D.No 583
06/02/2025

Board of Studies
Centre for Internet of Things

B.Tech.
Internet of Things
&
Internet of Things (IoT)

06 December, 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

माधव प्रौद्योगिकी एवं विज्ञान संस्थान, ग्वालियर
MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR
Deemed University
(Declared under Distinct Category by Ministry of Education, Government of India)
NAAC ACCREDITED WITH A++ Grade
Gola Ka Mandir, Gwalior (M.P.)- 474005, INDIA
Ph.:+91-751-2409300, E-mail: vicechancellor@mitsgwalior.in, Website: www.mitsgwalior.in
MITS

Centre for Internet of Things

Date: 07-12-2024

Summary

BoS Meeting scheduled on 07th December 2024

Courses where revision was carried out							
(Course 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
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New Courses added					
(Course name)	Course Code	Activities/contents which have a bearing on increasing skill and employability	Agenda Item No.	Page No.	Link of relevant documents/minutes
Sensors and Actuators	22241202	Hands-on training in sensor-actuator systems, IoT integration, industrial protocols, and troubleshooting enhances practical skills, for employability in automation, smart devices, and industrial applications.	03		Click Here
Fundamentals of Signal and Systems	22241203	Practical exposure to signal analysis, system modelling, MATLAB tools, and real-world applications like filtering and telecommunications equips students with problem-solving skills, boosting industry readiness.	03		Click Here

7/12/24

Centre for Internet of Things

Minutes of Meeting

Date: 07-12-2024

Board of Studies (BoS) meeting of the Centre for Internet of Things was held in hybrid mode on **December 7th, 2024 from 12:00 Noon onwards**. The following external members were invited and attended the meeting in addition to the faculty members of the Centre for IoT:

S.No.	Name of Expert	Designation and Organization
➢	**Dr. Mukhtiyar Singh**	**Professor,** Electrical Engineering Department Delhi Technological University , Delhi
➢	**Dr. Anmol Ratna Saxena**	**Associate Professor** Department of Electrical Engineering NIT-Delhi

BoS Members:

1. **Dr. Praveen Bansal,** Coordinator, CoT
2. **Dr. Dhananjay Bisen,** Assistant Professor
3. **Dr. Saurabh Rajput,** Assistant Professor
4. **Dr. Bhavna Rathore,** Assistant Professor
5. **Dr. Aditya Dubey,** Assistant Professor

BoS Agenda Items

Item CIoT1	To confirm the minutes of previous BoS meeting held in the month of September 2024 ➢ *The minutes of the last BoS held on* September 7th , *2024 at 11.30 AM were confirmed.*
Item CIoT2	**To review the scheme structure for the Batch admitted in 2024-25 academic session under the Madhav Institute of Technology & Science-Deemed University (MITS-DU) structure** ➢ *The scheme structure of B. Tech. Internet of Things for the batch admitted in 2024-25 is prepared and is annexed at* ***ANNEXURE-1*** ➢ *The scheme structure of B. Tech. Internet of Things (IoT) for the batch admitted in 2024-25 is prepared and is annexed at* ***ANNEXURE-2***
Item CIoT3	**To review & finalize the syllabi for all courses of B. Tech II Semester (for batch admitted in 2024-25) under the flexible curriculum along with their COs** ➢ *The syllabus of B. Tech. II Semester of B.Tech Internet of Things for the batch admitted in 2024-25 is prepared and is annexed at* ***ANNEXURE-3*** ➢ *The syllabus of B. Tech. II Semester of B.Tech Internet of Things (IoT) for the batch admitted in 2024-25 is prepared and is annexed at* ***ANNEXURE-4***

Item CIoT4	**To review and finalize the Experiment list/ Lab manual for all the Laboratory Courses and Micro Project-I to be offered in to be offered in B. Tech. II Semester (for batch admitted in 2024-25)** ➢ *The Experiment list/ Lab manual for various laboratory courses to be offered in along with the Course Outcomes and Micro Projects-I of II semester of the B.Tech Internet of Things students of 2024-25 admitted batch under the flexible curriculum is included at* ***ANNEXURE-5*** ➢ *The Experiment list/ Lab manual for various laboratory courses to be offered in along with the Course Outcomes and Micro Projects-I of II semester of the B.Tech Internet of Things(IoT) students of 2024-25 admitted batch under the flexible curriculum is included at* ***ANNEXURE-6***
Item CIoT5	**To review and finalize the syllabi of II semester PG Programme under the Madhav Institute of Technology & Science-Deemed University (MITS-DU) (M.E./M.Tech./MCA/MBA/MUP) along with their Course Outcomes (COs)** ***Not Applicable***
Item CIoT6	**To review and finalize the syllabus/module of Classified Novel Engaging Course to be offered in II semester of PG programme** ***Not Applicable***
Item CIoT7	**Any other matter:** • **To review syllabi of Ph.D. course work under the Madhav Institute of Technology & Science-Deemed University (MITS-DU)** ○ *The syllabi of all courses of PhD course work are annexed at* ***ANNEXURE-8***

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

BoS members of the centre

Dr. Bhavana Rathore | Dr. Dhananjay Bisen | Dr. Saurabh Rajput | Dr. Aditya Dubey

External Members

Present

Dr. Mukhtiyar Singh
Professor, Department of Electrical Engineering,
DTU

Present-

Dr. Anmol Ratna Saxena
Associate Professor,
NIT-Delhi

Dr. Praveen Bansal
Coordinator,
Centre for Internet of Things

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MITS-DU

Semester-Wise General Scheme Structure & Important Guidelines for Flexible Curriculum

(Batch admitted in Academic Session 2024-25 onwards)

Abbreviations Used

L	Lecture
T	Tutorial
P	Practical
HSMC	Humanities and Social Sciences including Management Courses
BSC	Basic Science Courses
ESC	Engineering Science Courses
DC	Departmental Core
DE	Departmental Elective
SPC	Specialization Courses
OC	Open Category
DLC	Departmental Laboratory Courses
MOOC	Massive Open Online Course
MWS	Mandatory Workshop
SP	Semester Proficiency
SIP	Skill Internship Program
SLP	Self-learning Presentation
PDC	Professional Development Component
PBL	Project Based Learning
PC	Professional Certification
MAC	Mandatory Audit Course
NEC	Novel Engaging Course

Recommended in BoS meeting of Centre for IoT held on 07. Dec.2024

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Centre for Internet of Things

Scheme of Evaluation

B. Tech. I Semester *Internet of Things*

(for batch admitted in academic session 2024-25)

S. No.	Course Code	Category Code	Course Name	Maximum Marks Allotted						Total Marks	Contact Hours per week			Total Credits	Mode of Learning	Mode of Major Evaluation	Duration of Major Evaluation
				Theory Block				Practical Block									
				Continuous Evaluation			Major Evaluation	Continuous Evaluation	Major Evaluation		L	T	P				
				Minor Evaluation I	Minor Evaluation II	Quiz/ Assignment		Lab Work & Sessional									
1.	22241101	DC	Principles of Internet of Things	20	20	30	30	-	-	100	3	-	-	3	Face to Face	PP	2 Hrs
2.	22241102	ESC	Computer Programming	20	20	30	30	-	-	100	2	-	-	2	Face to Face	MCQ	2 Hrs
3.	22241103	DC	Engineering Measurement	20	20	30	30	-	-	100	2	1	-	3	Face to Face	MCQ	2 Hrs
4.	22241104	DC	Digital Electronics and Logic Design	20	20	30	30	-	-	100	2	1	-	3	Face to Face	MCQ	2 Hrs
5.	22241105	BSC	Linear Algebra and Calculus	20	20	30	30	-	-	100	3	-	-	3	Face to Face	PP	2 Hrs
6.	22241106	DLC	Computer Programming Lab	-	-	-	-	70	30	100	-	-	2	1	Experimental	AO	-
7.	22241107	DLC	Internet of Things Lab	-	-	-	-	70	30	100	-	-	2	1	Experimental	AO	-
8.	22241108	SP	Semester Proficiency[$]	-	-	-	-	50	-	50	-	-	2	1	Face to Face	SO	-
9.	22241109	PBL	Micro Project-I[#]	-	-	-	-	70	30	100	-	-	2	1	Experiential	SO	-
10.	22241110	HSMC	Language Lab	-	-	-	-	70	30	100	-	-	2	1	Blended	AO	-
11.	NECXXXX	NEC	Novel Engaging Course (Activity Based Learning)	-	-	-	-	50	-	50	-	-	2	1	Interactive	SO	-
Total				100	100	150	150	380	120	1000	12	02	12	20	-	-	-
12.	22241111	MAC	Universal Human Values & Professional Ethics (UHVPE)	20	20	30	30	-	-	100	2	-	-	GRADE	Blended	MCQ	1.5 Hrs
13.	22241112	MWS	Mandatory Workshop on Indian Constitution and Traditional Knowledge at Department Level (Duration: Two Days)											GRADE	Interactive	MCQ	-
Induction programme of three weeks (MC): Physical activity, Creative Arts, Universal Human Values, Literary, Proficiency Modules, Lectures by Eminent People, Visits to local Areas, Familiarization to Dept./Branch & Innovations.																	
Skill Internship Program (Soft Skill): Minimum 45 hours duration: To be credited in II Semester.																	

[$]Semester Proficiency– includes the weightage towards ability/ skill/ competency /knowledge level /expertise attained etc. in the semester courses

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

[#]Micro Project-I will be presented and evaluated through an interdisciplinary project evaluation committee.

HSMC	BSC	ESC	DC	DE	SPC	OC	DLC	NEC	SP	SIP	SLP	PDC	PBL	MAC	MWS
1	1	1	3	0	0	0	2	1	1	0	0	0	1	1	1

Mode of Learning						Mode of Examination						Total Credits
Theory		NEC	Lab			Theory				NEC	Lab	
Face to Face	Online	Interactive	Blended	Experiential	Experimental	PP	AO	MCQ	OB	SO	SO	20
15	0	1	01	01	02	06	03	08	-	01	02	Credits %
75%	-	5%	5%	5%	10%	30%	15%	40%		5%	10%	

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Centre for Internet of Things

Scheme of Evaluation

B. Tech. II Semester *Internet of Things*

(for batch admitted in academic session 2024-25)

S. No.	Course Code	Category Code	Course Name	Maximum Marks Allotted						Total Marks	Contact Hours per week			Total Credits	Mode of Learning	Mode of Major Evaluation	Duration of Major Evaluation
				Theory Block				Practical Block									
				Continuous Evaluation			Major Evaluation	Continuous Evaluation	Major Evaluation								
				Minor Evaluation I	Minor Evaluation II	Quiz/ Assignment		Lab Work & Sessional			L	T	P				
1.	22241201	DC	Object-Oriented Programming	20	20	30	30	-	-	100	3	-	-	3	Face to Face	MCQ	2 Hrs
2.	22241202	DC	Sensors and Actuators	20	20	30	30	-	-	100	2	1	-	3	Face to Face	PP	2 Hrs
3.	22241203	DC	Fundamentals of Signal and Systems	20	20	30	30	-	-	100	2	1	-	3	Face to Face	MCQ	2 Hrs
4.	22241204	DC	Operating Systems	20	20	30	30	-	-	100	2	1	-	3	Face to Face	PP	2 Hrs
5.	22241205	ESC	Basic Electrical and Electronics Engineering	20	20	30	30	-	-	100	2	-	-	2	Face to Face	MCQ	2 Hrs
6.	22241206	DLC	Object-Oriented Programming Lab	-	-	-	-	70	30	100	-	-	2	1	Experimental	AO	-
7.	22241207	DLC	Sensors and Actuators Lab	-	-	-	-	70	30	100	-	-	2	1	Experimental	AO	-
8.	22241208	DLC	Electrical and Electronics Engineering Lab	-	-	-	-	70	30	100	-	-	2	1	Experimental	AO	-
9.	22241209	SP	Semester Proficiency[$]	-	-	-	-	50	-	50	-	-	2	1	Face to Face	SO	-
10.	22241210	PBL	Micro Project-II#	-	-	-	-	70	30	100	-	-	2	1	Experiential	SO	-
11.	NECXXXX	NEC	Novel Engaging Course (Activity Based Learning)	-	-	-	-	50	-	50	-	1	-	1	Interactive	SO	-
12.	SIP1XXXX	SIP	Skill Internship Program(Soft Skill)	-	-	-	-	60	-	60	-	-	-	2**	Experiential	SO	-
Total				100	100	150	150	440	120	1060	11	04	10	22	-	-	-
13.	22241211	MAC	Sustainability & Environmental Science	20	20	30	30	-	-	100	2	-	-	GRADE	Blended	MCQ	1.5 Hrs
14.	22241212	MWS	Mandatory Workshop on Indian Knowledge System at Department Level (Duration: Two Days)											GRADE	Interactive	MCQ	-

Summer Semester of six-eight week duration will be conducted for makeup of I& II semester examination.

[$]Semester Proficiency– includes the weightage towards ability/ skill/ competency /knowledge level /expertise attained etc. in the semester courses

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

** These credits will be transferred from Skill Internship Program

Micro Project-II will be presented and evaluated through an interdisciplinary project evaluation committee.

BSMC	BSC	ESC	DC	DE	SPC	OC	DLC	NEC	SP	SIP	SLP	PDC	PBL	MAC	MWS
0	0	1	4	0	0	0	3	1	1	1	0	0	1	1	1

Mode of Learning						Mode of Examination						Total Credits
Theory		NEC	Lab			Theory				NEC	Lab	
Face to Face	Online	Interactive	Blended	Experiential	Experimental	PP	AO	MCQ	OB	SO	SO	
15	00	01	00	03	03	06	03	08	-	01	04	22
68.18%	-	4.5%	-	13.63%	13.63%	27.27%	13.63%	36.36%	-	4.5%	18.18%	Credits %

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Scheme of Evaluation

B. Tech. III Semester *Internet of Things*

(for batch admitted in academic session 2024-25)

S. No.	Course Code	Category Code	Course Name	Maximum Marks Allotted						Total Marks	Contact Hours per week			Total Credits	Mode of Learning	Mode of Major Evaluation	Duration of Major Evaluation
				Theory Block				Practical Block									
				Continuous Evaluation			Major Evaluation	Continuous Evaluation	Major Evaluation		L	T	P				
				Minor Evaluation I	Minor Evaluation II	Quiz/ Assignment		Lab Work & Sessional									
1.	22242101	BSC	Probability and Statistics	20	20	30	30	-	-	100	3	-	-	3	Face to Face	PP	2Hrs
2.	22242102	DC	Embedded System &IoT	20	20	30	30	-	-	100	2	1	-	3	Face to Face	PP	2Hrs
3.	22242103	DC	Data Structures	20	20	30	30	-	-	100	2	1	-	3	Face to Face	MCQ	2Hrs
4.	22242104	DC	Electronic Devices and Circuits	20	20	30	30	-	-	100	2	1	-	3	Face to Face	MCQ	2Hrs
5.	22242105	DC	IoT Architecture and Protocol	20	20	30	30	-	-	100	2	1	-	3	Face to Face	MCQ	2Hrs
6.	22242106	DLC	Problem Solving through Python Programming	-	-	-	-	70	30	100	-	-	2	1	Experimental	AO	-
7.	22242107	DLC	Data Structures Lab	-	-	-	-	70	30	100	-	-	2	1	Experimental	AO	-
8.	22242108	DLC	IoT Architecture and Protocol Lab	-	-	-	-	70	30	100	-	-	2	1	Experimental	AO	
9.	22242109	SP	Semester Proficiency[$]	-	-	-	-	50	-	50	-	-	2	1	Face to Face	SO	-
10.	22242110	PBL	Macro Project-I[#]	-	-	-	-	70	30	100	-	-	2	1	Experiential	SO	-
11.	22242111	SLP	Self-learning/Presentation[$$$] (SWAYAM/NPTEL/MOOC)	-	-	-	-	40	-	40	-	-	2	1	Mentoring	SO	-
12.	NECXXXX	NEC	Novel Engaging Course (Activity Based Learning)	-	-	-	-	50	-	50	-	1	-	1	Interactive	SO	-
			Total	100	100	150	150	370	170	1040	11	05	12	22	-	-	-
13.	22242112	MAC	Cyber Security	20	20	30	30	-	-	100	2	-	-	GRADE	Blended	MCQ	1.5 Hrs
14.	22242113	MWS	Mandatory Workshop on Life Skills at Department Level (Duration: Two Days)											GRADE	Interactive	MCQ	-
			Skill Internship Program (Institute Level) (Qualifier): Minimum 30 hours duration: To be credited in IV Semester														

[$]Semester Proficiency- includes the weightage towards ability/ skill/ competency /knowledge level /expertise attained etc. in the semester courses

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

[#]Macro Project-I will be presented and evaluated through an interdisciplinary project evaluation committee.

[$$$]Compulsory registration for one online course using SWAYAM/NPTEL/ MOOC, evaluation through attendance and presentation.

HSMC	BSC	ESC	DC	DE	SPC	OC	DLC	NEC	SP	SIP	SLP	PDC	PBL	MAC	MWS
0	1	0	4	0	0	0	3	1	1	0	1	0	1	1	1

Mode of Learning							Mode of Examination						Total Credits
Theory		NEC	Lab				Theory				NEC	Lab	
Face to Face	Online	Interactive	Blended	Experiential	Mentoring	Experimental	PP	AO	MCQ	OB	SO	SO	
16	00	01	00	01	01	03	06	03	09	-	01	03	22
72.72%	-	4.5%	-	4.5%	4.5%	13.63%	27.27%	13.63%	40.90%	-	4.5%	13.63%	Credits %

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Centre for Internet of Things

Scheme of Evaluation

B. Tech. IV Semester *Internet of Things*

(for batch admitted in academic session 2024-25)

S. No.	Course Code	Category Code	Course Name	Maximum Marks Allotted						Total Marks	Contact Hours per week			Total Credits	Mode of Learning	Mode of Major Evaluation	Duration of Major Evaluation
				Theory Block				Practical Block									
				Continuous Evaluation			Major Evaluation	Continuous Evaluation	Major Evaluation		L	T	P				
				Minor Evaluation I	Minor Evaluation II	Quiz/ Assignment		Lab Work & Sessional									
1.	22242201	DC	Data Science	20	20	30	30	-	-	100	2	1	-	3	Face to Face	MCQ	2Hrs
2.	22242202	DC	Microcontrollers and its interfacing	20	20	30	30	-	-	100	2	1	-	3	Face to Face	PP	2Hrs
3.	22242203	DC	Design and Analysis of Algorithms	20	20	30	30	-	-	100	2	1	-	3	Face to Face	MCQ	2Hrs
4.	22242204	DC	IoT Cloud Security	20	20	30	30	-	-	100	2	1	-	3	Face in Face	PP	2Hrs
5.	22242205	DC	Wireless Technologies for IoT	20	20	30	30	-	-	100	3	-	-	3	Face to Face	MCQ	2Hrs
6.	22242206	DLC	Data Science Lab	-	-	-	-	70	30	100	-	-	2	1	Experimental	AO	-
7.	22242207	DLC	Design and Analysis of Algorithms Lab	-	-	-	-	70	30	100	-	-	2	1	Experimental	AO	-
8.	22242208	DLC	Wireless Technologies for IoT Lab	-	-	-	-	70	30	100	-	-	2	1	Experimental	AO	-
9.	22242209	SP	Semester Proficiency[$]	-	-	-	-	50	-	50	-	-	2	1	Face to Face	SO	-
10.	22242210	PBL	Macro Project-II[#]	-	-	-	-	70	30	100	-	-	2	1	Experiential	SO	-
11.	22242211	PC	Professional Certification	-	-	-	-	50	-	50	-	-	2	1	Blended	SO	-
12.	NECXXXX	NEC	Novel Engaging Course (Activity Based Learning)	-	-	-	-	50	-	50	-	1	-	1	Interactive	SO	-
13.	SIP3XXXX	SIP	Skill Internship Program	-	-	-	-	60	-	60	-	-	-	2**	Experiential	SO	-
			Total	**100**	**100**	**150**	**150**	**422**	**188**	**1110**	**11**	**05**	**12**	**24**	-	-	-
14.	22242212	MAC	Project Management, Economics & Financing	20	20	50	30	-	-	100	2	-	-	GRADE	Blended	MCQ	1.5 Hrs
15.	22242213	MWS	Mandatory Workshop on Computer Vision at Department Level (Duration: Two Days)											GRADE	Interactive	MCQ	-
			Summer Semester of six-eight week duration will be conducted for makeup of previous semester examination.														
			Additional Course for Honours or Minor Degree: Permitted to opt for maximum two additional courses for the award of Honours or Minor Degree														

[$]Semester Proficiency– includes the weightage towards ability/ skill/ competency /knowledge level /expertise attained etc. in the semester courses

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

[#]Macro Project-II will be presented and evaluated through an interdisciplinary project evaluation committee.

[**]These credits will be transferred from Skill Internship Program

PC	BSC	ESC	DC	DE	SPC	OC	DLC	NEC	SP	SIP	SLP	PDC	PBL	MAC	MWS
1	0	0	5	0	0	0	3	1	1	1	0	0	1	1	1

Mode of Learning						Mode of Examination						Total Credits
Theory		NEC	Lab			Theory				NEC	Lab	
Face to Face	Online	Interactive	Blended	Experiential	Experimental	PP	AO	MCQ	OB	SO	SO	
16	00	01	01	03	03	06	03	09	-	01	05	24
66.66%	-	4.12%	4.12%	12.5%	12.5%	25%	12.5%	37.5%	-	4.1%	20.83%	Credits %

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Scheme of Evaluation

B. Tech. V Semester *Internet of Things*

(for batch admitted in academic session 2024-25)

S. No.	Course Code	Category Code	Course Name	Maximum Marks Allotted								Total Marks	Contact Hours per week			Total Credits	Mode of Learning	Mode of Major Evaluation	Duration of Major Evaluation
				Theory Block				Practical Block		MOOCs									
				Continuous Evaluation			Major Evaluation	Continuous Evaluation	Major Evaluation	Assignment	Exam		L	T	P				
				Minor Evaluation I	Minor Evaluation II	Quiz/ Assignment		Lab Work & Sessional											
1.	22243101	DC	Database Management System	20	20	30	30	-	-	-	-	100	2	1	-	3	Face to Face	MCQ	2Hrs
2.	22243102	DC	Embedded Control of Electric Motors	20	20	30	30	-	-	-	-	100	2	1	-	3	Face to Face	PP	2Hrs
3.	22243103	DC	Artificial Intelligence & Machine Learning	20	20	30	30	-	-	-	-	100	2	1	-	3	Face to Face	MCQ	2Hrs
4.	222431xx	DE	Departmental Elective* (DE-1)	-	-	-	-	-	-	25	75	100	3	-	-	3	Online	MCQ	3 Hrs
5.	222431xx	SPC	Specialization Course (SPC-1)	20	20	30	30	-	-	-	-	100	2	1	-	3	Face to Face	PP	2Hrs
6.	22243104	DLC	Database Management System Lab	-	-	-	-	70	30	-	-	100	-	-	2	1	Experimental	AO	-
7.	22243105	DLC	Artificial Intelligence & Machine Learning Lab	-	-	-	-	70	30	-	-	100	-	-	2	1	Experimental	AO	-
8.	22243106	SP	Semester Proficiency[$]	-	-	-	-	50	-	-	-	50	-	-	2	1	Face to Face	SO	-
9.	22243107	PBL	Cornerstone Project	-	-	-	-	70	30	-	-	100	-	-	4	2	Experiential	SO	-
Total				**80**	**80**	**120**	**120**	**260**	**90**	**25**	**75**	**850**	**11**	**04**	**10**	**20**	-	-	-
10.	22243115	MAC	Supply Chain Management	20	20	30	30	-	-			100	2	-	-	GRADE	Blended	MCQ	1.5 Hrs
11.	22243116	MWS	Mandatory Workshop on Block chain at Department Level (Duration: Two Days)													GRADE	Interactive	MCQ	-
Additional Course for Honours or Minor Degree: Permitted to opt for maximum two additional courses for the award of Honours or Minor Degree																			

[$]Semester Proficiency– includes the weightage towards ability/ skill/ competency /knowledge level /expertise attained etc. in the semester courses

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

* Course run through SWAYAM/NPTEL/ MOOC Learning Based Platform

HSMC	BSC	ESC	DC	DE	SPC	OC	DLC	NEC	SP	SIP	SLP	PDC	PBL	MAC	MWS
0	0	0	3	1	1	0	2	0	1	0	0	0	1	1	1

Mode of Learning						Mode of Examination						Total Credits
Theory		NEC	Lab			Theory				NEC	Lab	
Face to Face	Online	Interactive	Blended	Experiential	Experimental	PP	AO	MCQ	OB	SO	SO	
13	03	00	00	02	02	06	02	09	-	00	03	20
65%	15%	-	-	10%	10%	30%	10%	45%	-	-	15%	Credits %

Recommended in BoS meeting of Centre for IoT held on 07. Dec.2024

MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR

(Deemed to be University)

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Centre for Internet of Things

Scheme of Evaluation

B. Tech. VI Semester *Internet of Things*

(for batch admitted in academic session 2024-25)

S. No.	Course Code	Category Code	Course Name	Maximum Marks Allotted								Total Marks	Contact Hours per week			Total Credits	Mode of Learning	Mode of Major Evaluation	Duration of Major Evaluation
				Theory Block				Practical Block		MOOCs									
				Continuous Evaluation			Major Evaluation	Continuous Evaluation	Major Evaluation	Assignment	Exam		L	T	P				
				Minor Evaluation I	Minor Evaluation II	Quiz/ Assignment		Lab Work & Sessional											
1.	22243201	DC	Software Engineering	20	20	30	30	-	-	-	-	100	2	1	-	3	Face to Face	MCQ	2Hrs
2.	22243202	DC	IoT System Design	20	20	30	30	-	-	-	-	100	2	1	-	3	Face to Face	MCQ	2Hrs
3.	222432 xx	DE	Departmental Elective* (DE-2)	-	-	-	-	-	-	25	75	100	3	-	-	3	Online	MCQ	3 Hrs
4.	222432xx	OC	Open Category Course (OC-1)	20	20	30	30	-	-	-	-	100	2	1	-	3	Face to Face	PP	2 Hrs
5.	222432xx	SPC	Specialization Course (SPC-2)	20	20	30	30	-	-	-	-	100	3	-	-	3	Face to Face	PP	2Hrs
6.	22243203	DLC	IoT System Design Lab	-	-	-	-	70	30	-	-	100	-	-	2	1	Experimental	AO	-
7.	22243204	DLC	Competitive Programming Lab	-	-	-	-	70	30	-	-	100	-	-	2	1	Experimental	AO	-
8.	22243205	SP	Semester Proficiency[$]	-	-	-	-	50	-	-	-	50	-	-	2	1	Face to Face	SO	-
9.	22243206	PBL	Capstone Project	-	-	-	-	70	30	-	-	100	-	-	4	2	Experiential	SO	-
Total				80	80	120	120	260	90	25	75	850	12	03	10	20	-	-	-
10.	22243214	MAC	Disaster Management	20	20	30	30	-	-	-	-	100	2	-	-	GRADE	Blended	MCQ	1.5 Hrs
11.	22243215	MWS	Mandatory Workshop on Intellectual Property Rights at Department Level (Duration: Two Days)													GRADE	Interactive	MCQ	-
Skill Enhancement Program/Research Internship/On Job Training for Four weeks duration (Mandatory)																			
Summer Semester of six-eight week duration will be conducted for makeup of previous semester examination																			
Additional Course for Honours or Minor Degree: Permitted to opt for maximum two additional courses for the award of Honours or Minor Degree																			

[$]Semester Proficiency– includes the weightage towards ability/ skill/ competency /knowledge level /expertise attained etc in the semester courses

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

* Course run through SWAYAM/NPTEL/ MOOC Learning Based Platform

HSMC	BSC	ESC	DC	DE	SPC	OC	DLC	NEC	SP	SIP	SLP	PDC	PBL	MAC	MWS
0	0	0	2	1	1	1	2	0	1	0	0	0	1	1	1

Mode of Learning						Mode of Examination						Total Credits
Theory		NEC	Lab			Theory				NEC	Lab	
Face to Face	Online	Interactive	Blended	Experiential	Experimental	PP	AO	MCQ	OB	SO	SO	
13	03	00	00	02	02	06	02	09	-	00	03	20
65%	15%	-	-	10%	10%	30%	10%	45%	-	-	15%	Credits %

Recommended in BoS meeting of Centre for IoT held on 07. Dec.2024

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Centre for Internet of Things

Scheme of Evaluation

B. Tech. VII Semester *Internet of Things*

(for batch admitted in academic session 2024-25)

S. No.	Course Code	Category Code	Course Name	Maximum Marks Allotted								Total Marks	Contact Hours per week			Total Credits	Mode of Learning	Mode of Major Evaluation	Duration of Major Evaluation
				Theory Block				Practical Block		MOOCs									
				Continuous Evaluation			Major Evaluation	Continuous Evaluation	Major Evaluation	Assignment	Exam		L	T	P				
				Minor Evaluation I	Minor Evaluation II	Quiz/ Assignment		Lab Work & Sessional											
1.	222441XX	DE	Departmental Elective# (DE-3)	20	20	30	30	-	-	-	-	100	3	-	-	3	Blended Mode	PP	2 Hrs
2.	222441XX	DE	Departmental Elective* (DE-4)	-	-	-	-	-	-	25	75	100	3	-	-	3	Online	MCQ	3 Hrs
3.	222441XX	OC	Open Category Course *(OC-2)					-	-	25	75	100	3	0	-	3	Online	MCQ	3 Hrs
4.	222441XX	SPC	Specialization Course#(SPC-3)	20	20	30	30	-	-	-	-	100	2	1	-	3	Blended Mode	PP	2 Hrs
5.	22244101	SIP	Skill Enhancement Program/Research Internship/ On Job Training	-	-	-	-	-	50	-	-	50	-	-	-	1**	Experiential	SO	-
6.	22244102	DLC	Creative Problem Solving	-	-	-	-	-	50	-	-	50	-	-	2	1	Experiential	SO	-
Total				40	40	60	60	-	100	50	150	500	11	01	02	14	-	-	-
Additional Course for Honours or Minor Degree: Permitted to opt for maximum two additional courses for the award of Honours or Minor Degree																			

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

*Course run through SWAYAM/NPTEL/ MOOC Learning Based Platform

** These credits will be transferred from Skill Enhancement Program/Research Internship/On Job Training

#Course run through MITS-DU MOOCs

HSMC	BSC	ESC	DC	DE	SPC	OC	DLC	NEC	SP	SIP	SLP	PDC	PBL	MAC	MWS
0	0	0	0	2	1	1	1	0	1	0	0	0	0	0	1

Mode of Learning						Mode of Examination						Total Credits
Theory		NEC	Lab			Theory				NEC	Lab	
Face to Face	Online	Interactive	Blended	Experiential	Experimental	PP	AO	MCQ	OB	SO	SO	
10	03	00	00	01	00	06	00	06	-	00	02	14
71.42%	21.42%	-	-	7.14%	-	42.85%	-	42.85%	-	-	14.28%	Credits %

Recommended in BoS meeting of Centre for IoT held on 07. Dec.2024

MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR
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Centre for Internet of Things

Scheme of Evaluation
B. Tech. VIII Semester *Internet of Things*

(for batch admitted in academic session 2024-25)

S. No.	Course Code	Category Code	Course Name	Maximum Marks Allotted								Total Marks	Contact Hours per week			Total Credits	Mode of Learning	Mode of Major Evaluation	Duration of Major Evaluation
				Theory Block				Practical Block		MOOCs									
				Continuous Evaluation			Major Evaluation	Continuous Evaluation	Major Evaluation	Assignment	Exam		L	T	P				
				Minor Evaluation I	Minor Evaluation II	Quiz/ Assignment													
1.	222442XX	DE	Departmental Elective* (DE-5)	-	-	-	-	-	-	25	75	100	3	-	-	3	Online	MCQ	3 Hrs
2.	222442XX	OC	Open Category Course* (OC-3)	-	-	-	-	-	-	25	75	100	3	-	-	3	Online	MCQ	3 Hrs
3.	22244201	PBL	Industry Internship/ Research Internship/ Innovation & Start-up	-	-	-	-	280	120	-	-	400	-	-	20	10	Experiential	SO	-
4.	22244202	PDC	Professional Development[@]	-	-	-	-	-	50	-	-	50	-	-	4	2	Interactive	SO	-
Total				-	-	-	-	280	170	50	150	650	06	-	24	18	-	-	-
Summer Semester of six-eight week duration will be conducted to complete any backlog courses.																			
Additional Course for Honours or Minor Degree: Permitted to opt for maximum two additional courses for the award of Honours or Minor Degree																			

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

*Course run through SWAYAM/NPTEL/ MOOC Learning Based Platform

[@] Evaluation will be based on participation/laurels brought by the students to the institution in national/state level technical and other events during the complete tenure of the UG programme (participation in professional chapter activities, club activities, cultural events, sports, personality development activities, collaborative events, MOOCs, technical events, institute/department committees, etc.)

HSMC	BSC	ESC	DC	DE	SPC	OC	DLC	NEC	SP	SIP	SLP	PDC	PBL	MAC	MWS
0	0	0	0	1	0	1	0	0	0	0	0	1	1	0	0

Mode of Learning						Mode of Examination						Total Credits
Theory		NEC	Lab			Theory				NEC	Lab	
Face to Face	Online	Interactive	Blended	Experiential	Experimental	PP	AO	MCQ	OB	SO	SO	
00	06	02	00	10	00	00	00	06	-	00	12	14
-	33.33%	11.11%	-	55.55%	-	-	-	33.33%	-	-	66.66%	Credits %

Recommended in BoS meeting of Centre for IoT held on 07. Dec.2024

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Semester-Wise General Scheme Structure & Important Guidelines for Flexible Curriculum

(Batch admitted in Academic Session 2024-25 onwards)

Abbreviations Used

L	Lecture
T	Tutorial
P	Practical
HSMC	Humanities and Social Sciences including Management Courses
BSC	Basic Science Courses
ESC	Engineering Science Courses
DC	Departmental Core
DE	Departmental Elective
SPC	Specialization Courses
OC	Open Category
DLC	Departmental Laboratory Courses
MOOC	Massive Open Online Course
MWS	Mandatory Workshop
SP	Semester Proficiency
SIP	Skill Internship Program
SLP	Self-learning Presentation
PDC	Professional Development Component
PBL	Project Based Learning
PC	Professional Certification
MAC	Mandatory Audit Course
NEC	Novel Engaging Course

Recommended in BoS meeting of Centre for IoT held on 07.Dec .2024

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Scheme of Evaluation

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

(for batch admitted in academic session 2024-25)

S. No.	Course Code	Category Code	Course Name	Maximum Marks Allotted						Total Marks	Contact Hours per week			Total Credits	Mode of Learning	Mode of Major Evaluation	Duration of Major Evaluation
				Theory Block				Practical Block									
				Continuous Evaluation			Major Evaluation	Continuous Evaluation	Major Evaluation		L	T	P				
				Minor Evaluation I	Minor Evaluation II	Quiz/ Assignment		Lab Work & Sessional									
1.	23241101	DC	Principles of Internet of Things	20	20	30	30	-	-	100	3	-	-	3	Face to Face	PP	2 Hrs
2.	23241102	ESC	Computer Programming	20	20	30	30	-	-	100	2	-	-	2	Face to Face	MCQ	2 Hrs
3.	23241103	DC	Engineering Measurement	20	20	30	30	-	-	100	2	1	-	3	Face to Face	MCQ	2 Hrs
4.	23241104	DC	Digital Electronics and Logic Design	20	20	30	30	-	-	100	2	1	-	3	Face to Face	MCQ	2 Hrs
5.	23241105	BSC	Linear Algebra and Calculus	20	20	30	30	-	-	100	3	-	-	3	Face to Face	PP	2 Hrs
6.	23241106	DLC	Computer Programming Lab	-	-	-	-	70	30	100	-	-	2	1	Experimental	AO	-
7.	23241107	DLC	Internet of Things Lab	-	-	-	-	70	30	100	-	-	2	1	Experimental	AO	-
8.	23241108	SP	Semester Proficiency[$]	-	-	-	-	50	-	50	-	-	2	1	Face to Face	SO	-
9.	23241109	PBL	Micro Project-I[#]	-	-	-	-	70	30	100	-	-	2	1	Experiential	SO	-
10.	23241110	HSMC	Language Lab	-	-	-	-	70	30	100	-	-	2	1	Blended	AO	-
11.	NECXXXX	NEC	Novel Engaging Course (Activity Based Learning)	-	-	-	-	50	-	50	-	-	2	1	Interactive	SO	-
			Total	100	100	150	150	380	120	1000	12	02	12	20	-	-	-
12.	23241111	MAC	Universal Human Values & Professional Ethics (UHVPE)	20	20	30	30	-	-	100	2	-	-	GRADE	Blended	MCQ	1.5 Hrs
13.	23241112	MWS	Mandatory Workshop on Indian Constitution and Traditional Knowledge at Department Level (Duration: Two Days)											GRADE	Interactive	MCQ	-
	Induction programme of three weeks (MC): Physical activity, Creative Arts, Universal Human Values, Literary, Proficiency Modules, Lectures by Eminent People, Visits to local Areas, Familiarization to Dept./Branch & Innovation.																
	Skill Internship Program (Soft Skill): Minimum 45 hours duration: To be credited in II Semester.																

[$]Semester Proficiency– includes the weightage towards ability/ skill/ competency /knowledge level /expertise attained etc. in the semester courses

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

[#] Micro Project-I will be presented and evaluated through an interdisciplinary project evaluation committee.

HSMC	BSC	ESC	DC	DE	SPC	OC	DLC	NEC	SP	SIP	SLP	PDC	PBL	MAC	MWS
1	1	1	3	0	0	0	2	1	1	0	0	0	1	1	1

Mode of Learning						Mode of Examination						Total Credits
Theory		NEC	Lab			Theory				NEC	Lab	
Face to Face	Online	Interactive	Blended	Experiential	Experimental	PP	AO	MCQ	OB	SO	SO	
15	0	1	01	01	02	06	03	08	-	01	02	20
75%	-	5%	5%	5%	10%	30%	15%	40%		5%	10%	Credits %

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Centre for Internet of Things

Scheme of Evaluation

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

(for batch admitted in academic session 2024-25)

S. No.	Course Code	Category Code	Course Name	Maximum Marks Allotted						Total Marks	Contact Hours per week			Total Credits	Mode of Learning	Mode of Major Evaluation	Duration of Major Evaluation
				Theory Block				Practical Block									
				Continuous Evaluation			Major Evaluation	Continuous Evaluation	Major Evaluation		L	T	P				
				Minor Evaluation I	Minor Evaluation II	Quiz/ assignment		Lab Work & Sessional									
1.	23241201	DC	ObjectOriented Programming	20	20	30	30	-	-	100	3	-	-	3	Face to Face	MCQ	2 Hrs
2.	23241202	DC	Sensors and Actuators	20	20	30	30	-	-	100	2	1	-	3	Face to Face	PP	2 Hrs
3.	23241203	DC	Discrete Structures	20	20	30	30	-	-	100	2	1	-	3	Face to Face	MCQ	2 Hrs
4.	23241204	DC	Operating Systems	20	20	30	30	-	-	100	2	1	-	3	Face to Face	PP	2 Hrs
5.	23241205	ESC	Basic Electrical and Electronics Engineering	20	20	30	30	-	-	100	2	-	-	2	Face to Face	MCQ	2 Hrs
6.	23241206	DLC	Object Oriented Programming Lab	-	-	-	-	70	30	100	-	-	2	1	Experimental	AO	-
7.	23241207	DLC	Sensors and Actuators Lab	-	-	-	-	70	30	100	-	-	2	1	Experimental	AO	-
8.	23241208	DLC	Electrical and Electronics Engineering Lab	-	-	-	-	70	30	100	-	-	2	1	Experimental	AO	-
9.	23241209	SP	Semester Proficiency[$]	-	-	-	-	50	-	50	-	-	2	1	Face to Face	SO	-
10.	23241210	PBL	Micro Project-II[@]	-	-	-	-	70	30	100	-	-	2	1	Experiential	SO	-
11.	NECXXXX	NEC	Novel Engaging Course (Activity Based Learning)	-	-	-	-	50	-	50	-	1	-	1	Interactive	SO	-
12.	SIP1XXXX	SIP	Skill Internship Program (Soft Skills)	-	-	-	-	60	-	60	-	-	-	2**	Experiential	SO	-
Total				100	100	150	150	440	120	1060	11	04	10	22	-	-	-
13.	23241211	MAC	Sustainability & Environmental Science	20	20	30	30	-	-	100	2	-	-	GRADE	Blended	MCQ	1.5 Hrs
14.	23241212	MWS	Mandatory Workshop on Indian Knowledge System at Department Level (Duration: Two Days)											GRADE	Interactive	MCQ	-

Summer Semester of six-eight week duration will be conducted for makeup of I& II semester examination.

[$]Semester Proficiency– includes the weightage towards ability/ skill/ competency /knowledge level /expertise attained etc. in the semester courses

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

** These credits will be transferred from Skill Internship Program (Soft Skill)

[@]Micro Project-II will be presented and evaluated through an interdisciplinary project evaluation committee.

HSMC	BSC	ESC	DC	DE	SPC	OC	DLC	NEC	SP	SIP	SLP	PDC	PBL	MAC	MWS
0	0	1	4	0	0	0	3	1	1	1	0	0	1	1	1

Mode of Learning						Mode of Examination						Total Credits
Theory		NEC	Lab			Theory				NEC	Lab	
Face to Face	Online	Interactive	Blended	Experiential	Experimental	PP	AO	MCQ	OB	SO	SO	
15	00	01	00	03	03	06	03	08	-	01	04	22
68.18%	-	4.5%	-	13.63%	13.63%	27.27%	13.63%	36.36%	-	4.5%	18.18%	Credits %

Dean
Faculty of Engineering & Technology
MITS-DU

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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 2024-25)

S. No.	Course Code	Category Code	Course Name	Maximum Marks Allotted						Total Marks	Contact Hours per week			Total Credits	Mode of Learning	Mode of Major Evaluation	Duration of Major Evaluation
				Theory Block				Practical Block									
				Continuous Evaluation			Major Evaluation	Continuous Evaluation	Major Evaluation								
				Minor Evaluation I	Minor Evaluation II	Quiz/ Assignment		Lab Work & Sessional			L	T	P				
1.	23242101	BSC	Probability and Statistics	20	20	30	30	-	-	100	3	-	-	3	Face to Face	PP	2Hrs
2.	23242102	DC	IoT Architecture and Protocol	20	20	30	30	-	-	100	2	1	-	3	Face to Face	MCQ	2Hrs
3.	23242103	DC	Data Structures	20	20	30	30	-	-	100	2	1	-	3	Face to Face	MCQ	2Hrs
4.	23242104	DC	Electronic Devices and Circuits	20	20	30	30	-	-	100	2	1	-	3	Face to Face	PP	2Hrs
5.	23242105	DC	Computer System Organization	20	20	30	30	-	-	100	2	1	-	3	Face to Face	MCQ	2Hrs
6.	23242106	DLC	Problem Solving through Python Programming	-	-	-	-	70	30	100	-	-	2	1	Experimental	AO	-
7.	23242107	DLC	Data Structures Lab	-	-	-	-	70	30	100	-	-	2	1	Experimental	AO	-
8.	23242108	DLC	IoT Architecture and Protocol Lab	-	-	-	-	70	30	100	-	-	2	1	Experimental	AO	-
9.	23242109	SP	Semester Proficiency[$]	-	-	-	-	50	-	50	-	-	2	1	Face to Face	SO	-
10.	23242110	PBL	Macro Project-I[#]	-	-	-	-	70	30	100	-	-	2	1	Experiential	SO	-
11.	23242111	SLP	Self-learning/Presentation[$$$] (SWAYAM/NPTEL/MOOC)	-	-	-	-	40	-	40	-	-	2	1	Mentoring	SO	-
12.	NECXXXX	NEC	Novel Engaging Course (Activity Based Learning)	-	-	-	-	50	-	50	-	1	-	1	Interactive	SO	-
Total				100	100	150	150	370	170	1040	11	05	12	22	-	-	-
13.	23242112	MAC	Cyber Security	20	20	30	30	-	-	100	2	-	-	GRADE	Blended	MCQ	1.5 Hrs
14.	23242113	MWS	Mandatory Workshop on Life Skills at Department Level (Duration: Two Days)											GRADE	Interactive	MCQ	-
Skill Internship Program (Institute Level) (Qualifier): Minimum 30 hours duration: To be credited in IV Semester																	

[$]Semester Proficiency- includes the weightage towards activity/ skill/ competency/ knowledge level/ expertise attained etc. in the semester courses

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

[#]Macro Project-I will be presented and evaluated through an interdisciplinary project evaluation committee.

[$$$]Completion registration for one online course using SWAYAM/NPTEL/ MOOC, evaluation through attendance and presentation.

HSMC	BSC	ESC	DC	DE	SPC	OC	DLC	NEC	SP	SIP	SLP	PDC	PBL	MAC	MWS
0	1	0	4	0	0	0	3	1	1	0	1	0	1	1	1

Mode of Learning							Mode of Examination						Total Credits
Theory		NEC	Lab				Theory				NEC	Lab	
Face to Face	Online	Interactive	Blended	Experiential	Mentoring	Experimental	PP	AO	MCQ	OB	SO	SO	
16	00	01	00	01	01	03	06	03	09	-	01	03	22
72.72%	-	4.5%	-	4.5%	4.5%	13.63%	27.27%	13.63%	40.90%	-	4.5%	13.63%	Credits %

Recommended in BoS meeting of Centre for IoT held on 07.Dec .2024

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Centre for Internet of Things

Scheme of Evaluation

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

(for batch admitted in academic session 2024-25)

S. No.	Course Code	Category Code	Course Name	Maximum Marks Allotted						Total Marks	Contact Hours per week			Total Credits	Mode of Learning	Mode of Major Evaluation	Duration of Major Evaluation
				Theory Block				Practical Block									
				Continuous Evaluation			Major Evaluation	Continuous Evaluation	Major Evaluation		L	T	P				
				Minor Evaluation I	Minor Evaluation II	Quiz/ Assignment		Lab Work & Sessional									
1.	23242201	DC	Data Science	20	20	30	30	-	-	100	2	1	-	3	Face to Face	MCQ	2Hrs
2.	23242202	DC	Computer Networks and Protocols	20	20	30	30	-	-	100	2	1	-	3	Face to Face	MCQ	2Hrs
3.	23242203	DC	Design and Analysis of Algorithms	20	20	30	30	-	-	100	2	1	-	3	Face to Face	MCQ	2Hrs
4.	23242204	DC	Embedded Systems&IoT	20	20	30	30	-	-	100	2	1	-	3	Face to Face	PP	2Hrs
5.	23242205	DC	Software Engineering	20	20	30	30	-	-	100	3	-	-	3	Face to Face	PP	2Hrs
6.	23242206	DLC	Data Science Lab	-	-	-	-	70	30	100	-	-	2	1	Experimental	AO	-
7.	23242207	DLC	Design and Analysis of Algorithms Lab	-	-	-	-	70	30	100	-	-	2	1	Experimental	AO	-
8.	23242208	DLC	Wireless Technologies for IoT Lab	-	-	-	-	70	30	100	-	-	2	1	Experimental	AO	-
9.	23242209	SP	Semester Proficiency[$]	-	-	-	-	50	-	50	-	-	2	1	Face to Face	SO	-
10.	23242210	PBL	Macro Project-II[#]	-	-	-	-	70	30	100	-	-	2	1	Experiential	SO	-
11.	23242211	PC	Professional Certification	-	-	-	-	50	-	50	-	-	2	1	Blended	SO	-
12.	NECXXXX	NEC	Novel Engaging Course (Activity Based Learning)	-	-	-	-	50	-	50	-	1	-	1	Interactive	SO	-
13.	SIPXXXX	SIP	Skill Internship Program (Evaluation)	-	-	-	-	60	-	60	-	-	-	2**	Experiential	SO	-
Total				100	100	150	150	422	188	1110	11	05	12	24	-	-	-
14.	23242212	MAC	Project Management, Economics & Financing	20	20	30	30	-	-	100	2	-	-	GRADE	Blended	MCQ	1.5 Hrs
15.	23242213	MWS	Mandatory Workshop on Computer Vision at Department Level (Duration: Two Days)											GRADE	Interactive	MCQ	-
Summer Semester of six-eight week duration will be conducted for makeup of previous semester examination.																	
Additional Course for Honours or Minor Degree: Permitted to opt for maximum two additional courses for the award of Honours or Minor Degree																	

[$]Semester Proficiency– includes the weightage towards ability/ skill/ competency /knowledge level /expertise attained etc. in the semester courses

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

[#]Macro Project-II will be presented and evaluated through an interdisciplinary project evaluation committee.

[**]These credits will be transferred from Skill Internship Program.

PC	BSC	ESC	DC	DE	SPC	OC	DLC	NEC	SP	SIP	SLP	PDC	PBL	MAC	MWS
1	0	0	5	0	0	0	3	1	1	1	0	0	1	1	1

Mode of Learning						Mode of Examination						Total Credits
Theory		NEC	Lab			Theory				NEC	Lab	
Face to Face	Online	Interactive	Blended	Experiential	Experimental	PP	AO	MCQ	OB	SO	SO	
16	00	01	01	03	03	06	03	09	-	01	05	24
66.66%	-	4.12%	4.12%	12.5%	12.5%	25%	12.5%	37.5%	-	4.1%	20.83%	Credits %

Recommended in BoS meeting of Centre for IoT held on 07.Dec .2024

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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 2024-25)

S. No.	Course Code	Category Code	Course Name	Maximum Marks Allotted								Total Marks	Contact Hours per week			Total Credits	Mode of Learning	Mode of Major Evaluation	Duration of Major Evaluation
				Theory Block				Practical Block		MOOCs									
				Continuous Evaluation			Major Evaluation	Continuous Evaluation	Major Evaluation	Assignment	Exam		L	T	P				
				Minor Evaluation I	Minor Evaluation II	Quiz/ Assignment		Lab Work & Sessional											
1.	23243101	DC	Database Management and Warehousing	20	20	30	30	-	-	-	-	100	2	1	-	3	Face to Face	MCQ	2Hrs
2.	23243102	DC	Theory of Computation	20	20	30	30	-	-	-	-	100	2	1	-	3	Face to Face	PP	2Hrs
3.	23243103	DC	Artificial Intelligence & Machine Learning	20	20	30	30	-	-	-	-	100	2	1	-	3	Face to Face	MCQ	2Hrs
4.	232431xx	DE	Departmental Elective* (DE-1)	-	-	-	-	-	-	25	75	100	3	-	-	3	Online	MCQ	3 Hrs
5.	232431xx	SPC	Specialization Course (SPC-1)	20	20	30	30	-	-	-	-	100	2	1	-	3	Face to Face	PP	2Hrs
6.	23243104	DLC	Database Management System Lab	-	-	-	-	70	30	-	-	100	-	-	2	1	Experimental	AO	-
7.	23243105	DLC	Artificial Intelligence & Machine Learning Lab	-	-	-	-	70	30	-	-	100	-	-	2	1	Experimental	AO	-
8.	23243106	SP	Semester Proficiency[$]	-	-	-	-	50	-	-	-	50	-	-	2	1	Face to Face	SO	-
9.	23243107	PBL	Cornerstone Project	-	-	-	-	70	30	-	-	100	-	-	4	2	Experiential	SO	-
Total				**80**	**80**	**120**	**120**	**260**	**90**	**25**	**75**	**850**	**11**	**04**	**10**	**20**	-	-	-
10.	23243115	MAC	Supply Chain Management	20	20	30	30	-	-			100	2	-	-	GRADE	Blended	MCQ	1.5 Hrs
11.	23243116	MWS	Mandatory Workshop on Block chain at Department Level (Duration: Two Days)													GRADE	Interactive	MCQ	-
Additional Course for Honours or Minor Degree: Permitted to opt for maximum two additional courses for the award of Honours or Minor Degree																			

[$]Semester Proficiency– includes the weightage towards ability/ skill/ competency /knowledge level /expertise attained etc. in the semester courses

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

* Course run through SWAYAM/NPTEL/ MOOC Learning Based Platform

HSMC	BSC	ESC	DC	DE	SPC	OC	DLC	NEC	SP	SIP	SLP	PDC	PBL	MAC	MWS
0	0	0	3	1	1	0	2	0	1	0	0	0	1	1	1

Mode of Learning						Mode of Examination						Total Credits
Theory		NEC	Lab			Theory				NEC	Lab	
Face to Face	Online	Interactive	Blended	Experiential	Experimental	PP	AO	MCQ	OB	SO	SO	
13	03	00	00	02	02	06	02	09	-	00	03	20
65%	15%	-	-	10%	10%	30%	10%	45%	-	-	15%	Credits %

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Centre for Internet of Things

Scheme of Evaluation

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

(for batch admitted in academic session 2024-25)

S. No.	Course Code	Category Code	Course Name	Maximum Marks Allotted								Total Marks	Contact Hours per week			Total Credits	Mode of Learning	Mode of Major Evaluation	Duration of Major Evaluation
				Theory Block				Practical Block		MOOCs									
				Continuous Evaluation			Major Evaluation	Continuous Evaluation	Major Evaluation	Assignment	Exam		L	T	P				
				Minor Evaluation I	Minor Evaluation II	Quiz/ Assignment		Lab Work & Sessional											
1.	23243201	DC	Compiler Design	20	20	30	30	-	-	-	-	100	2	1	-	3	Face to Face	MCQ	2Hrs
2.	23243202	DC	IoTCloud Security	20	20	30	30	-	-	-	-	100	2	1	-	3	Face to Face	MCQ	2Hrs
3.	232432xx	DE	Departmental Elective* (DE-2)	-	-	-	-	-	-	25	75	100	3	-	-	3	Online	MCQ	3 Hrs
4.	232432xx	OC	Open Category Course (OC-1)	20	20	30	30	-	-	-	-	100	2	1	-	3	Face to Face	PP	2 Hrs
5.	232432xx	SPC	Specialization Course (SPC-2)	20	20	30	30	-	-	-	-	100	3	-	-	3	Face to Face	PP	2Hrs
6.	23243203	DLC	Industrial Internet of Things Lab	-	-	-	-	70	30	-	-	100	-	-	2	1	Experimental	AO	-
7.	23243204	DLC	Competitive Programming Lab	-	-	-	-	70	30	-	-	100	-	-	2	1	Experimental	AO	-
8.	23243205	SP	Semester Proficiency[$]	-	-	-	-	50	-	-	-	50	-	-	2	1	Face to Face	SO	-
9.	23243206	PBL	Capstone Project	-	-	-	-	70	30	-	-	100	-	-	4	2	Experiential	SO	-
Total				80	80	120	120	260	90	25	75	850	12	03	10	20	-	-	-
10.	23243214	MAC	Disaster Management	20	20	30	30	-	-	-	-	100	2	-	-	GRADE	Blended	MCQ	1.5 Hrs
11.	23243215	MWS	Mandatory Workshop on Intellectual Property Rights at Department Level (Duration: Two Days)													GRADE	Interactive	MCQ	-
Skill Enhancement Program/Research Internship/On Job Training for Four weeks duration (Mandatory)																			
Summer Semester of six-eight week duration will be conducted for makeup of previous semester examination																			
Additional Course for Honours or Minor Degree: Permitted to opt for maximum two additional courses for the award of Honours or Minor Degree																			

[$]Semester Proficiency– includes the weightage towards ability/ skill/ competency /knowledge level /expertise attained etc. in the semester courses

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

* Course run through SWAYAM/NPTEL/ MOOC Learning Based Platform

HSMC	BSC	ESC	DC	DE	SPC	OC	DLC	NEC	SP	SIP	SLP	PDC	PBL	MAC	MWS
0	0	0	2	1	1	1	2	0	1	0	0	0	1	1	1

Mode of Learning						Mode of Examination						Total Credits
Theory		NEC	Lab			Theory				NEC	Lab	
Face to Face	Online	Interactive	Blended	Experiential	Experimental	PP	AO	MCQ	OB	SO	SO	
13	03	00	00	02	02	06	02	09	-	00	03	20
65%	15%	-	-	10%	10%	30%	10%	45%	-	-	15%	Credits %

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Scheme of Evaluation

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

(for batch admitted in academic session 2024-25)

S. No.	Course Code	Category Code	Course Name	Maximum Marks Allotted								Total Marks	Contact Hours per week			Total Credits	Mode of Learning	Mode of Major Evaluation	Duration of Major Evaluation
				Theory Block				Practical Block		MOOCs									
				Continuous Evaluation			Major Evaluation	Continuous Evaluation	Major Evaluation	Assignment	Exam		L	T	P				
				Minor Evaluation I	Minor Evaluation II	Quiz/ Assignment		Lab Work & Sessional											
1.	232441XX	DE	Departmental Elective*(DE-3)	20	20	30	30	-	-	-	-	100	3	-	-	3	Blended Mode	PP	2 Hrs
2.	232441XX	DE	Departmental Elective* (DE-4)	-	-	-	-	-	-	25	75	100	3	-	-	3	Online	MCQ	3 Hrs
3.	232441XX	OC	Open Category Course* (OC-2)	-	-	-	-	-	-	25	75	100	3	-	-	3	Online	MCQ	3 Hrs
4.	232441XX	SPC	Specialization Course$ (SPC-3)	20	20	30	30	-	-	-	-	100	2	1	-	3	Blended Mode	PP	2 Hrs
5.	23244101	SP	Skill Enhancement Program/Research Internship/ On Job Training	-	-	-	-	-	50	-	-	50	-	-	-	1**	Experiential	SO	-
6.	23244102	DLC	Creative Problem Solving	-	-	-	-	-	50	-	-	0	-	-	2	1	Experiential	SO	-
Total				40	40	60	60	50	100	50	150	500	11	01	02	14	-	-	-
Additional Course for Honours or Minor Degree: Permitted to opt for maximum two additional courses for the award of Honours or Minor Degree																			

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

*Course run through *Course run through SWAYAM/NPTEL/ MOOC Learning Based Platform

** These credits will be transferred from Skill Enhancement Program/Research Internship/On Job Training

$Course run through MITS-DU MOOCs

HSMC	BSC	ESC	DC	DE	SPC	OC	DLC	NEC	SP	SIP	SLP	PDC	PBL	MAC	MWS
0	0	0	0	2	1	1	1	0	1	0	0	0	0	0	1

Mode of Learning						Mode of Examination						Total Credits
Theory		NEC	Lab			Theory				NEC	Lab	
Face to Face	Online	Interactive	Blended	Experiential	Experimental	PP	AO	MCQ	OB	SO	SO	
10	03	00	00	01	00	06	00	06	-	00	02	14
71.42%	21.42%	-	-	7.14%	-	42.85%	-	42.85%	-	-	14.28%	Credits %

Recommended in BoS meeting of Centre for IoT held on 07.Dec .2024

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Scheme of Evaluation

B. Tech. VIII Semester *Internet of Things(IoT)* *(for batch admitted in academic session 2024-25)*

S. No.	Course Code	Category Code	Course Name	Maximum Marks Allotted								Total Marks	Contact Hours per week			Total Credits	Mode of Learning	Mode of Major Evaluation	Duration of Major Evaluation
				Theory Block				Practical Block		MOOCs									
				Continuous Evaluation			Major Evaluation	Continuous Evaluation	Major Evaluation	Assignment	Exam		L	T	P				
				Minor Evaluation I	Minor Evaluation II	Quiz/ Assignment													
1.	232442XX	DE	Departmental Elective* (DE-5)	-	-	-	-	-	-	25	75	100	3	-	-	3	Online	MCQ	3 Hrs
2.	232442XX	OC	Open Category Course* (OC-3)	-	-	-	-	-	-	25	75	100	3	-	-	3	Online	MCQ	3 Hrs
3.	23244201	PBL	Industry Internship/ Research Internship/ Innovation & Start-up	-	-	-	-	280	120	-	-	400	-	-	20	10	Experiential	SO	-
4.	23244202	PDC	Professional Development**	-	-	-	-	-	50	-	-	50	-	-	4	2	Interactive	SO	-
Total				-	-	-	-	280	170	50	150	650	06	-	24	18	-	-	-
Summer Semester of six-eight week duration will be conducted to complete any backlog courses.																			
Additional Course for Honours or Minor Degree: Permitted to opt for maximum two additional courses for the award of Honours or Minor Degree																			

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

*Course run through SWAYAM/NPTEL/ MOOC Learning Based Platform

** Evaluation will be based on participation/laurels brought by the students to the institution in national/state level technical and other events during the complete tenure of the UG programme (participation in professional chapter activities, club activities, cultural events, sports, personality development activities, collaborative events, MOOCs, technical events, institute/department committees, etc.)

HSMC	BSC	ESC	DC	DE	SPC	OC	DLC	NEC	SP	SIP	SLP	PDC	PBL	MAC	MWS
0	0	0	0	1	0	1	0	0	0	0	0	1	1	0	0

Mode of Learning						Mode of Examination						Total Credits
Theory		NEC	Lab			Theory				NEC	Lab	
Face to Face	Online	Interactive	Blended	Experiential	Experimental	PP	AO	MCQ	OB	SO	SO	
00	06	02	00	10	00	00	00	06	-	00	12	14
-	33.33%	11.11%	-	55.55%	-	-	-	33.33%	-	-	66.66%	Credits %

Recommended in BoS meeting of Centre for IoT held on 07.Dec .2024

Item-03

Syllabi for all courses of B. Tech II Semester (for batch admitted in 2024-25) under the flexible curriculum along with their COs

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Object Oriented Programming (22241201)

Course Objectives:

- *To understand the fundamentals of C++ programming including keywords, data type, functions etc.*
- *To apply object oriented features to solve real world problems.*
- *To familiar with programming structure and debugging process.*
- *To implement object oriented concept using C++ language.*

Unit 1:

Introduction to C++, Tokens, Input/output Statements, Program structure, Program Execution, Translation Process and compiler Installation, reference variables, Operators, decision control and loops, array, pointer, Functions and its type, function prototyping, Default Arguments, recursion, structures.

Unit 2:

Object Oriented Concepts, features of OOP, procedural oriented programming, Abstract data type, scope resolution operator. Classes and Objects, Specification of Class, Visibility Modes: Private, Public, Protected, Defining Member Functions, Creating of Objects, Characteristics of Object, Static Data Member, Static Member Function, Object as Arguments.

Unit 3:

Constructors and Destructors, Types of Constructors, Default Constructor, Parameterized Constructor, Copy Constructor, Polymorphism, Type of Polymorphism, Compile Time and Run Time, operator overloading, Function Overloading, Friend Function and its usage, Arithmetic and Assignment Operators, Unary Operators.

Unit 4:

Association, aggregation and generalization, Inheritance, Introduction to Code Reuse, Visibility Modes, Types of Inheritance, Single Level, Multilevel, Multiple, Hybrid, constructor and destructor in inheritance, this pointer, new and delete, method overriding, virtual function, pure virtual function.

Unit 5:

Exceptional handling, File handling in C++, various files and its operation, create, open, read, write and close a file, fstreams library, file functions, Inline Function, abstract class, template, type conversion, namespace, Introduction to STL.

Recommended Books:

1. *C++ How to program H M Deitel and P J Deitel, Prentice Hall.*
2. *Programming with C++, D Ravichandran, TMH.*
3. *Object-Oriented Programming in C++, E. Balagurusamy, Mc Graw Hill.*
4. *The complete Reference in C++, Herbert Schildt, TMH.*

Course Outcomes:

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

CO1. **Illustrate** basic C++ programming terms and programming syntax.
CO2. **Explain** the features of object oriented paradigm.
CO3. **Design** appropriate solutions for problem using concepts of class, object and encapsulation.
CO4. **Analyse** the use of inheritance and polymorphism in problem solving.
CO5. **Apply** file handling operations to work efficiently with files.

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

Recommended in BoS Meeting of CIoT held on 07 December 2024 *Admitted Batch 2024-2025*

Sensors and Actuators (22241202)

Course Objective. To provide a comprehensive understanding of sensors, actuators, working principles, interface circuits, smart sensors, and their applications across various fields.

Unit I. Introduction to Sensors and Actuators. Fundamentals of sensors and actuators, importance in automation and control system, characteristics: transfer function, sensitivity, range, resolution, linearity, hysteresis, repeatability, accuracy, sensor calibration, units of measurements, basic signal types.

Unit II. Sensor Technologies. classification of sensors: passive vs. active sensors, absolute vs. relative sensors, analog vs. digital, primary vs secondary, proximity sensor. types of sensors: resistive: potentiometers, strain gauges, thermistors, inductive and capacitive sensors: LVDT, proximity sensors, capacitive touch sensors, optical sensors: photodiodes, phototransistors, magnetic sensor: hall-effect sensors, magnetometers. thermal sensors: thermocouples, RTD, thermistor, infrared sensors. advanced sensors: mems sensors, biosensors, wireless sensors.

Unit III. Actuator Technologies. Actuator dynamics: force, torque, speed, and position control, classification of actuators: mechanical, electromechanical, hydraulic, pneumatic, and piezoelectric actuators, linear and rotary actuators, solenoids, servomotors, stepper motors, DC motor.

Unit IV. Interfacing Electronic Circuit. Input characteristics of interface circuits, excitation circuits, operational amplifiers and its applications: inverting, non-inverting, adder, subtracter, voltage follower, comparator, filters, differentiator, integrator, cascaded amplifier, direct digitization and processing, sampling theorem, sample and hold circuit, analog to digital converters, digital to analog converter, bridge circuits.

Unit V Sensors and Actuators in IoT Applications. Integration, challenges, and opportunities in IoT systems, industrial applications: automation, process control, condition monitoring. healthcare applications: biosensors, wearable devices, medical actuators, smart parking, smart transportation, smart grid.

Recommended Books:

1. Introduction to Sensors and Actuators" by Robert F. Coughlin and Frederick F. Driscoll, Prentice Hall, 1990.
2. Sensors and Actuators: Engineering System Instrumentation" by Clarence W. de Silva, CRC Press, 2007.
3. Smart Sensors and MEMS: Intelligent Devices and Microsystems for Industrial Applications" by S. Nihtianov and A. Luque, Woodhead Publishing, 2014.
4. Sensor Technology Handbook" by Jon S. Wilson, Newnes (Elsevier), 2004.
5. Sensors and Actuators: Control System Instrumentation" by Clarence W. de Silva, CRC Press, 2015.
6. Handbook of Modern Sensors: Physics, Designs, and Applications" by Jacob Fraden, Springer, 2010 (4th Edition).

Course Outcomes:

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

CO 1. **Explain** fundamentals of Sensors & Actuators
CO 2. **Classify** various types of sensors, understand their operational principles
CO 3. **Analyze** the dynamics and control mechanisms of different actuators
CO 4. **Design** electronic circuits for sensor and actuator interfacing
CO 5. **Able** to integrate sensors and actuators into IoT systems

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

1 - Slightly; 2 - Moderately; 3 – Substantially

Recommended in BoS Meeting of CIoT held on 07 December 2024 *Admitted Batch 2024-2025*

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Centre for Internet of Things

Fundamentals of Signal and Systems (22241203)

Course Objectives:

1. *To develop an understanding of fundamental characteristics of signals and systems.*
2. *To develop mathematical skills to solve problems involving convolution, and sampling.*
3. *To understand the concepts of various transforms for signal analysis.*

UNIT-1 Introduction to Signal & Systems:

Basic definitions of signals and systems, Basic elementary signals, Classification of signals and systems. Signal operations and properties. Basic continuous time signals, Basic system properties. Linear Time Invariant (LTI) systems

UNIT-2 Laplace Transform:

Review of Laplace transforms, Inverse Laplace transform, Concept of region of convergence (ROC) for Laplace transforms, Properties of L.T's

UNIT-3 Fourier Series & Transform :

Representation of Fourier series, Continuous time periodic signals, Dirichlet's conditions, Trigonometric Fourier Series, Exponential Fourier Series, Properties of Fourier series, Complex Fourier spectrum. Fourier Transform definition, Relation between Laplace Transform and Fourier Transform. Properties of Continuous Time Fourier transform. System Analysis using Fourier Transform.

UNIT-4 Z Transform:

The z-Transform, Convergence of z-Transform, , Properties of z-Transform, Inverse z-Transform , LTI System analysis from Linear Constant Coefficient Difference Equations using z-Transform.

UNIT-5 Sampling & Reconstruction:

Representation of digital signals, The Sampling Theorem, Sampling with a zero order hold, Reconstruction of a signal from its samples using interpolation, Aliasing and its effects.

Recommended Books:

1. *Signal and systems by Oppenheim AV, Willisky AS and Nawab SH, Pearson*
2. *Signals and systems by Hwei. P. Hsu, Schaum's outlines, TME*
3. *Digital Signal Processing Principles by Proakis JP, Manolaxis, Pearson*
4. *Fundamentals of Signals & Systems by Michael J Roberts, McGraw Hill*
5. *Control System Engineering by I.J. Nagrath and M. Gopal, New Age International Publication.*
6. *Control System Engineering by Norman Wiley Publication.*
7. *Linear Control Systems by B. S. Manke, Khanna Publishers*
8. *Modern Control Systems by R. C. Dorf and R. H. Bishop, Addison-Wesley publishing company.*

Course Outcomes

After the completion of this course students will be able to:

CO 1. **Describe** the elementary characteristics of the signals and systems.
CO 2. **Analyze** the spectral characteristics of periodic signals using Fourier Transforms.
CO 3. **Explain** the sampling process and discrete transforms for the analysis of discrete time-signals and systems.
CO 4. **Apply** the Laplace transform for the analysis of continuous-time signals and systems.
CO 5. **Applt** the concepts of sampling for signal reconstruction

Course Articulation Matrix

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

1 - Slightly; 2 - Moderately; 3 – Substantially

Recommended in BoS Meeting of CIoT held on 07 December 2024 *Admitted Batch 2024-2025*

Operating System (22241204)

Course Objectives

1. *To provide basic knowledge of computer operating system structures and functioning.*
2. *To compare several different approaches to memory management, file management and process management.*
3. *To understand various problems related to concurrent operations and their solutions.*

Unit I: Basics of Operating System: Generations, Types, Structure, Services, System Calls, System Boot, System Programs, Protection and Security.

Unit II: Process Management: Process Concepts, Process States, Process Control Block, Scheduling-Criteria, Scheduling Algorithms and their Evaluation, Threads, Threading Issues.

Unit III: Process Synchronization: Background, Critical-Section Problem, Peterson's Solution, Synchronization Hardware, Semaphores, Classic Problems of Synchronization, Monitors.Deadlock: System Model, Deadlock Characterization, Deadlock Prevention, Detection and Avoidance, Recovery from Deadlock.

Unit IV: Memory Management: Main Memory, Swapping, Contiguous Memory Allocation, Paging, Structure of Page Table, Segmentation, Virtual Memory, Demand Paging, Page Replacement Algorithms, Allocation of Frames, Thrashing.

Unit V: Storage Management: Mass-Storage Structure, Overview, Disk Structure, Disk Attachment, Disk Scheduling. File System Interface: The Concept of a File, Access Methods, Directory Structure, File System Structure, Allocation Methods, Free-Space Management.

Recommended Books

1. *Operating System Concepts, Silberschatz, Ninth Edition, Willey Publication.*
2. *Operating Systems, Internals and Design Principles, Stallings, Seventh Edition, Pearson Publication.*
3. *Modern Operating Systems, Tanenbaum, Fourth Edition. Pearson Publication.*

Course Outcomes

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

CO 1. **Describe** the basic concept of operating systems
CO 2. **Analyze** the working of operating system
CO 3. **Examine** the working of various scheduling/allocation approaches
CO 4. **Measure** the performance of various scheduling/allocation approaches
CO 5. **Analyze** the various operating system problems/issues

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	2	2	1	1	1	1	2	3	-	-
CO5	3	3	3	3	2	2	2	1	1	1	2	3	-	-

1 - Slightly; 2 - Moderately; 3 – Substantially

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Centre for Internet of Things

Basic Electrical and Electronics Engineering (22241205)

Course Objectives:

- *To impart basic knowledge of the DC and AC circuits and their applications.*
- *To familiarize the students with the basic knowledge of magnetic circuits, transformer, rotating electrical machine and its terminology.*
- *To make familiarize the students about the working of, various electronic circuits and its importance.*

Unit I - D.C. Circuits Analysis: Voltage and Current Sources: Dependent and independent source, Source conversion, Kirchhoff's Law, Mesh and Nodal analysis. Network theorems: Superposition theorem, Thevenin's theorem & Norton's theorem and their applications.

Unit II –Single-phase AC Circuits: Generation of sinusoidal AC voltage, definitions: Average value, R.M.S. value, Form factor and Peak factor of AC quantity, Concept of Phasor, analysis of R-L, R-C, R-L-C Series and Parallel circuit, Power and importance of Power factor.

Unit III- Magnetic Circuits & Resonance: Magnetic Circuits: Concept of MMF, flux and magnetic reluctance, Self and mutual inductances, Dot convention, coefficient of coupling and coupled circuits. Resonance: Series and Parallel resonance, Bandwidth, Q-factor and selectivity.

Unit IV- Single-phase Transformer & Rotating Electrical Machines: Single phase transformer, Basic concepts, construction and working principal, Ideal Transformer and its phasor diagram at No Load, Voltage, current and impedance transformation, Equivalent circuits and its Phasor diagram, voltage regulation, losses and efficiency, testing of transformers, Construction & working principle of DC and AC machine.

Unit V - Electronics, Devices & Circuits: Introduction to semiconductors, Diodes, V-I characteristic and its application, Bipolar junction transistors and their working, Introduction to Common Base, Common Emitter & Common Collector transistor configurations.

Recommended Books:

1. *Basic Electrical and Electronics Engineering, D.P. Kothari &I.J. Nagrath-Tata McGraw Hill*
2. *Basic Electrical and Electronics Engineering, V N Mittle& Arvind Mittal -Tata McGraw Hill*
3. *Basic Electrical and Electronics Engineering, S. K Bhattacharya -Pearson*
4. *Electrical Machinery- A.E. Fitzgerald, C. Kingsley and Umans - TMH*
5. *Principles of Electrical Engineering- Vincdent Del Toro- Prentice Hall.*
6. *Basic Electrical Engineering -A,E. Fitzgerald, Higginbotham and Grabel -TMH*
7. *Integrated Electronics- Millmann& Halkias*

Course Outcomes

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

- **CO 1.** Solve DC by applying fundamental laws & theorems
- **CO 2.** Analyze the elementary concepts of single phase AC circuits
- **CO 3.** Analyze magnetic circuits and resonance characteristics of ac electric circuits
- **CO 4.** Describe the working, construction, applications of single phase transformer & rotating electrical machines
- **CO 5.** Explain the characteristics and parameters of Diode and Transistors.

Course Articulation Matrix

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

1 - Slightly; 2 - Moderately; 3 – Substantially

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Sustainability & Environmental Science (22241211)

Course Objectives:

To equip students with a comprehensive understanding of environmental science, pollution control, sustainability, and global frameworks, enabling them to analyze environmental challenges and contribute to sustainable solutions through informed decision-making and responsible practices.

Unit I Introduction to Environmental Science: definition, importance and its components. Ecosystem and its components. Water cycle, carbon cycle, food chain, energy flow in ecosystem. Current state of environment in India and world; Underlying reasons (root causes) of modern environmental degradation (social, psychological, cultural).

Unit II Environmental Pollution and Management: air, water, noise, soil, thermal and radioactive. Causes, impacts, pollution control techniques and mitigation strategies. Solid waste management: Principles of waste management, different components of waste management system and introduction to management of hazardous waste like e-waste, plastic waste. Global environmental issues: Climate change, global warming, ozone layer depletion.

Unit III Environmental policies and laws in India: Environmental Protection Act, Water Act, Air Act. Overview of global environmental policies and frameworks: Kyoto protocol, Montreal protocol, COP summits. Introduction to clean development mechanism, carbon credit, carbon trading.

Unit IV Sustainability concepts: definition, importance, pillars of sustainability (economic, environmental, and social). Sustainable development. Overview of UN Sustainable Development Goals (SDGs) and their global relevance. Concept of circular economy, resource efficiency, energy conservation, green buildings and sustainable manufacturing.

Unit V Sustainable Energy solutions: New Energy Sources: Need of new sources. Different types new energy sources. Applications of- Hydrogen energy, Ocean energy resources, Tidal energy conversion. Concept, origin and power plants of geothermal energy. Introduction to sustainable transportation systems and sustainable water infrastructure.

Reference Book

1. D. K. Asthana, Meera Asthana, A Text Book of Environmental Studies, S Chand & Co., New Delhi.
2. S. K. Dhameja, Environmental Engineering & Management, S K Kataria & Sons, New Delhi
3. C. S. Rao, Environmental Pollution Control Engineering, C.S. Rao, New Age International Publishers
4. A. K. Gupta, Environmental Sustainability and Green Technologies, PHI Learning.

Course Outcomes:

Upon completion of the course the student will be able to:

***CO 1: Explain** the fundamental concepts of environmental science, including ecosystems and the causes of environmental degradation.*
***CO 2: Analyze** the sources, causes, and impacts of air, water, and solid waste pollution and propose appropriate mitigation strategies.*
***CO 3: Evaluate** the effectiveness of environmental policies and global frameworks in addressing environmental challenges.*
***CO 4: Explain** the concepts of sustainability and sustainable development goals.*
***CO 5: Apply** various solutions for achieving sustainable development.*

Course Articulation Matrix

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

1 - Slightly; 2 - Moderately; 3 – Substantially

Recommended in BoS Meeting of CIoT held on 07 December 2024 *Admitted Batch 2024-2025*

Item 03

Sensors and Actuators (23241202)

Course Objective. To provide a comprehensive understanding of sensors, actuators, working principles, interface circuits, smart sensors, and their applications across various fields.

Unit I. Introduction to Sensors and Actuators. Fundamentals of sensors and actuators, importance in automation and control system, characteristics: transfer function, sensitivity, range, resolution, linearity, hysteresis, repeatability, accuracy, sensor calibration, units of measurements, basic signal types.

Unit II. Sensor Technologies. classification of sensors: passive vs. active sensors, absolute vs. relative sensors, analog vs. digital, primary vs secondary, proximity sensor. types of sensors: resistive: potentiometers, strain gauges, thermistors, inductive and capacitive sensors: LVDT, proximity sensors, capacitive touch sensors, optical sensors: photodiodes, phototransistors, magnetic sensor: hall-effect sensors, magnetometers. thermal sensors: thermocouples, RTD, thermistor, infrared sensors. advanced sensors: mems sensors, biosensors, wireless sensors.

Unit III. Actuator Technologies. Actuator dynamics: force, torque, speed, and position control, classification of actuators: mechanical, electromechanical, hydraulic, pneumatic, and piezoelectric actuators, linear and rotary actuators, solenoids, servomotors, stepper motors, DC motor.

Unit IV. Interfacing Electronic Circuit. Input characteristics of interface circuits, excitation circuits, operational amplifiers and its applications: inverting, non-inverting, adder, subtracter, voltage follower, comparator, filters, differentiator, integrator, cascaded amplifier, direct digitization and processing, sampling theorem, sample and hold circuit, analog to digital converters, digital to analog converter, bridge circuits.

Unit V Sensors and Actuators in IoT Applications. Integration, challenges, and opportunities in IoT systems, industrial applications: automation, process control, condition monitoring. healthcare applications: biosensors, wearable devices, medical actuators, smart parking, smart transportation, smart grid.

Recommended Books:

1. Introduction to Sensors and Actuators" by Robert F. Coughlin and Frederick F. Driscoll, Prentice Hall, 1990.
2. Sensors and Actuators: Engineering System Instrumentation" by Clarence W. de Silva, CRC Press, 2007.
3. Smart Sensors and MEMS: Intelligent Devices and Microsystems for Industrial Applications" by S. Nihtianov and A. Luque, Woodhead Publishing, 2014.
4. Sensor Technology Handbook" by Jon S. Wilson, Newnes (Elsevier), 2004.
5. Sensors and Actuators: Control System Instrumentation" by Clarence W. de Silva, CRC Press, 2015.
6. Handbook of Modern Sensors: Physics, Designs, and Applications" by Jacob Fraden, Springer, 2010 (4th Edition).

Course Outcomes:

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

CO 1. **Explain** fundamentals of Sensors & Actuators
CO 2. **Classify** various types of sensors, understand their operational principles
CO 3. **Analyze** the dynamics and control mechanisms of different actuators
CO 4. **Design** electronic circuits for sensor and actuator interfacing
CO 5. **Able** to integrate sensors and actuators into IoT systems

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

1 - Slightly; 2 - Moderately; 3 – Substantially

Recommended in BoS meeting of Centre for IoT held on 07.Dec .2024

Admitted Batch 2024-2025

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Centre for Internet of Things

Discrete Structures (23241202)

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

Recommended in BoS meeting of Centre for IoT held on 07.Dec .2024

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Operating System (23241204)

Course Objectives

- *To provide basic knowledge of computer operating system structures and functioning.*
- *To compare several different approaches to memory management, file management and process management.*
- *To understand various problems related to concurrent operations and their solutions.*

Unit I: Basics of Operating System: Generations, Types, Structure, Services, System Calls, System Boot, System Programs, Protection and Security.

Unit II: Process Management: Process Concepts, Process States, Process Control Block, Scheduling-Criteria, Scheduling Algorithms and their Evaluation, Threads, Threading Issues.

Unit III: Process Synchronization: Background, Critical-Section Problem, Peterson's Solution, Synchronization Hardware, Semaphores, Classic Problems of Synchronization, Monitors.Deadlock: System Model, Deadlock Characterization, Deadlock Prevention, Detection and Avoidance, Recovery from Deadlock.

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Unit V: Storage Management: Mass-Storage Structure, Overview, Disk Structure, Disk Attachment, Disk Scheduling. File System Interface: The Concept of a File, Access Methods, Directory Structure, File System Structure, Allocation Methods, Free-Space Management.

Recommended Books

1. *Operating System Concepts, Silberschatz, Ninth Edition, Willey Publication.*
2. *Operating Systems, internals and Design Principles, Stallings, Seventh Edition, Pearson Publication.*
3. *Modern Operating Systems, Tanenbaum, Fourth Edition. Pearson Publication.*

Course Outcomes

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

CO 1. **Describe** the basic concept of operating systems
CO 2. **Analyze** the working of operating system
CO 3. **Examine** the working of various scheduling/allocation approaches
CO 4. **Measure** the performance of various scheduling/allocation approaches
CO 5. **Analyze** the various operating system problems/issues

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	2	2	1	1	1	1	2	3	-	-
CO5	3	3	3	3	2	2	2	1	1	1	2	3	-	-

1 - Slightly; 2 - Moderately; 3 – Substantially

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Basic Electrical and Electronics Engineering (22241205)

Course Objectives:

- *To impart basic knowledge of the DC and AC circuits and their applications.*
- *To familiarize the students with the basic knowledge of magnetic circuits, transformer, rotating electrical machine and its terminology.*
- *To make familiarize the students about the working of, various electronic circuits and its importance.*

Unit I - D.C. Circuits Analysis: Voltage and Current Sources: Dependent and independent source, Source conversion, Kirchhoff's Law, Mesh and Nodal analysis. Network theorems: Superposition theorem, Thevenin's theorem & Norton's theorem and their applications.

Unit II –Single-phase AC Circuits: Generation of sinusoidal AC voltage, definitions: Average value, R.M.S. value, Form factor and Peak factor of AC quantity, Concept of Phasor, analysis of R-L, R-C, R-L-C Series and Parallel circuit, Power and Importance of Power factor.

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Unit V - Electronics, Devices & Circuits: Introduction to semiconductors, Diodes, V-I characteristic and its application, Bipolar junction transistors and their working, Introduction to Common Base, Common Emitter & Common Collector transistor configurations.

Recommended Books:

1. *Basic Electrical and Electronics Engineering, D.P. Kothari &I.J. Nagrath-Tata McGraw Hill*
2. *Basic Electrical and Electronics Engineering, V N Mittle& Arvind Mittal -Tata McGraw Hill*
3. *Basic Electrical and Electronics Engineering, S. K Bhattacharya -Pearson*
4. *Electrical Machinery- A.E. Fitzgerald, C. Kingsley and Umans - TMH*
5. *Principles of Electrical Engineering- Vincdent Del Toro- Prentice Hall.*
6. *Basic Electrical Engineering -A.E. Fitzgerald, Higginbotham and Grabel -TMH*
7. *Integrated Electronics- Millmann& Halkias*

Course Outcomes

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

- **CO 1.** Solve DC by applying fundamental laws & theorems
- **CO 2.** Analyze the elementary concepts of single phase AC circuits
- **CO 3.** Analyze magnetic circuits and resonance characteristics of ac electric circuits
- **CO 4.** Describe the working, construction, applications of single phase transformer & rotating electrical machines
- **CO 5.** Explain the characteristics and parameters of Diode and Transistors.

Course Articulation Matrix

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

1 - Slightly; 2 - Moderately; 3 – Substantially

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Sustainability & Environmental Science (23241211)

Course Objectives:

To equip students with a comprehensive understanding of environmental science, pollution control, sustainability, and global frameworks, enabling them to analyze environmental challenges and contribute to sustainable solutions through informed decision-making and responsible practices.

Unit I Introduction to Environmental Science: definition, importance and its components. Ecosystem and its components. Water cycle, carbon cycle, food chain, energy flow in ecosystem. Current state of environment in India and world; Underlying reasons (root causes) of modern environmental degradation (social, psychological, cultural).

Unit II Environmental Pollution and Management: air, water, noise, soil, thermal and radioactive. Causes, impacts, pollution control techniques and mitigation strategies. Solid waste management: Principles of waste management, different components of waste management system and introduction to management of hazardous waste like e-waste, plastic waste. Global environmental issues: Climate change, global warming, ozone layer depletion.

Unit III Environmental policies and laws in India: Environmental Protection Act, Water Act, Air Act. Overview of global environmental policies and frameworks: Kyoto protocol, Montreal protocol, COP summits. Introduction to clean development mechanism, carbon credit, carbon trading.

Unit IV Sustainability concepts: definition, importance, pillars of sustainability (economic, environmental, and social). Sustainable development. Overview of UN Sustainable Development Goals (SDGs) and their global relevance. Concept of circular economy, resource efficiency, energy conservation, green buildings and sustainable manufacturing.

Unit V Sustainable Energy solutions: New Energy Sources: Need of new sources. Different types new energy sources. Applications of- Hydrogen energy, Ocean energy resources, Tidal energy conversion. Concept, origin and power plants of geothermal energy. Introduction to sustainable transportation systems and sustainable water infrastructure.

Reference Book

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2. S. K. Dhameja, *Environmental Engineering & Management*, S K Kataria & Sons, New Delhi
3. C. S. Rao, *Environmental Pollution Control Engineering*, C.S. Rao, New Age International Publishers
4. A. K. Gupta, *Environmental Sustainability and Green Technologies*, PHI Learning.

Course Outcomes:

Upon completion of the course the student will be able to:

***CO 1: Explain** the fundamental concepts of environmental science, including ecosystems and the causes of environmental degradation.*

***CO 2: Analyze** the sources, causes, and impacts of air, water, and solid waste pollution and propose appropriate mitigation strategies.*

***CO 3: Evaluate** the effectiveness of environmental policies and global frameworks in addressing environmental challenges.*

***CO 4: Explain** the concepts of sustainability and sustainable development goals.*

***CO 5: Apply** various solutions for achieving sustainable development.*

Course Articulation Matrix

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

1 - Slightly; 2 - Moderately; 3 – Substantially

Recommended in BoS meeting of Centre for IoT held on 07.Dec .2024

Admitted Batch 2024-2025

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Item 4

Experiment list/ Lab manual for all the Laboratory Courses and Micro Project-I to be offered in to be offered in B. Tech. II Semester (for batch admitted in 2024-25)

Recommended in BoS Meeting of CIoT held on 07 December 2024

Admitted Batch 2024-2025

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Object-Oriented Programming Lab (22241206)

Course Objectives:

- To develop knowledge for object oriented programming features.
- To enhance Practical programming Skills to solve real world problems.

List of Experiments

1. Write a program to swap two integers without using a third variable. The swapping must be done in a different method of class.
2. Write a program to calculate factorial of any number that will use concept of class and object where the member functions are defined outside of a class.
3. Create a class named 'Book' with attributes such as 'title', 'author', and 'price'. Instantiate objects of the 'Book' class and display their details.
4. Define a class 'Rectangle' with attributes 'length' and 'width'. Implement a parameterized constructor to initialize these attributes and calculate the area of the rectangle.
5. Write a program to demonstrate concept of static member variables and static member functions.
6. Implement a class 'Student' with attributes 'name' and 'age'. Write a default constructor that initializes these attributes with default values, and another constructor that allows custom initialization.
7. Develop a class 'Time' with attributes 'hours' and 'minutes'. Implement constructor overloading to initialize the time either by specifying both hours and minutes or just the minutes.
8. Write any suitable program to show concept of operator overloading.
9. Write any suitable program to show concept of friend function.
10. Create a base class 'Person' with attributes 'name' and 'age'. Derive a class 'Employee' from 'Person', adding an additional attribute 'salary'. Write functions to input and display details of an employee.
11. Design a class 'Vehicle' with a basic attribute 'speed'. Derive a class 'Car' from 'Vehicle' that adds the attribute 'fuelCapacity', and further derive a class 'ElectricCar' from 'Car' that includes the attribute 'batteryLife'. Implement methods to display all these attributes. [Multilevel Inheritance]
12. Create two base classes, 'Engine' with an attribute 'horsepower' and 'Transmission' with an attribute 'type'. Derive a class 'Car' from both these classes and implement methods to show the combined attributes. [Multiple Inheritance]
13. Write a class 'Calculator' with an 'add' function that can add two integers, three integers, or two floating- point numbers using polymorphism with function overloading.
14. Define a base class 'Shape' with a virtual function 'area()'. Derive two classes, 'Circle' and 'Rectangle', from 'Shape', each with its own implementation of the 'area()' function. Demonstrate polymorphism by calculating the area of different shapes using a pointer to the base class. [Polymorphism with Virtual Functions].
15. Create an abstract class 'Animal' with a pure virtual function 'sound()'. Derive classes 'Dog' and 'Cat' from 'Animal', each providing its own implementation of the 'sound()' function. Implement a program that demonstrates the concept using an array of 'Animal' pointers. [Abstract Class and Pure Virtual Functions]

Course Outcomes:

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

- **CO 1.** **Implement** programming logics in CPP language.
- **CO 2.** **Explore** knowledge of programming to solve real-world problems
- **CO 3.** **Apply** object oriented programming concept to implement program.
- **CO 4.** **Acquire** teamwork skill for working effectively in groups

Course Articulation Matrix

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

1 - Slightly; 2- Moderately; 3 – Substantially

Recommended in BoS Meeting of CIoT held on 07 December 2024

Admitted Batch 2024-2025

Sensors and Actuators (22241207)
List of Experiments

1. Measure the linear displacement of a mechanical object using a Linear Variable Differential Transformer (LVDT) and analyze the characteristics of the output signal.
2. Measure temperature using a thermistor and calibrate the output by comparing it with a reference thermometer.
3. Compare the performance of Resistance Temperature Detectors (RTD) and Thermocouples in measuring temperature across a range of values.
4. Measure the stress and strain on a cantilever beam using a strain gauge and correlate the output with the applied force.
5. Measure fluid pressure using a pressure transducer and analyze the response characteristics.
6. Use a photoelectric sensor to detect the presence of objects and measure the distance between the sensor and the object.
7. Implement a closed-loop temperature control system using a temperature controller and observe the system's response to changes in the setpoint.
8. Measure the water level in a tank using a strain gauge and analyze the relationship between the strain and the water level.
9. Measure the rotational speed of a motor using a Hall effect sensor and analyze the output signal.
10. Measure the flow rate of water in a pipe using a flow sensor and calibrate the system to ensure accuracy.
11. Use a proximity sensor to detect the presence of objects and analyze its sensing range and accuracy.
12. Design a controller for a stepper motor and observe its performance in controlling the motor's movement.

Course Outcomes:

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

- **CO 1.** **Analyze** sensor data factors and sensor limitations on measurement accuracy
- **CO 2.** **Apply** knowledge of sensors and measurement systems to solve real-world problems
- **CO 3.** **Acquire** teamwork skill for working effectively in groups
- **CO 4.** **Prepare** an organized technical report on experiments conducted in the laboratory

Course Articulation Matrix

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

1 - Slightly; 2 - Moderately; 3 – Substantially

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Electrical & Electronics Engineering Lab (22241208)

List of Experiments

1. To verify Kirchhoff's Current Law & Kirchhoff's Voltage Law.
2. To verify Superposition Theorem
3. To determine resistance & inductance of a choke coil.
4. To determine active & reactive power in a single phase A.C circuit.
5. To determine voltage ratio & current ratio of a single phase transformer.
6. To determine the polarity of a single phase transformer.
7. To perform open circuit & short circuit test on a single phase transformer.
8. To study multimeter & measure various electrical quantities
9. To study of constructional details of DC machine.
10. To determine the V-I characteristics of diode in forward bias & reverse bias condition.

Course Outcomes:

After the completion of the lab, the student will be able to –

- CO 1. ***Demonstrate*** *the ability to operate lab equipment and instruments relevant to the electrical engineering field*
- CO 2. ***Collect*** *experimental data accurately and effectively*
- CO 3. ***Integrate*** *theoretical knowledge from coursework into practical applications and experiments*
- CO 4. ***Communicate*** *experimental results effectively through oral presentations and written documentation*
- CO 5. ***Demonstrate*** *responsibility and professionalism in the completion of lab tasks and assignments*
- CO 6. ***Show*** *willingness to learn new techniques, tools, or methods to enhance practical engineering skills*

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	2	2	1	3	3	-
CO2	3	3	3	3	2	2	2	3	2	2	2	3	3	-
CO3	3	3	3	3	3	2	1	2	3	2	3	3	3	2
CO4	2	2	2	2	2	1	2	2	2	3	3	3	3	-
CO5	1	1	1	1	1	1	2	3	2	2	2	2	2	2
CO6	1	1	1	1	1	1	1	1	2	2	2	3		

1 - Slightly; 2 - Moderately; 3 – Substantially

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Micro Project-II (22241210)

LIST OF MICRO PROJECTS

1. Develop a smart home automation system to control the electric appliances using ESP32, relays, sensors and MQTT.
2. Develop an IoT Weather Station to monitor temperature and humidity via the internet using ESP32, DHT11 and Thing Speak.
3. Develop a Smart Plant Watering System to automatically water plants based on soil moisture levels using ESP32,Moisture Sensor, Water Pump, and Blynk.
4. Develop an IoT Air Quality Monitor to monitor air pollution levels and send data online using ESP32, Gas Sensor and Thing Speak
5. Develop a Wi-Fi Controlled RGB LED Strip to Change RGBLED colors wirelessly using a mobile app, ESP32, RGB LED Strip, MQTT
6. Construct a Home Security System that sends notifications when motion is detected using ESP32, PIR Sensor, Camera.
7. Develop a Wearable Fitness Tracker to monitor fitness activity using heart rate and motion sensors (accelerometer)and Blynk.
8. Construct a Smart Agriculture System to Monitor and automate irrigation systems based on sensor data usingESP32, Soil Moisture Sensor, Pump, Blynk.
9. Develop an IoT Trash Monitoring System to monitor the fill level of a trash can and send alerts when full using Node MCU, Ultrasonic Sensor, Thing Speak.
10. Develop an IoT-Based Parking System to create a system to monitor parking availability using ultrasonic sensors using Node MCU, Ultrasonic Sensor.
11. Develop an IoT Pet Feeder to feed pets remotely using a Wi-Fi-controlled feeder using Node MCU, Servo Motor, Blynk.
12. Build a portable GPS tracking system with cloud connectivity using Node MCU, GPS Module.
13. Use a current sensor with Node MCU to track power usage in real-time. Upload this data to Thing Speak to visualize and analyze energy consumption trends.
14. Use a water level sensor with Node MCU to monitor the water level in a tank. Send the data to Thing Speak to allow remote monitoring of the tank's status, with triggers for refilling or alert notifications.
15. Use NodeMCU with a camera or infrared sensor to monitor traffic flow in an area. Send traffic data to ThingSpeak for analysis and real-time updates, helping authorities track and manage traffic congestion.
16. Design a smart lock system using Node MCU and a servo motor. The Blynk app can control the locking/unlocking of the door remotely, or even provide a password-based authentication system.
17. Integrate a simple camera module (e.g., ESP32-CAM) with Node MCU to capture real-time video feeds. The Blynk app can display the video stream or send alerts if motion is detected, enabling remote surveillance.
18. Equip Node MCU with vibration sensors (such as the ADXL345 accelerometer) to detect seismic activity. When an earthquake-like vibration is detected, the system triggers an alert on the Blynk app to warn people in the affected area.
19. Create a smart shopping cart that uses Node MCU and RFID/NFC tags to automatically detect the items placed inside. The cart can automatically calculate the total amount of the shopping cart and display it on the Blynk app.
20. Implement a system where the lighting and fan of the classroom are automatically controlled based on the presence of students using motion sensors with Node MCU and controlled through the Blynk app.

Recommended in BoS Meeting of CIoT held on 07 December 2024

Admitted Batch 2024-2025

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Object-Oriented Programming Lab (23241206)

Course Objectives:

- To develop knowledge for object oriented programming features.
- To enhance Practical programming Skills to solve real world problems.

List of Experiments

1. Write a program to swap two integers without using a third variable. The swapping must be done in a different method of class.
2. Write a program to calculate factorial of any number that will use concept of class and object where the member functions are defined outside of a class.
3. Create a class named 'Book' with attributes such as 'title', 'author', and 'price'. Instantiate objects of the 'Book' class and display their details.
4. Define a class 'Rectangle' with attributes 'length' and 'width'. Implement a parameterized constructor to initialize these attributes and calculate the area of the rectangle.
5. Write a program to demonstrate concept of static member variables and static member functions.
6. Implement a class 'Student' with attributes 'name' and 'age'. Write a default constructor that initializes these attributes with default values, and another constructor that allows custom initialization.
7. Develop a class 'Time' with attributes 'hours' and 'minutes'. Implement constructor overloading to initialize the time either by specifying both hours and minutes or just the minutes.
8. Write any suitable program to show concept of operator overloading.
9. Write any suitable program to show concept of friend function.
10. Create a base class 'Person' with attributes 'name' and 'age'. Derive a class 'Employee' from 'Person', adding an additional attribute 'salary'. Write functions to input and display details of an employee.
11. Design a class 'Vehicle' with a basic attribute 'speed'. Derive a class 'Car' from 'Vehicle' that adds the attribute 'fuelCapacity', and further derive a class 'ElectricCar' from 'Car' that includes the attribute 'batteryLife'. Implement methods to display all these attributes. [Multilevel Inheritance]
12. Create two base classes, 'Engine' with an attribute 'horsepower' and 'Transmission' with an attribute 'type'. Derive a class 'Car' from both these classes and implement methods to show the combined attributes. [Multiple Inheritance]
13. Write a class 'Calculator' with an 'add' function that can add two integers, three integers, or two floating- point numbers using polymorphism with function overloading.
14. Define a base class 'Shape' with a virtual function 'area()'. Derive two classes, 'Circle' and 'Rectangle', from 'Shape', each with its own implementation of the 'area()' function. Demonstrate polymorphism by calculating the area of different shapes using a pointer to the base class. [Polymorphism with Virtual Functions].
15. Create an abstract class 'Animal' with a pure virtual function 'sound()'. Derive classes 'Dog' and 'Cat' from 'Animal', each providing its own implementation of the 'sound()' function. Implement a program that demonstrates the concept using an array of 'Animal' pointers. [Abstract Class and Pure Virtual Functions]

Course Outcomes:

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

- CO 1. **Implement** programming logics in CPP language.
- CO 2. **Explore** knowledge of programming to solve real-world problems
- CO 3. **Apply** object oriented programming concept to implement program.
- CO 4. **Acquire** teamwork skill for working effectively in groups

Course Articulation Matrix

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

1 - Slightly: 2- Moderately; 3 – Substantially

Recommended in BoS meeting of Centre for IoT held on 07.Dec .2024 *Admitted Batch 2024-2025*

Sensors and Actuators (23241207)

List of Experiments

1. Measure the linear displacement of a mechanical object using a Linear Variable Differential Transformer (LVDT) and analyze the characteristics of the output signal.
2. Measure temperature using a thermistor and calibrate the output by comparing it with a reference thermometer.
3. Compare the performance of Resistance Temperature Detectors (RTD) and Thermocouples in measuring temperature across a range of values.
4. Measure the stress and strain on a cantilever beam using a strain gauge and correlate the output with the applied force.
5. Measure fluid pressure using a pressure transducer and analyze the response characteristics.
6. Use a photoelectric sensor to detect the presence of objects and measure the distance between the sensor and the object.
7. Implement a closed-loop temperature control system using a temperature controller and observe the system's response to changes in the setpoint.
8. Measure the water level in a tank using a strain gauge and analyze the relationship between the strain and the water level.
9. Measure the rotational speed of a motor using a Hall effect sensor and analyze the output signal.
10. Measure the flow rate of water in a pipe using a flow sensor and calibrate the system to ensure accuracy.
11. Use a proximity sensor to detect the presence of objects and analyze its sensing range and accuracy.
12. Design a controller for a stepper motor and observe its performance in controlling the motor's movement.

Course Outcomes:

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

- **CO 1.** **Analyze** sensor data factors and sensor limitations on measurement accuracy
- **CO 2.** **Apply** knowledge of sensors and measurement systems to solve real-world problems
- **CO 3.** **Acquire** teamwork skill for working effectively in groups
- **CO 4.** **Prepare** an organized technical report on experiments conducted in the laboratory

Course Articulation Matrix

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

1 - Slightly; 2 - Moderately; 3 – Substantially

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Electrical & Electronics Engineering Lab (23241208)

List of Experiments

1. To verify Kirchhoff's Current Law & Kirchhoff's Voltage Law.
2. To verify Superposition Theorem
3. To determine resistance & inductance of a choke coil.
4. To determine active & reactive power in a single phase A.C circuit.
5. To determine voltage ratio & current ratio of a single phase transformer.
6. To determine the polarity of a single phase transformer.
7. To perform open circuit & short circuit test on a single phase transformer.
8. To study multimeter & measure various electrical quantities
9. To study of constructional details of DC machine.
10. To determine the V-I characteristics of diode in forward bias & reverse bias condition.

Course Outcomes:

After the completion of the lab, the student will be able to –

- CO 1. ***Demonstrate*** *the ability to operate lab equipment and instruments relevant to the electrical engineering field*
- CO 2. ***Collect*** *experimental data accurately and effectively*
- CO 3. ***Integrate*** *theoretical knowledge from coursework into practical applications and experiments*
- CO 4. ***Communicate*** *experimental results effectively through oral presentations and written documentation*
- CO 5. ***Demonstrate*** *responsibility and professionalism in the completion of lab tasks and assignments*
- CO 6. ***Show*** *willingness to learn new techniques, tools, or methods to enhance practical engineering skills*

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	2	2	1	3	3	-
CO2	3	3	3	3	2	2	2	3	2	2	2	3	3	-
CO3	3	3	3	3	3	2	1	2	3	2	3	3	3	2
CO4	2	2	2	2	2	1	2	2	2	3	3	3	3	-
CO5	1	1	1	1	1	1	2	3	2	2	2	2	2	2
CO6	1	1	1	1	1	1	1	1	2	2	2	3		

1 - Slightly; 2 - Moderately; 3 – Substantially

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Micro Project-II (23241210)

LIST OF MICRO PROJECTS

1. Develop a smart home automation system to control the electric appliances using ESP32, relays, sensors and MQTT.
2. Develop an IoT Weather Station to monitor temperature and humidity via the internet using ESP32, DHT11 and Thing Speak.
3. Develop a Smart Plant Watering System to automatically water plants based on soil moisture levels using ESP32,Moisture Sensor, Water Pump, and Blynk.
4. Develop an IoT Air Quality Monitor to monitor air pollution levels and send data online using ESP32, Gas Sensor and Thing Speak
5. Develop a Wi-Fi Controlled RGB LED Strip to Change RGBLED colors wirelessly using a mobile app, ESP32, RGB LED Strip, MQTT
6. Construct a Home Security System that sends notifications when motion is detected using ESP32, PIR Sensor, Camera.
7. Develop a Wearable Fitness Tracker to monitor fitness activity using heart rate and motion sensors (accelerometer)and Blynk.
8. Construct a Smart Agriculture System to Monitor and automate irrigation systems based on sensor data usingESP32, Soil Moisture Sensor, Pump, Blynk.
9. Develop an IoT Trash Monitoring System to monitor the fill level of a trash can and send alerts when full using Node MCU, Ultrasonic Sensor, Thing Speak.
10. Develop an IoT-Based Parking System to create a system to monitor parking availability using ultrasonic sensors using Node MCU, Ultrasonic Sensor.
11. Develop an IoT Pet Feeder to feed pets remotely using a Wi-Fi-controlled feeder using Node MCU, Servo Motor, Blynk.
12. Build a portable GPS tracking system with cloud connectivity using Node MCU, GPS Module.
13. Use a current sensor with Node MCU to track power usage in real-time. Upload this data to Thing Speak to visualize and analyze energy consumption trends.
14. Use a water level sensor with Node MCU to monitor the water level in a tank. Send the data to Thing Speak to allow remote monitoring of the tank's status, with triggers for refilling or alert notifications.
15. Use NodeMCU with a camera or infrared sensor to monitor traffic flow in an area. Send traffic data to ThingSpeak for analysis and real-time updates, helping authorities track and manage traffic congestion.
16. Design a smart lock system using Node MCU and a servo motor. The Blynk app can control the locking/unlocking of the door remotely, or even provide a password-based authentication system.
17. Integrate a simple camera module (e.g., ESP32-CAM) with Node MCU to capture real-time video feeds. The Blynk app can display the video stream or send alerts if motion is detected, enabling remote surveillance.
18. Equip Node MCU with vibration sensors (such as the ADXL345 accelerometer) to detect seismic activity. When an earthquake-like vibration is detected, the system triggers an alert on the Blynk app to warn people in the affected area.
19. Create a smart shopping cart that uses Node MCU and RFID/NFC tags to automatically detect the items placed inside. The cart can automatically calculate the total amount of the shopping cart and display it on the Blynk app.
20. Implement a system where the lighting and fan of the classroom are automatically controlled based on the presence of students using motion sensors with Node MCU and controlled through the Blynk app.

Recommended in BoS meeting of Centre for IoT held on 07.Dec .2024 *Admitted Batch 2024-2025*

माधव प्रौद्योगिकी एवं विज्ञान संस्थान, ग्वालियर
MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR
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(Declared under Distinct Category by Ministry of Education, Government of India)
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Item-07

Syllabi of Ph.D. course work courses under the Madhav Institute of Technology & Science-Deemed University (MITS-DU)

High Power Multilevel Converters-Analysis, Design & Operational Issues (22100001)

Course Objective:

- To provide participants with a comprehensive understanding of multilevel converter topologies, modulation techniques, and control strategies for improved power quality and efficiency in power systems.
- To equip participants with practical design and operational knowledge of multilevel inverters, enabling effective application in renewable energy systems and grid-connected infrastructures.

Unit 1: Introduction to Multilevel Converters: Introduction to Multilevel Inverters (MLI), Conventional MLI topologies viz. Diode-Clamped (Neutral Point Clamped - NPC), Flying Capacitor (FC), Cascaded H-Bridge (CHB), and Modular Multilevel Converter (MMC) and their application in renewable energy systems

Unit 2: Converter Topologies and Modulation Techniques: Various reduced device count inverter topologies and their comparison, Pulse Width Modulation (PWM), Space Vector Modulation (SVM), and Selective Harmonic Elimination (SHE) modulation techniques

Unit 3: Dynamic Modelling and Control of Multilevel Converters: Steady-state and transient modelling using Clarke and Park transformations, and control strategies like phase-locked loops (PLLs), voltage, and current control loops

Unit 4: Design Considerations and Operational Issues: Design aspects of multilevel converters, Selection of capacitors, inductors and switches, thermal management and protection circuits, design of gate driver circuits and operational issues

Unit 5: Grid-Connected Multilevel Inverters: Integration of renewable energy sources such as solar PV and wind systems, Power Quality Improvement, harmonic compensation and power factor correction techniques, applications in utility-scale and micro grid applications.

Reference/ Text Books:

1. ***"Multilevel Converters for Industrial Applications"*** *by Sergio Alberto Gonzalez, Ramon Vargas, Leopoldo G. Franquelo*
2. ***"Power Electronics: Converters, Applications, and Design"*** *by Ned Mohan, Tore M. Undeland, William P. Robbins*
3. ***"Multilevel Inverters: Control and Modulation Techniques for Power Conversion"*** *by Ersan Kabalci, Yasin Kabalci*

Course Outcomes:

After the completion of the course, the student will be able to –

CO 1. ***Explain*** *the fundamentals of multilevel inverter topologies*
CO 2. ***Analyze*** *and compare modulation techniques*
CO 3. ***Classify*** *different multilevel converter topologies using steady-state and dynamic modeling techniques.*
CO 4. ***Apply*** *design considerations for multilevel converters, including component selection, thermal management, and gate driver circuits.*
CO 5. ***Explore*** *grid-connected multilevel inverters for power quality improvement*

Course Articulation Matrix

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

1 - Slightly; 2 - Moderately; 3 – Substantially

Renewable Energy Engineering(22100005)

Course Objectives: To provide knowledge on different types of renewable energy sources and the methods involved in converting them into electrical energy.

Unit I. Ecological Impact of Power Generation: conventional sources: Limitation of fossil fuels. Atmospheric pollution – effects of hydro-electric projects – disposal of nuclear waste – green house gaseous mission from various energy sources and its effects – need for renewable energy sources.

Unit II. Solar Photovoltaic Technology: Solar radiation and its measurement – Angle of sun rays on solar collector – optimal angle for fixed collector – sun tracking, an introduction to solar cell, solar PV module, MPPT,PV system design and applications – stand-alone and grid connected systems and integration with DC-DC converters environmental impacts.

Unit III. Wind Energy Conversion: Wind energy, classification of wind turbines – aerodynamic operation of wind turbine, extraction of wind turbine power, wind turbine power curve, horizontal axis wind turbine generator – modes of wind power generation – stand-alone and grid connected system, environmental impacts

Unit IV. Fuel Cell Technology: Principle of operation of fuel cell, technical parameters of fuel cell, Types of fuel cell – advantages of fuel cell power plants, energy output, efficiency and emf of fuel cell – operating characteristics, applications and environmental impacts.

Unit V. Integrated Hybrid Energy Solutions: Need for hybrid systems, types, configuration and coordination, electrical interface – PV-Diesel, Wind-diesel, wind-PV, wind-PV- fuel cell.

Reference/ Text Books:

1. **Non-conventional Energy Sources** by G. D. Rai, Khanna Publishers, 5th Edition, 2014.
2. **Renewable Energy Sources and Emerging Technologies** by D. P. Kothari, K. C. Singal, and R. Ranjan, PHI, 2nd Edition, 2012.
3. **Solar Photo-voltaics – Fundamentals, Technologies, and Applications** by C. S. Solanki, PHI Pvt. Ltd., 2nd Edition, 2011.
4. **Wind Electric Systems** by S. N. Bhadra, D. Kastha, and S. Banerjee, Oxford Publications, 2nd Edition, 2007.

Course Outcomes:

After the completion of the course, the student will be able to –

1. Assess the environmental effects of conventional energy sources
2. Describe the principles of photovoltaic (PV) energy generation and grid-connected systems
3. Illustrate the process of wind energy generation.
4. Discuss the process of fuel cell energy production and explore its various applications.
5. Design and configure different types of hybrid energy systems.

6. **Course Articulation Matrix**

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

7. 1 - Slightly; 2 - Moderately; 3 – Substantially

Soft Computing Techniques for Energy Systems Control (22100009)

Unit I-Introduction to Soft Computing: Soft Computing v/s Hard Computing, Basic models of Artificial Neural Networks, Terminologies of ANNs McCulloch-Pitts Neurons, Linear Separability, Hebb Network, and Supervised Learning Networks: Introduction, Perceptron Networks, Back Propagation Networks, Radial Basis Function Networks, Hopefield Networks.

Unit II- Fuzzy Set Theory: Fuzzy Sets, Fuzzy Membership Functions, Operations on Fuzzy Sets, Fuzzy Relations, Fuzzy rules, Fuzzy Reasoning, Defuzzification: Lambda-Cuts for Fuzzy sets (Alpha Cuts), Lambda-Cuts for Fuzzy Relations. Fuzzy Inference System: Introduction, Mamdani Fuzzy Model, Takagi-Sugeno Fuzzy Model

Unit III- Metaheuristic Optimization Algorithms: Genetic Algorithm (GA) Flow, Swarm Optimization (PSO) Algorithm, Differential Evolution (DE) Algorithm, Artificial BeeColony (ABC) Algorithm, Ant Colony Optimization (ACO) Algorithm, Cuckoo Search (CS), Firefly Algorithm (FA), Immune Algorithm (IA), Grey Wolf Optimization (GWO), Spider Monkey Optimization.

Unit V- Hybrid Soft Computing Techniques: Introduction, Neuro-fuzzy Hybrid system, Adaptive Neuro fuzzy inference system (ANFIS), Genetic Neuro Hybrid system.

Unit V- Soft Computing Techniques Applications in Energy Systems: Application of Artificial neural networks (ANNs) in fault diagnosis, Fuzzy control applications in load forecasting, Application of Optimization techniques in optimal power flow and resource allocation, Applications of Hybrid Soft Computing in smart grid technologies, Case studies: Predictive maintenance and load forecasting, Review of significant applications in modern power systems.

Course Outcomes:

After the completion of the course, the student will be able to –

1. **Analyze**and distinguish between soft computing and hard computing approaches
2. **Design** and develop fuzzy logic systems, including fuzzy inference models
3. **Apply** metaheuristic optimization algorithms to optimize complex systems
4. **Integrate** advanced hybrid soft computing models, such as Neuro-fuzzy and Genetic Neuro systems
5. **Implement** soft computing techniques in energy systems

Reference/ Text Books:

1. *Principles of Soft Computing, S. N. Sivanandam and S. N. Deepa , Wiley Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis and Applications- S. Rajasekaran& G.A. VijayalakshmiPai, PH*
2. *Introduction to Soft Computing Neuro-Fuzzy and Genetic Algorithms, Samir Roy and Udit Chakraborty, Pearson*
3. *Neural Networks and Learning Machines-Simon Haykin PHI*
4. *Fuzzy Logic and Engineering Application, Tamthy Ross, TMH*
5. *Evolutionary Optimization Algorithms, D. Simon (2013), Wiley*
6. *Fundamentals of Natural Computing: Basic Concepts, Algorithms, and Applications, L. N. deCastro (2006), CRC Press.*

Course Articulation Matrix

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

1 - Slightly; 2 - Moderately; 3 – Substantially