	October 11, 2024	October 27, 2024	
10.		Data Structure and Algorithms using Java	IIT KGP	12 Weeks	July 22, 2024	October 11, 2024	October 26, 2024	
11.		Programming in Modern C++	IITKGP	12 Weeks	July 22, 2024	October 11, 2024	November 03, 2024	
12.	Robotics	Industrial Robotics : Theories for Implementation	IIT Kharagpur	12 Weeks	July 22, 2024	October 11, 2024	November 2, 2024	
13.		Mechanism and Robot Kinematics	IIT Kharagpur	8 Weeks	August 19, 2024	October 11, 2024	November 3, 2024	
14.		Mechanics and Control of Robotic Manipulators	IIT Madras	8 Weeks	July 22, 2024	September 13, 2024	September 22, 2024	

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Minor Specialization (for students of other departments)

Following courses are identified & proposed for their requirement towards getting Minor Speciation in Internet of Things:

Domain	Course Name	Offered By	Duration of course	Exam date	Name of Mentor Faculty
Internet of Things	Introduction To Internet of Things	IITKGP	12 Weeks	October 26, 2024	
	Introduction To Industry 4.0 And Industrial Internet of Things	IITKGP	12 Weeks	October 26, 2024	
	Analog Electronic Circuit	IIT Delhi	12 Weeks	November 2, 2024	
	Microelectronics: Devices to Circuits	IIT Roorkee	12 Weeks	November 2, 2024	

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DISCRETE STRUCTURES :3230321

COURSE OBJECTIVES

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

Unit-I

Finite and Infinite Sets, Mathematical Induction, Principles of Inclusion and Exclusion, Multisets, Functions and Relations, Binary Relations, Equivalence Relations and Partitions, Partial Ordering Relations and Lattices, Chains, Pigeonhole Principle.

Unit-II

Propositional Logic, Syntax, Semantics of ATF (Atomic Formula), WFF (Well Formed Formulas), Validity and Satisfiability of WFF by Quine's Method, Normal and Closure Form of Propositional Calculus.

Unit-III

Introduction and Basic Terminology of Graphs, Planar Graphs, Multi-Graphs and Weighted Graph, Shortest Path in Weighted Graph, Introduction to Eularian Paths and Circuits, Hamiltonian Paths and Circuits, Introduction to Trees, Rooted Trees, Path Length in Rooted Trees, Spanning Trees and Cut Trees.

Unit-IV

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.

Unit-V

Introduction to Group, Subgroups, Generations and Evaluation of Power, Cosets and Lagrange's Theorem, Group Codes, Isomorphism and Automorphism, Homomorphism and Normal Sub Groups, Ring, Integral Domain and Field.

Recommended Books

1. J. Tremblay and Manohar: Discrete Mathematical Structures with Application to Computer science.
2. Kenneth Rosen: Discrete mathematics and its applications (6th edition). 2006. McGraw-Hill
3. C. Liu, D. Mohapatra: Elements of Discrete Mathematics. 2008. Tata McGraw-Hill.
4. T. Koshy: Discrete mathematics with applications. 2003. Academic Press.
5. J. Hein: Discrete structures, logic, and computability. 2009. Jones & Bartlett Publishers.

COURSE OUTCOMES

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

CO 1. Explain the basic concept of set theory, propositional logic.
CO 2. Illustrate the knowledge of discrete numeric function and algebraic structure in terms of their applications.
CO 3. Identify the concepts of graph and tree for solving problems.
CO 4. Apply the concepts of studied topics with suitable technique faced in engineering problems
CO 5. Build analytical skills and interpret applications of engineering beneficial in real time troubleshooting.

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	-	-
CO2	3	3	2	2	2	1	1	1	1	1	1	3	-	-
CO3	3	3	2	2	3	1	1	1	1	1	1	3	-	-
CO4	3	3	2	2	3	1	1	1	1	1	1	3	-	-
CO5	3	3	2	2	2	1	1	1	1	1	1	3	-	-

1 - Slightly; 2 - Moderately; 3 – Substantially

COMPUTER NETWORKS AND PROTOCOLS (3230322)

Course Objectives

- Familiarize the student with the basic taxonomy and terminology of the computer networking & Protocols.
- Provide detail knowledge about various layers, protocols and devices that facilitate networking.
- Enable students to deal with various networking problems such as flow control, error control and congestion control.

Unit-I

Introduction: Computer Network Types, OSI Reference Model & TCP/IP Reference Mode, Circuit Switching, Message Switching & Packet Switching, Frequency Division Multiplexing, Wavelength Division Multiplexing & Time Division Multiplexing, ISDN, SONET. Physical Layer: Data Transmission Modes, Network topologies, Line Coding, Synchronous & Asynchronous Transmission, Transmission Medium- Guided & Unguided, Networking Devices, Performance Criteria.

Unit-II

Data Link Layer: Introduction, Design Issues, Services, Framing, Error Control, Flow Control, ARQ Strategies, Error Detection and Correction, Parity Bits, Cyclic Redundant Code (CRC), Hamming Codes, MAC Sub Layer- Channel Allocation Problem, Pure ALOHA, Slotted ALOHA, CSMA, CSMA/CD, IEEE 802.3, IEEE 802.4 and IEEE 802.5, HDLC.

Unit-III

Network Layer Protocols: Introduction, Design Issues, Services, Routing- Distance Vector Routing, Hierarchical Routing & Link State Routing, Shortest Path Algorithm- Dijkstra's Algorithm & Floyd–Warshall's Algorithm, Routing Protocols, Flooding, Connection Oriented & Connectionless Service, IP Addressing, IPV4, IPV6, Internet Protocol Datagram, Fragmentation, ICMP, IGMP.

Unit-IV

Transport Layer Protocols: Datagram Protocol (UDP) - Process To Process Communication, Port Number, Socket Address, User Datagram, UDP Operation. TCP Services, Process To Process Communication, Stream Delivery Service, Full Duplex Communication, Connection Oriented Service, Reliable Service, TCP Features- Numbering System, Flow Control, Error Control, Congestion Control, TCP Segment, Flow Control-Sliding Window Protocol, Silly Window Syndrome Error Control-Checksum, Acknowledgement, Retransmission, Congestion Control.

Unit-V

Application Layer Protocols: Introduction, Design Issues, Presentation Layer- Translation, Encryption- Substitutions and Transposition Ciphers, Compression- Lossy and Lossless. Session Layer – Dialog Control, Synchronization. Application Layer- Remote Login, File Transfer & Electronic Mail. Domain Name System (DNS), Telnet, FTP, TFTP, Email Protocol: SMTP, POP, IMAP.

COURSE OUTCOMES

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

CO1. **Explain** the fundamental concepts of computer network.
CO2. **Illustrate** the basic taxonomy & terminologies of computer network protocols.
CO3. **Explain** IP addressing and routing mechanism.
CO5. **Apply** the concept of computer network in congestion and internet.
CO6. **Design** the network environment for implementation of computer networking concept.

Reference Books/ Text Books:

1. Data Communication and Networking, Behrouz A. Forouzan, McGraw Hill.
2. Computer Networks, Andrew S. Tanenbaum, Pearson Education India.
3. Computer Networks and Internets, Douglas E. Comer, Pearson India.
4. TCP/IP Protocol Suite, B. A. Fourozan, Tata McGraw Hill
5. Internetworking with TCP/IP, Douglas E. Comer, Publisher- PHI, New Delhi
6. TCP/IP Illustrated by Richard Stevens, Publisher- Addison – Wesley.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	1	2	1	1	1	1	1	2	3	-	-
CO2	3	2	1	2	3	1	1	1	1	1	2	3	-	-
CO3	3	3	3	3	3	3	1	1	1	1	2	3	-	-
CO4	3	2	2	1	3	3	1	1	1	1	3	3	-	-
CO5	3	3	3	3	3	3	2	1	1	1	3	3	-	-
CO6	3	3	3	3	3	3	3	1	1	1	3	3	-	-

1 - Slightly; 2 - Moderately; 3 – Substantially

DESIGN & ANALYSIS OF ALGORITHMS : 3230323

COURSE OBJECTIVES

- To introduce the topic of algorithms as a precise mathematical concept.
- To study the techniques like recursion, divide and conquer, dynamic programming, greedy approach, backtracking and branch and bound.
- To practice their skills on many well-known algorithms and data structures designed to solve real-life problems.

Unit-I Introduction to Computational Model: Algorithms and its Importance, Recurrences and Asymptotic Notations, Mathematical Analysis of Non-Recursive and Recursive Algorithm, Review of Sorting & Searching Algorithms, Basic Tree and Graph Concepts: B-Trees and Traversal Techniques, Topological sort.

Unit-II Divide and Conquer Method: Introduction and its Examples such as Finding the Maximum and Minimum, Binary Search, Merge Sort, Quick Sort and Strassen's Matrix Multiplication and Additional Real World Problems on Divide and Conquer.

Unit-III Greedy Method: Introduction, Characteristics, Examples of Greedy Methods such as Single-Source Shortest Paths, Minimum Cost Spanning Trees : Prims's and Kruskal's Algorithm, Knapsack Problem, Dijkstra's Single Source Shortest Path Algorithm,Optimal Storage on Tapes.

Unit-IV Dynamic Programming: Introduction, The Principle of Optimality, Examples of Dynamic Programming Methods such as – 0/1 Knapsack, Traveling salesman problem, Floyd's All Pairs Shortest Path, Longest Common Subsequence and Reliability Design, Matrix Chain Multiplication

Unit-V Backtracking: Concept and its Examples like 4-Queen's Problem, Knapsack problem Hamiltonian Circuit Problem, Graph Coloring Problem etc. Branch &Bound:Introductionand its Examples like - Traveling Salesperson Problem etc. NP- Completeness: Introduction, Class P and NP, Polynomial Reduction, NP-Hard and NP-Complete Problems.

Course Outcomes

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

CO1. **Define** the basic features of Algorithms.
CO2. **Describe** major Algorithms and Data Structures.
CO3. **Apply** various algorithmic design paradigms.
CO4. **Analyze** the asymptotic performance of Algorithms.
CO5. **Compare** different design techniques to develop algorithms for computational problems.
CO6. **Design** algorithms using greedy strategy, divide and conquer approach, dynamic programming, backtracking, branch and bound approach.

Reference Books/ Text Books:

1. Fundamentals of Computer Algorithms, Horowitz &Sahani, Universities press.
2. Introduction to Algorithms, Coremen Thomas, Leiserson CE, RivestRL, PHI.
3. Design & Analysis of Computer Algorithms, Ullmann, Pearson.
4. Algorithm Design, Michael T Goodrich, RobartoTamassia, Wiley India.

5. **Course Articulation Matrix**

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

6. 1 - Slightly; 2 - Moderately; 3 – Substantially

Database Management System (3230324)

Course Objectives:

- To understand the different issues involved in the design and implementation of a database system
- To study the physical and logical database designs, database modeling, relational, hierarchical and network models.
- To understand and use data manipulation language to query, update and manage a database.

Unit 1: Introduction – Database Approach v/s Traditional File Approach, Advantages of Database System, Database Users and Administrator, Database System Environment, Application Architectures, Schemas, Instances, Data Independence, Data Models: Hierarchical Data Model, Network Data Model & Relational Data Model, Comparison between Models. Entities and Relationship Model: Entity types, Entity sets, Attributes and Keys, Relationship Types and Sets, Constraints, Design issue, E-R Diagram, Weak Entity Sets.

Unit 2: Relational Model – Structure of Relational Databases: Relation, Attribute, Domain, Tuples, Degree, Cardinality, Views, Database Relations, Properties of Relations, Attributes, Keys, Attributes of Relation, Domain Constraints, Integrity Constraints. Relational Algebra: Concepts and Operations: Select Project, Division, Intersection, Union, Division, Rename, Join etc.

Unit 3: SQL – Purpose of SQL, Data Definition Language (DDL) Statements, Data Manipulation Language (DML) Statements Update Statements & Views in SQL, Data Control Language (DCL), Triggers.

Unit 4: Relational Database Design – Purpose of Normalization, Data Redundancy and Update Anomalies, Functional Dependency, Process of Normalization, Various Normal Forms: 1NF, 2NF, 3NF, BCNF, Decomposition, Desirable Properties of Decomposition: Dependency Preservation, Lossless Join, Problems with Null Valued & Dangling Tuple, Multivalued Dependencies.

Unit 5: Transaction Management – Transaction Concept, Transaction State, Concurrent Executions, Serializability: Conflict and View Serializability, Concurrency Control: Lock-Based Protocol, Recovery: Log-Based Recovery.

Reference Books/ Text Books:

1. Database System Concepts, Abraham Silberschatz Henry F. Korth S. Sudarshan, McGraw-Hill 6 th Edition.
2. Database Management System, Raghu Ramakrishnan Johannes Gehrke, McGraw Hill 3 rd Edition.
3. Fundamentals of Database System, Elmasri & Navathe, Addison-Wesley Publishing, 5 th Edition.
4. An Introduction to Database Systems, Date C. J, Addison-Wesley Publishing, 8 th Edition.

Course Outcomes:

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

CO1. Demonstrate the concepts of different types of database system.
CO2. Apply relational algebra concepts to design database system.
CO3. Make use of queries to design and access database system.
CO4. Analyze the evaluation of transaction processing and concurrency control.
CO5. Determine the normal form of the relation.
CO6. Design a ER diagram/database system for a real world application.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	1	1	1	1	1	1	2	3	-	-
CO2	3	3	3	2	1	3	1	1	1	1	2	3	-	-
CO3	3	3	3	2	2	2	1	1	1	1	2	3	-	-
CO4	3	3	3	3	3	1	1	1	1	1	3	3	-	-
CO5	3	2	3	3	3	2	1	1	1	1	3	3	-	-
CO6	3	2	3	3	3	3	1	1	1	1	3	3	-	-

1 - Slightly; 2 - Moderately; 3 – Substantially

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Database Management System (3230324)

Course Objectives:

- To understand the different issues involved in the design and implementation of a database system.
- To study the physical and logical database designs, database modeling, relational, hierarchical and network models.
- To understand and use data manipulation language to query, update and manage a database.

Unit 1: Introduction – Database Approach v/s Traditional File Approach, Advantages of Database System, Database Users and Administrator, Database System Environment, Application Architectures, Schemas, Instances, Data Independence, Data Models: Hierarchical Data Model, Network Data Model & Relational Data Model, Comparison between Models. Entities and Relationship Model: Entity types, Entity sets, Attributes and Keys, Relationship Types and Sets, Constraints, Design issue, E-R Diagram, Weak Entity Sets.

Unit 2: Relational Model – Structure of Relational Databases: Relation, Attribute, Domain, Tuples, Degree, Cardinality, Views, Database Relations, Properties of Relations, Attributes, Keys, Attributes of Relation, Domain Constraints, Integrity Constraints. Relational Algebra: Concepts and Operations: Select Project, Division, Intersection, Union, Division, Rename, Join etc.

Unit 3: SQL – Purpose of SQL, Data Definition Language (DDL) Statements, Data Manipulation Language (DML) Statements Update Statements & Views in SQL, Data Control Language (DCL), Triggers.

Unit 4: Relational Database Design – Purpose of Normalization, Data Redundancy and Update Anomalies, Functional Dependency, Process of Normalization, Various Normal Forms: 1NF, 2NF, 3NF, BCNF, Decomposition, Desirable Properties of Decomposition: Dependency Preservation, Lossless Join, Problems with Null Valued & Dangling Tuple, Multivalued Dependencies.

Unit 5: Transaction Management – Transaction Concept, Transaction State, Concurrent Executions, Serializability: Conflict and View Serializability, Concurrency Control: Lock-Based Protocol, Recovery: Log-Based Recovery.

Reference Books/ Text Books:

1. Database System Concepts, Abraham Silberschatz Henry F. Korth S. Sudarshan, McGraw-Hill 6 th Edition.
2. Database Management System, Raghu Ramakrishnan Johannes Gehrke, McGraw Hill 3 rd Edition.
3. Fundamentals of Database System, Elmasri & Navathe, Addison-Wesley Publishing, 5 th Edition.
4. An Introduction to Database Systems, Date C. J, Addison-Wesley Publishing, 8 th Edition.

Course Outcomes:

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

CO1. Demonstrate the concepts of different types of database system.
CO2. Apply relational algebra concepts to design database system.
CO3. Make use of queries to design and access database system.
CO4. Analyze the evaluation of transaction processing and concurrency control.
CO5. Determine the normal form of the relation.
CO6. Design a ER diagram/database system for a real world application.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	1	1	1	1	1	1	2	3	-	-
CO2	3	3	3	2	1	3	1	1	1	1	2	3	-	-
CO3	3	3	3	2	2	2	1	1	1	1	2	3	-	-
CO4	3	3	3	3	3	1	1	1	1	1	3	3	-	-
CO5	3	2	3	3	3	2	1	1	1	1	3	3	-	-
CO6	3	2	3	3	3	3	1	1	1	1	3	3	-	-

1 - Slightly; 2 - Moderately; 3 – Substantially

ELECTRONIC SYSTEMS THINKING & CIRCUITS : 3230325

Course Objective: The course aims to equip students with a deep understanding of semiconductor devices and circuits, including diodes, transistors, operational amplifiers, and power systems. Through theoretical learning and practical exercises, students will develop analytical and practical skills to design, analyze, and troubleshoot electronic circuits, fostering critical thinking and innovation.

Unit-1: PN JUNCTION DIODE and its application:

Semiconductor materials- intrinsic and extrinsic types, Ideal Diode, Terminal characteristics of diodes: p-n junction under open circuit condition p-n junction under forward bias and reverse bias conditions p-n junction in breakdown region, Diode small signal model , Zener diode and applications , Clipping and Clamping circuits

UNIT-2: RECTIFIERS AND FILTERS:

PN junction as a rectifier, half wave rectifier, Center-Tapped full wave rectifier, Bridge full wave Rectifier, Harmonic components in a rectifier circuit, Capacitor filter and Inductor filter.

UNIT-3: Bipolar junction transistors (BJT):

Physical structure and operation modes , Active region operation of transistor , D.C. analysis of transistor circuits , Transistor as an amplifier , Biasing the BJT: fixed bias, emitter feedback bias, collector feedback bias and voltage divider bias , Basic BJT amplifier configuration: common emitter, common base and common collector amplifiers, Transistor as a switch: cut-off and saturation modes ,Transistor as a rectifier

UNIT-4: Operation Amplifier (Op-Amps):

Ideal Op-amp, Differential amplifier: differential and common mode operation common mode rejection ratio (CMRR), Practical op-amp circuits: inverting amplifier, non -inverting amplifier, weighted summer, integrator, differentiator, large signal operation of op-amps, other applications of op-amps: instrumentation circuits, active filters, controlled sources, logarithmic amplifiers, waveform generators, Schmitt triggers, comparators

UNIT-5: Power circuits and systems:

Regulated power supply, Shunt voltage regulator, and Transistorized series voltage regulator (basic and with feedback, without derivation), Three Terminal Fixed/variable voltage regulator: 78xx, 79xx, LM317 etc, Switch mode power supply(SMPS) Uninterruptible power supply(UPS).

Course Outcomes:

- **CO 1:** **Demonstrate** a comprehensive understanding of semiconductor materials, diode and transistor operation
- **CO 2:** **Analyze** terminal characteristics of diodes, transistor operation modes, and operational amplifier circuits to solve complex electronic problems.
- **CO 3:** **Apply** theoretical knowledge to design and implement various electronic circuits including rectifiers, filters, amplifiers, and power supply systems.
- **CO 4:** **Develop** the ability to troubleshoot and rectify issues in electronic circuits through systematic analysis and testing.
- **CO 5:** **Evaluate** the innovative solutions for improving circuit performance, efficiency, and reliability in real-world applications.

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	2	-
CO2	3	3	3	3	2	1	1	1	1	1	1	3	2	-
CO3	3	3	3	3	2	1	1	1	1	1	1	3	2	-
CO4	3	3	2	3	3	1	1	1	1	1	1	3	3	-
CO5	3	2	2	3	3	1	1	1	1	1	1	3	3	-

1 - Slightly; 2 - Moderately; 3 – Substantially

PROGRAMMING IN JAVA: 2230521

COURSE OBJECTIVE

- To understand the fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries, etc.
- To acquire the ability to write a computer program to solve specified problems.
- To use Java SDK environment to create, debug, and run simple Java programs

Unit 1: Introduction to Java programming: History and Features of Java, C++ vs. Java, Download and installation, IDE, JDK, JRE, and JVM (Java Virtual Machine), first Java program, Flowchart and algorithm, Data types in Java, Variables, expressions, keywords, Operators and statements, Type Conversion, static members, command line arguments, packages in java, use of import in java.

Unit 2: Control Statements: Conditional statements (if, else, if, else), Switch-case statements, Looping statements (for, while, do-while), array, type of array, Function, ways of passing arguments to functions, user-defined and inbuilt functions.

Unit 3: **Exception and File Handling:** Exceptions handling with try and catch block, Unchecked Exception Handling, Explicit throw an exception, Use of throws in checked exception, Introduction to file handling, file class, reading, writing to file, and appending a file, Input and output streams.

Unit 4: Collections Framework: Overview of collections (List, Set, Map), Iterators and Enumerations, Array List, Linked List, Hash Map, Multithreading, Introduction to threads, Synchronization and coordination of multiple threads, string package and operations, Abstract class, Abstract Method, Interface, Introduction to Swing and Applet.

Unit 5: Object-oriented programming: Classes and Objects, Wrapper classes, Access modifiers, Constructors and Destructors, Inheritance, Types of Inheritance, Overloading and Overriding, Final, This and Super keyword, static members in inheritance, Constructor in inheritance, Polymorphism, Type of Polymorphism: Compile Time Polymorphism and Run Time Polymorphism.

Recommended Books:

1. Programming with JAVA: A Primer, E. Balagurusamy, Tata McGraw Hill.
2. JAVA: The Complete Reference, Herbert Schildt, McGraw Hill Education.
3. JAVA-2: The Complete Reference, Patrick Naughton, Herbert Schidt.

COURSE OUTCOMES:

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

CO1. Define basic syntax and features of Java programming language
CO2. Solve computational problems using Java language.
CO3. Inspect the Java program for errors.
CO4. Design a program using the features of object-oriented concepts.
CO5. Construct the Java code for real-world problems using the libraries.

Course Articulation Matrix

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

1 - Slightly; 2 - Moderately; 3 – Substantially

Data Sciences in IoT: 2230522

COURSE OBJECTIVES

- To understand the key technologies in analytics for IoT.
- To understand the IoT data and requirements of analysis.
- To gain practical, hands-on experience with statistics programming languages, tools.

Unit-I: Introduction to Data Science, IoT Analytics and Challenges, Data Analytics Life Cycle, IoT Analytics for the Cloud, Types of Analytics: Streaming Analytics, Spatial, Time Series, and Prescriptive Analytics, various fields, and impact of Data Science in IoT, data lakes, Data retention strategy.

Unit-II: Introduction to Data Acquisition, Types of Data, Multi-Dimensional Data, Data collection strategies, Digital Data, Source of data and IoT data, CSV and JSON Data of IoT system, Descriptive Statistics, Mean, Standard Deviation, Skewness and Kurtosis, Inferential Statistics, sampling Distribution, Hypothesis Testing.

Unit-III: Introduction to Data wrangling, Exploratory Data Analytics, Feature engineering with IoT data, Missing value analysis, Data Cleaning and Transformation, Feature Improvements, Feature Selection, Feature Extraction and Handling Outliers, and Outlier Detection Analysis.

Unit-IV: Introduction to Data Visualization and Representation, Model Evaluation using Visualization, different kind of plotting: Line, Scatter, Bar, Histogram, Residual Plot, Distribution Plot, Box Plots, Pivot Table, Heat Map and Correlation Matrix.

Unit-V: Model Development using Simple and Multiple Regression, Polynomial Regression, and Pipelines in IoT data, Measures for In-sample Evaluation, Prediction, and Decision-making, IoT-based applications, Healthcare, Marketing, Finance, Smart Cities, Agriculture, and Weather Forecasting, and other domains; Real Time IoT-based data analysis.

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

CO1: **Define** the fundamentals of data science and its importance concerning IoT.

CO2: **Classify** data and the role of statistical techniques in IoT data.

CO3: **Analyze** the pre-processing and data-wrangling strategies.

CO4: **Summarize** the different data visualization and representation techniques.

CO5: **Explore** the different real-time applications and evaluate the performance of IoT-based projects.

Reference Books/ Text Books:

1. JojoMoolayil, "Smarter Decisions: The Intersection of IoT and Data Science", Packt, 2016.
2. Cathy O'Neil and Rachel Schutt, "Doing Data Science", O'Reilly, 2015.
3. David Dietrich, Barry Heller, Beibei Yang, "Data Science and Big data Analytics", EMC 2013.
4. Andrew Minteer, "Analytics for the Internet of Things IoT" (1 ed.), Packt Publishing, 2017. ISBN 978-1787120730.
5. HwaiyuGeng, Internet of Things and Data Analytics Handbook (1st st ed.), Wiley, 2017. ISBN 978-1119173649.

Course Articulation Matrix

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

1 - Slightly; 2 - Moderately; 3 - Substantially

Theory of Computation : 2230523

COURSE OBJECTIVE

- To understand computability, decidability, and complexity through problem solving.
- To analyse and design abstract model of computation & formal languages
- To understand and conduct mathematical proofs for computation and algorithms.

Unit-I : Introduction of Automata Theory: Examples of automata machines, Finite Automata as a language acceptor and translator, Moore machines and mealy machines, composite machine, Conversion from Mealy to Moore and vice versa.

Unit-II :Types of Finite Automata: Non Deterministic Finite Automata (NDFA), Deterministic finite automata machines, conversion of NDFA to DFA, minimization of automata machines, regular expression, Arden's theorem. Meaning of union, intersection, concatenation and closure, 2 way DFA.

Unit-III :Grammars: Types of grammar, context sensitive grammar, and context free grammar, regular grammar. Derivation trees, ambiguity in grammar, simplification of context free grammar, conversion of grammar to automata machine and vice versa, Chomsky hierarchy of grammar, killing null and unit productions. Chomsky normal form and Greibach normal form.

Unit-IV :Push down Automata: example of PDA, deterministic and non-deterministic PDA, conversion of PDA into context free grammar and vice versa, CFG equivalent to PDA, Petrinet model.

Unit-V :Turing Machine: Techniques for construction. Universal Turing machine Multitape, multihead and multidimensional Turing machine, N-P complete problems. Decidability and Recursively Enumerable Languages, decidability, decidable languages, undecidable languages, Halting problem of Turing machine & the post correspondence problem.

RECOMMENDED BOOKS

1. *Introduction to Automata Theory Language & Computation, Hopcroft & Ullman, Narosa Publication.*
2. *Element of the Theory Computation, Lewis &Christors, Pearson.*
3. *Theory of Computation, Chandrasekhar & Mishra, PHI.*
4. *Theory of Computation, Wood, Harper & Row.*
5. *Introduction to Computing Theory, Daniel I-A Cohen, Wiley.*

COURSE OUTCOMES

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

CO1. explain the basic concepts of switching and finite automata theory & languages.
CO2. relate practical problems to languages, automata, computability and complexity.
CO3. construct abstract models of computing and check their power to recognize the languages.
CO4. analyze the grammar, its types, simplification and normal form.
CO5. interpret rigorously formal mathematical methods to prove properties of languages, grammars and automata.
CO6. develop an overview of how automata theory, languages and computation are applicable in engineering application.

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	2	-
CO2	1	3	3	3	2	1	1	1	2	1	1	3	2	-
CO3	3	1	1	1	2	1	1	1	1	2	1	3	2	-
CO4	3	1	2	3	3	1	1	1	1	1	1	3	3	-

Wireless technologies for IoT: (2230524)

Course Objective:

- This course focused into the realm of wireless technologies in the Internet of Things (IoT), focusing on hands-on applications using Arduino, NodeMCU, and ESP32. Through practical experiments and theoretical discussions, students will gain a comprehensive understanding of various wireless communication protocols and their integration into IoT systems.

Unit 1: Introduction: Introduction to various Arduino platforms, NodeMCU, and ESP32, covering hardware specifications, programming environments, and basic interfacing techniques and its application in industry

Unit 2: Wi-Fi Technologies: Introduction on Wi-Fi communication, various Wi-Fi modules, particularly ESP8266 and ESP32, Wi-Fi networks for data transmission and its significance in IoT applications.

Unit 3: Bluetooth and Zigbee Technologies: Introduction to Bluetooth and Zigbee Technologies, Bluetooth Low Energy (BLE) and Zigbee Protocol and interfacing devices, concepts of different Bluetooth modules like HC-05 and HM-10, as well as Zigbee modules such as Xbee, Security and Optimization in Bluetooth and Zigbee Networks, exchanging data, and setting up Zigbee networks and integrating these technologies into IoT projects.

Unit 4: Long-Range and Low-Power Wireless Technologies: Introduction to LPWAN Technologies, Principles of LoRa Modulation, LoRaWAN Architecture, LoRaWAN Network Deployment, LoRaWAN Protocol Stack, Security and Performance Optimization and Emerging Trends and Future Directions

Unit 5: Cellular and Satellite Connectivity: Introduction to Cellular and Satellite Communication Technologies for IoT Integration and Deployment of Cellular and Satellite Connectivity using GSM/GPRS modules like SIM800, SIM900, LTE modules, and satellite communication modules, interfacing with microcontroller and use cases in applications such as connected vehicles, remote monitoring, and global tracking.

TEXT BOOKS:

1. 1. Arduino Programming in 24 Hours, Sams Teach Yourself by Richard Blum and Tim McGrath
2. Getting Started with ESP8266: Programming the Internet of Things with Lua and Arduino by Simon Monk
3. Bluetooth Low Energy: The Developer's Handbook by Robin Heydon
4. Zigbee Wireless Networking by Drew Gislason
5. LoRa for the Internet of Things by Agamemnon T. Filippou and George Mastorakis
6. Cellular Internet of Things: Technologies, Standards, and Performance by OlofLiberg, Marten Sundberg, and Eric Wanglund

Course Outcomes

At the end of the course, student will be able to:

CO1: **Gain** knowledge of Arduino platforms, NodeMCU, and ESP32, including hardware specifications.
CO2: **Explain** Wi-Fi communication principles, Wi-Fi modules (especially ESP8266 and ESP32), and their significance in IoT applications.
CO3: **Describe** Bluetooth Low Energy (BLE) and Zigbee protocols, along with practical skills.
CO4: **Apply** LPWAN technologies, LoRa modulation principles and itsLoRaWAN architecture.
CO5: **Acquire** skills in integrating and deploying cellular (e.g., GSM, LTE) and satellite connectivity for IoT applications.

Course Articulation Matrix

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

1 - Slightly; 2 - Moderately; 3 – Substantially

Cloud Computing (2230525)

Course Objective:

- Understand the concepts, technologies, architecture, and applications of cloud computing and learn the underlying principles of cloud virtualization, cloud storage, data management, and data visualization.
- Explore different cloud programming platforms and tools for developing and deploying applications on the cloud.
- Understand significant considerations for choosing a cloud platform and gain knowledge of AWS IoT Core, Microsoft Azure – IoT, and Google Cloud IoT Core.

Unit-I: Cloud Architecture and Model: Technologies for Network-Based System, System Models for Distributed and Cloud Computing, NIST Cloud Computing Reference Architecture. Cloud Models:- Characteristics, Cloud Services, Cloud models (IaaS, PaaS, SaaS), Public vs Private Cloud, Cloud Solutions Cloud ecosystem, Service management, Computing on demand.

Unit-II: Virtualization: Basics of Virtualization, Types of Virtualization, Implementation Levels of Virtualization, Virtualization Structures, Tools and Mechanisms, Virtualization of CPU, Memory, I/O Devices. Virtual Clusters and Resource management, Virtualization for Data-center Automation.

Unit-III: Cloud Infrastructure: Layered Cloud Architecture Development, Design Challenges, Inter Cloud Resource Management, Resource Provisioning and Platform Deployment, Global Exchange of Cloud Resources. Introduction to IoT Platform, Cloud IoT Architecture, IoT Cloud Services.

Unit-IV: Programming Model: Parallel and Distributed Programming Paradigms- MapReduce, Twister and Iterative MapReduce, Hadoop Library from Apache, Google App Engine (GAE), Amazon Web Service (AWS) and Microsoft Azure IoT Core Services, Business & Technical Considerations for Choosing the Right IoT Cloud Platform.

Unit-V: Security in the Cloud: Security Overview, Cloud Security Challenges and Risks, Software-as-a-Service Security, Security Governance, Risk Management, Security Monitoring, Security Architecture Design, Data Security, Application Security, Virtual Machine Security, Identity Management and Access Control.

Recommended Books:

1. Kai Hwang, Geoffrey C Fox, Jack G Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
2. John W. Rittinghouse and James F. Ransome, "Cloud Computing: Implementation, Management, and Security", CRC Press, 2010.
3. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing, A Practical Approach", TMH, 2009.
4. Kumar Saurabh, "Cloud Computing—insights into New-Era Infrastructure", Wiley India, 2011.
5. George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud" O'Reilly.
6. James E. Smith, Ravi Nair, "Virtual Machines: Versatile Platforms for Systems and Processes", Elsevier/Morgan Kaufmann, 2005.

Course Outcomes

At the completion of course, student will be able to:

CO1: **Describe** various basic concepts related to cloud computing.

CO2: **Explain** the architecture, infrastructure and delivery models of cloud computing.

CO3: **Design** and develop cloud infrastructure for IoT applications.

CO4: **Analyze** various security issues in cloud computing.

CO5: **Compose** virtualization, security and programming modules in cloud computing solutions.

Course Articulation Matrix

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

1 - Slightly; 2 - Moderately; 3 – Substantially

Data Analytics for IoT (230734)

Course Objectives:

- To Understand IoT Analytics and Challenges.
- To Analyze the IoT data to infer the protocol and device characteristics.
- To Explore and visualize data, and techniques to understand data quality.

Unit 1: Introduction to Data Analytics – Python Fundamentals, Central Tendency and Dispersion, Introduction to Probability, Probability Distributions, Sampling and Sampling Distribution, Distribution of Sample Means, population, and variance.

Unit 2: Exploring IoT Data – Confidence interval estimation, Hypothesis Testing, Errors in Hypothesis Testing, Two sample test, ANOVA, Post Hoc Analysis (Tukey's test), Randomize block design (RBD), Two Way ANOVA.

Unit 3: Prediction on IoT Data – Linear Regression, Estimation, Prediction of Regression Model, Residual Analysis, Multiple Regression, Categorical variable regression, Maximum Likelihood Estimation, Logistic Regression, Linear Regression Model vs. logistic Regression Model, Bias-variance tradeoff.

Unit 4: Measures on IoT Data – Confusion matrix and Region of Convergence (ROC), Performance of Logistic Model, Regression Analysis Model Building, Chi-Square Test of Independence, Chi-Square Goodness of Fit Test.

Unit 5: Cluster Analysis and Classifications – Introduction, K- Means Clustering, Hierarchical method of clustering, Classification and Regression Trees, Measures of attribute selection, Attribute selection Measures in CART, Classification and Regression Trees (CART).

Reference Books/ Text Books:

1. Douglas C. Montgomery, George C. Runger (2002). Applied Statistics & Probability for Engineering. "John Wiley & Sons, Inc".
2. Jay L. Devore (2011). Probability and Statistics for Engineering and the Sciences. "Cengage Learning".
3. David W. Hosmer, Stanley Lemeshow (2000). Applied logistic regression (Wiley Series in probability and statistics). "Wiley-Interscience Publication".
4. Minteer, Andrew, Analytics for the Internet of Things (IoT), Packt Publishing Ltd. July 2017, ISBN 9781787120730.
5. John Soldatos, Building Blocks for IoT Analytics Internet-of-Things Analytics, River Publishers.

Course Outcomes:

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

CO1. Illustrate the fundamentals of IoT Analytics and Challenges.
CO2: Learn about different types of IoT devices and the data they generate.
CO3: Explore data collection and storage methods for IoT data.
CO4: Apply statistical and machine learning techniques to analyze IoT data.
CO5: Gain hands-on experience with IoT data analytics tools and platforms.

Course Articulation Matrix:

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

1 - Slightly; 2 - Moderately; 3 – Substantially

Mobile Computing (230735)

Course Objective:

- To introduce the basic concepts and principles in mobile computing.
- To provide a computer systems perspective on the converging areas of wireless networking, mobile devices, and network protocols.
- To introduce wireless communication and networking principles, that support connectivity to cellular networks, wireless internet and sensor devices.

Unit-I: Review of Personal Communication Services (PCS): Basic Concepts of Cellular Systems, Evolution of mobile technologies 1G to 4G (LTE, LTEA, LTEA Pro), Global System for Mobile Communication (GSM), Protocols, Handover, Data Services, and Multiple Division Techniques.

Unit-II: General Packet Radio Services (GPRS): GPRS Architecture, GPRS Network Nodes. Mobile Data Communication: WLANs (Wireless LANs) IEEE 802.11 Standard, Mobile IP.

Unit-III: Wireless Application Protocol (WAP): Mobile Internet Standard. WAP Gateway and Protocols, Wireless Markup Languages (WML).

Unit-IV: Third Generation (3G) Mobile Services: Introduction to International Mobile Telecommunications 2000 (IMT 2000) Vision, Wideband Code Division Multiple Access (W-CDMA) and CDMA 2000, Quality of Services in 3G.

Unit-V: Overview of 5G Mobile Communication: An overview of 5G requirements, Regulations for 5G, Spectrum Analysis and Sharing for 5G, Channel Models for mmWave MIMO Systems, 3GPP standards for 5G, IEEE 802.15.4.

Recommended Books:

1. Mobile communications, J. Schiller, Pearson Education.
2. Wireless and Mobile Networks Architecture, by Yi – Bing Lin, John Wiley & Sons.
3. Mobile & Personnel Communication Systems and Services, Raj Pandya, Prentice Hall India.
4. Wireless Communication- Principles and Practices, Theodore S. Rappaport, Pearson Education.
5. The Wireless Application Protocol, Singhal & Bridgman, Pearson Education.

Course Outcomes

At the completion of course, student will be able to:

CO1: **Explain** the basic concepts of mobile telecommunications system.
CO2: **Demonstrate** the infrastructure to develop mobile communications system.
CO3: **Classify** the different generations and technology for mobile communications.
CO4: **Examine** the working of different protocols of wireless mobile communication technology.
CO5: **Determine** the importance of each technology suitable for different situation of mobile and Wireless communications.

Course Articulation Matrix

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

1 - Slightly; 2 - Moderately; 3 – Substantially