DEPARTMENT OF INFORMATION TECHNOLOGY

Department of information technology [BOS-(IoT)-15-12-2023]

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE VIDISHA (M.P.)

(A Govt. Aided UGC Autonomous & NAAC Accredited Institute Affiliated to RGPV Bhopal)

Department Of Information Technology

Programme -IoT

Scheme-2022-2023

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE VIDISHA (M.P.)

(A Govt. Aided UGC Autonomous & NAAC Accredited Institute Affiliated to RGPV Bhopal)

Scheme of Examination (Semester-I)

for Batch Admitted in session - 2022-23

Bachelor of Technology (B. Tech.) – Internet of Things

Subject Code	Subject Category	Subject Name	Maximum Marks Allotted								Contact Hrs.			Total Credits
			Theory				Practical			Total Marks				
			ES	MS	Assign ment	Quiz	ES	LW	Quiz		L	T	P	
PYB101	BSC	Applied Physics	60	20	10	10	30	10	10	150	3	0	2	4
CSA 101	ESC	Introduction to Computer Science Engineering	60	20	10	10	30	10	10	150	3	0	2	4
IOA103	ESC	Basic Electrical Engineering	60	20	10	10	30	10	10	150	3	0	2	4
CSA102	ESC	Digital Electronics	60	20	10	10	--	--	--	100	3	0	0	3
MAB101	BSC	Linear Algebra and Calculus	60	20	10	10	--		--	100	3	1	0	4
MAC101	MAC*	Universal Human Values	--	--		--	60	20	20	100	0	0	2	Grade
ILC100	ILC	Extracurricular Activities	It is a one credit per year activity endorse in eight semester marksheet											
Total			**300**	**100**	**50**	**50**	**150**	**50**	**50**	**750**	**15**	**1**	**6**	**19**

MST: Minimum two mid semester tests to be conducted during Semester, MAC: Mandatory courses classes will be conducted in off hours (Weekends)

MAC	Induction Program	Non-Credit
HEC	NSS/NCC/NSO	Non-Credit

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE VIDISHA (M.P.)

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Scheme of Examination (Semester-II)

for Batch Admitted in session - 2022-23

Bachelor of Technology (B. Tech.) – Internet of Things

Subject Code	Subject Category	Subject Name	Maximum Marks Allotted								Contact Hrs.			Total Credits
			Theory				Practical			Total Marks				
			ES	MS	Assignment	Quiz	ES	LW	Quiz		L	T	P	
CHB101	BSC	Applied Chemistry	60	20	10	10	30	10	10	150	3	0	2	4
CSA 103	ESC	Problem Solving Using Data Structure	60	20	10	10	30	10	10	150	3	0	2	4
ITC 101	ITC	Python Programming	60	20	10	10	30	10	10	150	3	0	2	4
HUB 101	HSMC	Language and Writing Skills	60	20	10	10	--	--	--	100	3	0	0	3
MAB 102	BSC	Probability Distribution and Differential Equation	60	20	10	10	--	--	--	100	3	1	0	4
CSL 110	ESC	Computer Workshop(Linux Lab)	--	--	--	--	30	10	10	50	1	0	2	2
MAC 102	MAC	Professional Ethics and Social Responsibility	--	--	--	--	30	10	10	50	0	0	2	Grade
ILC 100	ILC	Extracurricular Activities	It is a one credit per year activity endorse in eight semester marksheet											
Total			**300**	**100**	**50**	**50**	**150**	**50**	**50**	**750**	**15**	**1**	**10**	**21**

MST: Minimum two mid semester tests to be conducted during Semester, MAC: Mandatory courses classes will be conducted in off hours (Weekends)

ILC	Internship-I (60 Hrs) Institute Level	Non-Credit
HEC	NSS/NCC/NSO	Non-Credit

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE VIDISHA (M.P.)
(A Govt. Aided UGC Autonomous & NAAC Accredited Institute Affiliated to RGPV Bhopal)

Scheme of Examination (Semester-III)

for Batch Admitted in session - 2022-23

Bachelor of Technology (B. Tech.) – Internet of Things(Dept. of CS & IT)

Subject Code	Subject Category	Subject Name	Maximum Marks Allotted								Contact Hrs. per week			Total Credits
			Theory				Practical			Total Marks				
			ES	MS	Assignment	Quiz	ES	LW	Quiz		L	T	P	
MAB 201	BSC	Discrete Mathematics	60	20	10	10	--	--	--	100	3	1	0	4
IOC 202	DC	Analysis and Design of Algorithms	60	20	10	10	30	10	10	150	3	0	2	4
IOC 203	DC	Object Oriented Programming	60	20	10	10	30	10	10	150	3	0	2	4
IOC 204	DC	Electronic Devices & Circuits	60	20	10	10	30	10	10	150	3	0	2	4
IOO 205	OC	OC-1	60	20	10	10	--	--	--	100	3	0	0	3
IOL 206	DLC	Internet Programming	--	--	--	--	30	10	10	50	0	0	4	2
ILT 208	ILC	Internship-I (60 Hrs) Institute Level (Evaluation)	--	--	--	--	50	--	--	50	-	-	2	2
Total			**300**	**100**	**50**	**50**	**170**	**40**	**40**	**750**	**15**	**1**	**12**	**23**
ILC 200	ILC	Extracurricular Activities	It is a one credit per year activity to be endorsed in eight semester marks sheet.											
MAC 207	MAC*	Energy, Ecology, Environment & Society												Grade
HUM 209	HEC	Holistic Education Course												Grade

MST: Minimum two mid semester tests to be conducted during Semester* MAC and HEC courses classes will be conducted in off hours (Weekends)

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE VIDISHA (M.P.)
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Scheme of Examination (Semester-IV)

for Batch Admitted in session - 2022-23

Bachelor of Technology (B. Tech.) – Internet of Things(Dept. of CS & IT)

Subject Code	Subject Category	Subject Name	Maximum Marks Allotted								Contact Hrs. per week			Total Credits
			Theory				Practical			Total Marks				
			ES	MS	Assignment	Quiz	ES	LW	Quiz		L	T	P	
IOC 251	DC	Microprocessors and Microcontrollers	60	20	10	10	30	10	10	150	3	0	2	4
IOC 252	DC	Database Management System	60	20	10	10	30	10	10	150	3	0	2	4
IOC 253	DC	Signals and Systems	60	20	10	10	30	10	10	150	3	0	2	4
IOC 254	DC	Foundation of IoT	60	20	10	10	-	-	-	100	3	1	0	4
IOO 255	OC	OC -2	60	20	10	10	-	-	-	100	3	0	0	3
IOL 256	DLC	Advance Java Programming	-	-	-	-	60	20	20	100	0	0	4	2
		Total	**300**	**100**	**50**	**50**	**150**	**50**	**50**	**750**	**15**	**1**	**10**	**21**
HUM 257	MAC*	Indian Constitution												Grade
HUM 258	HEC	Holistic Education Course												Grade
VAO 259	VAO	Open Source Tools I	Respective faculty to create his/her own rubric for evaluation											Grade
ILC 250	ILC	Extracurricular Activities	It is a one credit per year activity endorse in eight semester mark sheet											

MST: Minimum two mid semester tests to be conducted during Semester* MAC and HEC courses classes will be conducted in off hours (Weekends)

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE VIDISHA (M.P.)
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Scheme of Examination (Semester-V)
for Batch Admitted in session - 2022-23
Bachelor of Technology (B. Tech.) – Internet of Things

Subject Code	Subject Category	Subject Name	Maximum Marks Allotted								Contact Hrs. per week			Total Credits
			Theory				Practical			Total Marks				
			ES	MS	Assignment	Quiz	ES	LW	Quiz		L	T	P	
IO 501	DC	Artificial Intelligence & Machine Learning	60	20	10	10	30	10	10	150	3	0	2	4
IO 502	DC	Operating Systems for IoT	60	20	10	10	30	10	10	150	3	0	2	4
IO 503	DC	Ad-hoc & Sensor Networks	60	20	10	10	30	10	10	150	3	0	2	4
IO 504	DE	DE -1	60	20	10	10	--	--	--	100	3	1	0	4
OE 505	OC	OC-3	60	20	10	10	--	--	--	100	3	0	0	3
IO 506	DLC	IoT Lab	--	--	--	--	30	10	10	50	0	0	4	2
IO 507	ILC	Internship-II (60 Hrs) Institute Level (Evaluation)	--	--	--	--		50	--	50	-	-	2	2
Total			**300**	**100**	**50**	**50**	**120**	**90**	**40**	**750**	**15**	**1**	**12**	**23**
	ILC	Extracurricular Activities	It is a one credit per year activity to be endorsed in eight semester marks sheet.											

	DE -1	OC-3
A	IoT Communication Protocols	IoT Communication Protocols
B	5G and IoT Technologies	Operating Systems for IoT
C	Wireless network	Ad-hoc & Sensor Networks

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE VIDISHA (M.P.)
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Scheme of Examination (Semester-VI)

for Batch Admitted in session - 2022-23

Bachelor of Technology (B. Tech.) – Internet of Things

Subject Code	Subject Category	Subject Name	Maximum Marks Allotted								Contact Hrs. per week			Total Credits
			Theory				Practical			Total Marks				
			ES	MS	Assignment	Quiz	ES	LW	Quiz		L	T	P	
IO 601	DC	IoT Cloud Processing and Analytics	60	20	10	10	30	10	10	150	3	0	2	4
IO 602	DC	Programming Languages for IoT	60	20	10	10	30	10	10	150	3	0	2	4
IO 603	DE	DE-2	60	20	10	10				100	3	0	0	3
IO 604	DE	DE -3	60	20	10	10				100	3	1	0	4
OE 605	OC	OC – 4	60	20	10	10				100	3	0	0	3
IO 606	DLC	Lab View					30	10	10	50	0	0	2	1
IO 607	DLC	Minor Project					50	50		100	0	0	4	2
			300	**100**	**50**	**50**	**140**	**80**	**30**	**750**	**15**	**`1**	**10**	**21**
	ILC	Extracurricular Activities	It is a one credit per year activity endorse in eight semester mark sheet											
MST: Minimum two mid semester tests to be conducted during Semester														

	DE -2	DE -3	OC – 4
A	IoT Security	Mobile Application Development for IoT	IoT Cloud Processing and Analytics
B	Cryptography	Web Technology	Programming Languages for IoT
C	Information Theory and Coding	UI/UX	IoT Security

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Scheme of Examination (Semester-VII)

for Batch Admitted in session - 2022-23

Bachelor of Technology (B. Tech.) –Internet of Things

Subject Code	Subject Category	Subject Name	Maximum Marks Allotted								Contact Hrs. per week			Total Credits
			Theory				Practical			Total Marks				
			ES	MS	Assignment	Quiz	ES	LW	Quiz		L	T	P	
IO 701	DC	Data Analytics for IoT	60	20	10	10	30	10	10	150	3	0	2	04
IO 702	DE	DE-4	60	20	10	10	--	--		100	3	1	0	04
IO 703	DE	DE-5	60	20	10	10	--	--		100	3	1	0	04
IO 704	PROJ	Major Project Prelim	--	--	--		60	40		100	0	0	4	02
IO 705	ILC	Internship-III (Completed in Third Year)	--	--	--			50		50	0	0	2	02
Total			**180**	**60**	**30**	**30**	**90**	**100**	**10**	**500**	**9**	**2**	**8**	**16**
	ILC	Extracurricular Activities			It is a one credit per year activity endorse in eight semester mark sheet									

MST: Minimum two mid semester tests to be conducted during Semester

	DE -4	DE-5
A	IoT System Architectures	Industrial IoT
B	Embedded Systems Design	AR and VR
C	Real time Systems	Edge Computing

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Scheme of Examination (Semester-VIII)

for Batch Admitted in session - 2022-23

Bachelor of Technology (B. Tech.) -Internet of Things

Subject Code	Subject Category	Subject Name	Maximum Marks Allotted						Contact Hrs. per week			Total Credits
			Theory			Practical		Total Marks				
			ES	MS	Assignment/ Quiz	ES	LW/ Quiz		L	T	P	
IO 801	PROJ	Major Project				300	200	500	0	0	12	06
IO 802	DE	SWAYAM/NPTEL MOOC's Course *				--	--	--	0	0	0	03
IO 803	DE	SWAYAM/NPTEL MOOC's Course *				--	--	--	0	0	0	03
	ILC	Extracurricular Activities		It is a one credit per year activity endorsed in eight semester mark sheet								04
Total						**300**	**200**	**500**				**16**

	DE-6	DE-7
A	Foundation of Cloud IoT Edge ML	Digital Design with Verilog
B	Foundations of Cyber Physical Systems	Cloud Computing and Distributed Systems
C	Information Security - 5 - Secure Systems Engineering	Systems and Usable Security

SWAYAM/NPTEL MOOC's Course *

For batch admitted 2022-23

DE-6	DE-7
A. Foundation of Cloud IoT Edge ML	A. Digital Design with Verilog
B. Foundations of Cyber Physical Systems	B. Cloud Computing and Distributed Systems
C. Information Security - 5 - Secure Systems Engineering	C. Systems and Usable Security

Sr. No	***Credit Points***	***Course/subject Name***	***Equivalent Course in NPTEL***	***Course Duration (Week)***	**Link**
1.	03	Foundation of Cloud IoT Edge ML	https://onlinecourses.nptel.ac.in/noc23_cs65/preview	08	https://archive.nptel.ac.in/courses/106/104/106104242/
2.	03	Foundations of Cyber Physical Systems	https://onlinecourses.nptel.ac.in/noc23_cs62/preview	12	https://nptel.ac.in/courses/106105241
3.	03	Information Security - 5 - Secure Systems Engineering	https://onlinecourses.nptel.ac.in/noc23_cs10/preview	08	https://archive.nptel.ac.in/courses/106/106/106106199/
4.	03	Digital Design with Verilog	https://onlinecourses.nptel.ac.in/noc24_cs61/preview	12	https://nptel.ac.in/courses/108103179
5.	03	Cloud Computing and Distributed Systems	https://onlinecourses.nptel.ac.in/noc21_cs15/preview	08	https://nptel.ac.in/courses/106104182
6.	03	Systems and Usable Security	https://onlinecourses.nptel.ac.in/noc22_cs36/preview	04	https://nptel.ac.in/courses/106106234

Note: Pool of subjects for DE-6&7 is subjected to change as floated by NPTEL/MOOC's/SWAYAM.

Tentative Pool of subjects for Honours and Minor Degree

SWAYAM/NPTEL/MOOC's Courses

S. No.	Honours Degree for students of parent department	Minor Degree for students of other department	Remark
1.	Cloud Computing and Distributed Systems	Analog and Digital Electronics	8-12 Weeks
2.	Switching Circuits and Logic Design	Computer Networks And Internet Protocol	8-12 Weeks
3.	Advanced Computer Networks	Microprocessor and Microcontroller	8-12 Weeks
4.	Embedded System Design with ARM	Foundation of Cloud IoT Edge ML	8-12 Weeks
5.	Embedded Sensing, Actuation and Interfacing Systems	Foundations of Cyber Physical Systems	8-12 Weeks
6.	Digital System Design	Introduction to Embedded System Design	8-12 Weeks
7.	An Introduction to Information Theory	Introduction To Industry 4.0 And Industrial Internet Of Things	8-12 Weeks
8.	Industrial Automation And Control	Introduction To Internet Of Things	8-12 Weeks

*Note: Those subjects which are already studied in the core scheme from I to VIII semester cannot be opted.

20 additionally to be earned between V to VIII semester Maximum 6 credits per semester from V semester onwards will be permitted.

Tentative pool of subjects for Honours & Minor Degree

SWAYAM/NPTEL/ MOOC's Course *

Annexure-I

NPTEL Courses Equivalence for Departmental and Open Electives
For
(Honour's Degree)

ExistingElectives			SimilarNPTELCourse		
Sr. No	*Credit Points*	*Course/subjectName*	*Equivalent Course inNPTEL*	*CourseDuration(Week)*	Link
7.	2	Cloud Computing and Distributed Systems	https://onlinecourses.nptel.ac.in/noc21_cs15/preview	08	https://nptel.ac.in/courses/106104182
8.	3	Switching Circuits and Logic Design	https://onlinecourses.nptel.ac.in/noc20_cs67/preview	12	https://nptel.ac.in/courses/106105185
9.	3	Advanced Computer Networks	https://onlinecourses.nptel.ac.in/noc23_cs35/preview	12	https://nptel.ac.in/courses/106106243
10.	2	Embedded System Design with ARM	https://onlinecourses.nptel.ac.in/noc22_cs93/preview	08	https://nptel.ac.in/courses/106105193
11.	3	Embedded Sensing, Actuation and Interfacing Systems	https://onlinecourses.nptel.ac.in/noc24_ee68/preview	12	https://nptel.ac.in/courses/108105376
12.	3	Digital System Design	https://onlinecourses.nptel.ac.in/noc21_ee39/preview	12	https://nptel.ac.in/courses/108106177
13.	2	An Introduction to Information Theory	https://onlinecourses.nptel.ac.in/noc22_ee49/preview	08	https://nptel.ac.in/courses/117104129
14.	3	Industrial Automation And Control	https://onlinecourses.nptel.ac.in/noc21_me67/preview	12	https://nptel.ac.in/courses/108105088

Tentative pool of subjects for Honours & Minor Degree

SWAYAM/NPTEL/ MOOC's Course *

Annexure-II

NPTEL Courses Equivalence for Departmental and Open Electives
For
(Minor Degree)

ExistingElectives			SimilarNPTELCourse		
Sr.No.	*Credit Points*	*Course/subjectName*	*Equivalent Course inNPTEL*	*CourseDuration(Week)*	Link
1.		Analog and Digital Electronics	https://nptel.ac.in/courses/108105158		https://nptel.ac.in/courses/108102112
2.	3	Computer Networks And Internet Protocol	https://onlinecourses.nptel.ac.in/noc22_cs19/preview	12	https://nptel.ac.in/courses/106105183
3.	3	Microprocessor and Microcontroller	https://onlinecourses.nptel.ac.in/noc22_ee12/preview	12	https://nptel.ac.in/courses/108105102
4.	2	Foundation of Cloud IoT Edge ML	https://onlinecourses.nptel.ac.in/noc23_cs65/preview	08	https://nptel.ac.in/courses/106104242
5.	3	Foundations of Cyber Physical Systems	https://onlinecourses.nptel.ac.in/noc23_cs62/preview	12	https://nptel.ac.in/courses/106105241
6.	3	Introduction to Embedded System Design	https://onlinecourses.nptel.ac.in/noc20_ee98/preview	12	https://nptel.ac.in/courses/108102169
7.	3	Introduction To Industry 4.0 And Industrial Internet Of Things	https://onlinecourses.nptel.ac.in/noc20_cs69/preview	12	https://nptel.ac.in/courses/106105195
8.	3	Introduction To Internet Of Things	https://onlinecourses.nptel.ac.in/noc22_cs53/preview	12	https://nptel.ac.in/courses/106105166

DETAILS OF HOLISTIC EDUCATION COURSES

Name of Faculty Mentor	**Ms. Rashi Kumar (Asst. Prof)**
Holistic Education Course Title	**Technical Writing Skills**
Objectives of Course	1. To build up the calibre to convey complex technical information in a simpler manner. 2. To be able explain a topic in detail while being accessible to a general audience.
Content	Language support and writing tools- Grammarly-cloud based writing assistant, Turnitin - Plagiarism checking tool, Introduction to Typesetting in Latex; Writing a technical report in Latex- outline & Contents, Mathematical style- Mathematics in Science and Technology, writing manuscript in Latex- working with figures, tables, Making presentation in Latex, Beamer, Online tools- CV, Sharelatex, OverLeaf,
Contact hrs	30 hrs
Outcomes of Course	Upon completion of the course, the students will be able to: • To Identify the Common Errors in Writing technical documents. • To Achieve better technical writing and Presentation skills for employment. • To learn about Tools and Techniques for Information representation by making informative tables, figures etc.

DETAILS OF HOLISTIC EDUCATION COURSES

Name of Faculty Mentor	**Ms. Sheena Kumar (Asst. Prof)**
Holistic Education Course Title	: **Yoga and Meditation**
Objectives of Course	Take care of their own physical, mental, emotional, social and spiritual health.
Content	**Introduction to Yoga and yogic practices**: Yoga: Definition, aim, objectives and misconceptions, its origin, history and development, perform warming up exercise. Loosening practices, Sukshma vyayama, Surya namaskar, shav asanas for relaxation. **Asanas:** Sarvangasna,Halasana, Kandharasana(setubandhasana) , Bhujangasana etc. **Breathing Exercises**: anuloma viloma ,nadi shodhana, brrahmri, Kapal bhati, Bhastrika. **Practicing Meditation:,** Rajyoga meditation, breathing meditation, om dhyana, mantra enchanting, introspection , SWOT analysis.
Contact hrs	30 hrs
Outcomes of Course	Upon completion of the course, the students will be able to: CO1. Understanding and knowledge of yoga and meditation. CO2: Able to perform asanas, breathing exercises, surya namaskar etc. CO3: Able to improve their focus and mindfulness.

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Scheme of Examination (Semester-III)

for Batch Admitted in session - 2022-23

Bachelor of Technology (B. Tech.) – Internet of Things(Dept. of CS & IT)

Subject Code	Subject Category	Subject Name	Maximum Marks Allotted								Contact Hrs. per week			Total Credits
			Theory				Practical			Total Marks				
			ES	MS	Assignment	Quiz	ES	LW	Quiz		L	T	P	
MAB 201	BSC	Discrete Mathematics	60	20	10	10	--	--	--	100	3	1	0	4
IOC 202	DC	Analysis and Design of Algorithms	60	20	10	10	30	10	10	150	3	0	2	4
IOC 203	DC	Object Oriented Programming	60	20	10	10	30	10	10	150	3	0	2	4
IOC 204	DC	Electronic Devices & Circuits	60	20	10	10	30	10	10	150	3	0	2	4
IOO 205	OC	OC-1	60	20	10	10	--	--	--	100	3	0	0	3
IOL 206	DLC	Internet Programming	--	--	--	--	30	10	10	50	0	0	4	2
ILT 208	ILC	Internship-I (60 Hrs) Institute Level (Evaluation)	--	--	--	--	50	--	--	50	-	-	2	2
Total			**300**	**100**	**50**	**50**	**170**	**40**	**40**	**750**	**15**	**1**	**12**	**23**
ILC 200	ILC	Extracurricular Activities	It is a one credit per year activity to be endorsed in eight semester marks sheet.											
MAC 207	MAC*	Energy, Ecology, Environment & Society												Grade
HUM 209	HEC	Holistic Education Course												Grade

MST: Minimum two mid semester tests to be conducted during Semester* MAC and HEC courses classes will be conducted in off hours (Weekends)

Open Courses Offered by IoT in Session: 2023-24 Semester III			
Open Course-I (IOO-205)	**A**	**B**	**C**
	Computer System Organisation	Object Oriented Programming	Data Structure
Prerequisite	Fundamental knowledge of Digital Electronics	Fundamental knowledge of Programming Skills	Logical Thinking and Computer Fundamentals
Remark	Open to All	Not Applicable for - CSE and Allied branches	Not Applicable for - CSE and Allied branches, EC

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE
(Engineering College), VIDISHA M.P.
(An Autonomous Institute Affiliated to RGPV Bhopal)
DEPARTMENT OF CS & IT

Semester/Year	III/II	Program	B.Tech – Internet of Things
Subject Category: DC	Subject Code: IOC 202	Subject Name	Analysis and Design of Algorithms

Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			Total Marks				
ES	MS	Assignment	Quiz	ES	LW	Quiz		L	T	P	
60	20	10	10	30	10	10	150	3	0	2	4

Prerequisites:

Fundamentals of Data Structures

Course Objective:

- Determine different time complexities of a given algorithm
- Demonstrate algorithms using various design techniques.
- Develop algorithms using various design techniques for a given problem.

UNITs	Descriptions	Hrs.
I	**Algorithms:**Definition and characteristics. Analysis: Space and Time Complexity, Asymptotic Notations, Time Complexity Analysis of algorithms (Linear Search, Insertion Sort etc.)Recursive algorithms and recurrence relations. Solutions of recurrence relations. **Divide** and conquer technique, analysis, design and comparison of various algorithms based on this technique, example binary search, quick sort, merge sort, Heap Sort, Strassen's matrix multiplication with their complexity analysis.	8
II	**Greedy Algorithms:** Knapsack problem, Job sequencing with deadlines, optimal merge patterns, Huffman coding, Dynamic Programming: Multistage Graph, all pairs shortest paths, 0-1 Knapsack, Chained matrix multiplication, Longest common subsequence, Travelling salesperson problem.	8
III	**Graph and Tree Algorithms**: Traversal algorithms: Depth First Search (DFS) and Breadth First Search (BFS); Shortest path algorithms- Dijkstra's Algorithms and Complexity Analysis, Transitive closure, Minimum Spanning Tree- Prim's and Kruskal's Algorithm and their complexity analysis, Union Find Data Structure, Topological sorting, Network Flow Algorithm.	8
IV	**Branch &Bound technique**: Definition and application to solve 0/1 Knapsack Problem, 8-puzzle problem, travelling salesman problem. Back tracking concept and its examples like 8 Queens's problem, Hamiltonian cycle, Graph Coloring problem.	8
V	**Tractable and Intractable Problems:** Computability of Algorithms- P, NP, NP-complete and NP-hard. Introduction to Approximation Algorithms, NP-complete problems and Reduction techniques. Lower bound theory and its use in solving algebraic problem.	8
Total Hours		40

Course Outcomes:

CO1: Analyze and justify the running time complexity of algorithms
CO2: Articulate the effectiveness of divide and conquer methods to solve searching, sorting and other problems.
CO3: Understand the combinatorial problems and justify the use of Greedy and Dynamic Programming techniques to solve them.
CO4: Model graph or tree **f**or a given engineering problem, and write the corresponding algorithm to solve it.
CO-5: Able to analyses the NP-complete

Text Book

1. Thomas Cormen, Charles Leiserson, Ronald Rivest and Cliford Stein, "Introduction to Algorithms", PHI, 3rd

edition.

2. Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, "Fundamentals of Computer Algorithms", Universities Press.

Reference Books

1. Gilles Brassard and Paul Bratley, "Fundamentals of Algorithmics", PHI.

List/Links of e-learning resource

- https://archive.nptel.ac.in/courses/106/106/106106131/

Modes of Evaluation and Rubric

The evaluation modes consist of performance in two mid semester Tests, Quiz/Assignments, term work, end semester practical examination.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1	PO_{11}	PO_{12}	PSO-1	PSO2
CO-1	3	3	2	3	1							2	3	
CO-2		3	3	2	3									
CO-3	2	3	3	3	2									
CO-4		2	3	3										
CO-5		3	2	3										

Suggestive list of experiments:

1. Implement Algorithm to calculate factorial of given number using iteration method and recursive Method.
2. Implement logic to swap two integer numbers using three different approaches.
3. Implement Algorithm to determine if a given number is divisible by 5 or not without using % Operator.
4. Implement Algorithm to convert binary number to decimal number without using array and Power function.
5. Implement Algorithm to print reverse of string using recursion and without using characterArray.
6. Implement Linear Search Algorithm.
7. Implement Binary Search Algorithm (By using Iterative Approach)
8. Implement Binary Search Algorithm (By using Recursive Approach)
9. Implement Insertion Sort Algorithm
10. Implement Quick Sort Algorithm (By using Recursive Approach)
11. Implement Quick Sort Algorithm (By using Non Recursive Approach).
12. Implement Merge Sort Algorithm.

Recommendation by Board of studies on	
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Subject handled by department	Department of CS & IT

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE
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(An Autonomous Institute Affiliated to RGPV Bhopal)
DEPARTMENT OF CS & IT

Semester/Year		III/II		Program		B.Tech – Internet of Things
Subject Category	DC	Subject Code:	IOC 203	Subject Name		Object Oriented Programming

Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			Total Marks				
ES	MS	Assignment	Quiz	ES	LW	Quiz		L	T	P	
60	20	10	10	30	10	10	150	3	0	2	4

Prerequisites:

Fundamentals of Programming Skills

Course Objective:

- Enable students to understand concepts and principles of object oriented programming methodologies using JAVA as a vehicle.
- Also learn software development and problem solving using this JAVA technology.

UNITs	Descriptions	Hrs.
I	Introduction: Procedural Paradigms of programming, Object Oriented Paradigm for programming, Procedural vs. Object Oriented Programming, Principles of OOP, Benefits and applications of OOP. OOP Concepts: Data Abstraction, Encapsulation, Inheritance and Polymorphism. Introduction of Java, Features of Java, Byte Code and Java Virtual Machine, Java Development Kit (JDK). Basics of objects and classes in Java, tokens, keywords, identifiers, variables, data types, and operators in java, Type casting, strict keyword.	8
II	Control Statements — If, else, nested if, if-else ladders, Switch, while, do-while, for, for-each, break, continue. Command Line Argument, Classes and Objects, Encapsulation, Tightly Encapsulated classes, Nested class, Inner class, and Anonymous inner class. Inbuilt classes: Object, String, String Buffer, Array, Vector. Wrapper classes. Data members, member Function, Data Hiding: Visibility modifiers in java.	8
III	Is-A relationship, Has-A relationship, Inheritance in Java, types of inheritance, Super and sub class, Method Signature. Overloading, Constructor Overloading, Method Overloading, this and static keyword, finalize () method, Casting objects, Instance of operator, Overriding, covariant return type. Super, final keyword, overloading vs. overriding. Static control flow, instance control flow.	8
IV	Abstraction: Abstract class, Interface in Java, differences between classes and interfaces. Defining an interface, implementing interface, applying interfaces, variables in interface, extending interfaces. Defining, Creating and Accessing a Package, Understanding CLASSPATH, importing packages. Coupling, Cohesion.	8
V	Exception Handling: Concepts of Exception handling, types of exceptions, usage of try, catch, throw, throws and finally keywords, Built-in exceptions, creating own exception sub classes. Multithreading: Concepts of Multithreading, differences between process and thread, thread life cycle, creating multiple threads using Thread class, Runnable interface. Synchronization, threads priorities, inter thread communication, daemon threads, deadlocks, thread groups. Introduction of Java Micro services.	8
Total Hours		40

Course Outcomes:

CO-1 Define classes, objects, members of a class and relationships among them needed for a specific program.
CO-2 Write the java application programs using OOPs principles.
CO-3 Write java application on constructors, overloading.

CO-4 Demonstrate package creating and accessing members of a packages.
CO-5 Understand and develop collection frame work and its application programs.

Text Book

1. Naughton & Schildt, "The Complete Reference Java 2", TataMcGraw Hill
2. E Balaguruswamy, "Programming in Java", TMH Publications

Reference Books

1. Deitel "Java-How to Program:" Pearson Education, Asia
2. Horstmann & Cornell, "Core Java 2" (Vol I & II), Sun Microsystems
3. Ivan Bayross, "java 2.0", BPB publications
4. Java Programming for the absolute beginners By Russell, PHI Learning
5. Java Programming by Hari Mohan Pandey, Pearson.

List/Links of e-learning resource

- https://archive.nptel.ac.in/courses/106/105/106105153/

Modes of Evaluation and Rubric

The evaluation modes consist of performance in two mid semester Tests, Quiz/Assignments, term work, end semester practical examination.

CO-PO Mapping:

COs	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_1	PO_{11}	PO_{12}	PSO1	PSO2
CO-1	1	1									3	3	3	2
CO-2	1		1	2							2	1	3	2
CO-3	2	1									2	2	1	2
CO-4	3	2	3	2	1			1	2		3		3	1
CO-5	3	3	2	1				2		2	2	3	1	1

Suggestive list of experiments:

1. Write a java program to find the Fibonacci series using recursive and non-recursive functions.
2. Write a java program to multiply two given matrices.
3. Write a java program for Method overloading and Constructor overloading.
4. Write a java program to display the employee details using Scanner class.
5. Write a java program that checks whether a given string is palindrome or not.
6. A. Write a java program to represent Abstract class with example.

B. Write a java program to implement Interface using extends keyword.

7. A. Write a java program to create inner classes.

B. Write a java program to create user defined package.

8. A. Write a java program for creating multiple catch blocks.

B. Write a java program for producer and consumer problem using Threads.

9. Write a Java program that implements a multi-thread application that has three threads.
10. A. Write a java program to display File class properties.

B. Write a java program to represent ArrayList class.

C. Write a Java program loads phone no, name from a text file using hashtable.

11. Write an applet program that displays a simple message.
12. A. Write a Java program computes factorial value using Applet.

B. Write a program for passing parameters using Applet.

13. A. Write a java program for handling Mouse events and Key events.

B. Write a java program for handling Key events.

14. Write a java program that connects to a database using JDBC.
15. A. Write a java program to connect to a database using JDBC and insert values into it.

B. Write a java program to connect to a database using JDBC and delete values from it.

16. Write a java program that works as a simple calculator. Use a Grid Layout to arrange Buttons for digits and for the + - * %operations. Add a text field to display the result

Recommendation by Board of studies on	
Approval by Academic council on	
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Subject handled by department	Department of CS & IT

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE
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(An Autonomous Institute Affiliated to RGPV Bhopal)
DEPARTMENT OF CS & IT

Semester/Year		III/II		Program		B.Tech – Internet of Things
Subject Category	DC	Subject Code:	IOC 204	Subject Name		Electronic Devices and Circuits

Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			Total Marks				
ES	MS	Assignment	Quiz	ES	LW	Quiz		L	T	P	
60	20	10	10	30	10	10	150	3	0	2	4

Prerequisites:

Applied Physics

Course Objective:

- The purpose of the course is to teach the fundamental principle of electronics.
- The material covers a variety of topics including various types of diodes, transistor, amplifiers and application.

UNITs	Descriptions	Hrs.
I	Semiconductor Diodes: Basics of semiconductor theory, Introduction to PN junction diode, Special function diode, Zener diode, PIN, Varactor, Tunnel, Schottky, LED & Photo diode and its applications. Design circuits using diodes. Half wave & Half Wave rectifier, Clampers and clippers.	8
II	Bipolar Junction Transistors (BJTs): Transistor construction and operation, CB configuration, transistor amplifying action, CE & CC configuration, Limits of operation, BJT Biasing.	8
III	Field Effect Transistor (FET): Junction Field-Effect Transistor (JFET) - Construction, Operation and Biasing, Depletion-type MOSFET, Enhancement-type MOSFET: structure and physical operation, current-voltage characteristics, D.C. operation, Biasing, configuration: common source, gate and drain types.	8
IV	Compound Configurations: Cascade and cascade connection, Darlington connection, CMOS circuit, current source circuit, current mirror circuits, differential amplifier circuits.	8
V	Operational Amplifier and Application: Differential and common mode operations, Op-amp basics, practical Op-amp circuits, Op-amp Specification- DC offset parameters & frequency parameters, Op-amp unit specifications. Op-amp Applications: Constant gain multiplier, voltage summing, voltage buffer, comparator.	8
Total Hours		40

Course Outcomes:

CO1: Identify and understand the fundamental principle and working of Diodes.

CO2: Analyze the behavior of BJT and its biasing.

CO3: Analyze the behavior of FET and its biasing.

CO4: Examine the various configurations of BJT and FET.

CO5: Analyze and synthesize the Op-amps.

Text Book

1. Electronic Devices & circuits – Boyelstad & Neshelsky – PHI
2. Intuitive Analog Circuit Design- Marc T. Thompson

Reference Books

1. A Text of electronic" 2nd edition S.Chand-R.S Sedha
2. Integrated Electronics. – Millman Halkias
3. Electronic Devices & Circuits – David A. Bell – PHI
4. Principles of Electronic Devices – Malvino
5. Starting Electronics (Fourth Edition)-Keith Brindley
6. Microelectronics & circuit 5th edition - Sandra & Smith.

List/Links of e-learning resource

- https://archive.nptel.ac.in/noc/courses/noc21/SEM2/noc21-ee80/

Modes of Evaluation and Rubric

The evaluation modes consist of performance in two mid semester Tests, Quiz/Assignments, term work, end semester practical examination.

CO-PO Mapping:

COs	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_1	PO_{11}	PO_{12}	PSO1	PSO2
CO-1	2	1	1										1	1
CO-2	2	1	2	1	1								2	1
CO-3	2	1	2	1	1								2	1
CO-4	2	2	2	1									2	1
CO-5	2	2	2	1									1	1

Suggestive list of experiments:

1. Design voltage regulator using Zener diode and verify its characteristics.
2. To draw the output waveform of Full wave rectifier. Calculate PIV, Ripple Factor, Form Factor and Efficiency.
3. Analysis of common base PNP bipolar junction transistor and verify input and output characteristics.
4. Analysis of common emitter NPN bipolar junction transistor and verify input and output characteristics.
5. To draw the static characteristics of JFET and find out its parameters.
6. To design the power supply of +5V and -5V using IC regulator.
7. To design a positive clipper circuit using a 1 kHz square wave with a 10 volt peak-to-peak magnitude as the input signal.
8. To design a negative clamper circuit using a 1 kHz square wave with a 10-volt peak-to-peak magnitude as the input signal.
9. To draw the frequency response of two stages RC coupled class A amplifier using transistor.
10. To draw the frequency response of two stages Direct coupled class A amplifier using transistor.

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DEPARTMENT OF CS & IT

Semester/Year	III/II	Programme	B.Tech – Internet of Things
Subject Category: DLC	Subject Code:	IOL 206	Subject Name: Internet Programming

Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			Total Marks				
ES	MS	Assignment	Quiz	ES	LW	Quiz		L	T	P	
				30	10	10	50	0	0	4	2

Prerequisites:

Fundamental Knowledge of Programming

Course Objective:

Understand Static and Dynamic Web Pages.

UNITs	Descriptions	Hrs.
I	WEBSITE BASICS, Web Essentials: Clients, Servers and Communication, The Internet, Basic Internet protocols, World wide web.	8
II	HTTP Request Message, HTTP Response Message, Web Clients, Web Servers, HTML5, Tables, Lists, Image, HTML5 control elements, Semantic elements, Drag and Drop, Audio , Video control	8
III	CSS3, Inline, embedded and external style sheets, Rule cascading, Inheritance, Backgrounds, Border Images, Colors Shadows, Text, Transformations, Transitions, Animations.	8
IV	Java Script: An introduction to JavaScript, JavaScript DOM Model-Date and Objects, function, Regular Expressions.	8
V	Exception Handling-Validation-Built-in objects-Event Handling- DHTML with JavaScript. XML- Elements, attributes, parser, DOM, query.	8
Total Hours		40

Course Outcomes:

CO1: To understand and interpret the basic concepts of the Internet, tools.
CO2: To understand, analyse CSS components and apply them web page design tools like HTML,CSS.
CO3: To know and analyse client side scripting language concepts.
CO4: Design and Develop Internet applications with the help of Java script.
CO5: Understand the concept of exceptional handling

Text Book & Reference Books-

1. Achyut Godbole, Atul Kahate & quot ;Web Technologies: TCP/IP, Web/Java Programming, and Cloud Computing", Third Edition, McGraw Hill Education.

1. Deitel, Deitel, Goldberg, " Internet & World Wide Web How to Program & quot, Third Edition,Pearson Education.
2. Raj Kamal, "Internet and Web Technologies", Tata McGraw-Hill.

List/Links of e-learning resource

- https://archive.nptel.ac.in/noc/courses/noc16/SEM2/noc16-cs10/

Modes of Evaluation and Rubric

The evaluation modes consist of performance in two mid-semester Tests, Quiz/Assignments, term work, end semester practical examination.

CO-PO Mapping:

COs	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_1	PO_{11}	PO_{12}	PSO1	PSO2
CO1	2	1	2										1	1
CO2	2	1	2										1	1
CO3	2	1	2										1	2
CO4	2	2	2										1	2
CO5	1	2	2	1	2								2	1

Suggestive list of experiments:
1. Design a web page to display your CV. 2. Design a web page using HTML tags to take the input in a form and display it in another page/frame. 3. Design a web page to isolate a part of the text that might be formatted in a different direction from other text outside it 4. Create a Zebra Striping a Table and make an image rounded with CSS3. 5. Create speech bubble shape and Image cross effect with CSS3 transition. 6. Using HTML, CSS create a styled checkbox with animation on state change. 7. Using HTML, CSS create display an image overlay effect on hover. 8. Using HTML, CSS create a list with floating headings for each section. 9. Using HTML, CSS, JavaScript create a typewriter effect animation. 10. Using HTML, CSS create an animated underline effect when the user hovers over the text. 11. Write a JavaScript program to set paragraph background colour. 12. Write a JavaScript function to add rows to a table. 13. Write a JavaScript function that accepts a row, column (to identify a particular cell) and a string to update the cell and the cell's content. 14. Write a JavaScript program to highlight the bold words of the following paragraph, on mouse over a certain link. 15. Write a JavaScript program to get the window width and height (any time the window is resized).

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Subject handled by department	Department of CS & IT

Open Courses Offered by IoT in Session: 2023-24 Semester III			
Open Course-I (IOO-205)	**A**	**B**	**C**
	Computer System Organisation	Object Oriented Programming	Data Structure
Prerequisite	Fundamental knowledge of Digital Electronics	Fundamental knowledge of Programming Skills	Logical Thinking and Computer Fundamentals
Remark	Open to All	Not Applicable for - CSE and Allied branches	Not Applicable for - CSE and Allied branches, EC

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DEPARTMENT OF CS & IT

Semester/Year		III/II		Program		B.Tech –Internet of Things					
Subject Category	OC	Subject Code:		IOO 205 (OC -1A)	Subject Name	Computer System Organization					
Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			Total Marks				
ES	MS	Assignment	Quiz	ES	LW	Quiz		L	T	P	
60	20	10	10				100	3	0	0	3

Prerequisites:

Fundamental knowledge of Digital Electronics

Course Objective:

- Understand the organization and architecture of computer systems and electronic computers.
- Study the assembly language program execution, instruction format, and instruction cycle.
- Design a simple computer using hardwired and microprogrammed control methods.
- Study the basic components of computer systems besides computer arithmetic.
- Understand input-output organization, memory organization and management, and pipelining

UNITs	Descriptions	Hrs.
I	Introduction: Function and structure of a computer, Functional components of a computer, Interconnection of components, Performance of a computer, Register Transfer language : Register Transfer, Bus and Memory Transfers, Three-Stare Bus Buffers, Memory Transfer, Arithmetic Microoperations Binary Adder, Binary Adder-Subtractor, Binary incremenrer, Arithmetic Circuit, Logic Microoperations, Shift Microoperations, Arithmetic Logic Shift Unit, List of Logic Microoperations, , Shift Micro operations, Arithmetic Logic Shift Unit	7
II	Control unit: Control memory, address sequencing, micro program example, Microinstruction Format, Symbolic Microinstructions, The Fetch Routine, Symbolic Micro program and design of the control unit, Microprogram Sequencer.	7
III	CPU design: Instruction cycle, data representation, memory reference instructions, input-output, and interrupt, addressing modes, data transfer, and manipulation, and program control. Computer arithmetic: Addition and subtraction, floating point arithmetic operations, decimal arithmetic unit.	7
IV	Memory organization: Memory hierarchy, main memory, auxiliary memory, associative memory, cache memory, virtual memory; Input or output organization: Input or output Interface, asynchronous data transfer, modes of transfer, priority interrupt, direct memory access.	7
V	Pipeline: Parallel processing, pipelining-arithmetic pipeline, instruction pipeline; Multiprocessors: Characteristics of multiprocessors, interconnection structures, inter-processor arbitration, inter-processor communication, and synchronization.	7
Total Hours		35

Course Outcomes:

CO1: Understand the organization and levels of design in computer architecture and understand the concepts of Register transfer languages.

CO2: Describe arithmetic micro-operations, logic micro-operations, shift micro-operations address sequencing, microprogram example, and design of control unit

CO3: Understand the Instruction cycle, data representation, memory reference instructions, input-output, and interrupt, addressing modes, data transfer, and manipulation, program control. Addition and subtraction, floating point arithmetic operations, decimal arithmetic unit.

CO4: Knowledge about Memory hierarchy, main memory, auxiliary memory, associative memory, cache memory, virtual memory Input or output Interface, asynchronous data transfer, modes of transfer, Priority interrupt, and direct memory access.

CO5: Explore the Parallel processing, pipelining-arithmetic pipeline, instruction pipeline Characteristics of multiprocessors, interconnection structures, inter-processor arbitration, inter-processor Communication, and synchronization.

Text Book

1. M. Morris Mano, "Computer Systems Architecture", Pearson, 3rd edition.

Reference Books

1. John D. Carpinelli, "Computer Systems Organization and Architecture", Pearson, 1st Edition.
2. Patterson, Hennessy,"ComputerOrganizationandDesign:TheHardware/Software Interface", Morgan Kaufmann.

List/Links of e-learning resource

- https://archive.nptel.ac.in/noc/courses/noc22/SEM1/noc22-cs15/

Modes of Evaluation and Rubric

The evaluation modes consist of performance in two mid-semester Tests. Quiz/Assignments, term work.

CO-PO Mapping:

COs	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_1	PO_{11}	PO_{12}	PSO1	PSO2
CO-1	1	1	2										1	2
CO-2	2	2	2										1	2
CO-3	2	1	2										1	2
CO-4	2	1	2											2
CO-5	2	2	1										1	2

Recommendation by Board of studies on	
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Compiled and designed by	
Subject handled by department	Department of CS & IT

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE
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DEPARTMENT OF CS & IT

Semester/Year		III/II		Program		B.Tech – Internet of Things
Subject Category	OC	Subject Code:	IOO 205 (OC -1B)	Subject Name		Object Oriented Programming

Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			Total Marks				
ES	MS	Assignment	Quiz	ES	LW	Quiz		L	T	P	
60	20	10	10	-	-	-	100	3	0	0	3

Prerequisites:

Fundamental knowledge of Programming Skills

Course Objective:

- Enable students to understand concepts and principles of object oriented programming methodologies using JAVA as a vehicle.
- Also learn software development and problem solving using this JAVA technology.

UNITs	Descriptions	Hrs.
I	Introduction: Procedural Paradigms of programming, Object Oriented Paradigm for programming, Procedural vs. Object Oriented Programming, Principles of OOP, Benefits and applications of OOP. OOP Concepts: Data Abstraction, Encapsulation, Inheritance and Polymorphism. Introduction of Java, Features of Java, Byte Code and Java Virtual Machine, Java Development Kit (JDK). Basics of objects and classes in Java, tokens, keywords, identifiers, variables, data types, and operators in java, Type casting, strictfp keyword.	7
II	Control Statements — If, else, nested if, if-else ladders, Switch, while, do-while, for, for-each, break, continue. Command Line Argument, Classes and Objects, Encapsulation, Tightly Encapsulated classes, Nested class, Inner class, and Anonymous inner class. Inbuilt classes: Object, String, String Buffer, Array, Vector. Wrapper classes. Data members, member Function.	7
III	Is-A relationship, Has-A relationship, Inheritance in Java, types of inheritance, Super and sub class, Method Signature. Overloading, Constructor Overloading, Method Overloading, this and static keyword, finalize () method, Casting objects, Instance of operator, Overriding, covariant return type. Super, final keyword, overloading vs. overriding.	7
IV	Abstraction: Abstract class, Interface in Java, differences between classes and interfaces. Defining an interface, implementing interface, applying interfaces, variables in interface, extending interfaces. Defining, Creating and Accessing a Package, Understanding CLASSPATH, importing packages.	7
V	Exception Handling: Concepts of Exception handling, types of exceptions, usage of try, catch, throw, throws and finally keywords, Built-in exceptions, creating own exception sub classes. Multithreading: Concepts of Multithreading, differences between process and thread, thread life cycle, creating multiple threads using Thread class, Runnable interface. Synchronization.	7
Total Hours		35

Course Outcomes:

CO-1 Define classes, objects, members of a class and relationships among them needed for a specific program.
CO-2 Write the java application programs using OOPs principles.
CO-3 Write java application on constructors, overloading.
CO-4 Demonstrate package creating and accessing members of a packages.
CO-5 Understand and develop collection frame work and its application programs.

Text Book

1. Naughton & Schildt, "The Complete Reference Java 2", TataMcGraw Hill
2. E Balaguruswamy, "Programming in Java", TMH Publications

Reference Books

1. Deitel "Java-How to Program:" Pearson Education, Asia
2. Horstmann & Cornell, "Core Java 2" (Vol I & II), Sun Microsystems
3. Ivan Bayross, "java 2.0", BPB publications
4. Java Programming for the absolute beginners By Russell, PHI Learning
5. Java Programming by Hari Mohan Pandey, Pearson.

List/Links of e-learning resource

- https://archive.nptel.ac.in/courses/106/105/106105153/

Modes of Evaluation and Rubric

The evaluation modes consist of performance in two mid semester Tests, Quiz/Assignments, term work, end semester practical examination.

CO-PO Mapping:

COs	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_1	PO_{11}	PO_{12}	PSO1	PSO2
CO-1	1	1									3	3	3	2
CO-2	1		1	2							2	1	3	2
CO-3	2	1									2	2	1	2
CO-4	3	2	3	2	1			1	2		3		3	1
CO-5	3	3	2	1				2		2	2	3	1	1

Suggestive list of experiments:

1. Write a java program to find the Fibonacci series using recursive and non-recursive functions.
2. Write a java program to multiply two given matrices.
3. Write a java program for Method overloading and Constructor overloading.
4. Write a java program to display the employee details using Scanner class.
5. Write a java program that checks whether a given string is palindrome or not.
6. A. Write a java program to represent Abstract class with example.
   B. Write a java program to implement Interface using extends keyword.
7. A. Write a java program to create inner classes.
   B. Write a java program to create user defined package.
8. A. Write a java program for creating multiple catch blocks.
   B. Write a java program for producer and consumer problem using Threads.
9. Write a Java program that implements a multi-thread application that has three threads.
10. A. Write a java program to display File class properties.
    B. Write a java program to represent Array List class.

C. Write a Java program loads phone no, name from a text file using hashtable.

11. Write an applet program that displays a simple message.
12. A. Write a Java program computes factorial value using Applet.
    B. Write a program for passing parameters using Applet.
13. A. Write a java program for handling Mouse events and Key events.
    B. Write a java program for handling Key events.
14. Write a java program that connects to a database using JDBC.
15. A. Write a java program to connect to a database using JDBC and insert values into it.
    B. Write a java program to connect to a database using JDBC and delete values from it.
16. Write a java program that works as a simple calculator. Use a Grid Layout to arrange Buttons for digits and for the + - * %operations. Add a text field to display the result

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Approval by Academic council on	
Compiled and designed by	
Subject handled by department	Department of CS & IT

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE
(Engineering College), VIDISHA M.P.
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DEPARTMENT OF CS & IT

Semester/Year		III/II	Program		B.Tech – Internet of Things
Subject Category	OC	Subject Code:	IOO 205 (OC – 1C)	Subject Name	Data Structure

Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical							
ES	MS	Assignment	Quiz	ES	LW	Quiz	Total Marks	L	T	P	
60	20	10	10	-	-	-	100	3	0	0	3

Prerequisites:

LogicalthinkingandComputerFundamentals

Course Objective:

- Introduce the fundamentals of data structures
- Utilization of the concepts are useful in problem solving.

UNITs	Descriptions	Hrs.
I	Problem solving concepts: top-down, bottom-up design, Concept ofdatatype,variable,constantandpointers.Dynamicmemoryallocation. Algorithm:DefinitionandcomplexityAnalysis. Introductiontodatastructure:Linear,Nonlinear,PrimitiveandNonprimitive. Arrays-ConceptsofArrays,Singledimensionalarray,two-dimensionalarray-RepresentationandAddressCalculation,Operationsonarrayswithalgorithms(traversing,searching,inserting,deleting).	7
II	List-Singly linked lists: Representation in memory, Operations onsinglylinkedlistwithalgorithms(traversing,searching,insertion, deletion)Doublylinkedlist-Operationswithalgorithms. Circularlinkedlists-Operationswithalgorithmsandanalysis.Representation&manipulationsofpolynomials/setsusinglinkedlists.	7
III	Stack- Introduction to Stack and its operations, Implementation ofstackusingarrayandlinkedlistwithcomparison.Applicationofstacks(PolishNotations,convertinginfixtopostfixnotation,evaluatingpostfixnotation,Parenthesisbalancing,Recursion). Queue- Introduction to Queue and its operations. Implementation ofqueueusingarrayandlinkedlist.De-queue,circularqueue,priorityqueue.Applicationsofqueue.	7
IV	Tree-Definitionandterminology,conceptofbinarytreeandrepresentation, Traversing binary tree (pre order, post order, in order)Operation with algorithm -insertion and deletion. Binary Search Trees and its Applications. Graph- Definition and terminology, Types of graphs, Representationofgraph.Traversingofgraph-BreadthFirstTraversingandDepthFirstTraversing.	7
V	Searching-Searchmethods-Linearsearch,BinarysearchandHashing (collision, chaining and probing) with their algorithms. Sorting-Sorting Methods-Bubble sort, Selection sort, Insertion	7

	sort,Quicksort,Mergesort.	
Total Hours		35

Course Outcomes:

CO-1Understand-Problemsolvingusingofdatastructureandvarioussearchingandsortingmethods.
CO-2Apply-Applydifferentconceptsofdatastructurestosolvedifferentcomputingproblems.
CO-3Analyse-Analyzetheaccesspatternofvariousdatastructureandunderstandtheirapplicability.
CO-4Evaluate-EvaluateandCompareheperformanceofdifferentdatastructuresonrealworldproblems.
CO-5Discuss-GraphandTreestructurewiththeiroperationsandapplicability

Text Book

1. DataStructure-HorwitzandSartajSahni

Reference Books

1. DataStructure-Schaum'sSeries-McGrawHillPublication
2. DataStructurethroughC,YashwantKanekar,BPBPublication.

List/Links of e-learning resource

- https://archive.nptel.ac.in/courses/106/106/106106127/

Modes of Evaluation and Rubric

The evaluation modes consist of performance in two mid semester Tests, Quiz/Assignments, term work, end semester practical examination.

CO-PO Mapping:

COs	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_1	PO_{11}	PO_{12}	PSO1	PSO2
CO-1	2	2	1										1	2
CO-2	2	2	2	1									1	2
CO-3	2	2	2	1									1	2
CO-4	2	2	2	1									1	2
CO-5	2	2	1										1	2

Recommendation by Board of studies on	
Approval by Academic council on	
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Subject handled by department	Department of CS & IT

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE VIDISHA (M.P.)
(A Govt. Aided UGC Autonomous & NAAC Accredited Institute Affiliated to RGPV Bhopal)

Scheme of Examination (Semester-IV)

for Batch Admitted in session - 2022-23

Bachelor of Technology (B. Tech.) – Internet of Things(Dept. of CS & IT)

Subject Code	Subject Category	Subject Name	Maximum Marks Allotted								Contact Hrs. per week			Total Credits
			Theory				Practical			Total Marks				
			ES	MS	Assignment	Quiz	ES	LW	Quiz		L	T	P	
IOC 251	DC	Microprocessors and Microcontrollers	60	20	10	10	30	10	10	150	3	0	2	4
IOC 252	DC	Database Management System	60	20	10	10	30	10	10	150	3	0	2	4
IOC 253	DC	Signals and Systems	60	20	10	10	30	10	10	150	3	0	2	4
IOC 254	DC	Foundation of IoT	60	20	10	10	-	-	-	100	3	1	0	4
IOO 255	OC	OC -2	60	20	10	10	-	-	-	100	3	0	0	3
IOL 256	DLC	Advance Java Programming	-	-	-	-	60	20	20	100	0	0	4	2
Total			**300**	**100**	**50**	**50**	**150**	**50**	**50**	**750**	**15**	**1**	**10**	**21**
HUM 257	MAC*	Indian Constitution												Grade
HUM 258	HEC	Holistic Education Course												Grade
VAO 259	VAO	Open Source Tools I	Respective faculty to create his/her own rubric for evaluation											Grade
ILC 250	ILC	Extracurricular Activities	It is a one credit per year activity endorse in eight semester mark sheet											

MST: Minimum two mid semester tests to be conducted during Semester* MAC and HEC courses classes will be conducted in off hours (Weekends)

OPEN ELECTIVES

Open Course Offered by IoT in Session: 2023-24 Semester IV			
Open Course-II (IOO-255)	**A**	**B**	**C**
	Microprocessor	Foundation of IoT	Foundation of Blockchain Technology
Prerequisite	Digital Electronics	--	Basic knowledge of Mathematics
Remark	Open to All	Open to All	Not applicable for - Block Chain

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE
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DEPARTMENT OF CS & IT

Semester/Year		IV/II		Program		B.Tech – Internet of Things				
Subject Category	DC	Subject Code:	IOC 251	Subject Name	Microprocessors and Microcontrollers					

Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			Total Marks				
ES	MS	Assignment	Quiz	ES	LW	Quiz		L	T	P	
60	20	10	10	30	10	10	150	3	0	2	4

Prerequisites:

Basic Computing and Logical reasoning.

Course Objective:

- To make students familiar with the basic blocks of 8 bit Microcontroller & 16 bit microprocessor device in general.
- To provide comprehensive knowledge of the architecture, features and interfacing with peripheral devices.
- To use assembly and high level languages to interface the microcontroller to various devices.

UNITs	Descriptions	Hrs.
I	Introduction to 16 bit Microprocessor-Introduction to 8086 Microprocessor family Architecture, Pin diagram, Instruction set, Assembler directive, Addressing modes, Maximum and Minimum Mode operation, Elementary 8086 Programming.	8
II	Microcontrollers and Embedded processors, overview of 8051 family. 8051 microcontroller hardware, oscillator and clock, CPU registers, Register banks and stack, flags, PSW, SFR's, I/O ports, internal memory, 8051 pin description. 8051 programming model, Assembly, Language programming, Data types, directives. Addressing modes of 8051, memory access using various addressing modes, Bit addresses for I/O and RAM, I/O port programming.	8
III	Arithmetic Operations with 8051: Arithmetic instructions, signed number concepts and arithmetic operations. Branch Instructions: Jump Loop and Call Instructions, Time delay calculations. Logical Operations & Bit manipulation instructions: Logic and compare instructions rotate and swap instructions, data serialization, single bit instructions, operations with carry, reading input pins.	8
IV	Timers: Programming, Counter programming, Serial communication, RS232, 8051 programming for serial port, Serial Port programming, 8051 Interrupts, programming timer interrupts, external hardware interrupts, serial communication interrupts, interrupt priority in 8051, Interrupt programming.	8
V	Interface 8051, LCD Interfacing, memory address decoding, interfacing with external ROM, data memory space, accessing external memory in C, Interfacing 8255, programming 8255, modes of 8255, 8255 connection to stepper motor, LCD,& ADC, 8051 programming for 8255.	8
Total Hours		40

Course Outcomes:

CO 1: Acquire and demonstrate fundamental knowledge of microprocessors or interfacing and programming
CO 2: Understanding the fundamentals of 8051 microcontroller.
CO 3: Apply the arithmetic and logical operations with the help of instructions.
CO 4: Analyze the concept of Timer, Serial Communication and interrupt.
CO5: To understand the interfacing of 8051 microcontroller with peripheral devices.

Text Book

1. A K Ray & K M Bhurchandi, Advanced Microprocessor and Peripheral, Tata McGraw-Hill Publishing Company Limited.
2. M A Mazidi, J G Mazidi and R D McKinley, The 8051 Microcontroller and Embedded Systems: Using Assembly and C, Pearson.

Reference Books

1. Ramesh S Goankar, Microprocessor Architecture, Programming & Applications with the 8085, Penram International Publishing (India) Pvt. Ltd., Fourth Edition, 2002.
2. Douglas V. Hall, Microprocessors and interfacing programming and hardware Gregg Division, McGraw-Hill, 1986

List/Links of e-learning resource

- https://archive.nptel.ac.in/courses/108/105/108105102/

Modes of Evaluation and Rubric

The evaluation modes consist of performance in two mid semester Tests, Quiz/Assignments, term work, end semester practical examination.

CO-PO Mapping:

COs	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_1	PO_{11}	PO_{12}	PSO1	PSO2

CO-1	**2**	**2**	**1**										**1**	**2**
CO-2	**2**	**2**	**2**										**1**	**2**
CO-3	**2**	**2**	**2**	**1**									**1**	**2**
CO-4	**3**	**2**	**2**	**1**									**1**	**2**
CO-5	**2**	**2**	**1**	**1**									**1**	**2**

Suggestive list of experiments:

1. WAP to add a data byte located at the offset address 0500H in the segment 2000H to another data byte located at the offset address 0600H in the segment 3000H.
2. WAP to move 0500H to register BX and CX, add 05H to each of them and store the result in 0700H. Segment address: 5000H.
3. WAP to add the contents of 2000H: 0500H to the contents of 3000H: 0600H and store the result in 5000H: 0700H.
4. WAP to find the square of a given number.
5. WAP to find the 2's compliment of a given number.
6. WAP to find the square root of a given number.
7. WAP to arrange the given set of bytes in ascending order.
8. WAP to arrange the given set of bytes in the descending order.
9. WAP to find out the largest number in the given set of 8-bit number stored at memory location 0500H in the segment 2000H.
10. WAP to find out the even and odd numbers from the given set of 10 data bytes stored at memory location 4000H: 0400H.

Recommendation by Board of studies on	
Approval by Academic council on	
Compiled and designed by	
Subject handled by department	Department of CS & IT

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE
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DEPARTMENT OF CS & IT

Semester/Year	IV/II	Program	B.Tech – Internet of Things
Subject Category: DC	Subject Code: IOC 252	Subject Name	Database Management System

Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			Total Marks				
ES	MS	Assignment	Quiz	ES	LW	Quiz		L	T	P	
60	20	10	10	30	10	10	150	3	0	2	4

Prerequisites:

Basic Knowledge of Mathematics and Programming

Course Objective:

- To understand the different issues involved in the design and implementation of a database system.
- To represent a database system using ER diagrams and to learn normalization techniques
- To learn the fundamentals of data models, relational algebra, and SQL.
- To understand the basic issues of transaction processing and concurrency control.
- To become familiar with database storage structures and access techniques

UNITs	Descriptions	Hrs.
I	Introduction: Purpose of Database System -– Views of data – data models, database management system, three-schema architecture of DBMS, components of DBMS. E/R Model - Conceptual data modeling - motivation, entities, entity types, attributes relationships, relationship types, E/R diagram notation, examples.	8
II	Relational Model: Relational Data Model - Concept of relations, schema-instance distinction, keys, referential integrity and foreign keys, relational algebra operators, SQL - Introduction, data definition in SQL, table, key and foreign key definitions, update behaviors. Querying in SQL, notion of aggregation, aggregation functions group by and having clauses.	8
III	Database Design: Dependencies and Normal forms, dependency theory - functional dependencies, Armstrong's axioms for FD's, closure of a set of FD's, minimal covers, definitions of 1NF, 2NF, 3NF and BCNF, decompositions and desirable properties of them, algorithms for 3NF and BCNF normalization, 4NF, and 5NF.	8
IV	Transactions: Transaction processing and Error recovery - concepts of transaction processing, ACID properties, concurrency control, locking based protocols for CC, error recovery and logging, undo, redo, undo-redo logging and recovery methods.	8
V	Implementation Techniques: Data Storage and Indexes - file organizations, primary, secondary index structures, various index structures - hash-based, dynamic hashing techniques, multi-level indexes, B+ trees.	8
Total Hours		40

Course Outcomes:

CO-1: Understand the basic concepts, principles and applications of database systems.

CO-2: Discuss the components of DBMS, data models, Relational models.

CO-3: Use knowledge to find the functional dependencies and differentiate between different normal forms.

CO-4: Execute transaction concepts and concurrency protocols

CO-5: Articulate the basic concept of storage and access techniques.

Text Book

1. RamezElmasri and Shamkant B. Navathe, Fundamentals of Database Systems , Pearson Education
2. Silberschatz, Korth, "Data base System Concepts", 7th ed., McGraw hill.

Reference Books

1. C. J. Date, "An Introduction to Database Systems", 8th ed., Pearson.
2. Raghu Ramakrishnan and Johannes Gehrke, Database Management Systems McGraw Hill.
3. Peter Rob and Carlos Coronel, Database System- Design, Implementation and Management , Cengage Learning.

List/Links of e-learning resource

- https://nptel.ac.in/courses/106/104/106104135/
- https://nptel.ac.in/courses/106/106/106106220

Modes of Evaluation and Rubric

The evaluation modes consist of performance in two mid semester Tests, Quiz/Assignments, term work, end semester practical examination.

CO-PO Mapping:

COs	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_1	PO_{11}	PO_{12}	PSO1	PSO2
CO-1	1	1	2										1	2
CO-2	3	2	2										1	2
CO-3	2	1	2		2								1	2
CO-4	2	1	2											2
CO-5	2	2	2											1

Suggestive list of experiments:

1. Design a Database and create required tables. For e.g. Bank, College Database
2. Apply the constraints like Primary Key , Foreign key, NOT NULL to the tables
3. Write a sql statement for implementing ALTER,UPDATE and DELETE
4. Write the queries to implement the joins
5. Write the query for implementing the aggregate functions
6. Write the query to implement the concept of Integrity constraints
7. Write the query to create the views
8. Perform the queries with group by and having clauses
9. Perform the following operation for demonstrating the insertion , updation and deletion using the referential integrity constraints
10. Write the query for creating the users and their role

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SAMRAT ASHOK TECHNOLOGICAL INSTITUTE
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DEPARTMENT OF CS & IT

Semester/Year		IV/II		Program		B.Tech – Internet of Things				
Subject Category	DC	Subject Code:		IOC 253	Subject Name	Signals and Systems				
Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			Total Marks				
ES	MS	Assignment	Quiz	ES	LW	Quiz		L	T	P	
60	20	10	10	30	10	10	150	3	0	2	4

Prerequisites:

Engineering Mathematics

Course Objective:

- Understand the fundamentals of the Signals and systems.
- Understand linear time invariant systems and able to obtain mathematical modelling of the system.
- Apply the concepts of frequency domain representations to analyze continuous and discrete time signals/systems
- Understand and apply the Z-Transform, to the analysis and description of LTI discrete-time systems.
- Able to apply the knowledge to model a system

UNITs	Descriptions	Hrs.
I	An Introduction to Signals and Systems: Definition of signal and systems, Classification of signals: continuous time and discrete time signal, even and odd, periodic and non-periodic, deterministic and non-deterministic, energy and power. Elementary signals/Functions: exponential, sine, unit impulse, unit step and its properties, ramp, rectangular, triangular, signum. Operations on signals: Amplitude scaling, addition, multiplication, differentiation, integration, time scaling, time shifting, and time folding. System properties: linearity, additively and homogeneity, causality, stability, reliability. Introduction to different types of systems like causal & non causal systems, static& dynamic, stable &unstable, linear& nonlinear, time variant &time invariant systems.	8
II	Linear Time- Invariant Systems: Introduction, Convolution: impulse response representation for LTI systems, properties of the impulse response representation for LTI systems, differential and difference equation for LTI Systems, Singularity functions.	8
III	The response of LTI system to complex exponential, Fourier series(FS) representation of continuous time periodic signals, convergence of Fourier series, Properties of CT-FS, FS representation of Discrete Time(DT) periodic Signal, Properties of DT-FS.	8
IV	Representation of periodic signals: the continuous time Fourier Transform (CT-FT), FT for periodic signals, Properties of CT-FT, the convolution property. Representation of DT-FT(for periodic and aperiodic signals), properties of DT-FT, Sampling Theorem, and Representation of CT signals by its samples, reconstruction of a signal from its samples, aliasing.	8
V	The z transform Basic principle of z-transform, definition, region of convergence, system functions, poles and zeros of systems and sequences, properties of ROC, properties of z-transform, inverse z-transform using, Analysis and characterization of LTI system using Z-transform.	8
Total Hours		40

Course Outcomes:

CO 1: Acquire knowledge of basics, fundamentals of signal

CO 2: Understanding the fundamentals for LTI system.

CO3: To know the concept of Fourier Series.

CO4: To know the concept of Fourier Transform.

CO5: Apply the fundamentals of Z-Transform.

Text Book & Reference Books-

1. T. K. Rawat, Signals and Systems, Oxford University Press.
2. A.V. Oppenheim, A.S. Willsky and I.T. Young, "Signals and Systems", Prentice Hall.

1. B.P. Lathi, "Signal Processing and Linear Systems", Oxford University Press.
2. Douglas K. Lindner, "Introduction to Signals and Systems", McGraw Hill International Edition.
3. J. Nagrath, S. N. Sharan, R. Ranjan, S. Kumar, "Signals and Systems", Tata McGraw Hill Publishing Company Ltd., New Delhi

List/Links of e-learning resource

- https://archive.nptel.ac.in/courses/108/104/108104100/

Modes of Evaluation and Rubric

The evaluation modes consist of performance in two mid semester Tests, Quiz/Assignments, term work, end semester practical examination.

CO-PO Mapping:

COs	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_1	PO_{11}	PO_{12}	PSO1	PSO2
CO-1	3	2	1										1	2
CO-2	2	2	1	1									1	2
CO-3	3	1	2	1									1	2
CO-4	3	1	2	1									1	2
CO-5	3	2	1										1	2

Suggestive list of experiments:

1. Introduction to MATLAB
2. Generation of continuous time signals.
3. Basic operations on the signals.
4. Systems and their properties.
5. Convolution of signals.
6. Transformation of signals into time and frequency domains.

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Subject handled by department	Department of CS & IT

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE
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DEPARTMENT OF CS & IT

Semester/Year	IV/II	Program	B.Tech – Internet of Things
Subject Category: DC	Subject Code:	IOC 254	Subject Name: Foundation of IoT

Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			Total Marks				
ES	MS	Assignment	Quiz	ES	LW	Quiz		L	T	P	
60	20	10	10	-	-	-	100	3	1	0	4

Prerequisites:

NA

Course Objective:

- Tomake students know the IoT ecosystem.
- ToprovideanunderstandingofthetechnologiesandthestandardsrelatingtotheInternetofThings.
- TodevelopskillsonIoTtechnicalplanning.

UNITs	Descriptions	Hrs.
I	Introduction & concepts: definition and characteristics of IoT, physical design of IoT, Logical Design of IoT, IoT enabling technologies, IoT levels and development templates, IoT and M2M, IoT design Methodology.	8
II	IoT Networking: Connectivity Technologies, Gateway Prefix Allotment, Impact of Mobility on Addressing, Multihoming, Deviations from Regular Web, IoT identification and Data Protocols(IPv4, IPv6, MQTT, CoAP, XMPP and AMQP)	8
III	Connectivity Technologies: Introduction, IEEE 802.15.4, ZigBee, 6LoWPAN, RFID, HART and Wireless HART, NFC, Bluetooth, Z-Wave, ISA 100.11A.	8
IV	Wireless Sensor Network: Introduction, Components of Sensor Node, Modes of Detection, Challenges in WSN. UAV Network: Introduction, UAV Network (Feature, Challenges and Topology) FANET: Introduction, FANET design consideration.	8
V	Application of IoT: Smart Homes – Introduction, Origin of Smart Homes, Smart Home Technologies. Smart Cities – Characteristics of Smart Cities, Smart City Framework, Challenges in Smart Cities. Connected Vehicles – Introduction, levels of Automation, Vehicle to Everything(V2X) Paradigm, Vehicular Ad-hoc Network (VANETs)	8
Total Hours		40

Course Outcomes:

CO1: TounderstandtheFundamentals of IoT.

CO2: To know about the networking concepts of IoT.

CO3: Toknow about the different connectivity technologies.

CO4: To know about the WSN and UAV network.

CO5: To know about the various applications of IoT.

Text Book

1. Arshdeep Bagha and Vijay Madisetti, "Internet of Things – A hands-on approach", Orient Blackswan Private Limited - New Delhi.
2. Dr.JeevaJose,InternetofThings,KhannaPublishingHouse.
3. NiteshDhanjani,AbusingtheInternetofThings,ShroffPublisher/O'ReillyPublisher.

Reference Books

1. InternetofThings,RMDSundaramShriramKVasudevan,AbhishekSNagarajan,JohnWiley and Sons.
2. Internet of Things, Shriram K Vasudevan, Abhishek S Nagarajan, RMD Sundaram,JohnWiley & Sons.
3. CunoPfister,"GettingStartedwiththeInternetofThings",ShroffPublisher/MakerMedia.
4. FrancisdaCosta,"RethinkingtheInternetofThings:AScalableApproachtoConnectingEverything", 1 st Edition, Apress Publications.
5. MassimoBanzi,MichaelShilohMake:GettingStartedwiththeArduino,ShroffPublisher/MakerMedia Publishers.

List/Links of e-learning resource

- https://onlinecourses.nptel.ac.in/noc19_cs65/preview

Modes of Evaluation and Rubric

The evaluation modes consist of performance in two mid semester Tests, Quiz/Assignments, term work, end semester practical examination.

CO-PO Mapping:

COs	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_1	PO_{11}	PO_{12}	PSO1	PSO2

CO-1	**2**	**1**	**2**										**1**	**2**
CO-2	**2**	**1**	**1**										**1**	**2**
CO-3	**2**	**1**	**1**										**1**	**2**
CO-4	**2**	**1**	**1**	**1**									**1**	**2**
CO-5	**2**	**1**	**1**	**1**									**1**	**2**

Recommendation by Board of studies on	
Approval by Academic council on	
Compiled and designed by	
Subject handled by department	Department of CS & IT

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE
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DEPARTMENT OF CS & IT

Semester/Year		**IV/II**		**Program**		**B.Tech – Internet of Things**					
Subject Category	**DLC**	**Subject Code:**		**IOL 256**	**Subject Name**	**Advanced Java Programming**					
Maximum Marks Allotted								**Contact Hours**			**Total Credits**
Theory				**Practical**			**Total Marks**				
ES	**MS**	**Assignment**	**Quiz**	**ES**	**LW**	**Quiz**		**L**	**T**	**P**	
				60	**20**	**20**	**100**	**0**	**0**	**4**	**2**

Prerequisites:

Concepts of Object Oriented Programming and core Java

Course Objective:

- To introduce and understand students to programming concepts and techniques using the Java language and programming environment, class and objects.
- To learn about lifetime, scope and the initialization mechanism of variables and improve the ability general problem solving abilities in programming.
- Be able to use the Java SDK environment to create, debug and run simple Java program

UNITs	**Descriptions**	**Hrs.**
I	Basic Java Features - C++ vs JAVA, JAVA virtual machine, Exception Handling, File and Streams, Visibility, Constructors, Operator and Methods Overloading, Static Members, Inheritance: Polymorphism, Abstract methods and Classes .	**6**
II	Java Collective Frame Work - Generics: Introduction, Overloading Generic Methods, Generic Classes, Collections: Interface Collection and Class Collections, Lists, Array List and Iterator, Linked List, Vector. Collections Algorithms: sort, shuffle, reverse, fill, copy, max and min ,binary Search, Stack Class of Package java. Util, Class Priority Queue and Interface Queue, Maps, Properties Class, Unmodifiable Collections.	8
III	Advance Java Features - Multithreading: Multithreading with GUI, Monitors and Monitor Locks. Networking: Manipulating URLs, Reading a file on a Web Server, Socket programming, Security and the Network, RMI, Networking, Accessing Databases with JDBC.	8
IV	Advance Java Technologies - Servlet: Overview and Architecture, Handling HTTP & HTTPS, get Requests, JDBC, Using JDBC from a Servlet, Java Server Pages (JSP): First JSP Example, JSP elements, JSP tag library, Session tracking, , Java Cryptographic Architecture (JCA).	10
V	Advance Web/Internet Programming (Overview): Struts- Basics of MVC, architecture, action class, interceptors, tag library, validations, Hibernate- basics, architecture, CRUD, Spring- framework introduction.	8
Total Hours		40

Course Outcomes:

CO1: Use the syntax and semantics of java programming language and basic concepts of OOP.

CO2: Write basic Java applications and use arrays.

CO3: Develop reusable programs using the concepts of RMI and JDBC.

CO4: Apply the concepts of Servlet and JSP using advanced tools.

CO5: Design event driven GUI and web related applications which mimic the real word scenarios.

Text Book

1. E. Balaguruswamy, “Programming In Java”; TMH Publications
2. The Complete Reference: Herbert Schildt, TMH

Reference Books

1. Deitel & Deitel, ”JAVA, How to Program”; PHI, Pearson
2. Cay Horstmann, Big JAVA, Wiley India
3. Merlin Hughes, et al; Java Network Programming , Manning Publications/Prentice Hall

List/Links of e-learning resource

- https://archive.nptel.ac.in/courses/106/105/106105191/

Modes of Evaluation and Rubric

The evaluation modes consist of performance in two mid semester Tests, Quiz/Assignments, term work, end semester practical examination.

CO-PO Mapping:

COs	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_1	PO_{11}	PO_{12}	PSO1	PSO2
CO-1	2	2	2										1	2
CO-2	2	2	2										1	2
CO-3	2	1	2	1									1	2
CO-4	2	1	2	1										2
CO-5	2	2	1	1									1	2

Suggestive list of experiments:

1. Installation of JDK.
2. Write a program to show Scope of Variables
3. Write a program to show Concept of CLASS in JAVA
4. Write a program to show Type Casting in JAVA
5. Write a program to show How Exception Handling is in JAVA
6. Write a Program to show Inheritance
7. Write a program to show Polymorphism
8. Write a program to show Access Specifiers (Public, Private, Protected) in JAVA
9. Write a program to show use and Advantages of CONSTRUCTOR
10. Write a program to show Interfacing between two classes
11. Write a program to Add a Class to a Package
12. Write a program to show Life Cycle of a Thread
13. Write a program to demonstrate AWT.
14. Write a program to Hide a Class
15. Write a Program to show Data Base Connectivity Using JAVA
16. Write a Program to show “HELLO JAVA ” in Explorer using Applet
17. Write a Program to show Connectivity using JDBC
18. Write a program to demonstrate multithreading using Java.
19. Write a program to demonstrate applet life cycle.
20. Write a program to demonstrate concept of servlet.

Recommendation by Board of studies on	
Approval by Academic council on	
Compiled and designed by	
Subject handled by department	Department of CS & IT

OPEN ELECTIVES

Open Course Offered by IoT in Session: 2023-24 Semester IV			
Open Course-II (IOO-255)	**A**	**B**	**C**
	Microprocessor	Foundation of IoT	Foundation of Blockchain Technology
Prerequisite	Digital Electronics	--	Basic knowledge of Mathematics
Remark	Open to All	Open to All	Not applicable for - Block Chain

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE
(Engineering College), VIDISHA M.P.
(An Autonomous Institute Affiliated to RGPV Bhopal)
DEPARTMENT OF CS & IT

Semester/Year		**IV/II**		**Program**		**B.Tech – Internet of Things**					
Subject Category	**OC**	**Subject Code:**		**IOC 255 (OC-2A)**	**Subject Name**	**Microprocessor**					
Maximum Marks Allotted								**Contact Hours**			**Total Credits**
Theory				**Practical**			**Total Marks**				
ES	**MS**	**Assignment**	**Quiz**	**ES**	**LW**	**Quiz**		**L**	**T**	**P**	
60	**20**	**10**	**10**	**-**	**-**	**-**	**100**	**3**	**0**	**0**	**3**

Prerequisites:

Digital Electronics

Course Objective:

- The objective of this course is to become familiar with the architecture and the instruction set of an Intel microprocessor.
- Assembly language programming will be studied as well as the design of various types of digital and analog interfaces.
- To introduce 8051 microcontrollers.

UNITs	**Descriptions**	**Hrs.**
I	Introduction: Evolution of microprocessor, architecture, instruction, Instruction sets, Arithmetic and Logic Instruction, Program control instruction, addressing modes, physical memory organization, general bus operation, I/O addressing capability, machine language, assembly language, high level language, programming microprocessor, program execution process.	7
II	8086 architecture: ALU, Timing and control Unit, Registers, data and Address bus, instructions format, addressing modes, stack structure, interrupts, and interrupts service routines; interrupt cycle, maskable and non maskable interrupts, maximum mode, minimum mode, timing and delays.	7
III	8086 Programming: Machine level program, machine coding of the program, instructions set, Assembly language programming, assembler directives operators.	7
IV	Peripherals and interfacing: memory interfacing, I/O ports, I/O ports interfacing, I/O ports Addressing, PIO 8255, 8253 interval timer, 8259A Programmable Interrupt Controller, 8257 DMA Controller, DMA transfers and operations, memory unit, different semiconductor technologies for memory, cache memory, addressing of the memory, addressing capacity of the CPU.	7
V	80286/80386/80486/Pentium: salient features, internal architecture, addressing modes, Data types, virtual mode, numeric coprocessor, MMX, MMX architecture, MMX data types, Microcontroller 8051, architecture, register set, Instruction set, Interrupts of 8051, Intel's Family of 8-bit and 16-bit microcontroller.	7
Total Hours		35

Course Outcomes:

CO-1: Describe architecture and instructions, Differentiate among different programming language; define various addressing modes and memory organization.
CO-2: Justify the different part (control unit, registers, and address bus) of microprocessors. Write and use different instructions. Understand the importance of interrupt service routine.
CO-3: Write and use assembly level codes to solve problems
CO-4: Identify the need of interfacing units and describe various interfacing chips.
CO-5: Differentiate between microprocessor and microcontroller and Understand the advance features of advance microprocessors (8020, 286).

Text Book

1. A.K.Ray K. M. Bhurchandi, "Advanced Microprocessor and peripherals" TMH
2. Douglas V Hall, "Microprocessors and interfacing – Programming & Hardware" TMH

Reference Books

1. Barry B. Brey, "The intel Microprocessor – 8086", Pearson Education
2. Kenneth J.Ayala, "The 8086 Microprocessor: Programming & Interfacing The PC",Cengage Learning
3. Krishna Kant, "Microprocessors and Microcontrollers", PHI Learning
4. R.S. Gaonkar ,"Microprocessors and interfacing", TMH

List/Links of e-learning resource

- https://archive.nptel.ac.in/courses/108/103/108103157/

Modes of Evaluation and Rubric

The evaluation modes consist of performance in two mid semester Tests, Quiz/Assignments, term work, end semester practical examination.

CO-PO Mapping:

COs	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_1	PO_{11}	PO_{12}	PSO1	PSO2
CO-1	**2**	**2**	**2**	**1**									**1**	**2**
CO-2	**2**	**2**	**2**	**1**									**1**	**2**
CO-3	**2**	**2**	**2**	**1**									**2**	**2**
CO-4	**2**	**2**	**2**	**1**									**2**	**2**
CO-5	**2**	**1**	**1**	**1**									**2**	**2**

Recommendation by Board of studies on	
Approval by Academic council on	
Compiled and designed by	
Subject handled by department	Department of CS & IT

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE
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DEPARTMENT OF CS & IT

Semester/Year	IV/II	Program	B.Tech – Internet of Things
Subject Category: OC	Subject Code: IOC 255 (OC-2B)	Subject Name	Foundation of IoT

Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			Total Marks				
ES	MS	Assignment	Quiz	ES	LW	Quiz		L	T	P	
60	20	10	10	-	-	-	100	3	0	0	3

Prerequisites:

NA

Course Objective:

- Tomake students know the IoT ecosystem.
- ToprovideanunderstandingofthetechnologiesandthestandardsrelatingtotheInternetofThings.
- TodevelopskillsonIoTtechnicalplanning.

UNITs	Descriptions	Hrs.
I	Introduction & concepts: definition and characteristics of IoT, physical design of IoT, Logical Design of IoT, IoT enabling technologies, IoT levels and development templates, IoT and M2M, IoT design Methodology.	7
II	IoT Networking: Connectivity Technologies, Gateway Prefix Allotment, Impact of Mobility on Addressing, Multihoming, Deviations from Regular Web, IoT identification and Data Protocols(IPv4, IPv6, MQTT, CoAP, XMPP and AMQP)	7
III	Connectivity Technologies: Introduction, IEEE 802.15.4, ZigBee, 6LoWPAN, RFID, HART and Wireless HART, NFC, Bluetooth, Z-Wave, ISA 100.11A.	7
IV	Wireless Sensor Network: Introduction, Components of Sensor Node, Modes of Detection, Challenges in WSN. UAV Network: Introduction, UAV Network (Feature, Challenges and Topology) FANET: Introduction, FANET design consideration.	7
V	Application of IoT: Smart Homes – Introduction, Origin of Smart Homes, Smart Home Technologies. Smart Cities – Characteristics of Smart Cities, Smart City Framework, Challenges in Smart Cities. Connected Vehicles – Introduction, levels of Automation, Vehicle to Everything(V2X) Paradigm, Vehicular Ad-hoc Network (VANETs)	7
Total Hours		35

Course Outcomes:

CO1: TounderstandtheFundamentals of IoT.

CO2: To know about the networking concepts of IoT.

CO3: Toknow about the different connectivity technologies.

CO4: To know about the WSN and UAV network.

CO5: To know about the various applications of IoT.

Text Book

1. Arshdeep Bagha and Vijay Madisetti, "Internet of Things – A hands-on approach", Orient Blackswan Private Limited - New Delhi.
2. Dr.JeevaJose,InternetofThings,KhannaPublishingHouse.
3. NiteshDhanjani,AbusingtheInternetofThings,ShroffPublisher/O'ReillyPublisher.

Reference Books

1. InternetofThings,RMDSundaramShriramKVasudevan,AbhishekSNagarajan,JohnWiley and Sons.
2. Internet of Things, Shriram K Vasudevan, Abhishek S Nagarajan, RMD Sundaram,JohnWiley & Sons.
3. CunoPfister,"GettingStartedwiththeInternetofThings",ShroffPublisher/MakerMedia.
4. FrancisdaCosta,"RethinkingtheInternetofThings:AScalableApproachtoConnectingEverything", 1 st Edition, Apress Publications.
5. MassimoBanzi,MichaelShilohMake:GettingStartedwiththeArduino,ShroffPublisher/MakerMedia Publishers.

List/Links of e-learning resource

- https://onlinecourses.nptel.ac.in/noc19_cs65/preview

Modes of Evaluation and Rubric

The evaluation modes consist of performance in two mid semester Tests, Quiz/Assignments, term work, end semester practical examination.

CO-PO Mapping:

COs	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_1	PO_{11}	PO_{12}	PSO1	PSO2
CO-1	**2**	**1**	**2**										**1**	**2**
CO-2	**2**	**1**	**1**										**1**	**2**
CO-3	**2**	**1**	**1**										**1**	**2**
CO-4	**2**	**1**	**1**	**1**									**1**	**2**
CO-5	**2**	**1**	**1**	**1**									**1**	**2**

Recommendation by Board of studies on	
Approval by Academic council on	
Compiled and designed by	
Subject handled by department	Department of CS & IT

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE
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DEPARTMENT OF CS & IT

Semester/Year		**IV/II**	**Program**		**B.Tech – Internet of Things**
Subject Category	**OC**	**Subject Code:**	**IOC 255 (OC-2C)**	**Subject Name**	**Foundation of Blockchain**

Maximum Marks Allotted								**Contact Hours**			**Total Credits**
Theory				**Practical**			**Total Marks**				
ES	**MS**	**Assignment**	**Quiz**	**ES**	**LW**	**Quiz**		**L**	**T**	**P**	
60	**20**	**10**	**10**	**-**	**-**	**-**	**100**	**3**	**0**	**0**	**3**

Prerequisites:

Basic Knowledge of mathematics.

Course Objective:

- Technology behind blockchain
- Emerging trends in blockchain .
- Real-world applications of block chain

UNITs	**Descriptions**	**Hrs.**
I	Introduction to Blockchain Technology: Basic ideas behind block chain, how it is changing the landscape of digitalization, introduction to cryptographic concepts, Hashing, public key cryptosystems, private vs public block chain and use cases, Hash Puzzles	7
II	Blockchain Fundamentals: Basic architecture of Blockchain, different terminologies associated, Characteristics of Block chain, Types of networks, Introducing Smart contract concept in Blockchain.	7
III	Components of Blockchain: Core components of Blockchain, Types of Block chains; Blockchain Protocol, Permission & Permission less Block chains,	7
IV	Digital Ledger: Short History of Money and Trust, Bitcoin Mechanics, Introduction to Ethereum, Introduction to Hyperledger, Hyperledger Fabric and its architecture, Hyperledger Composer Emerging Trends in Blockchain: Cloud-based block chain, Multi chain, Geth , Stellar , Ripple, R3 Corda, Blockchain API, Blockchain Sandboxes	7
V	Block Chain Use Cases: Supply Chain Management, Finance, Health Care, Internet of Things (IoT), Remittance, Land Records, Voting and election, Loyalty Programs, Go Green (Renewable Energy)	7
Total Hours		35

Course Outcomes:

CO-1: Understand the basic concepts, principles and applications of block chain.

CO-2: Understand basic architecture of Block chain, Characteristics of Block chain.

CO-3: Explain Core components of Block chain, Types of Block chains; Blockchain Protocol.

CO-4: Compare the working of different block chain platforms.

CO-5: Analyse the importance of block chain in finding the solution to the real-world problems.

Text Book

1. Artemis Caro, "Blockchain: The Beginners Guide to Understanding the Technology BehindBitcoin& Crypto currency".

Reference Books

1. Scott Marks, "Blockchain for Beginners: Guide to Understanding the Foundation and Basics of the Revolutionary Blockchain Technology", Create Space Independent Publishing Platform.
2. Mark Watney, "Blockchain for Beginners".
3. Alwyn Bishop, "Blockchain Technology Explained".

List/Links of e-learning resource

- https://archive.nptel.ac.in/courses/106/104/106104220/

Modes of Evaluation and Rubric

The evaluation modes consist of performance in two mid semester Tests, Quiz/Assignments, term work, end semester practical examination.

CO-PO Mapping:

COs	**PO_1**	**PO_2**	**PO_3**	**PO_4**	**PO_5**	**PO_6**	**PO_7**	**PO_8**	**PO_9**	**PO_1**	**PO_{11}**	**PO_{12}**	**PSO1**	**PSO2**

CO-1	**3**	**1**											**3**	**3**
CO-2	**3**	**1**											**1**	**3**
CO-3	**3**	**2**											**2**	**1**
CO-4	**3**	**3**	**2**											**3**
CO-5	**3**	**3**	**2**										**3**	

Recommendation by Board of studies on	
Approval by Academic council on	
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Subject handled by department	Department of CS & IT

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE VIDISHA (M.P.)
(A Govt. Aided UGC Autonomous & NAAC Accredited Institute Affiliated to RGPV Bhopal)

Scheme of Examination (Semester-V)

for Batch Admitted in session - 2022-23

Bachelor of Technology (B. Tech.) – Internet of Things

Subject Code	Subject Category	Subject Name	Maximum Marks Allotted								Contact Hrs. per week			Total Credits
			Theory				Practical			Total Marks				
			ES	MS	Assignment	Quiz	ES	LW	Quiz		L	T	P	
IO 501	DC	Artificial Intelligence & Machine Learning	60	20	10	10	30	10	10	150	3	0	2	4
IO 502	DC	Operating Systems for IoT	60	20	10	10	30	10	10	150	3	0	2	4
IO 503	DC	Ad-hoc & Sensor Networks	60	20	10	10	30	10	10	150	3	0	2	4
IO 504	DE	DE -1	60	20	10	10	--	--	--	100	3	1	0	4
OE 505	OC	OC-3	60	20	10	10	--	--	--	100	3	0	0	3
IO 506	DLC	IoT Lab	--	--	--	--	30	10	10	50	0	0	4	2
IO 507	ILC	Internship-II (60 Hrs) Institute Level (Evaluation)	--	--	--	--		50	--	50	-	-	2	2
Total			**300**	**100**	**50**	**50**	**120**	**90**	**40**	**750**	**15**	**1**	**12**	**23**
	ILC	Extracurricular Activities	It is a one credit per year activity to be endorsed in eight semester marks sheet.											

	DE -1	OC-3
A	IoT Communication Protocols	IoT Communication Protocols
B	5G and IoT Technologies	Operating Systems for IoT
C	Wireless network	Ad-hoc & Sensor Networks

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE

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DEPARTMENT OF IT

Semester/Year	V / III	Program	B.Tech – Internet of Things

Subject Category	DC	Subject Code:	IO 501	Subject Name	Artificial Intelligence & Machine Learning

Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			Total Marks				
ES	MS	Assignment	Quiz	ES	LW	Quiz		L	T	P	
60	20	10	10	30	10	10	150	3	0	2	4

Prerequisites:

1. Data Structures
2. Knowledge on statistical methods

Course Objective:

- Identify problems that are amenable to solution by AI methods, and which AI methods may be suited to solving a given problem.
- This course explains machine learning techniques such as decision tree learning, Bayesian learning etc.
- To understand computational learning theory.
- To study the pattern comparison techniques.

UNITs	Descriptions	Hrs.
I	The AI Problems, The Underlying Assumption, AI Techniques, Level of the Model, Criteria for Success, Some general references, one Final Word. Problems and State Space Search, Defining Problems as a State Space Search, Production Systems, Production Characteristics, Production System Characteristics, and issues in the design of Search Programs, additional problems. Generate-and-Test, Hill Climbing, Best-First Search, Problem Reduction, Constraint Satisfaction, Means-Ends Analysis.	**8**
II	INTRODUCTION Machine-Learning Paradigms: Introduction. Machine Learning Systems, Forms of Learning: Supervised and Unsupervised Learning, reinforcement – theory of learning – feasibility of learning – Data Preparation– training versus testing and split. Supervised Learning: Regression: Linear Regression, multi linear regression, Polynomial Regression, logistic regression, Non-linear Regression, Model evaluation methods.	8
III	Classification: – support vector machines – soft margin SVM – going beyond linearity – generalization and over fitting – regularization – validation-Naïve Bayes classification, Ensemble Learning: BOOSTING - AdaBoost –Stumping Gradient Boosting Machines and XGBoost -BAGGING -Subagging -Different Ways to Combine Classifiers-Random forest Classifier	8
IV	Unsupervised learning Nearest neighbor models – K-means – clustering around medoids – silhouettes – hierarchical clustering – k-d trees – locality sensitive hashing –	8

	non-parametric regression. Clustering trees – learning ordered rule lists – learning unordered rule lists – descriptive rulelearning – association rule mining – first-order rule learning.	
V	Neural Networks - The Perceptron -The Perceptron Learning Algorithm - LINEAR SEPARABILITY: The Perceptron Convergence Theorem - The Exclusive or (XOR) Function BACK-PROPAGATION OF ERROR : The Multi-layer Perceptron Algorithm -Different Output Activation Functions -Sequential and Batch Training - Local Minima - Picking Up Momentum- Minibatches and Stochastic Gradient Descent- A Regression Problem - Classification with the MLP.	8
Total Hours		40

Course Outcomes:

CO-1 Understand the concepts of computational intelligence like machine learning.

CO-2 Ability to get the skill to apply machine learning techniques to address the real time problems in different areas.

CO-3 Understand the Neural Networks and its usage in machine learning application.

CO-4 Describe various searching methods and reasoning in AI.

CO-5 Uses of Knowledge Representation Techniques.

Text Book & Reference Books-

3. Machine Learning – Tom M. Mitchell, - MGH
4. Machine Learning: An Algorithmic Perspective, Stephen Marshland, Taylor & Francis
5. Artificial Intelligence -By Elaine Rich And Kevin Knight (2nd Edition) Tata Mcgraw-Hill
6. "PROLOG Programming For Artificial Intelligence" -By Ivan Bratko(Addison-Wesley

List/Links of e-learning resource

- https://nptel.ac.in/courses/106102220

Modes of Evaluation and Rubric

The evaluation modes consist of performance in two mid semester Tests, Quiz/Assignments, term work, end semester practical examination.

CO-PO Mapping:

COs	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_1	PO_{11}	PO_{12}	PSO1	PSO2
CO-1	1	1	2	1									1	2
CO-2	2	1	1	1	2								1	2
CO-3	2	1	2	1			1						1	1
CO-4	2	1	2	1										2
CO-5	2	1			1								1	

List of Experiments:

1. Implementation of Python Basic Libraries such as Statistics, Math, Numpy and Scipy
2. Implementation of Python Libraries for ML application such as Pandas and Matplotlib.
3. Creation and Loading different datasets in Python
4. Write a python program to compute Mean, Median, Mode, Variance, Standard Deviation using Datasets
5. Write a Python program to implement Simple Linear Regression and plot the graph.

6. Implementation of Multiple Linear Regression for House Price Prediction using sklear 7. Implementation of Logistic Regression for iris using sklearn. 8. Implementation of random forest algorithm. 9. Implementation of navie bayes classifier algorithm and plot the graph. 10. Implementation of SVM classification and plot the graph.

Recommendation by Board of studies on	
Approval by Academic council on	
Compiled and designed by	
Subject handled by department	Department of IT

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE

(Engineering College), VIDISHA M.P.

(An Autonomous Institute Affiliated to RGPV Bhopal)

DEPARTMENT OF IT

Semester/Year		V/ III	Program		B.Tech – Internet of Things
Subject Category	DC	Subject Code:	IO 502	Subject Name	Operating Systems for IoT

Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			Total Marks				
ES	MS	Assignment	Quiz	ES	LW	Quiz		L	T	P	
60	20	10	10	30	10	10	150	3	0	2	4

Prerequisites:

Course Objective:

- Knowledge on Various Operating Systems of IoT.

UNITs	Descriptions	Hrs.
I	Processes, Tools, Tool chains and Hardware: Design to Code -A Practical Approach, The Stm32cube Software Tool, The Practical Tool Set, The Stm32 Graphical Tool-Stm32cube Mx Details, The Stm32cubehal, Free RTOS Configuration in A Cube Project, The Stm32cube Cubeide Development Platform.	**8**
II	Introducing Micropython: Micropython Features, Micropython Limitations, What Does Micropython Run On? Experimenting With Python On Your Pc, How Micropython Works, Off And Running With Micropython.	8
III	Micropython Hardware: Getting Started with Micropython Boards, Micropython-Ready Boards, Networking with The Pyboard, Getting Started with Wipy, Connecting to Your Wifi Network, Micropython-Compatible Boards, Other Boards, Breakout Boards and Add-Ons.	8
IV	How To Program In Micropython: Basic Concepts, Basic Data Structures, Statements, Modularization; Modules, Functions, And Classes, Learning Python By Example.	8
V	Introducing the Windows 10 Iot Core: Windows 10 Iot Core Features, Things You'll Need, Getting Started with Windows 10 Iot Core.	8
Total Hours		40

Course Outcomes:

CO-1 Understanding Free RTOS Techniques of Cube Software Tool.

CO-2 Knowledge on Micro Python Features.

CO-3 Understand and Acquire Knowledge on Micropython Hardware.

CO-4 Apply Basic Data Structures and Functions of Micro Python.

CO-5 Knowledge on Windows 10 For Iot Operating System.

Text Book & Reference Books-

1. Jim Cooling, Real-Time Operating Systems Book 2 - The Practice: Using Stm Cube, Freertos And the Stm32 Discovery Board (Engineering of Real-Time Embedded Systems) Jim Cooling, Isbn-10: 1973409933, Isbn-13: 978-1973409939.
2. Charles Bell, Micropython For the Internet of Things, A Beginner's Guide to Programming with Python on Microcontrollers, Apress, Isbn-13 (Pbk): 978-1-4842-3122-7, Isbn-13 (Electronic): 978-1-4842-3123-4.
3. Charles Bell Windows 10 For the Internet of Things 1st Edition, Apress, Isbn-13 (Pbk): 978-1- 4842-2107-5 Isbn-13, (Electronic): 978-1-4842-2108-2.

List/Links of e-learning resource

- https://nptel.ac.in/courses/106102220

Modes of Evaluation and Rubric

The evaluation modes consist of performance in two mid semester Tests, Quiz/Assignments, term work, end semester practical examination.

CO-PO Mapping:

COs	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_1	PO_{11}	PO_{12}	PSO1	PSO2
CO-1	1	1	2	1									1	2
CO-2	2	1	1	1	1								1	2
CO-3	2	1	2	1			1						1	1
CO-4	2	1	2	1										2
CO-5	2	1			1								1	

Recommendation by Board of studies on	
Approval by Academic council on	
Compiled and designed by	
Subject handled by department	Department of IT

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE

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DEPARTMENT OF IT

Semester/Year		V / III		Program		B.Tech – Internet of Things					
Subject Category	DC	Subject Code:		IO 503	Subject Name	Ad-hoc & Sensor Networks					
Maximum Marks Allotted									Contact Hours			Total Credits
Theory				Practical			Total Marks					
ES	MS	Assignment	Quiz	ES	LW	Quiz			L	T	P	
60	20	10	10	30	10	10	150		3	0	2	4

Prerequisites:

Computer Networks, Mobile Computing

Course Objective:

- To understand the concepts of sensor networks.
- To understand the MAC and transport protocols for ad hoc networks.
- To understand the security of sensor networks.
- To understand the applications of adhoc and sensor networks.

UNITs	Descriptions	Hrs.
I	Introduction to Ad Hoc Networks - Characteristics of MANETs, Applications of MANETs and Challenges of MANETs. Routing in MANETs - Criteria for classification, Taxonomy of MANET routing algorithms, Topologybased routing algorithms-Proactive: DSDV; Reactive: DSR, AODV; Hybrid: ZRP; Position-based routing algorithms-Location Services-DREAM, Quorum-based; Forwarding Strategies: Greedy Packet, Restricted Directional Flooding-DREAM, LAR.	8
II	Data Transmission - Broadcast Storm Problem, Rebroadcasting Schemes-Simple-flooding, Probability-based Methods, Area-based Methods, Neighbor Knowledge-based: SBA, Multipoint Relaying, AHBP. Multicasting: Tree-based: AMRIS, MAODV; Mesh-based: ODMRP, CAMP; Hybrid: AMRoute, MCEDAR.	8
III	Geocasting: Data-transmission Oriented-LBM; Route Creation Oriented-GeoTORA, MGR. TCP over Ad Hoc TCP protocol overview, TCP and MANETs, Solutions for TCP over Ad hoc	8
IV	Basics of Wireless, Sensors and Lower Layer Issues: Applications, Classification of sensor networks, Architecture of sensor network, Physical layer, MAC layer, Link layer, Routing Layer.	8
V	Upper Layer Issues of WSN: Transport layer, High-level application layer support, Adapting to the inherent dynamic nature of WSNs, Sensor Networks and mobile robots.	8
Total Hours		40

Course Outcomes:

CO1: Ability to understand the state-of-the-art research in the emerging subject of Ad Hoc and Wireless Sensor Networks

CO2: Ability to solve the issues in real-time application development based on ASN.

CO3: Ability to conduct further research in the domain of ASN

CO4: Ability to understand layers

CO5: Understanding the concept of dynamic nature of WSNs.

Text Book & Reference Books-

1. Ad Hoc and Sensor Networks – Theory and Applications, Carlos Corderio Dharma P. Aggarwal, World Scientific Publications, March 2006, ISBN – 981–256–681–3.
2. Wireless Sensor Networks: An Information Processing Approach, Feng Zhao, Leonidas Guibas, Elsevier Science, ISBN – 978-1-55860-914-3 (Morgan Kauffman).

List/Links of e-learning resource

- https://archive.nptel.ac.in/courses/106/105/106105160/

Modes of Evaluation and Rubric

The evaluation modes consist of performance in two mid semester Tests, Quiz/Assignments, term work, end semester practical examination.

CO-PO Mapping:

COs	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_1	PO_{11}	PO_{12}	PSO1	PSO2
CO-1	1	2	2										1	2
CO-2	3	2	2	2									2	1
CO-3	3	2	2	2									2	1
CO-4	3	2	2	2									2	1
CO-5	2	2	1	1									1	2

Suggestive list of experiments:

Note: Implement Experiment No: 1 to 5 using NS2/NS3 Simulation Tool. Implement Experiment No: 6 to 10 using MATLAB Tool.

1. Create a sample wireless topology using Simulation Tool.
2. Create a mobile Ad-hoc networks using Simulation Tool.
3. Implement an Ad-hoc On-demand Distance Vector protocol using Simulation Tool.
4. Implement a Transmission Control Protocol using Simulation Tool.
5. Implement an User Datagram Protocol using Simulation Tool.
6. Implement a Low Energy Adaptive Hierarchy protocol using Simulation Tool.
7. Implement a Power Efficient Gathering in Sensor Information System using Simulation Tool.
8. Implement a Sensor Protocol for Information via Negotiation (SPIN) using Simulation Tool.
9. Implement a Power Efficient and Delay Aware MAC protocol using Simulation Tool
10. Implement a Scheduling based protocol for WSNs using Simulation Tool.

Recommendation by Board of studies on	
Approval by Academic council on	
Compiled and designed by	

Subject handled by department	Department of CS & IT

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE

(Engineering College), VIDISHA M.P.

(An Autonomous Institute Affiliated to RGPV Bhopal)

DEPARTMENT OF IT

Semester/Year		V / III		Program		B.Tech – Internet of Things				
Subject Category	DE	Subject Code:	IO 504 DE-1 (A)	Subject Name	IoT Communication Protocols					

Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			Total Marks				
ES	MS	Assignment	Quiz	ES	LW	Quiz		L	T	P	
60	20	10	10	-	-	-	100	3	1	0	4

Prerequisites:

Course Objective:

- In this course, learners will be going to learn about various protocols designed for the implementation of the Internet of Things (IoT) applications.

UNITs	Descriptions	Hrs.
I	Introduction: IoT architecture outline, standards - IoT Technology Fundamentals- Devices and gateways, Local and wide area networking, Data management, Business processes in IoT, Everything as a Service (XaaS), M2M and IoT Analytics.	8
II	Iot Reference Architecture: Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant Architectural views. Real-World Design Constraints- Introduction, Technical Design constraints.	8
III	IoT Data Link Layer: PHY/MAC Layer (3GPP MTC, IEEE 802.11, IEEE 802.15), Wireless HART, ZWave, Bluetooth Low Energy, Zigbee Smart Energy, DASH7	8
IV	Network Layer Protocols: Network Layer-IPv4,IPv6, 6LoWPAN, 6TiSCH,ND, DHCP, ICMP, RPL, CORPL, CARP.	8
V	IOT Transport & Session Layer Protocols: Transport Layer (TCP, MPTCP, UDP, DCCP, SCTP)- (TLS, DTLS) – Session Layer-HTTP, CoAP, XMPP, AMQP, MQTT.	8
Total Hours		40

Course Outcomes:

CO1: Understand fundamentals of IoT architecture outline and standards

CO2: Understand and analyze different architectural views.

CO3: Understand the importance of IoT Data Link Layer & Network Layer Protocols.

CO4: Understand the importance of Iot Transport.

CO5: Understand the importance of Session Layer Protocols.

Text Book & Reference Books-

1. Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications", ISBN: 978-1-118-47347-4, Willy Publications ,2016
2. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence",1st Edition, Academic Press, 2015
3. Bernd Scholz-Reiter, Florian Michahelles, "Architecting the Internet of Things", ISBN 978-3- 642-19156-5 e-ISBN 978-3-642-19157-2, Springer, 2016.

List/Links of e-learning resource

- https://nptel.ac.in/courses/106105166

Modes of Evaluation and Rubric

The evaluation modes consist of performance in two mid semester Tests, Quiz/Assignments, term work, end semester practical examination.

CO-PO Mapping:

COs	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_1	PO_{11}	PO_{12}	PSO1	PSO2
CO-1	2	2	2										1	2
CO-2	3	2	2	2									2	1
CO-3	3	2	2	2									2	1
CO-4	3	2	2	2									2	1
CO-5	2	2	1	1									1	2

Suggestive list of experiments:

Recommendation by Board of studies on	
Approval by Academic council on	
Compiled and designed by	
Subject handled by department	Department of IT

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE

(Engineering College), VIDISHA M.P.

(An Autonomous Institute Affiliated to RGPV Bhopal)

DEPARTMENT OF IT

Semester/Year	V / III	Program	B.Tech – Internet of Things

Subject Category	DE	Subject Code:	IO 504 DE-1 (B)	Subject Name	5G and IoT Technologies

Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			Total Marks				
ES	MS	Assignment	Quiz	ES	LW	Quiz		L	T	P	
60	20	10	10	30	10	10	150	3	1	0	4

Prerequisites:

Course Objective:

- Students will be explored to the interconnection and integration of the physical world and the cyber space. They are also able to design & develop IoT Devices.

UNITs	Descriptions	Hrs.
I	Overview of 5G Broadband Wireless Communications: Evolution of mobile technologies 1G to 4G (LTE, LTEA, LTEA Pro), An Overview of 5G requirements, Regulations for 5G, Spectrum Analysis and Sharing for 5G.	8
II	The 5G wireless Propagation Channels: Channel modeling requirements, propagation scenarios and challenges in the 5G modeling, Channel Models for mmWave MIMO Systems, 3GPP standards for 5G, IEEE 802.15.4	8
III	Introduction to Internet of Things –Definition and Characteristics of IoT, Physical Design of IoT – IoT Protocols, IoT communication models, Iot Communication APIs, IoT enabled Technologies – Wireless Sensor Networks, Cloud Computing, Big data analytics, Communication protocols, Embedded Systems, IoT Levels and Templates, Domain Specific IoTs – Home, City, Environment, Energy, Retail, Logistics, Agriculture, Industry, health and Lifestyle.	8
IV	IoT and M2M – Software defined networks, network function virtualization, difference between SDN and NFV for IoT. Basics of IoT System Management with NETCOZF, YANGNETCONF, YANG, SNMP NETOPEER	8
V	IoT Physical Devices and Endpoints - Introduction to Raspberry PI - Interfaces (serial, SPI, I2C). Programming – Python program with Raspberry PI with focus of interfacing external gadgets, controlling output, reading input from pins.	8
Total Hours		40

Course Outcomes:

CO1: Able to understand the application areas of IoT.

CO2: Able to realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks.

CO3: Able to understand building blocks of Internet of Things and characteristics.

CO4: Understand IoT and M2M.

CO5: Understanding the concept Raspberry PI with focus of interfacing external gadgets.

Text Book & Reference Books-

1. Internet of Things - A Hands-on Approach, Arshdeep Bahga and Vijay Madisetti, Universities Press, 2015, ISBN: 9788173719547
2. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014, ISBN: 9789350239759

List/Links of e-learning resource

Modes of Evaluation and Rubric

The evaluation modes consist of performance in two mid semester Tests, Quiz/Assignments, term work, end semester practical examination.

CO-PO Mapping:

COs	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_1	PO_{11}	PO_{12}	PSO1	PSO2
CO-1	2	2	2										1	2
CO-2	3	2	2	2									2	1
CO-3	3	2	2	2									2	1
CO-4	3	2	2	2									2	1
CO-5	2	2	1	1									1	2

Suggestive list of experiments:

3.

Recommendation by Board of studies on	
Approval by Academic council on	
Compiled and designed by	
Subject handled by department	Department of IT

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE

(Engineering College), VIDISHA M.P.

(An Autonomous Institute Affiliated to RGPV Bhopal)

DEPARTMENT OF IT

Semester/Year		V / III	Program		B.Tech – Internet of Things
Subject Category	DE	Subject Code:	IO 504 DE-1 (C)	Subject Name	Wireless network

Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			Total Marks				
ES	MS	Assignment	Quiz	ES	LW	Quiz		L	T	P	
60	20	10	10	-	-	-	100	3	1	0	4

Prerequisites:

Wireless Sensor Networks.

Course Objective:

- To study the fundamentals of wireless Ad-Hoc Networks.
- To study the operation and performance of various Ad Hoc wireless network protocols.
- To study the architecture and protocols of Wireless sensor networks.

UNITs	Descriptions	Hrs.
I	Wireless LANs and PANs: Introduction, Fundamentals of WLANS, IEEE 802.11 Standards, HIPERLAN Standard, Bluetooth, Home RF. Ad-Hoc Wireless Networks: Introduction, Issues in Ad Hoc Wireless Networks.	8
II	MAC Protocols: Introduction, Issues in Designing a MAC protocol for Ad Hoc Wireless Networks, Design goals of a MAC Protocol for Ad Hoc Wireless Networks, Classifications of MAC Protocols, Contention - Based Protocols, Contention - Based Protocols with reservation Mechanisms, Contention – Based MAC Protocols with Scheduling Mechanisms, MAC Protocols that use Directional Antennas, Other MAC Protocols.	8
III	Routing Protocols: Introduction, Issues in Designing a Routing Protocol for Ad Hoc Wireless Networks, Classification of Routing Protocols, Table –Driven Routing Protocols, On – Demand Routing Protocols, Hybrid Routing Protocols, Routing Protocols with Efficient Flooding Mechanisms, Hierarchical Routing Protocols, Power – Aware Routing Protocols.	8
IV	Transport Layer Protocols: Introduction, Issues in Designing a Transport Layer Protocol for Ad Hoc Wireless Networks, Design Goals of a Transport Layer Protocol for Ad Hoc Wireless Networks, Classification of Transport Layer Solutions, TCP Over Ad Hoc Wireless Networks, Other Transport Layer Protocol for Ad Hoc Wireless Networks.	8
V	Wireless Sensor Networks: Introduction, Sensor Network Architecture, Data Dissemination, Data Gathering, MAC Protocols for Sensor Networks, Location Discovery, Quality of a Sensor Network, Evolving Standards, Other Issues.	8

Total Hours	40

Course Outcomes:

CO1: Students will be able to understand the basis of Ad-hoc wireless networks.

CO2: Students will be able to understand design, operation and the performance of MAC layer protocols of Ad Hoc wireless networks.

CO3: Students will be able to understand design, operation and the performance of routing protocol of Ad Hoc wireless network.

CO4: Students will be able to understand design, operation and the performance of transport layer protocol of Ad Hoc wireless networks.

CO5: Students will be able to understand sensor network Architecture and will be able to distinguish between protocols used in Adhoc wireless networks and wireless sensor networks.

Text Book & Reference Books-

1. Ad Hoc Wireless Networks: Architectures and Protocols - C. Siva Ram Murthy and B.S.Manoj, 2004, PHI.
2. Wireless Ad- hoc and Sensor Networks: Protocols, Performance and Control - Jagannathan Sarangapani, CRC Press.

List/Links of e-learning resource

- https://archive.nptel.ac.in/courses/106/105/106105160/

Modes of Evaluation and Rubric

The evaluation modes consist of performance in two mid semester Tests, Quiz/Assignments, term work, end semester practical examination.

CO-PO Mapping:

COs	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_1	PO_{11}	PO_{12}	PSO1	PSO2
CO-1	2	2	2										1	2
CO-2	3	2	2	2									2	1
CO-3	3	2	2	2									2	1
CO-4	3	2	2	2									2	1
CO-5	2	2	1	1									1	2

Suggestive list of experiments:

Recommendation by Board of studies on	
Approval by Academic council on	
Compiled and designed by	
Subject handled by department	Department of IT

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE

(Engineering College), VIDISHA M.P.

(An Autonomous Institute Affiliated to RGPV Bhopal)

DEPARTMENT OF IT

Semester/Year		V / III	Program		B.Tech – Internet of Things
Subject Category	OC	Subject Code:	IO 505 OC-3 (A)	Subject Name	IoT Communication Protocols

Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			Total Marks				
ES	MS	Assignment	Quiz	ES	LW	Quiz		L	T	P	
60	20	10	10	-	-	-	100	3	0	0	3

Prerequisites:

Course Objective:

- In this course, learners will be going to learn about various protocols designed for the implementation of the Internet of Things (IoT) applications.

UNITs	Descriptions	Hrs.
I	Introduction: IoT architecture outline, standards - IoT Technology Fundamentals- Devices and gateways, Local and wide area networking, Data management, Business processes in IoT, Everything as a Service (XaaS), M2M and IoT Analytics.	8
II	Iot Reference Architecture: Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant Architectural views. Real-World Design Constraints- Introduction, Technical Design constraints.	8
III	IoT Data Link Layer: PHY/MAC Layer (3GPP MTC, IEEE 802.11, IEEE 802.15), Wireless HART, ZWave, Bluetooth Low Energy, Zigbee Smart Energy, DASH7	8
IV	Network Layer Protocols: Network Layer-IPv4,IPv6, 6LoWPAN, 6TiSCH,ND, DHCP, ICMP, RPL, CORPL, CARP.	8
V	IOT Transport & Session Layer Protocols: Transport Layer (TCP, MPTCP, UDP, DCCP, SCTP)- (TLS, DTLS) – Session Layer-HTTP, CoAP, XMPP, AMQP, MQTT.	8
Total Hours		40

Course Outcomes:

CO1: Understand fundamentals of IoT architecture outline and standards

CO2: Understand and analyze different architectural views.

CO3: Understand the importance of IoT Data Link Layer & Network Layer Protocols.

CO4: Understand the importance of Iot Transport.

CO5: Understand the importance of Session Layer Protocols.

Text Book & Reference Books-

4. Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications", ISBN: 978-1-118-47347-4, Willy Publications ,2016
5. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence",1st Edition, Academic Press, 2015
6. Bernd Scholz-Reiter, Florian Michahelles, "Architecting the Internet of Things", ISBN 978-3- 642-19156-5 e-ISBN 978-3-642-19157-2, Springer, 2016.

List/Links of e-learning resource

- https://nptel.ac.in/courses/106105166

Modes of Evaluation and Rubric

The evaluation modes consist of performance in two mid semester Tests, Quiz/Assignments, term work, end semester practical examination.

CO-PO Mapping:

COs	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_1	PO_{11}	PO_{12}	PSO1	PSO2
CO-1	2	2	2										1	2
CO-2	3	2	2	2									2	1
CO-3	3	2	2	2									2	1
CO-4	3	2	2	2									2	1
CO-5	2	2	1	1									1	2

Suggestive list of experiments:

Recommendation by Board of studies on	
Approval by Academic council on	
Compiled and designed by	
Subject handled by department	Department of IT

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE

(Engineering College), VIDISHA M.P.

(An Autonomous Institute Affiliated to RGPV Bhopal)

DEPARTMENT OF IT

Semester/Year		V / III	Program		B.Tech – Internet of Things
Subject Category	OC	Subject Code:	IO 505 OC- 3 (B)	Subject Name	Operating Systems for IoT

Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			Total Marks				
ES	MS	Assignment	Quiz	ES	LW	Quiz		L	T	P	
60	20	10	10	-	-	-	100	3	0	0	3

Prerequisites:

Data Structures

Course Objective:

- This course explains machine learning techniques such as decision tree learning, Bayesian learning etc.
- To understand computational learning theory.
- To study the pattern comparison techniques.
- Identify problems that are amenable to solution by AI methods, and which AI methods may be suited to solving a given problem.

UNITs	Descriptions	Hrs.
I	Introduction - Well-posed learning problems, designing a learning system, Perspectives and issues in machine learning Concept learning and the general to specific ordering – introduction, a concept learning task, concept learning as search, find-S: finding a maximally specific hypothesis, version spaces and the candidate elimination algorithm, remarks on version spaces and candidate elimination, inductive bias.	**8**
II	Decision Tree Learning – Introduction, decision tree representation, appropriate problems for decision tree learning, the basic decision tree learning algorithm, hypothesis space search in decision tree learning, inductive bias in decision tree learning, issues in decision tree learning.	8
III	Artificial Neural Networks-1– Introduction, neural network representation, appropriate problems for neural network learning, perceptions, multilayer networks and the back-propagation algorithm. Artificial Neural Networks-2- Remarks on the Back-Propagation algorithm, An illustrative example: face recognition, advanced topics in artificial neural networks. Evaluation Hypotheses – Motivation, estimation hypothesis accuracy, basics of sampling theory, a general approach for deriving confidence intervals, difference in error of two hypotheses, comparing learning algorithms.	8
IV	Bayesian learning – Introduction, Bayes theorem, Bayes theorem and concept learning, Maximum Likelihood and least squared error hypotheses, maximum likelihood hypotheses for predicting probabilities, minimum description length principle, Bayes optimal classifier, Gibs algorithm, Naïve Bayes classifier, an example: learning to classify text, Bayesian belief networks, the EM algorithm. Computational learning	8

	theory – Introduction, probably learning an approximately correct hypothesis, sample complexity for finite hypothesis space, sample complexity for infinite hypothesis spaces, the mistake bound model of learning. Instance-Based Learning- Introduction, k-nearest neighbour algorithm, locally weighted regression, radial basis functions, case-based reasoning, remarks on lazy and eager learning.	
V	The AI Problems, The Underlying Assumption, AI Techniques, Level of the Model, Criteria for Success, Some general references, one Final Word. Problems and State Space Search, Defining Problems as a State Space Search, Production Systems, Production Characteristics, Production System Characteristics, and issues in the design of Search Programs, additional problems. Generate-and-Test, Hill Climbing, Best-First Search, Problem Reduction, Constraint Satisfaction, Means-Ends Analysis.	8
Total Hours		40

Course Outcomes:

CO-1 Understand the concepts of computational intelligence like machine learning.

CO-2 Ability to get the skill to apply machine learning techniques to address the real time problems in different areas.

CO-3 Understand the Neural Networks and its usage in machine learning application.•

CO-4 Describe various searching methods and reasoning in AI.

CO-5 Uses of Knowledge Representation Techniques.

Text Book & Reference Books-

7. Machine Learning – Tom M. Mitchell, - MGH
8. Machine Learning: An Algorithmic Perspective, Stephen Marshland, Taylor & Francis
9. Artificial Intelligence -By Elaine Rich And Kevin Knight (2nd Edition) Tata Mcgraw-Hill
10. "PROLOG Programming For Artificial Intelligence" -By Ivan Bratko(Addison-Wesley

List/Links of e-learning resource

- https://nptel.ac.in/courses/106102220

Modes of Evaluation and Rubric

The evaluation modes consist of performance in two mid semester Tests, Quiz/Assignments, term work, end semester practical examination.

CO-PO Mapping:

COs	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_1	PO_{11}	PO_{12}	PSO1	PSO2
CO-1	1	1	2	1									1	2
CO-2	2	1	1	1	2								1	2
CO-3	2	1	2	1			1						1	1
CO-4	2	1	2	1										2
CO-5	2	1			1								1	

Recommendation by Board of studies on	
Approval by Academic council on	
Compiled and designed by	

Subject handled by department	Department of IT

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE

(Engineering College), VIDISHA M.P.

(An Autonomous Institute Affiliated to RGPV Bhopal)

DEPARTMENT OF CS & IT

Semester/Year		VII/IV	Program		B.Tech – Internet of Things
Subject Category	OC	Subject Code:	IO 505 OC- 3 (C)	Subject Name	Ad-hoc & Sensor Networks

Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			Total Marks				
ES	MS	Assignment	Quiz	ES	LW	Quiz		L	T	P	
60	20	10	10	-	-	-	100	3	0	0	3

Prerequisites:

Computer Networks, Mobile Computing

Course Objective:

- To understand the concepts of sensor networks.
- To understand the MAC and transport protocols for ad hoc networks.
- To understand the security of sensor networks.
- To understand the applications of adhoc and sensor networks.

UNITs	Descriptions	Hrs.
I	Introduction to Ad Hoc Networks - Characteristics of MANETs, Applications of MANETs and Challenges of MANETs. Routing in MANETs - Criteria for classification, Taxonomy of MANET routing algorithms, Topologybased routing algorithms-Proactive: DSDV; Reactive: DSR, AODV; Hybrid: ZRP; Position-based routing algorithms-Location Services-DREAM, Quorum-based; Forwarding Strategies: Greedy Packet, Restricted Directional Flooding-DREAM, LAR.	8
II	Data Transmission - Broadcast Storm Problem, Rebroadcasting Schemes-Simple-flooding, Probability-based Methods, Area-based Methods, Neighbor Knowledge-based: SBA, Multipoint Relaying, AHBP. Multicasting: Tree-based: AMRIS, MAODV; Mesh-based: ODMRP, CAMP; Hybrid: AMRoute, MCEDAR.	8
III	Geocasting: Data-transmission Oriented-LBM; Route Creation Oriented-GeoTORA, MGR. TCP over Ad Hoc TCP protocol overview, TCP and MANETs, Solutions for TCP over Ad hoc	8
IV	Basics of Wireless, Sensors and Lower Layer Issues: Applications, Classification of sensor networks, Architecture of sensor network, Physical layer, MAC layer, Link layer, Routing Layer.	8
V	Upper Layer Issues of WSN: Transport layer, High-level application layer support, Adapting to the inherent dynamic nature of WSNs, Sensor Networks and mobile robots.	8

Total Hours	40

Course Outcomes:

CO1: Ability to understand the state-of-the-art research in the emerging subject of Ad Hoc and Wireless Sensor Networks

CO2: Ability to solve the issues in real-time application development based on ASN.

CO3: Ability to conduct further research in the domain of ASN

CO4: Ability to understand layers

CO5: Understanding the concept of dynamic nature of WSNs.

Text Book & Reference Books-

3. Ad Hoc and Sensor Networks – Theory and Applications, Carlos Corderio Dharma P. Aggarwal, World Scientific Publications, March 2006, ISBN – 981–256–681–3.
4. Wireless Sensor Networks: An Information Processing Approach, Feng Zhao, Leonidas Guibas, Elsevier Science, ISBN – 978-1-55860-914-3 (Morgan Kauffman).

List/Links of e-learning resource

- https://archive.nptel.ac.in/courses/106/105/106105160/

Modes of Evaluation and Rubric

The evaluation modes consist of performance in two mid semester Tests, Quiz/Assignments, term work, end semester practical examination.

CO-PO Mapping:

COs	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_1	PO_{11}	PO_{12}	PSO1	PSO2
CO-1	1	2	2										1	2
CO-2	3	2	2	2									2	1
CO-3	3	2	2	2									2	1
CO-4	3	2	2	2									2	1
CO-5	2	2	1	1									1	2

Suggestive list of experiments:

Recommendation by Board of studies on	
Approval by Academic council on	
Compiled and designed by	
Subject handled by department	Department of IT

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE

(Engineering College), VIDISHA M.P.

(An Autonomous Institute Affiliated to RGPV Bhopal)

DEPARTMENT OF CS & IT

Semester/Year		VII/IV	Program		B.Tech – Internet of Things
Subject Category	DLC	Subject Code:	IO 506	Subject Name	IoT Lab

Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			Total Marks				
ES	MS	Assignment	Quiz	ES	LW	Quiz		L	T	P	
-	-	-	-	30	10	10	50	0	0	4	4

Prerequisites:

Computer Networks, Mobile Computing

Course Objective:

- To introduce the raspberry PI platform, that is widely used in IoT applications.
- To introduce the implementation of distance sensor on IoT devices.

UNITs	Descriptions	Hrs.
I	1. Using raspberry pi a. Calculate the distance using a distance sensor. b. Basic LED functionality. 2. Using Arduino a. Calculate the distance using a distance sensor. b. Basic LED functionality. c. Calculate temperature using a temperature sensor. 3. Using Node MCU a. Calculate the distance using a distance sensor. b. Basic LED functionality. c. Calculate temperature using a temperature sensor.	40
Total Hours		40

Course Outcomes:

CO1: Ability to introduce the concept of M2M (machine to machine) with necessary protocols and get awareness in implementation of distance sensor.

CO2: Get the skill to program using python scripting language which is used in many IoT devices.

Text Book & Reference Books-

1. Internet of Things - A Hands-on Approach, Arshdeep Bahga and Vijay Madisetti, Universities Press, 2015, ISBN: 9788173719547.
2. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014, ISBN: 9789350239759.

List/Links of e-learning resource

- https://archive.nptel.ac.in/courses/106/105/106105160/

Modes of Evaluation and Rubric

The evaluation modes consist of performance in two mid semester Tests, Quiz/Assignments, term work, end semester practical examination.

CO-PO Mapping:

COs	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_1	PO_{11}	PO_{12}	PSO1	PSO2
CO-1	1	2	2										1	2
CO-2	3	2	2	2									2	1
CO-3	3	2	2	2									2	1
CO-4	3	2	2	2									2	1
CO-5	2	2	1	1									1	2

Suggestive list of experiments:

Recommendation by Board of studies on	
Approval by Academic council on	
Compiled and designed by	
Subject handled by department	Department of IT

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE VIDISHA (M.P.)
(A Govt. Aided UGC Autonomous & NAAC Accredited Institute Affiliated to RGPV Bhopal)

Scheme of Examination (Semester-VI)

for Batch Admitted in session - 2022-23

Bachelor of Technology (B. Tech.) – Internet of Things

Subject Code	Subject Category	Subject Name	Maximum Marks Allotted								Contact Hrs. per week			Total Credits
			Theory				Practical			Total Marks				
			ES	MS	Assignment	Quiz	ES	LW	Quiz		L	T	P	
IO 601	DC	IoT Cloud Processing and Analytics	60	20	10	10	30	10	10	150	3	0	2	4
IO 602	DC	Programming Languages for IoT	60	20	10	10	30	10	10	150	3	0	2	4
IO 603	DE	DE-2	60	20	10	10				100	3	0	0	3
IO 604	DE	DE -3	60	20	10	10				100	3	1	0	4
OE 605	OC	OC – 4	60	20	10	10				100	3	0	0	3
IO 606	DLC	Lab View					30	10	10	50	0	0	2	1
IO 607	DLC	Minor Project					50	50		100	0	0	4	2
			300	**100**	**50**	**50**	**140**	**80**	**30**	**750**	**15**	**`1**	**10**	**21**
	ILC	Extracurricular Activities	It is a one credit per year activity endorse in eight semester mark sheet											
MST: Minimum two mid semester tests to be conducted during Semester														

	DE -2	DE -3	OC – 4
A	IoT Security	Mobile Application Development for IoT	IoT Cloud Processing and Analytics
B	Cryptography	Web Technology	Programming Languages for IoT
C	Information Theory and Coding	UI/UX	IoT Security

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE
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DEPARTMENT OF IT

Semester/Year	VI/III	Program	B.Tech – Internet of Things

Subject Category	DC	Subject Code:	IO 601	Subject Name	IoT Cloud Processing and Analytics

Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			Total Marks				
ES	MS	Assignment	Quiz	ES	LW	Quiz		L	T	P	
60	10	10	10	30	10	10	150	3	0	2	4

Prerequisites:

Course Objective:

Knowledge on IoT networking connectivity protocols and IoT Analytics for the cloud processing.

UNITs	Descriptions	Hrs.
I	IoT devices, Networking basics, IoT networking connectivity protocols, IoT networking data messaging protocols, Analyzing data to infer protocol and device characteristics.	**6**
II	IoT Analytics for the Cloud: Introduction to elastic analytics, Decouple key components, Cloud security and analytics, Designing data processing for analytics, Applying big data technology to storage.	8
III	Exploring IoT Data: Exploring and visualizing data, Techniques to understand data quality, Basic time series analysis, Statistical analysis.	8
IV	Data Science for IoT Analytics: Introduction to Machine Learning, Feature engineering with IoT data, Validation methods, Understanding the bias–variance tradeoff, Use cases for deep learning with IoT data.	10
V	Strategies to Organize Data for Analytics: Linked Analytical Datasets, Managing data lakes, data retention strategy.	8
Total Hours		40

Course Outcomes:

CO1:Implement the architectural components and protocols for application development

CO2:Identify data analytics and data visualization tools as per the problem characteristics.

CO3:Learning data exploration techniques.

CO4: To get to know the different data science techniques.

CO5: Form the strategies to organize data.

Text Book & Reference Books-

1. ArshdeepB ahga and Vijay Madisetti, “Internet of Things – A Hands on Approach”, Universities Press, 2015.
2. Kevin, Townsend, Carles, Cufí, Akiba and Robert Davidson, "Getting Started with Bluetooth Low Energy” O'Reilly.
3. Madhur Bhargava “IoT Projects with Bluetooth Low Energy, Packt Publishing, August 2017.
4. Robin Heydon,” Bluetooth Low Energy: The Developer's Handbook”, Pearson, October 2012
5. Kumar Saurabh,” Cloud Computing”, Wiley India, 1st Edition, 2016.

List/Links of e-learning resource

- https://archive.nptel.ac.in/courses/106/105/106105166/

Modes of Evaluation and Rubric

The evaluation modes consist of performance in two mid semester Tests, Quiz/Assignments, term work, end semester practical examination.

CO-PO Mapping:

COs	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_1	PO_{11}	PO_{12}	PSO1	PSO2
CO-1	3	1	2										1	2
CO-2	3	2	2	1									1	2
CO-3	3	2	2	1									2	1
CO-4	3	2	2	1									2	1
CO-5	3	2	1										1	1

Suggestive list of experiments:

1. Install Virtualbox/Vmware Workstation with different flavors of linux or windows OS on top of

windows7 or 8.

2. Install a C compiler in the virtual machine created using virtual box and execute Simple Programs
3. Install Google App Engine. Create a hello world app and other simple web applications using python/java.
4. Find a procedure to transfer the files from one virtual machine to another virtual machine.
5. Find a procedure to launch virtual machine using trystack (Online Openstack Demo Version)
6. Install Hadoop single node cluster and run simple applications like word count.

Recommendation by Board of studies on	
Approval by Academic council on	
Compiled and designed by	
Subject handled by department	Department of IT

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE
(Engineering College), VIDISHA M.P.
(An Autonomous Institute Affiliated to RGPV Bhopal)
DEPARTMENT OF IT

Semester/Year		VI/III	Program		B.Tech – Internet of Things
Subject Category	DC	Subject Code:	IO 602	Subject Name	Programming Languages for IoT

Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			Total Marks				
ES	MS	Assignment	Quiz	ES	LW	Quiz		L	T	P	
60	10	10	10	30	10	10	150	3	0	2	4

Prerequisites:

Course Objective:

1. This program aims to train students to be equipped with a solid theoretical foundation, Systematic professional knowledge and strong practical skills in the Raspberry Pi.
2. The course focuses on higher-level operating systems, advanced networking, user interfaces, Multimedia and uses more computing intensive IoT applications as examples using Raspberry Pi running Linux as the platform of choice.

UNITs	Descriptions	Hrs.
I	Getting Started with Raspberry Pi: Basic functionality of Raspberry Pi B+ board, setting up the board, configuration and use, booting Raspberry Pi 3, Downloading an Operating System, format an SD card and booting the OS, Interfacing Hardware with the Raspberry Pi, Raspberry Pi Remote Access, operates the Raspberry Pi in "headless mode", Bash Command line, operating Raspberry Pi without needing a GUI interface. Basics of Python programming language: Programming on the Raspberry Pi. Python on Raspberry Pi, Python Programming Environment, Python Expressions, Strings, Functions and Function arguments, Lists, List Methods, Control Flow.	**6**
II	**Introducing Micro Python:** MicroPython Features, MicroPython Limitations, Experimenting with Python on PC, Installing Python 3 on Windows 10, Running the Python Console, Running Python Programs with the Interpreter, The Run, Evaluate, Print Loop (REPL Console), Off and Running with MicroPython, Additional Hardware, Basic Electronics Kit, Breadboard and Jumper Wires and 3 Examples.	8
III	**IoT Physical Servers and Cloud Offerings:** Introduction to Cloud Storage models and communication APIs. Web Server – Web server for IoT, Cloud for IoT, Python web application framework. Designing a RESTful web API. Connecting to APIs.	8
IV	**Baking Pi:** Powering Raspberry Pi, Formatting SD cards, Installing and connecting Raspberry pi, How to tell Raspberry pi is working, Installing Raspbian with NOOBS, Networking Raspberry Pi, Connecting with Ethernet, Connecting Via Local Computer Network, Connecting Via Wireless Network, Updating and Upgrading, Setting up a Host Name, Connecting Raspberry pi with SSH, Creating Simple Raspberry pi application.	10
V	**FIRST Project on Java:** Bill of Materials, Getting Started with NetBeans, Downloading and Configuring NetBeans, Revisiting HelloRaspberryPi, Brewing Java, Communicating with a USB Scale, Coffee Calculator, Asynchronous Communication, Coffee Brewing Recipe, Commercial Licensing.	8
Total Hours		40

Course Outcomes:

CO1: Knowing the fundamentals of R- Pi
CO2: Understanding the basi concepts of MicroPython.
CO3: Understanding the cloud server and web server.
CO4: To get to know the working of R-Pi
CO5: Understanding the concepts of NetBeans.

Text Book & Reference Books-

1. Simon Monk, "Programming the Raspberry Pi: Getting Started with Python", January 2012, McGraw Hill Professional.
2. MicroPython for the Internet of Things, A Beginner's Guide to Programming with Python on Microcontrollers, Charles Bell, Apress.
3. Raspberry Pi with Java: Programming the Internet of Things (IoT) (Oracle Press) 1st Edition.
4. Eben Upton and Gareth Halfacree, "Raspberry Pi User Guide", August 2016, 4th edition, John Wiley & Sons
5. Alex Bradbury and Ben Everard, "Learning Python with Raspberry Pi", Feb 2014, JohnWiley & Sons
6. Michael Margolis, "Arduino Cookbook", First Edition, March 2011, O'Reilly Media, Inc
7. The official raspberry Pi Projects Book,

List/Links of e-learning resource

- https://archive.nptel.ac.in/courses/106/105/106105166/

Modes of Evaluation and Rubric

The evaluation modes consist of performance in two mid semester Tests, Quiz/Assignments, term work, end semester practical examination.

CO-PO Mapping:

COs	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_1	PO_{11}	PO_{12}	PSO1	PSO2
CO-1	3	1	2										1	2
CO-2	3	1	2	1									1	2
CO-3	3	2	2	1									2	1
CO-4	3	1	2	1									2	1
CO-5	3		1										1	1

Suggestive list of experiments:

1. Program to On Board blink LED
2. Program to blink External LED
3. Program to Control LED using Button
4. Program for Boot Button LED
5. Program to Get input from two switches and switch on corresponding LEDs.
6. Program to Flash an LED at a given on time and off time cycle, where the two times are taken from a file.
7. Program to read Buntton 35
8. Program to Switch on a relay at a given time using sleep function, where the relay's contact terminals are connected to a load.
9. Program for Buzzer
10. Program for Thermistor

Recommendation by Board of studies on	
Approval by Academic council on	
Compiled and designed by	
Subject handled by department	Department of IT

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE
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DEPARTMENT OF IT

Semester/Year		V/III	Program		B.Tech – Internet of Things							
Subject Category	DE	Subject Code:	IO 603 DE -2A	Subject Name	IoT Security							
Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			Total Marks				
ES	MS	Assignment	Quiz	ES	LW	Quiz		L	T	P	
60	20	10	10				100	3	-	-	3

Prerequisites:

Course Objective:

1. Understand the fundamentals, various attacks and importance of Security aspects in IoT.
2. Understand the techniques, protocols and some idea on security towards Gaming models.
3. Understand the operations of Bitcoinblockchain, crypto-currency as application of blockchain technology.
4. Understand the essential components of IoT.
5. Understand security and privacy challenges of IoT.

UNITs	Descriptions	Hrs.
I	Fundamentals of IoT and Security and its need, Prevent Unauthorized Access to Sensor Data, Block ciphers, Introduction to Blockchain, Introduction of IoT devices, IoT Security Requirements, M2M Security, Message integrity, Modeling faults and adversaries, Difference among IoT devices, computers, and embedded devices.	**6**
II	IoT and cyber-physical systems RFID Security, Authenticated encryption Byzantine Generals problem sensors and actuators in IoT. IoT security (vulnerabilities, attacks, and countermeasures), Cyber Physical Object Security, Hash functions, Consensus algorithms and their scalability problems, Accelerometer, photoresistor, buttons.	8
III	Security engineering for IoT development Hardware Security, Merkle trees and Elliptic curves digital signatures, verifiable random functions, Zero-knowledge systems motor, LED, vibrator. IoT security lifecycle, Front-end System Privacy Protection, Management, Secure IoT Databases, Public-key crypto (PKI), blockchain, the challenges, and solutions, analog signal vs. digital signal.	8
IV	Data Privacy Networking Function Security Trees signature algorithms proof of work, Proof of stake, Networking in IoT, Device/User Authentication in IoTIoT Networking Protocols, Crypto-currencies, alternatives to Bitcoin consensus, Bitcoin scripting language and their use Real-time communication.	10
V	Introduction to Authentication Techniques Secure IoT Lower Layers, Bitcoin P2P network, Ethereum and Smart Contracts, Bandwidth efficiency, Data Trustworthiness in IoT Secure IoT Higher Layers, Distributed consensus, Smart Contract Languages and verification challenges data analytics in IoT - simple data analyzing methods.	8
Total Hours		40

Course Outcomes:

CO1: Incorporate the best practices learnt to identify the attacks and mitigate the same.
CO2: Adopt the right security techniques and protocols during the design of IoT products.
CO3: Assimilate and apply the skills learnt on ciphers and block chains when appropriate.
CO4: Describe the essential components of IoT.
CO5: Find appropriate security/privacy solutions for IoT.

Text Book & Reference Books-

1. B. Russell and D. Van Duren, “Practical Internet of Things Security,” Packt Publishing, 2016.
2. FeiHU, “Security and Privacy in Internet of Things (IoTs): Models, Algorithms, and Implementations”, CRC Press, 2016.
3. Narayanan et al., “Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction,”
4. Princeton University Press, 2016.
5. A. Antonopoulos, “Mastering Bitcoin: Unlocking Digital Cryptocurrencies,” O’Reilly, 2014.
6. T. Alpcan and T. Basar, “Network Security: A Decision and Game-theoretic Approach,”
7. Cambridge University Press, 2011.
8. Security and the IoT ecosystem, KPMG International, 2015.
9. Internet of Things: IoT Governance, Privacy and Security Issues” by European Research Cluster.
10. Ollie Whitehouse, “Security of Things: An Implementers' Guide to Cyber-Security for Internet of Things Devices and Beyond”, NCC Group, 2014
11. Josh Thompson, ‘Blockchain: The Blockchain for Beginnings, Guide to Blockchain Technologyand Blockchain Programming’, Create Space Independent Publishing Platform, 2017.

List/Links of e-learning resource

- https://archive.nptel.ac.in/courses/106/106/106106129/

Modes of Evaluation and Rubric

The evaluation modes consist of performance in two mid semester Tests, Quiz/Assignments, term work, end semester practical examination.

CO-PO Mapping:

COs	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_1	PO_{11}	PO_{12}	PSO1	PSO2
CO-1	3	1	2										1	2
CO-2	3	2	1	1									1	2
CO-3	3	2	1	1									2	1
CO-4	3	2	2	1									2	1
CO-5	3	2	1										1	1

Suggestive list of experiments:

Recommendation by Board of studies on	
Approval by Academic council on	
Compiled and designed by	
Subject handled by department	Department of IT

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE
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DEPARTMENT OF IT

Semester/Year		VI/III	Program		B.Tech – Internet of Things
Subject Category	DE	Subject Code:	IO 603 DE -2B	Subject Name	Cryptography

Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			Total Marks				
ES	MS	Assignment	Quiz	ES	LW	Quiz		L	T	P	
60	20	10	10				100	3	-	-	3

Prerequisites:

Course Objective:

1. Gain in-depth knowledge on Lightweight Cryptography and its relation to the new security in RFID tags.
2. Apply proactive and defensive measures to counter potential threats, attacks and intrusions.

UNITs	Descriptions	Hrs.
I	**Anti-counterfeiting and RFID** - Anti-Counterfeiting and Supply Chain Security, Networked RFID Systems, PC Network Architecture, A Security Primer.	**6**
II	**Security and Privacy Current Status -** Addressing Insecurities and Violations of Privacy, RFID Tag Vulnerabilities in RFID Systems, From Identification to Authentication – A Review of RFID Product Authentication Techniques.	8
III	**Network Based Solutions** - EPC System for a Safe & Secure Supply Chain and How it is Applied, The Potential of RFID and NFC in Anti-Counterfeiting, Improving the Safety and Security of the Pharmaceutical Supply Chain.	8
IV	**Cryptographic Solutions** - Product Specific Security Based on RFID Technology, Strengthening the Security of Machine-Readable Documents, Enhancing Security of Class I Generation 2 RFID against Traceability and Cloning.	10
V	**Low-cost Cryptographic Solutions**: A Random Number Generator for Application in RFID Tags, A Low-Cost Solution to Cloning and Authentication Based on a Lightweight Primitive, Lightweight Cryptography for Low Cost RFID.	8
Total Hours		40

Course Outcomes:

CO1: Ability to learn Cryptographic based solutions, attacks and intrusions.
CO2: Understand security and privacy issues in radio frequency identification (RFID) systems.
CO3: Understanding multiple ways to attack and defend in industrial systems.
CO4: Understanding the concepts of basics of cryptography solutions.
CO5: Application of low cost cryptography solutions.

Text Book & Reference Books-

1. Internet of Things - A Hands-on Approach, ArshdeepBahga and Vijay Madisetti, Universities Press, 2015, ISBN: 9788173719547
2. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014, ISBN: 9789350239759
3. Jonathan Rodriguez, "Fundamentals of 5G Mobile Networks", John Wiley & Sons.
4. AmitabhaGhosh and RapeepatRatasuk "Essentials of LTE and LTE-A", Cambridge University Press.
5. Athanasios G. Kanatos, Konstantina S. Nikita, PanagiotisMathiopoulos, "New Directions in Wireless Communication Systems from Mobile to 5G", CRC Press.

6. Theodore S. Rappaport, Robert W. Heath, Robert C. Danials, James N. Murdock "Millimeter Wave Wireless Communications", Prentice Hall Communications.

List/Links of e-learning resource

- https://archive.nptel.ac.in/courses/106/105/106105162/

Modes of Evaluation and Rubric

The evaluation modes consist of performance in two mid semester Tests, Quiz/Assignments, term work, end semester practical examination.

CO-PO Mapping:

COs	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_1	PO_{11}	PO_{12}	PSO1	PSO2
CO-1	3	2	2										1	2
CO-2	3	1	2	1									1	2
CO-3	3	1	2	1									2	1
CO-4	3	2	2	1									2	1
CO-5	3	2	1										1	1

Suggestive list of experiments:

Recommendation by Board of studies on	
Approval by Academic council on	
Compiled and designed by	
Subject handled by department	Department of IT

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE
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DEPARTMENT OF IT

Semester/Year		VI/III	Program		B.Tech – IT
Subject Category	DE	Subject Code:	IO 603 DE –2C	Subject Name	Information Theory & Coding

Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			Total Marks				
ES	MS	Assignment	Quiz	ES	LW	Quiz		L	T	P	
60	20	10	10				100	3	0	0	3

Prerequisites:

Basic Knowledge of probability.

Course Objective:

- To understand Information properties and source coding techniques.
- To acquire knowledge about error coding techniques for efficient transmission.
- To understand various compression algorithms for data, Image and video.

UNITs	Descriptions	Hrs.
I	Information–Entropy-Information rate-classification of codes – Kraft McMillanine quality-Source coding theorem–Shannon – Fano coding – Huffman coding–Extended, Huffman coding – Joint and conditional entropies-Mutual information-Discrete memory less channels–BSC- BEC – Channel capacity-Shannon limit.	8
II	Text: Adaptive Huffman Coding – Arithmetic Coding – LZW algorithm– Audio: Perceptual coding-Masking techniques – Psychoacousticmodel-MEGAudiolayersI,II,III,DolbyAC3- Speech: Channel Vocoder-Linear Predictive Coding.	8
III	Image and Video Formats–GIF–TIFF– SIF–CIF – QCIF–Image compression: READ- JPEG – Video Compression: Principles-I, B, P frames - Motion estimation - Motion compensation - H.261 -MPEG standard.	8
IV	Definitions and Principles: Hamming weight-Hamming distance-Minimum distance decoding –Single parity codes – Hamming codes – Repetition codes – Linear block codes – Cyclic codes –Syndrome calculation-Encoder and decoder– Cyclic Redundancy check codes.	8
V	Convolutional codes–code tree–trellis-state diagram-Encoding–Decoding: Sequential search and Viterbi algorithm– Principle of Turbo coding.	8
Total Hours		40

Course Outcomes:

CO-1: Apply the suitable coding schemes for information..
CO2: Make use of coding schemes for text compression**.**
CO-3: Illustrate the compression schemes for video and image. .
CO-4: Utilize the various types of error control codes**.**
CO-5: Construct the code tree and state diagram for error control codes.

Text Book & Reference Books-

1. Ranjan Bose, “Information Theory, Coding and Cryptography”, Tata McGraw Hill, 2nd edition.
2. P.S. Satyanarayana, “Concepts of Information Theory and Coding”, Dynaram Publication, 2005
3. Richard B. Wells, “Applied Coding and Information Theory for Engineers” Pearson Education, LPE 2004.
4. Shu Lin and Daniel Castello, “Error Control Coding – Fundamentals and Applications”, second

edition 2004

5. Thomas M Cover, Joy Thomas, "Elements of Information Theory", MGH 2006.

List/Links of e-learning resource

- https://archive.nptel.ac.in

Modes of Evaluation and Rubric

The evaluation modes consist of performance in two mid semester Tests, Quiz/Assignments, term work, end semester practical examination.

CO-PO Mapping:

COs	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_1	PO_{11}	PO_{12}	PSO1	PSO2
CO-1	3	3	2	3	1							2	3	1
CO-2		2	3	2	3									
CO-3	2	1	2	3	2								1	
CO-4		2	3	2								1		2
CO-5		1	2	3									2	

Suggestive list of experiments:

Recommendation by Board of studies on	
Approval by Academic council on	
Compiled and designed by	
Subject handled by department	Department of IT

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE
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DEPARTMENT OF IT

Semester/Year		VI/III	Program		B.Tech – Internet of Things
Subject Category	DE	Subject Code:	IO 604 DE – 3A	Subject Name	Mobile Application Development for IoT

Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			Total Marks				
ES	MS	Assignment	Quiz	ES	LW	Quiz		L	T	P	
60	20	10	10				100	3	0	0	3

Prerequisites:

Course Objective:

Students will learn mobile application development for Internet of Things (IoT) devices.

UNITs	Descriptions	Hrs.
I	IoT Product Conceptualization: IoT Product Development Lifecycle, IoT Product Conceptualizations IoT Programming Fundamentals: Getting Started, IoT Programming setup for LED flashing, Program to display message on screen, Program to read LDR level and display on screen, Android APK to perform read write operation, Particle android APK to control LED intensity, LED switching with HTML interface, Cloud based motion detection, Displaying temperature sensor data on terminal, Publishing sensor values on the cloud, Performing computation on sensor values.	**6**
II	**IoT Programming Applications:** Gas level detection using MQ2 sensor, Blink Android Application for controlling LED from mobile, Integration of Temperature and Gas Sensor with Blynk Mobile Application, Printing real-time Date and Time values on serial terminal, Display temperature value on serial terminal, Display temperature values on 16*2 LCD display Interfacing: Interfacing of Nokia 5110 display, display image on Nokia 5110, Particle Electron displaying battery charging level status, GPS tracking device interface to get coordinates.	8
III	**IoT Product Hardware Development:** Product realization, Connection diagram of IoT product, Engineering board development, Product board customization and optimization, Flowchart of IoT warehouse monitoring system, Wireless communication between the multiple kits, Particle cloud IDE.	8
IV	**IoT Advance Wireless Interfaces:** Bluetooth communication between master and slave module, Data visualization on ThingSpeak cloud using webhook services, Storing data into google excel sheet and sending the sheets to emails.	10
V	**IoT Production System:** IoT Warehouse Monitoring System, IoT Product Packaging, Future of IoT Product Development.	8
Total Hours		40

Course Outcomes:

CO1: Understand significance of IoT programming fundamentals.
CO2: Understand and analyzeIoT programming applications.
CO3: Develops IoT applications using standardized hardware.
CO4: Discuss concepts of IoT Advance Wireless Interfaces and IoT Production System.
CO5: To get the basics of production system.

Text Book & Reference Books-

1. IoT Product Development with Programming: Stepwise programming approach with Particle Development board Kindle Edition by Mahesh Jadhav and TejasSarangPatil.
2. Kale, Vivek. Parallel Computing Architectures and APIs: IoT Big Data Stream Processing 1st edition, CRC Press, 2019.
3. IoT Product Development with Programming: Stepwise programming approach with Particle Development board Kindle Edition by Mahesh Jadhav and TejasSarangPatil.

List/Links of e-learning resource

- https://archive.nptel.ac.in/courses/106/106/106106156/

Modes of Evaluation and Rubric

The evaluation modes consist of performance in two mid semester Tests, Quiz/Assignments, term work, end semester practical examination.

CO-PO Mapping:

COs	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_1	PO_{11}	PO_{12}	PSO1	PSO2
CO-1	2	1	2										1	2
CO-2	3	2	2	1									1	2
CO-3	3	2	2	1									2	1
CO-4	3	2	2	1									2	1
CO-5	2	2	1										1	1

Suggestive list of experiments:

Recommendation by Board of studies on	
Approval by Academic council on	
Compiled and designed by	
Subject handled by department	Department of IT

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE
(Engineering College), VIDISHA M.P.
(An Autonomous Institute Affiliated to RGPV Bhopal)
DEPARTMENT OF IT

Semester/Year		VI/III		Program			B.Tech – Internet of Things				
Subject Category	DE	Subject Code:		IO 604 DE – 3B	Subject Name		Web Engineering				
Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			Total Marks				
ES	MS	Assignment	Quiz	ES	LW	Quiz		L	T	P	
60	20	10	10	-	-	-	100	3	1	0	4

Prerequisites:

Course Objective:

- Understand the characteristics of web applications
- Learn to Model web applications
- Be aware of Systematic methods
- Be familiar with the testing techniques for web applications

UNITs	Descriptions	Hrs.
I	**Introduction To Web Engineering And Requirements Engineering**, Motivation, Categories of Web Applications, Characteristics of Web Applications, Product-related Characteristics, Usage related Characteristics, Development-related Characteristic, Evolution of web engineering – Requirements Engineering Activities RE Specifics in Web Engineering, Principles for RE of Web Applications, Adapting RE Methods to Web Application Development, Requirement Types, Notations, Tools	8
II	**Web Application Architectures &Modelling WebApplications:** Introduction- Categorizing Architectures, Specifics of Web Application Architectures, Components of a Generic Web Application Architecture, Layered Architectures, 2-Layer Architectures, N-Layer Architectures Data-aspect Architectures, Database-centric Architectures, Architectures for Web Document Management, Architectures for Multimedia Data Modeling Specifics in Web Engineering, Levels, Aspects, Phases Customization, Modeling Requirements, Hypertext Modeling, Hypertext Structure Modeling Concepts.	8
III	**Web Application Design** Introduction, Web Design from an Evolutionary Perspective, Information Design, Software Design: A Programming Activity, Merging Information Design and Software Design, Problems and Restrictions in Integrated Web Design, A Proposed Structural Approach, Presentation Design, Presentation of Nodes and Meshes, Device-independent Development, Approaches, Inter action Design, User Interaction User Interface Organization, Navigation Design, Designing a Link Representation, Designing Link Internals, Navigation and Orientation, Structured Dialog for Complex Activities, Interplay with Technology and Architecture, Functional Design.	8
IV	**TESTING WEB APPLICATIONS** Introduction, Fundamentals, Terminology, Quality Characteristics, Test Objectives, Test Levels, Role of the Tester, Test Specifics in Web Engineering, Test Approaches, Conventional Approaches, Agile Approaches, Test Scheme, Three Test Dimensions, Applying the Scheme to Web Applications, Test Methods and Techniques, Link Testing, Browser Testing, Usability Testing, Load, Stress, and Continuous Testing, Testing Security, Test-driven Development, Test Automation, Benefits and Drawbacks of Automated Test, Test Tools.	8
V	**WEB PROJECT MANAGEMENT** Understanding Scope, Refining Framework Activities, Building a Web Team, Managing Risk, Developing a Schedule, Managing Quality, Managing Change, Tracking the Project. Introduction to node JS – web sockets.	8

Total Hours	40

Course Outcomes:

CO-1: Understand and apply the characteristics of web applications by requirements engineering.
CO-2: Categorizing web architecture and model web applications.
CO-3: Design and development of web applications.
CO-4: Applying various test on web applications.
CO-5: Scope and utility of web project management.

Text Book

1.Gerti Kappel, Birgit Proll, "Web Engineering", John Wiley and Sons Ltd.

Reference Books

1. Roger S. Pressman, David Lowe, "Web Engineering", Tata McGraw Hill Publication.
2. Guy W. Lecky-Thompson, "Web Programming", Cengage Learning.
3. Chris Bates, "Web Programming: Building Internet Applications", Third Edition, Wiley India Edition.
4. John Paul Mueller, "Web Development with Microsoft Visual Studio 2005", Wiley Dream Tech.

List/Links of e-learning resource

- https://nptel.ac.in/courses/106105084

Modes of Evaluation and Rubric

The evaluation modes consist of performance in two mid semester Tests, Quiz/Assignments, term work, end semester practical examination.

CO-PO Mapping:

COs	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_1	PO_{11}	PO_{12}	PSO1	PSO2
CO-1	2	1	2										1	2
CO-2	3	2	2	1									1	2
CO-3	3	2	2	1									1	2
CO-4	3	2	2	1										2
CO-5	2	2	1										1	2

Suggestive list of experiments:

1. Design the following static web pages required for an online book store web site. 1) HOME PAGE: The static home page must contain three frames. 2) LOGIN PAGE 3) CATOLOGUE PAGE: The catalogue page should contain the details of all the books available in the web site in a table. 4) REGISTRATION PAGE
2. Write JavaScript to validate the following fields of the Registration page. 1. First Name (Name should contains alphabets and the length should not be less than 6 characters). 2. Password (Password should not be less than 6 characters length). 3. E-mail id (should not contain any invalid and must follow the standard pattern name@domain.com) 4. Mobile Number (Phone number should contain 10 digits only). 5. Last Name and Address (should not be Empty).
3. Develop and demonstrate the usage of inline, internal and external style sheet using CSS
4. Develop and demonstrate JavaScript with POP-UP boxes and functions for the following problems: a) Input: Click on Display Date button using onclick( ) function Output: Display date in the textbox b) Input: A number n obtained using prompt Output: Factorial of n number using alert c) Input: A number n obtained using prompt Output: A multiplication table of numbers from 1 to 10 of n using alert d) Input: A number n obtained using prompt and add another number using confirm Output: Sum of the entire n numbers using alert
5. Write an HTML page that contains a selection box with a list of 5 countries. When the user selects a country, its capital should be printed next in the list. Add CSS to customize the properties of the font of the capital (color, bold and font size).
6. Write an HTML page including any required JavaScript that takes a number from text field in the range of 0 to 999 and shows it in words. It should not accept four and above digits, alphabets and special characters.
7. Develop and demonstrate PHP Script for the following problems: a) Write a PHP Script to find out the Sum of the Individual Digits. b) Write a PHP Script to check whether the given number is Palindrome or not
8. Create an XML document that contains 10 users information. Write a Java Program, which takes User Id as input and returns the user details by taking the user information from XML document using DOM parser or SAX parser.

Recommendation by Board of studies on	
Approval by Academic council on	
Compiled and designed by	
Subject handled by department	Department of IT

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE
(Engineering College), VIDISHA M.P.
(An Autonomous Institute Affiliated to RGPV Bhopal)
DEPARTMENT OF CS & IT

Semester/Year		VI/III		Program		B.Tech – Internet of Things					
Subject Category	DE	Subject Code:		IO 604 DE – 3C	Subject Name	UI/UX					
Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			Total Marks				
ES	MS	Assignment	Quiz	ES	LW	Quiz		L	T	P	
60	20	10	10	-	-	-	100	3	1	0	4

Prerequisites:

Knowledge of computer programming with any programming language like C/C++, Java.

Course Objective:

- The aim of the UI/UX course is to provide students with the knowledge of user- centered design, user-cantered methods in design, graphic design on screens, simulation and prototyping techniques.
- Also usability testing methods, interface technologies and user centered design in corporate perspective.

UNITs	Descriptions	Hrs.
I	Introduction to the UI: What is User Interface Design (UI) -The Relationship Between UI and UX, Roles in UI/UX, A Brief Historical Overview of Interface Design, Interface Conventions, Approaches to Screen Based UI, Template vs Content, Formal Elements of Interface Design, Active Elements of Interface Design, Composing the Elements of Interface Design, UI Design Process, Visual Communication design component in Interface Design.	7
II	Introduction to UX: UX Basics- Foundation of UX design, Good and poor design, Understanding Your Users, Designing the Experience Elements of user Experience, Visual Design Principles, Functional Layout, Interaction design.	7
III	Introduction to the Interface, Navigation Design, User Testing, Developing and Releasing Your Design.	7
IV	UI/ UX Design Tools: User Study- Interviews, writing personas: user and device personas, User Context, Building Low Fidelity Wireframe and High-Fidelity Polished Wireframe Using wire framing Tools, Creating the working Prototype using Prototyping tools, Sharing and Exporting Design.	7
V	Information and Data Study: Understanding and collection of data, methods of collecting data, tools for collecting data, analysing data, using data analytics tools like Google analytics for user experience, heat mapping tools.	7
Total Hours		35

Course Outcomes:

CO1: Understand iterative user-centered design of graphical user interfaces.
CO2: Apply the user Interfaces to different devices and requirements.
CO3: Create high quality professional documents and artifacts related to the design process.
CO4: Students are capable of programming using mainstream programming languages, can conduct fine software-engineering practices to implement problem-solving schemes as correct, efficient, and well-structured programs
CO5: Students have the logical, algorithmic, andmathematical capability to model and analyze real-world problems in different application domains

Text Book &

1. A Project Guide to UX Design: For user experience designers in the field or in the making (2nd. ed.). Russ Unger and Carolyn Chandler. New Riders Publishing, USA, 2012..

Reference Books

1. The Elements of User Experience: User-Centered Design for the Web and Beyond, Second Edition Jesse James Garrett, Pearson Education. 2011
2. The Essential Guide to User Interface Design: An Introduction to GUI Design Principles and Techniques, Third Edition Wilbert O. Galitz , Wiley Publishing, 2007.
3. The UX Book Process and Guidelines for Ensuring a Quality User Experience, Rex Hartson and Pardha S. Pyla, Elsevier, 2012.

List/Links of e-learning resource

- https://onlinecourses.nptel.ac.in/noc21_ar05/preview

Modes of Evaluation and Rubric

The evaluation modes consist of performance in two mid semester Tests, Quiz/Assignments, term work, end semester practical

examination.

CO-PO Mapping:

COs	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_1	PO_{11}	PO_{12}	PSO1	PSO2
CO-1	3	2	1			1							1	2
CO-2	3	2	1										1	2
CO-3	3	2	1							1				1
CO-4	3	2	1	1	1			1						1
CO-5	3	2	1										1	1

Recommendation by Board of studies on	
Approval by Academic council on	
Compiled and designed by	
Subject handled by department	Department of CS & IT

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE
(Engineering College), VIDISHA M.P.
(An Autonomous Institute Affiliated to RGPV Bhopal)
DEPARTMENT OF IT

Semester/Year		VI/III	Program		B.Tech – Internet of Things
Subject Category	OE	Subject Code:	OE 605 OE – 4A	Subject Name	IoT Cloud Processing and Analytics

Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			Total Marks				
ES	MS	Assignment	Quiz	ES	LW	Quiz		L	T	P	
60	10	10	10				100	3	0	0	3

Prerequisites:

Course Objective:

Knowledge on IoT networking connectivity protocols and IoT Analytics for the cloud processing.

UNITs	Descriptions	Hrs.
I	IoT devices, Networking basics, IoT networking connectivity protocols, IoT networking data messaging protocols, Analyzing data to infer protocol and device characteristics.	**6**
II	IoT Analytics for the Cloud: Introduction to elastic analytics, Decouple key components, Cloud security and analytics, Designing data processing for analytics, Applying big data technology to storage.	8
III	Exploring IoT Data: Exploring and visualizing data, Techniques to understand data quality, Basic time series analysis, Statistical analysis.	8
IV	Data Science for IoT Analytics: Introduction to Machine Learning, Feature engineering with IoT data, Validation methods, Understanding the bias–variance tradeoff, Use cases for deep learning with IoT data.	10
V	Strategies to Organize Data for Analytics: Linked Analytical Datasets, Managing data lakes, data retention strategy.	8
Total Hours		40

Course Outcomes:

CO1: Implement the architectural components and protocols for application development
CO2: Identify data analytics and data visualization tools as per the problem characteristics.
CO3: Learning data exploration techniques.
CO4: To get to know the different data science techniques.
CO5: Form the strategies to organize data.

Text Book & Reference Books-

6. ArshdeepBahga and Vijay Madisetti, “Internet of Things – A Hands on Approach”, Universities Press, 2015.
7. Kevin, Townsend, Carles, Cufí, Akiba and Robert Davidson, "Getting Started with Bluetooth Low Energy” O'Reilly.
8. MadhurBhargava “IoT Projects with Bluetooth Low Energy, Packt Publishing, August 2017.
9. Robin Heydon,” Bluetooth Low Energy: The Developer's Handbook”, Pearson, October 2012
10. Kumar Saurabh,” Cloud Computing”, Wiley India, 1st Edition, 2016.

List/Links of e-learning resource

- https://archive.nptel.ac.in/courses/106/105/106105166/

Modes of Evaluation and Rubric

The evaluation modes consist of performance in two mid semester Tests, Quiz/Assignments, term work, end semester practical examination.

CO-PO Mapping:

COs	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_1	PO_{11}	PO_{12}	PSO1	PSO2
CO-1	3	1	2										1	2
CO-2	3	2	2	1									1	2
CO-3	3	2	2	1									2	1

CO-4	**3**	**2**	**2**	**1**									**2**	**1**
CO-5	**3**	**2**	**1**										**1**	**1**

Suggestive list of experiments:	
Recommendation by Board of studies on	
Approval by Academic council on	
Compiled and designed by	
Subject handled by department	Department of IT

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE
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DEPARTMENT OF IT

Semester/Year		VI/III	Program		B.Tech – Internet of Things
Subject Category	OE	Subject Code:	OE 605 OE – 4B	Subject Name	Programming Languages for IoT

Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			Total Marks				
ES	MS	Assignment	Quiz	ES	LW	Quiz		L	T	P	
60	10	10	10				100	3	0	0	3

Prerequisites:

Course Objective:

- This program aims to train students to be equipped with a solid theoretical foundation, systematic professional knowledge and strong practical skills in the Raspberry Pi.
- The course focuses on higher-level operating systems, advanced networking, user interfaces, multimedia and uses more computing intensive IoT applications as examples using Raspberry Pi running Linux as the platform of choice.

UNITs	Descriptions	Hrs.
I	Getting Started with Raspberry Pi: Basic functionality of Raspberry Pi B+ board, setting up the board, configuration and use, booting Raspberry Pi 3, Downloading an Operating System, format an SD card and booting the OS, Interfacing Hardware with the Raspberry Pi, Raspberry Pi Remote Access, operates the Raspberry Pi in "headless mode", Bash Command line, operating Raspberry Pi without needing a GUI interface. Basics of Python programming language: Programming on the Raspberry Pi. Python on Raspberry Pi, Python Programming Environment, Python Expressions, Strings, Functions and Function arguments, Lists, List Methods, Control Flow.	**6**
II	**Introducing Micro Python:** MicroPython Features, MicroPython Limitations, Experimenting with Python on PC, Installing Python 3 on Windows 10, Running the Python Console, Running Python Programs with the Interpreter, The Run, Evaluate, Print Loop (REPL Console), Off and Running with MicroPython, Additional Hardware, Basic Electronics Kit, Breadboard and Jumper Wires and 3 Examples.	8
III	**IoT Physical Servers and Cloud Offerings:** Introduction to Cloud Storage models and communication APIs. Web Server – Web server for IoT, Cloud for IoT, Python web application framework. Designing a RESTful web API. Connecting to APIs.	8
IV	**Baking Pi:** Powering Raspberry Pi, Formatting SD cards, Installing and connecting Raspberry pi, How to tell Raspberry pi is working, Installing Raspbian with NOOBS, Networking Raspberry Pi, Connecting with Ethernet, Connecting Via Local Computer Network, Connecting Via Wireless Network, Updating and Upgrading, Setting up a Host Name, Connecting Raspberry pi with SSH, Creating Simple Raspberry pi application.	10
V	**FIRST Project on Java:** Bill of Materials, Getting Started with NetBeans, Downloading and Configuring NetBeans, Revisiting HelloRaspberryPi, Brewing Java, Communicating with a USB Scale, Coffee Calculator, Asynchronous Communication, Coffee Brewing Recipe, Commercial Licensing.	8
Total Hours		40

Course Outcomes:

CO1: Knowing the fundamentals of R- Pi
CO2: Understanding the basi concepts of MicroPython.
CO3: Understanding the cloud server and web server.
CO4: To get to know the working of R-Pi
CO5: Understanding the concepts of NetBeans.

Text Book & Reference Books-

1. Simon Monk, "Programming the Raspberry Pi: Getting Started with Python", January 2012, McGraw Hill Professional.
2. MicroPython for the Internet of Things, A Beginner's Guide to Programming with Python on Microcontrollers, Charles Bell, Apress.
3. Raspberry Pi with Java: Programming the Internet of Things (IoT) (Oracle Press) 1st Edition.
4. Eben Upton and Gareth Halfacree, "Raspberry Pi User Guide", August 2016, 4th edition, John Wiley & Sons
5. Alex Bradbury and Ben Everard, "Learning Python with Raspberry Pi", Feb 2014, JohnWiley& Sons
6. Michael Margolis, "Arduino Cookbook", First Edition, March 2011, O'Reilly Media, Inc
7. The official raspberry Pi Projects Book,

List/Links of e-learning resource

- https://archive.nptel.ac.in/courses/106/105/106105166/

Modes of Evaluation and Rubric

The evaluation modes consist of performance in two mid semester Tests, Quiz/Assignments, term work, end semester practical examination.

CO-PO Mapping:

COs	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_1	PO_{11}	PO_{12}	PSO1	PSO2
CO-1	3	1	2										1	2
CO-2	3	1	2	1									1	2
CO-3	3	2	2	1									2	1
CO-4	3	1	2	1									2	1
CO-5	3		1										1	1

Suggestive list of experiments:

Recommendation by Board of studies on	
Approval by Academic council on	
Compiled and designed by	
Subject handled by department	Department of IT

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE
(Engineering College), VIDISHA M.P.
(An Autonomous Institute Affiliated to RGPV Bhopal)
DEPARTMENT OF IT

Semester/Year		V/III	Program		B.Tech – Internet of Things						
Subject Category	OE	Subject Code:	OE 605 OE – 4C	Subject Name	IoT Security						
Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			Total Marks				
ES	MS	Assignment	Quiz	ES	LW	Quiz		L	T	P	
60	20	10	10				100	3	-	-	3

Prerequisites:

Course Objective:

- Understand the fundamentals, various attacks and importance of Security aspects in IoT.
- Understand the techniques, protocols and some idea on security towards Gaming models.
- Understand the operations of Bitcoinblockchain, crypto-currency as application of blockchain
- technology.
- Understand the essential components of IoT.
- Understand security and privacy challenges of IoT.

UNITs	Descriptions	Hrs.
I	Fundamentals of IoT and Security and its need, Prevent Unauthorized Access to Sensor Data, Block ciphers, Introduction to Blockchain, Introduction of IoT devices, IoT Security Requirements, M2M Security, Message integrity, Modeling faults and adversaries, Difference among IoT devices, computers, and embedded devices.	**6**
II	IoT and cyber-physical systems RFID Security, Authenticated encryption Byzantine Generals problem sensors and actuators in IoT. IoT security (vulnerabilities, attacks, and countermeasures), Cyber Physical Object Security, Hash functions, Consensus algorithms and their scalability problems, Accelerometer, photoresistor, buttons.	8
III	Security engineering for IoT development Hardware Security, Merkle trees and Elliptic curves digital signatures, verifiable random functions, Zero-knowledge systems motor, LED, vibrator. IoT security lifecycle, Front-end System Privacy Protection, Management, Secure IoT Databases, Public-key crypto (PKI), blockchain, the challenges, and solutions, analog signal vs. digital signal.	8
IV	Data Privacy Networking Function Security Trees signature algorithms proof of work, Proof of stake, Networking in IoT, Device/User Authentication in IoTIoT Networking Protocols, Crypto-currencies, alternatives to Bitcoin consensus, Bitcoin scripting language and their use Real-time communication.	10
V	Introduction to Authentication Techniques Secure IoT Lower Layers, Bitcoin P2P network, Ethereum and Smart Contracts, Bandwidth efficiency, Data Trustworthiness in IoT Secure IoT Higher Layers, Distributed consensus, Smart Contract Languages and verification challenges data analytics in IoT - simple data analyzing methods.	8
Total Hours		40

Course Outcomes:

CO1: Incorporate the best practices learnt to identify the attacks and mitigate the same.
CO2: Adopt the right security techniques and protocols during the design of IoT products.
CO3: Assimilate and apply the skills learnt on ciphers and block chains when appropriate.
CO4: Describe the essential components of IoT.
CO5: Find appropriate security/privacy solutions for IoT.

Text Book & Reference Books-

12. B. Russell and D. Van Duren, "Practical Internet of Things Security," Packt Publishing, 2016.
13. FeiHU, "Security and Privacy in Internet of Things (IoTs): Models, Algorithms, and Implementations", CRC Press, 2016.
14. Narayanan et al., "Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction,"
15. Princeton University Press, 2016.
16. A. Antonopoulos, "Mastering Bitcoin: Unlocking Digital Cryptocurrencies," O'Reilly, 2014.
17. T. Alpcan and T. Basar, "Network Security: A Decision and Game-theoretic Approach,"
18. Cambridge University Press, 2011.
19. Security and the IoT ecosystem, KPMG International, 2015.
20. Internet of Things: IoT Governance, Privacy and Security Issues" by European Research Cluster.
21. Ollie Whitehouse, "Security of Things: An Implementers' Guide to Cyber-Security for Internet of Things Devices and Beyond", NCC Group, 2014
22. Josh Thompson, 'Blockchain: The Blockchain for Beginnings, Guide to Blockchain Technologyand Blockchain Programming', Create Space Independent Publishing Platform, 2017.

List/Links of e-learning resource

- https://archive.nptel.ac.in/courses/106/106/106106129/

Modes of Evaluation and Rubric

The evaluation modes consist of performance in two mid semester Tests, Quiz/Assignments, term work, end semester practical examination.

CO-PO Mapping:

COs	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_1	PO_{11}	PO_{12}	PSO1	PSO2
CO-1	3	1	2										1	2
CO-2	3	2	1	1									1	2
CO-3	3	2	1	1									2	1
CO-4	3	2	2	1									2	1
CO-5	3	2	1										1	1

Suggestive list of experiments:

Recommendation by Board of studies on	
Approval by Academic council on	
Compiled and designed by	
Subject handled by department	Department of IT

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE
(Engineering College), VIDISHA M.P.
(An Autonomous Institute Affiliated to RGPV Bhopal)
DEPARTMENT OF IT

Semester/Year	VI/III	Program	B.Tech – Internet of Things
Subject Category: DLC	Subject Code: IO 606	Subject Name	LabVIEW Programming

Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			Total Marks				
ES	MS	Assignment	Quiz	ES	LW	Quiz		L	T	P	
-	-	-	-	30	10	10	50	0	0	2	1

Prerequisites:

Basic Knowledge of Programming.

Course Objective:

- To impart adequate knowledge on virtual instrumentation for acquisition and analysis of real time application.

UNITs	Descriptions	Hrs.
I	1. Study of labVIEW and its Environment. I. Front Panel Window, Block diagram and Connector Pane II. Menus and Palettes III. Basic Operations and Configuration Options IV. Date Types 2. Study of Arithmetic Operators and Creating Vis using Basic Arithmetic operation. 3. Study of Logical Operators and Creating Vis using Logical Operation. 4. Study of Comparative Operators and C5rweating Vis using Comparative Operations. 5. Study of Array and Their basic Operations and developing VIS using these arrays. 6. Study of Control Structures using: I. For Loop and While Loop II. Shift Register and Tunnel III. Case and Sequence Structure 7. Study of Data Plotting: I. Waveform Graph II. Waveform Chart III. XY Graph 8. Study of NI ELVIS-II Proto Type Board. I. Instrument Control II. Introduction of Oscilloscope III. Function Generator and Power Supply IV. Digital Multimeter V. Digital Reader and Writer VI. Dynamic System Analyzer 9. Measure the passive components values using NI ELVIS-II proto type board. 10. Data Acquisition using LabVIEW. 11. Analyze the characteristic of active components using NI ELVIS-II proto type-e board. 12. Design a voltage divider circuit on the NI ELVIS-II proto type board.	

	13. Design and testing the RC Circuit with function generator and oscilloscope using NI ELVIS-II proto type board. **14.** Plot the frequency response of basic 741 Op-Amp circuit using NI ELVIS-II proto type board.	
Total Hours		40

Course Outcomes:

CO 1: To educate about the basic concept of VI.
CO2: To make them understand the programming concepts of VI.
CO 3: To Configure the interface various data acquisition hardware like DAQ, NI ELVIS-II and Sensors.
CO4: To provide an insight to various common instrument interfaces.
CO5: To impart engineering knowledge on various analysis tools of LabVIEW.

Text Book & Reference Books-

1. Jovitha Jerome, Virtual Instrumentation Using LabVIEw, PHI Publication, India 2010.
2. Sanjay Gupta, Virtual Instrumentation Using Labview 2E, McGraw-Hill Education (India) Pvt Limited, India 2010.

List/Links of e-learning resource

Modes of Evaluation and Rubric

The evaluation modes consist of performance in two mid semester Tests, Quiz/Assignments, term work, end semester practical examination.

CO-PO Mapping:

COs	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_1	PO_{11}	PO_{12}	PSO1	PSO2
CO-1	2	1	2										1	2
CO-2	3	2	2	1									1	2
CO-3	3	2	2	1									2	1
CO-4	3	2	2	1									2	1
CO-5	2	2	1										1	1

Suggestive list of experiments:

Recommendation by Board of studies on	
Approval by Academic council on	
Compiled and designed by	
Subject handled by department	Department of IT

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE
(Engineering College), VIDISHA M.P.
(An Autonomous Institute Affiliated to RGPV Bhopal)
DEPARTMENT OF IT

Semester/Year		VII/IV		Program		B.Tech – Internet of Things
Subject Category	PROJ	Subject Code:	IO 704	Subject Name		Minor Project Prelim

Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			Total Marks				
ES	MS	Assignment	Quiz	ES	LW	Quiz		L	T	P	
-	-	-	-	50	50	-	100	0	0	4	2

Prerequisites:

Course Objective:

- Knowledge on how edge computing and Internet of Things (IoT) can be used as a way to meet application demands in intelligent IoT systems.

UNITs	Descriptions	Hrs.
Procedure	a) Each defined project needs to be from Industry/Research organization/Govt.organization/socio-technical issues. b) Project identification should be based on Analysis carried out by the students after completion of B.E Semester 6th Examination but before starting of the 7th Semester. c) Problem definition for the project needs to be submitted by every student in the first week of the 7th Semester to his/her college. d) Each definition will be evaluated based on merit in the beginning of the 7th semester itself by the College. **Facilitation:** You may contact your Major Project In charge co-ordinator/Faculty /Department Head for skilfulAnalysis .	**40**
Guidliness :	1. The project work will be in-house industry project, where student need to implement project related to any domain of industry like education, legal, manufacturing, design, pharmaceutical, Ecommerce, etc. 2. Students are required to get approval of project definition from the department. 3. After approval of project definition students are required to report their project work weekly to respective internal guide. 4. Maximum 4 students can allow working in particular project group. 5. The students are required to identify their project within two weeks of the commencement of the classes and they are required to follow all the rules and instructions issued by department. 6. Each student or student group would work under the guidance of the Faculty from the College. In case any problem/other issue arises for the smooth progress of Inter Departmental project work discovery/Practical Training, it should be immediately brought to the notice of the major project in charge coordinators/Faculty. 7. The students are required to submit Project synopsis Pre-report to their Head of the Department with the remarks of guide in their College during Eighth week of the semester	
Total Hours		40

Course Outcomes:

On successful completion of the project student should be able to:

CO1: Identify the problem domain correctly and to represent problem using mathematical structures and logics.
CO2: Analyze possible solution strategies and investigate problem domain and design feasible solutions for it.
CO3: Make use of cutting edge tools and technologies to derive solutions for the problems and carried a detailed studied about the feasibility and societal impact of solutions
CO4: Acknowledges the previous work and support required in the solution. Justify the role of individual in project work. Demonstrate leadership skills in team work.
CO5: Present and communicate the importance of solutions of problem domain. Conduct and accomplish all the subtasks for project completion in time and cost effective manner and conclude the project work with possible scopes.

Text Book & Reference Books-

List/Links of e-learning resource

- https://onlinecourses.nptel.ac.in/noc24_cs66/preview

Modes of Evaluation and Rubric

The evaluation modes consist of performance in two mid semester Tests, Quiz/Assignments, term work, end semester practical examination.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1	PO11	PO12	PSO1	PSO2
CO-1	3	3	2										2	2
CO-2	2			2		1	2			1			2	
CO-3			3		3	2	3						2	2
CO-4									3				1	
CO-5					2					3	3	3		2

List of Experiments:

Recommendation by Board of studies on	
Approval by Academic council on	
Compiled and designed by	
Subject handled by department	Department of IT

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE VIDISHA (M.P.)
(A Govt. Aided UGC Autonomous & NAAC Accredited Institute Affiliated to RGPV Bhopal)

Scheme of Examination (Semester-VII)

for Batch Admitted in session - 2022-23

Bachelor of Technology (B. Tech.) –Internet of Things

Subject Code	Subject Category	Subject Name	Maximum Marks Allotted								Contact Hrs. per week			Total Credits
			Theory				Practical			Total Marks				
			ES	MS	Assignment	Quiz	ES	LW	Quiz		L	T	P	
IO 701	DC	Data Analytics for IoT	60	20	10	10	30	10	10	150	3	0	2	04
IO 702	DE	DE-4	60	20	10	10	--	--		100	3	1	0	04
IO 703	DE	DE-5	60	20	10	10	--	--		100	3	1	0	04
IO 704	PROJ	Major Project Prelim	--	--	--		60	40		100	0	0	4	02
IO 705	ILC	Internship-III (Completed in Third Year)	--	--	--			50		50	0	0	2	02
Total			**180**	**60**	**30**	**30**	**90**	**100**	**10**	**500**	**9**	**2**	**8**	**16**
	ILC	Extracurricular Activities			It is a one credit per year activity endorse in eight semester mark sheet									

MST: Minimum two mid semester tests to be conducted during Semester

	DE -4	DE-5
A	IoT System Architectures	Industrial IoT
B	Embedded Systems Design	AR and VR
C	Real time Systems	Edge Computing

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE

(Engineering College), VIDISHA M.P.

(An Autonomous Institute Affiliated to RGPV Bhopal)

DEPARTMENT OF IT

Semester/Year		VII/IV	Program		B.Tech – Internet of Things
Subject Category	DC	Subject Code:	IO 701	Subject Name	Data Analytics for IoT

Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			Total Marks				
ES	MS	Assignment	Quiz	ES	LW	Quiz		L	T	P	
60	20	10	10	30	10	10	150	3	0	2	4

Prerequisites:

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

Course Objective:

- This course explains machine learning techniques such as decision tree learning, Bayesian learning etc.
- To understand computational learning theory.
- To study the pattern comparison techniques.
- Identify problems that are amenable to solution by AI methods, and which AI methods may be suited to solving a given problem.

UNITs	Descriptions	Hrs.
I	Defining IoT Analytics and Challenges: Introduction to IoT, applications, IoT architectures, introduction to analytics, IoT analytics challenges.	**8**
II	IoT Devices and Networking Protocols: IoT devices, Networking basics, IoT networking connectivity protocols, IoT networking data messaging protocols, Analyzing data to infer protocol and device characteristics.	8
III	IoT Analytics for the Cloud: Introduction to elastic analytics, Decouple key components, Cloud security and analytics, Designing data processing for analytics, Applying big data technology to storage.	8
IV	Exploring IoT Data: Exploring and visualizing data, Techniques to understand data quality, Basic time series analysis, Statistical analysis.	8
V	Data Science for IoT Analytics: Introduction to Machine Learning, Feature engineering with IoT data, Validation methods, Understanding the bias–variance tradeoff, Use cases for deep learning with IoT data.	8
Total Hours		40

Course Outcomes:

CO-1 Understand the fundamentals of IoT Analytics and Challenges

CO-2 Understand and analyze IoT Devices and Networking Protocols

CO-3 Apply IoT Analytics for the Cloud.

CO-4 Understand exploring and visualizing data.

CO-5 Uses of Knowledge Representation Techniques.

Text Book & Reference Books-

1. Minteer, Andrew, Analytics for the Internet of Things (IoT), Packt Publishing Ltd. July 2017, ISBN 9781787120730
2. Kai Hwang, Min Chen, Big-Data Analytics for Cloud, IoT and Cognitive Computing, Wiley.
3. Hwaiyu Geng, Internet of Things and Data Analytics Handbook, Wiley
4. John Soldatos, Building Blocks for IoT Analytics Internet-of-Things Analytics, River Publishers Gerardus Blokdyk.

List/Links of e-learning resource

- https://nptel.ac.in/courses/106102220

Modes of Evaluation and Rubric

The evaluation modes consist of performance in two mid semester Tests, Quiz/Assignments, term work, end semester practical examination.

CO-PO Mapping:

COs	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_1	PO_{11}	PO_{12}	PSO1	PSO2
CO-1	1	1	2	1									1	2
CO-2	2	1	1	1	2								1	2
CO-3	2	1	2	1			1						1	1
CO-4	2	1	2	1										2
CO-5	2	1			1								1	

List of Experiments:

1.

Recommendation by Board of studies on	
Approval by Academic council on	
Compiled and designed by	
Subject handled by department	Department of IT

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE

(Engineering College), VIDISHA M.P.

(An Autonomous Institute Affiliated to RGPV Bhopal)

DEPARTMENT OF IT

Semester/Year		VII/IV	Program		B.Tech – Internet of Things
Subject Category	DE	Subject Code:	IO 702 DE – 4(A)	Subject Name	IoT System Architectures

Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			Total Marks				
ES	MS	Assignment	Quiz	ES	LW	Quiz		L	T	P	
60	20	10	10	-	-	-	100	3	1	0	4

Prerequisites:

Knowledge on concepts of IoT applications and IoT architectures, Event driven analysis and security testing IoT systems

Course Objective:

- This course explains machine learning techniques such as decision tree learning, Bayesian learning etc.
- To understand computational learning theory.
- To study the pattern comparison techniques.
- Identify problems that are amenable to solution by AI methods, and which AI methods may be suited to solving a given problem.

UNITs	Descriptions	Hrs.
I	The IoT Landscape: What Is IoT? Applications, Architectures, Wireless Networks, Devices, Security and Privacy, Event-Driven Systems. IoT System Architectures: Introduction, Protocols Concepts, IoTOriented Protocols, Databases, Time Bases, Securit	**8**
II	IoT Devices & Event-Driven System Analysis: The IoT Device Design Space, Cost of Ownership and Power Consumption, Cost per Transistor and Chip Size, Duty Cycle and Power Consumption, Platform Design. Event-Driven System Analysis: Introduction, Motivating Example, IoT Network Model, Events, Networks, Devices and Hubs, Single-Hub Networks, Multi-hub Networks, Network Models and Physical Networks, IoT Event Analysis, Event Populations, Stochastic Event Populations, Environmental Interaction Modeling, Event Transport and Migration.	8
III	Industrial Internet of Things: Introduction, Industry 4.0, Industrial Internet of Things (IIoT), IIoT Architecture, Basic Technologies, Applications and Challenges.	8
IV	Security and Safety: Introduction, Systems Security, Network Security, Generic Application Security, Application Process Security and Safety, Reliable-and-Secure-by-Design IoT Applications, Run-Time Monitoring, The ARMET Approach, Privacy and Dependability.	8
V	Security Testing IoT Systems: Introduction, Fuzz Testing for Security, White-Box Fuzzing, Black-Box Fuzzing, Fuzzing Industrial Control Network Systems, Fuzzing	8

	Modbus, The Modbus Protocol, Modbus/TCP Fuzzer.	
Total Hours		40

Course Outcomes:

CO-1 Understand IoT applications and IoT Architectures.

CO-2 Learn about IoT devices and event driven analysis

CO-3 Understand and analyze IIoT.

CO-4 Understand safety and security testing of IoT systems.

CO-5 Understand safety and network systemof IoT systems.

Text Book & Reference Books-

1. Dimitrios Serpanos, Marilyn Wol, Internet-of-Things (IoT) Systems Architectures, Algorithms, Methodologies, ISBN 978-3-319-69714-7.
2. Internet of Things – A hands-on approach, Arshdeep Bahga, Vijay Madisetti, Universities Press, 2015.
3. The Internet of Things – Key applications and Protocols, Olivier Hersent, David Boswarthick, Omar Elloumi and Wiley, 2012 (for Unit 2).
4. . "From Machine-to-Machine to the Internet of Things – Introduction to a New Age of Intelligence", Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stamatis, Karnouskos, Stefan Avesand. David Boyle and Elsevier, 2014.

List/Links of e-learning resource

- https://onlinecourses.nptel.ac.in/noc22_cs53/preview

Modes of Evaluation and Rubric

The evaluation modes consist of performance in two mid semester Tests, Quiz/Assignments, term work, end semester practical examination.

CO-PO Mapping:

COs	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_1	PO_{11}	PO_{12}	PSO1	PSO2
CO-1	1	1	2	1									1	2
CO-2	2	1	1	1	2								1	2
CO-3	2	1	2	1			1						1	1
CO-4	2	1	2	1										2
CO-5	2	1			1								1	

List of Experiments:

Recommendation by Board of studies on	
Approval by Academic council on	
Compiled and designed by	
Subject handled by department	Department of IT

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE

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DEPARTMENT OF IT

Semester/Year		VII/IV	Program		B.Tech – Internet of Things
Subject Category	DE	Subject Code:	IO 702 DE – 4(B)	Subject Name	Embedded Systems Design

Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			Total Marks				
ES	MS	Assignment	Quiz	ES	LW	Quiz		L	T	P	
60	20	10	10	-	-	-	100	3	1	0	4

Prerequisites:

Course Objective:

- To provide students with good depth of knowledge of Designing Embedded and IOT Systems for various application.
- Knowledge for the design and analysis of Embedded and IOT Systems for Electronics Engineering students.

UNITs	Descriptions	Hrs.
I	Introduction to Embedded Systems: Definition of embedded system, embedded systems vs. general computing systems, history of embedded systems, classification, major application areas, purpose of embedded systems, characteristics and quality attributes of embedded systems, common design metrics, and processor technology: general purpose processor, application specific processor, single purpose processor.	**8**
II	Input Output and Peripheral Devices Timers and counters, watchdog timers, interrupt controllers, PWM, keyboard controller, analog to digital converters, real time clock. Introduction to communication protocols: basic terminologies, concepts, serial protocol: I2C, CAN, firewire, USB. Parallel protocols: PCI bus, IrDA, bluetooth, IEEE 802.11, wireless protocols.	8
III	Input Output and Peripheral Devices Timers and counters, watchdog timers, interrupt controllers, PWM, keyboard controller, analog to digital converters, real time clock. Introduction to communication protocols: basic terminologies, concepts, serial protocol: I2C, CAN, firewire, USB. Parallel protocols: PCI bus, IrDA, bluetooth, IEEE 802.11, wireless	8
IV	Memory System Architecture Caches, virtual memory, MMU, address translation, memory and interfacing, memory write ability and storage performance. Memory types, composing memory – advance RAM interfacing, microprocessor interfacing I/O addressing, interrupts, direct memory access, arbitration multilevel bus architecture.	8
V	Embedded System Supporting Technologies Difference between normal OS and RTOS, scheduling algorithms. Case study: Tiny OS, VxWorks, QNX. Overview of VLSI technology, introduction to device drivers. Case studies: washing machine, air-	8

	conditioning, auto focus camera.	
Total Hours		40

Course Outcomes:

CO-1 Knowledge of theory and practice related to Embedded and IOT System.

CO-2 Ability to identify, formulate and solve engineering problems by using Embedded Systems with IoT.

CO-3 Ability to implement real field problem by gained knowledge of Embedded Systems with IoT capability.

CO-4 Understand the memory types used in embedded systems.

CO-5 Design a system, component, or process to meet desired needs within realistic constraints

such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.

Text Book & Reference Books-

1. F Vahid, T Giogarvis, Embedded systems: A unified hardware/software approach, Wiley,1999.
2. Raj Kamal, Embedded Systems Introduction, 2nd Ed., TMH publication, 2015.
3. David E Simons, An Embedded Software Primer, Pearson, 1999.

List/Links of e-learning resource

- https://onlinecourses.nptel.ac.in/noc22_cs53/preview

Modes of Evaluation and Rubric

The evaluation modes consist of performance in two mid semester Tests, Quiz/Assignments, term work, end semester practical examination.

CO-PO Mapping:

COs	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_1	PO_{11}	PO_{12}	PSO1	PSO2
CO-1	1	1	2	1									1	2
CO-2	2	1	1	1	2								1	2
CO-3	2	1	2	1			1						1	1
CO-4	2	1	2	1										2
CO-5	2	1			1								1	

List of Experiments:

Recommendation by Board of studies on	
Approval by Academic council on	
Compiled and designed by	
Subject handled by department	Department of IT

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE

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DEPARTMENT OF IT

Semester/Year		VII/IV	Program		B.Tech – Internet of Things
Subject Category	DE	Subject Code:	IO 702 DE – 4(C)	Subject Name	Real time Systems

Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			Total Marks				
ES	MS	Assignment	Quiz	ES	LW	Quiz		L	T	P	
60	20	10	10	-	-	-	100	3	1	0	4

Prerequisites:

Computer Organization and Operating System

Course Objective:

- To provide broad understanding of the requirements of Real Time Operating Systems.
- To make the student understand, applications of these Real Time features using case studies.

UNITs	Descriptions	Hrs.
I	Introduction: Introduction to UNIX/LINUX, Overview of Commands, File I/O,(open, create, close, lseek, read, write), Process Control (fork, vfork, exit, wait, waitpid, exec).	**8**
II	Real Time Operating Systems: Brief History of OS, Defining RTOS, The Scheduler, Objects, Services, Characteristics of RTOS, Defining a Task, asks States and Scheduling, Task Operations, Structure, Synchronization, Communication and Concurrency. Defining Semaphores, Operations and Use, Defining Message Queue, States, Content, Storage, Operations and Use	8
III	Objects, Services and I/O: Pipes, Event Registers, Signals, Other Building Blocks, Component Configuration, Basic I/O Concepts, I/O Subsystem	8
IV	Exceptions, Interrupts and Timers: Exceptions, Interrupts, Applications, Processing of Exceptions and Spurious Interrupts, Real Time Clocks, Programmable Timers, Timer Interrupt Service Routines (ISR), Soft Timers, Operations.	8
V	Case Studies of RTOS: RT Linux, MicroC/OS-II, Vx Works, Embedded Linux, and Tiny OS.	8
Total Hours		40

Course Outcomes:

CO-1 Be able to explain real-time concepts such as pre-emptive multitasking, task priorities, priority inversions, mutual exclusion, context switching, and synchronization, interrupt latency and response time, and semaphores.

CO-2 Able describe how a real-time operating system kernel is implemented.

CO-3 Explain how the real-time operating system implements time management.

CO-4 Discuss how tasks can communicate using semaphores, mailboxes, and queues.

CO-5 Be able to implement a real-time system on an embedded processor.

Text Book & Reference Books-

1. Real Time Concepts for Embedded Systems – Qing Li, Elsevier, 2011.
2. Embedded Systems- Architecture, Programming and Design by Rajkamal, 2007, TMH
3. Advanced UNIX Programming, Richard Stevens.
4. Embedded Linux: Hardware, Software and Interfacing – Dr. Craig Hollabaugh.

List/Links of e-learning resource

- https://onlinecourses.nptel.ac.in/noc22_cs53/preview

Modes of Evaluation and Rubric

The evaluation modes consist of performance in two mid semester Tests, Quiz/Assignments, term work, end semester practical examination.

CO-PO Mapping:

COs	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_1	PO_{11}	PO_{12}	PSO1	PSO2
CO-1	1	1	2	1									1	2
CO-2	2	1	1	1	2								1	2
CO-3	2	1	2	1			1						1	1
CO-4	2	1	2	1										2
CO-5	2	1			1								1	

List of Experiments:

Recommendation by Board of studies on	
Approval by Academic council on	
Compiled and designed by	
Subject handled by department	Department of IT

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE

(Engineering College), VIDISHA M.P.

(An Autonomous Institute Affiliated to RGPV Bhopal)

DEPARTMENT OF IT

Semester/Year		VII/IV	Program		B.Tech – Internet of Things
Subject Category	DE	Subject Code:	IO 703 DE – 5(A)	Subject Name	Industrial IoT

Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			Total Marks				
ES	MS	Assignment	Quiz	ES	LW	Quiz		L	T	P	
60	20	10	10	-	-	-	100	3	1	0	4

Prerequisites:

Computer Organization and Operating System

Course Objective:

- To provide students with a good depth of knowledge of Designing Industrial IOT Systems for various applications.

UNITs	Descriptions	Hrs.
I	Introduction to Industrial Internet and Use-Cases: Industrial Internet- Key IIoT TechnologiesInnovation and the IIoT -Key Opportunities and Benefits -The Digital and Human Workforce - Logistics and the Industrial Internet- IOT Innovations in Retail.	**8**
II	The Technical and Business Innovators of The Industrial Internet: Cyber Physical Systems (CPS) – IP Mobility – Network Virtualization - SDN (Software Defined Networks)- The Cloud and Fog – Role of Big Data in IIOT - Role of Machine learning and AI in IIOT	8
III	IIOT Reference Architecture: Industrial Internet Architecture Framework (IIAF) - Industrial Internet Viewpoints -. Architectural Topology: The Three-Tier Topology- Key System Characteristics- Data Management- Advanced data analytics.	8
IV	Protocols for Industrial Internet Systems: Legacy Industrial Protocols - Modern Communication Protocols-Proximity Network Communication Protocols- Wireless Communication TechnologiesGateways: industrial gateways - CoAP (Constrained Application Protocol)	8
V	Middleware Software Patterns and IIOT Platforms: Publish/Subscribe Pattern: MQTT, XMPP, AMQP, DDS- Middleware Architecture- SigFox- LoRaWAN Augmented reality- Real-World Smart Factories Application of IIOT: Case study: Health monitoring, Iot smart city, Smart irrigation, Robot surveillance.	8
Total Hours		40

Course Outcomes:

CO-1 Identify the Key opportunities and benefits in Industrial IoT.

CO-2 Able describe how a real-time operating system kernel is implemented.

CO-3 Apply virtual network to demonstrate the use of Cloud in Industrial IoT.

CO-4 Summarize Legacy Industrial and Modern Communication Protocols.

CO-5 Describe Middleware Architecture, LoRaWAN- and Augmented reality.

Text Book & Reference Books-

1. Gilchrist, Alasdair, "Industry 4.0 The Industrial Internet of Things", Apress, 2017.
2. Zaigham Mahmood, "The Internet of Things in the Industrial Sector: Security and Device connectivity, smart environments and Industry 4.0 (Springer), 2019.
3. Sabina Jeschke, Christian Brecher, Houbing Song, Danda B. Rawat "Industrial Internet of Things: Cyber manufacturing Systems" (Springer), 2017.
4. Industrial IoT Challenges, Design Principles, Applications, and Security by Ismail Butun (editor)
5. Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands-on-Approach)", 1st Edition, VPT, 2014

List/Links of e-learning resource

- https://onlinecourses.nptel.ac.in/noc20_cs69/preview

Modes of Evaluation and Rubric

The evaluation modes consist of performance in two mid semester Tests, Quiz/Assignments, term work, end semester practical examination.

CO-PO Mapping:

COs	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_1	PO_{11}	PO_{12}	PSO1	PSO2
CO-1	1	1	2	1									1	2
CO-2	2	1	1	1	2								1	2
CO-3	2	1	2	1			1						1	1
CO-4	2	1	2	1										2
CO-5	2	1			1								1	

List of Experiments:

5.

Recommendation by Board of studies on	
Approval by Academic council on	
Compiled and designed by	
Subject handled by department	Department of IT

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE

(Engineering College), VIDISHA M.P.

(An Autonomous Institute Affiliated to RGPV Bhopal)

DEPARTMENT OF IT

Semester/Year		VII/IV	Program		B.Tech – Internet of Things
Subject Category	DE	Subject Code:	IO 703 DE – 5(B)	Subject Name	AR and VR

Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			Total Marks				
ES	MS	Assignment	Quiz	ES	LW	Quiz		L	T	P	
60	20	10	10	-	-	-	100	3	1	0	4

Prerequisites:

Computer Organization and Operating System

Course Objective:

- The objective of this course is to provide a foundation to the fast-growing field of AR and make the students aware of the various AR devices.
- To give historical and modern overviews and perspectives on virtual reality. It describes the fundamentals of sensation, perception, technical and engineering aspects of virtual reality systems.

UNITs	Descriptions	Hrs.
I	Introduction to Augmented Reality: What Is Augmented Reality - Defining augmented reality, history of augmented reality, The Relationship Between Augmented Reality and Other Technologies-Media, Technologies, Other Ideas Related to the Spectrum Between Real and Virtual Worlds, applications of augmented reality Augmented Reality Concepts- How Does Augmented Reality Work? Concepts Related to Augmented Reality, Ingredients of an Augmented Reality Experience.	**8**
II	AR Devices & Components: AR Components – Scene Generator, Tracking system, monitoring system, display, Game scene. AR Devices – Optical See- Through HMD, Virtual retinal systems, Monitor bases systems, Projection displays, Video see-through systems.	8
III	Introduction to Virtual Reality: Defining Virtual Reality, History of VR, Human Physiology and Perception, Key Elements of Virtual Reality Experience, Virtual Reality System, Interface to the Virtual World-Input & output- Visual, Aural & Haptic Displays, Applications of Virtual Reality.	8
IV	Representing the Virtual World: Representation of the Virtual World, Visual Representation in VR, Aural Representation in VR and Haptic Representation in VR, Case Study: GHOST (General Haptics Open Software Toolkit) software development toolkit.	8
V	Visual Perception & Rendering: Visual Perception - Perception of Depth, Perception of Motion, Perception of Color, Combining Sources of Information, Visual Rendering -Ray Tracing and Shading Models, Rasterization, Correcting Optical Distortions, Improving	8

	Latency and Frame Rates.	
Total Hours		40

Course Outcomes:

CO-1 Describe how AR systems work and list the applications of AR

CO-2 Understand and analyze the hardware requirement of AR.

CO-3 Describe how VR systems work and list the applications of VR.

CO-4 Understand the design and implementation of the hardware that enables VR systems to be built

CO-5 Describe Augmented reality.

Text Book & Reference Books-

1. Allan Fowler-AR Game Development‖, 1st Edition, A press Publications, 2018, ISBN 978- 1484236178
2. Augmented Reality: Principles & Practice by Schmalstieg / Hollerer, Pearson Education India; First edition (12 October 2016), ISBN-10: 9332578494
3. Virtual Reality, Steven M. LaValle, Cambridge University Press, 2016.
4. Understanding Virtual Reality: Interface, Application and Design, William R Sherman and Alan B Craig, (The Morgan Kaufmann Series in Computer Graphics)". Morgan Kaufmann Publishers, San Francisco, CA, 2002.
5. Developing Virtual Reality Applications: Foundations of Effective Design, Alan B Craig,William R Sherman and Jeffrey D Will, Morgan Kaufmann, 2009.

List/Links of e-learning resource

- https://nptel.ac.in/courses/121106013

Modes of Evaluation and Rubric

The evaluation modes consist of performance in two mid semester Tests, Quiz/Assignments, term work, end semester practical examination.

CO-PO Mapping:

COs	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_1	PO_{11}	PO_{12}	PSO1	PSO2
CO-1	1	1	2	1									1	2
CO-2	2	1	1	1	2								1	2
CO-3	2	1	2	1			1						1	1
CO-4	2	1	2	1										2
CO-5	2	1			1								1	

List of Experiments:

Recommendation by Board of studies on	
Approval by Academic council on	
Compiled and designed by	
Subject handled by department	Department of IT

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE

(Engineering College), VIDISHA M.P.

(An Autonomous Institute Affiliated to RGPV Bhopal)

DEPARTMENT OF IT

Semester/Year		VII/IV	Program		B.Tech – Internet of Things
Subject Category	DE	Subject Code:	IO 703 DE – 5(C)	Subject Name	Edge Computing

Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			Total Marks				
ES	MS	Assignment	Quiz	ES	LW	Quiz		L	T	P	
60	20	10	10	-	-	-	100	3	1	0	4

Prerequisites:

Course Objective:

- Knowledge on how edge computing and Internet of Things (IoT) can be used as a way to meet application demands in intelligent IoT systems.

UNITs	Descriptions	Hrs.
I	IoT and Edge Computing Definition and Use Cases: Introduction to Edge Computing Scenario's and Use cases - Edge computing purpose and definition, Edge computing use cases, Edge computing hardware architectures, Edge platforms, Edge vs Fog Computing, Communication Models - Edge, Fog and M2M.	**8**
II	IoT Architecture and Core IoT Modules-A connected ecosystem,IoT versus machine-to-machine versus, SCADA, The value of a network and Metcalfe's and Beckstrom's laws, IoT and edge architecture, Role of an architect, Understanding Implementations with examples-Example use case and deployment, Case study – Telemedicine palliative care, Requirements, Implementation, Use case retrospective.	8
III	RaspberryPi: Introduction to RaspberryPi, About the RaspberryPi Board: Hardware Layout and Pinouts, Operating Systems on RaspberryPi, Configuring RaspberryPi, Programming RaspberryPi, Connecting Raspberry Pi via SSH, Remote access tools, Interfacing DHT Sensor with Pi, Pi as Webserver, Pi Camera, Image & Video Processing using Pi.	8
IV	Implementation of Microcomputer RaspberryPi and device Interfacing, Edge to Cloud ProtocolsProtocols, MQTT, MQTT publish-subscribe, MQTT architecture details, MQTT state transitions, MQTT packet structure, MQTT data types, MQTT communication formats, MQTT 3.1.1 working example.	8
V	Edge computing with RaspberryPi, Industrial and Commercial IoT and Edge, Work with RaspberryPi components and evaluate its performance..	8
Total Hours		40

Course Outcomes:

CO-1 Understand use of the IoT architecture with its entities and protocols, from the IoT devices.

CO-2 Security and privacy issues related to the area of edge computing and IoT.

CO-3 Understand the RaspberryPi architecture and its components.

CO-4 Work with RaspberryPi components and evaluate its performance.

Text Book & Reference Books-

1. IoT and Edge Computing for Architects - Second Edition, by Perry Lea, Publisher: Packt Publishing, 2020, ISBN: 9781839214806.
2. Raspberry Pi Cookbook, 3rd Edition, by Simon Monk, Publisher: O'Reilly Media, Inc., 2019, ISBN: 978149204322.
3. Fog and Edge Computing: Principles and Paradigms by Rajkumar Buyya, Satish Narayana Srirama, wiley publication, 2019, ISBN: 9781119524984.
4. David Jensen, "Beginning Azure IoT Edge Computing: Extending the Cloud to the Intelligent Edge, MICROSOFT AZURE.

List/Links of e-learning resource

- https://onlinecourses.nptel.ac.in/noc24_cs66/preview

Modes of Evaluation and Rubric

The evaluation modes consist of performance in two mid semester Tests, Quiz/Assignments, term work, end semester practical examination.

CO-PO Mapping:

COs	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_1	PO_{11}	PO_{12}	PSO1	PSO2
CO-1	1	1	2	1									1	2
CO-2	2	1	1	1	2								1	2
CO-3	2	1	2	1			1						1	1
CO-4	2	1	2	1										2
CO-5	2	1			1								1	

List of Experiments:

Recommendation by Board of studies on	
Approval by Academic council on	
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Subject handled by department	Department of IT

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE

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DEPARTMENT OF IT

Semester/Year		VII/IV	Program		B.Tech – Internet of Things
Subject Category	PROJ	Subject Code:	IO 704	Subject Name	Major Project Prelim

Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			Total Marks				
ES	MS	Assignment	Quiz	ES	LW	Quiz		L	T	P	
60	20	10	10	-	-	-	100	3	1	0	4

Prerequisites:

Course Objective:

- Knowledge on how edge computing and Internet of Things (IoT) can be used as a way to meet application demands in intelligent IoT systems.

UNITs	Descriptions	Hrs.
Procedure	a) Each defined project needs to be from Industry/Research organization/Govt.organization/socio-technical issues. b) Project identification should be based on Analysis carried out by the students after completion of B.E Semester 6th Examination but before starting of the 7th Semester. c) Problem definition for the project needs to be submitted by every student in the first week of the 7th Semester to his/her college. d) Each definition will be evaluated based on merit in the beginning of the 7th semester itself by the College. **Facilitation:** You may contact your Major Project In charge co-ordinator/Faculty /Department Head for skilfulAnalysis .	**40**
Guidliness:	1. The project work will be in-house industry project, where student need to implement project related to any domain of industry like education, legal, manufacturing, design, pharmaceutical, Ecommerce, etc. 2. Students are required to get approval of project definition from the department. 3. After approval of project definition students are required to report their project work weekly to respective internal guide. 4. Maximum 4 students can allow working in particular project group. 5. The students are required to identify their project within two weeks of the commencement of the classes and they are required to follow all the rules and instructions issued by department. 6. Each student or student group would work under the guidance of the Faculty	

	from the College. In case any problem/other issue arises for the smooth progress of Inter Departmental project work discovery/Practical Training, it should be immediately brought to the notice of the major project in charge coordinators/Faculty. 7. The students are required to submit Project synopsis Pre-report to their Head of the Department with the remarks of guide in their College during Eighth week of the semester	
Total Hours		40

Course Outcomes:

On successful completion of theproject student should be able to:

CO1: Identify the problem domain correctly and to represent problem using mathematical structures and logics.

CO2: Analyze possible solution strategies and investigate problem domain and design feasible solutions for it.

CO3: Make use of cutting edge tools and technologies to derive solutions for the problems and carried a detailed studied about the feasibility and societal impact of solutions

CO4: Acknowledges the previous work and support required in the solution. Justify the role of individual in project work. Demonstrate leadership skills in team work.

CO5: Present and communicate the importance of solutions of problem domain. Conduct and accomplish all the subtasks for project completion in time and cost effective manner and conclude the project work with possible scopes.

Text Book & Reference Books-

List/Links of e-learning resource

- https://onlinecourses.nptel.ac.in/noc24_cs66/preview

Modes of Evaluation and Rubric

The evaluation modes consist of performance in two mid semester Tests, Quiz/Assignments, term work, end semester practical examination.

CO-PO Mapping:

COs	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_1	PO_{11}	PO_{12}	PSO1	PSO2
CO-1	3	3	2										2	2
CO-2	2			2		1	2			1			2	
CO-3			3		3	2	3						2	2
CO-4									3				1	
CO-5					2					3	3	3		2

List of Experiments:

Recommendation by Board of studies on	
Approval by Academic council on	
Compiled and designed by	

Subject handled by department	Department of IT

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE VIDISHA (M.P.)
(A Govt. Aided UGC Autonomous & NAAC Accredited Institute Affiliated to RGPV Bhopal)

Scheme of Examination (Semester-VIII)

for Batch Admitted in session - 2022-23

Bachelor of Technology (B. Tech.) -Internet of Things

Subject Code	Subject Category	Subject Name	Maximum Marks Allotted						Contact Hrs. per week			Total Credits
			Theory			Practical		Total Marks				
			ES	MS	Assignment/ Quiz	ES	LW/ Quiz		L	T	P	
IO 801	PROJ	Major Project				300	200	500	0	0	12	06
IO 802	DE	SWAYAM/NPTEL MOOC's Course *				--	--	--	0	0	0	03
IO 803	DE	SWAYAM/NPTEL MOOC's Course *				--	--	--	0	0	0	03
	ILC	Extracurricular Activities		It is a one credit per year activity endorsed in eight semester mark sheet								04
Total						**300**	**200**	**500**				**16**

	DE-6	DE-7
A	Foundation of Cloud IoT Edge ML	Digital Design with Verilog
B	Foundations of Cyber Physical Systems	Cloud Computing and Distributed Systems
C	Information Security - 5 - Secure Systems Engineering	Systems and Usable Security

DEPARTMENT OF INFORMATION TECHNOLOGY

Department of information technology [BOS-(IoT)-15-12-2023]

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE VIDISHA (M.P.)

(A Govt. Aided UGC Autonomous & NAAC Accredited Institute Affiliated to RGPV Bhopal)

Department Of Information Technology

Programme -IoT

Scheme-2021-2022

Samrat Ashok Technological Institute (Engineering. College) VIDISHA (M.P.)
(An Autonomous Institute Affiliated to RGPV, Bhopal)
Proposed Scheme of Examination
Bachelor of Technology (B.Tech.) in Internet of Things (IoT)

Semester-III

S. No.	Subject Code	Category	Subject Name / Title	Maximum Marks Allotted						Contact Hrs.			Total Credits
				Theory Slot			Practical Slot						
				End Sem.	Mid Sem. Exam	Quiz, Assignment	End Sem.	Term work Lab Work & Sessional	Total Marks	L	T	P	
1	IoT-2031	DC	Signals & Systems	70	20	10	-	-	100	3	1	-	4
2	IoT-2032	DC	Electronic Devices & Circuits	70	20	10	30	20	150	3	-	2	4
3	IoT-2033	DC	Analog Electronics	70	20	10	30	20	150	3	-	2	4
4	IoT -2034	DC	Digital Electronics	70	20	10	30	20	150	3	-	2	4
5	IoT -2035	BSC	Engineering Mathematics-III	70	20	10	-	-	100	3	-	-	3
6	IoT -2036	HSMC	Language Lab	-	-	-	30	20	50	-	-	2	1
7	IoT -2037	DLC	Evaluation of Internship – I completed at I year level & Seminar (personality development)	-	-	-	50	-	50	-	-	4	2
8		DLC	90 hrs Internship based on using various software's Internship – II	To be completed anytime during Third/Fourth semester. Its evaluation/ credit to be added in fifth semester.									
			Total	**350**	**100**	**50**	**170**	**80**	**750**	**15**	**1**	**12**	**22**
9		MC	Constitution of India (Ethics)	Non Credit	-	-	-	-	-	-	-	-	-
10		SL	MOOCs	-	-	-	-	-	-	-	-	-	-
11		NLC	Participation & Winning in National level competition	-	-	-	-	-					
12			NSS/NCC	Qualifier									

MST: Minimum two mid semester tests to be conducted during Semester L: Lecture T: Tutorial P: Practical

Mr. Sudesh Morey Mr. Satish Asnani Dr. Dhananjay V. Gadre Dr. N. P. Patidar Prof. Vipin Patait Dr. Divya Rishi Sahu Prof. Shaila Chugh

Prof. C. S. Sharma Dr. Jyotsna V Ogale Dr. J. S. Chauhan

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE VIDISHA (M.P.)

(A Govt. Aided UGC Autonomous & NAAC Accredited Institute Affiliated to RGPV Bhopal)

Scheme of Examination (Semester-IV)

for Batch Admitted in session - 2021-22

Bachelor of Technology (B. Tech.) – Internet of Things

Subject Code	Subject Category	Subject Name	Maximum Marks Allotted						Contact Hrs.			Total Credits
			Theory			Practical		Total Marks				
			ES	MS	Assignment/ Quiz	ES	Term Work, Lab Work or Sessional		L	T	P	
IoT 2041	DC	Data Structure and Algorithm	70	20	10	30	20	150	3	0	2	4
IoT 2042	DC	Operating System	70	20	10	30	20	150	3	0	2	4
IoT 2043	DC	Python Programming	70	20	10	30	20	150	3	0	2	4
IoT 2044	DC	Fundamentals of IoT	70	20	10	--		100	3	0	0	3
IoT 2045	DC	Sensors and Actuators	70	20	10	--		100	3	1	0	4
IoT 2046	DLC	Linux and Shell Programming	--	--	--	60	40	100	0	0	2	1
	DLC	Internship II (90 hrs.)	To be completed by the student during IV semester and will be evaluated in the V semester									
Total			**350**	**100**	**50**	**150**	**100**	**750**	**15**	**1**	**8**	**20**

MST: Minimum two mid semester tests to be conducted during Semester.

ES: End Semester MS: Mid Semester L: Lecture T: Tutorial P: Practical

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE VIDISHA (M.P.)

(A Govt. Aided UGC Autonomous & NAAC Accredited Institute Affiliated to RGPV Bhopal)

Scheme of Examination (Semester-V)

for Batch Admitted in session - 2021-22

Bachelor of Technology (B. Tech.) – Internet of Things

Subject Code	Subject Category	Subject Name	Maximum Marks Allotted						Contact Hrs.			Total Credits
			Theory			Practical		Total Marks				
			ES	MS	Assignment/ Quiz	ES	Term Work, Lab Work or Sessional		L	T	P	
IoT 2051	DC	Microprocessors and Microcontrollers	70	20	10	30	20	150	3	0	2	4
IoT 2052	DC	Foundation of Data Science	70	20	10	30	20	150	3	0	2	4
IoT 2053	DC	Database Management System	70	20	10	30	20	150	3	0	2	4
IoT 2054	DC	Object Oriented Programming	70	20	10	-	-	100	3	1	0	4
IoT 2055	OC	OC -1	70	20	10	--	-	100	3	0	0	3
IoT 2056	DLC	Android Programming	--	--	--	50		50	0	0	2	1
IoT 2057	DLC	Internship II (90 hrs.)					50	50			4	2
Total			**350**	**100**	**50**	**140**	**110**	**750**	**15**	**1**	**12**	**22**

MST: Minimum two mid semester tests to be conducted during Semester,

	OC -1
A	Computer Networks
B	Communication System

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE VIDISHA (M.P.)
(A Govt. Aided UGC Autonomous & NAAC Accredited Institute Affiliated to RGPV Bhopal)

Scheme of Examination (Semester-VI)

for Batch Admitted in session - 2021-22

Bachelor of Technology (B. Tech.) – Internet of Things

Subject Code	Subject Category	Subject Name	Maximum Marks Allotted						Contact Hrs.			Total Credits
			Theory			Practical		Total Marks				
			ES	MS	Assignment/ Quiz	ES	Term Work, Lab Work or Sessional		L	T	P	
IoT 2061	DC	Automata and compiler design	70	20	10	-	-	100	3	0	0	3
IoT 2062	DE	DE -1	70	20	10	30	20	150	3	0	2	4
IoT 2063	DE	DE -2	70	20	10	30	20	150	3	0	2	4
IoT 2064	DE	DE -3	70	20	10	30	20	150	3	0	2	4
IoT 2065	OC	OC-2	70	20	10	--	-	100	3	0	0	3
IoT 2066	DLC	Minor Project I	--	--	--	50	50	100	0	0	4	2
Total			**350**	**100**	**50**	**140**	**110**	**750**	**15**	**0**	**10**	**20**

MST: Minimum two mid semester tests to be conducted during Semester,

ES: End Semester MS: Mid Semester L: Lecture T: Tutorial P: Practical

	DE – 1	DE -2	DE -3	OC
A	Introduction to IoT Development Boards	Web Engineering	Cloud Computing for IoT	Artificial Intelligence for IoT
B	Soft Computing	Computer Graphics	Digital Signal Processing	Advanced Computer Architecture

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE VIDISHA (M.P.)

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Scheme of Examination (Semester-VII)

for Batch Admitted in session - 2020-21

Bachelor of Technology (B. Tech.) – Internet of Things

Subject Code	Subject Category	Subject Name	Maximum Marks Allotted						Contact Hrs.			Total Credits
			Theory			Practical		Total Marks				
			ES	MS	Assignment/ Quiz	ES	Term Work, Lab Work or Sessional		L	T	P	
IoT 2071	DE	DE – 4	70	20	10	-	-	100	3	1	-	4
IoT 2072	DE	DE – 5	70	20	10	-	-	100	3	1	-	4
IoT 2073	DE	DE – 6	70	20	10	-	-	100	3	0	-	3
IoT 2074	OC	OC – 3	70	20	10	-	-	100	3	0	-	3
IoT 2075	OC	OC - 4	70	20	10	--	-	100	3	0	-	3
IoT 2076	DLC	Digital Sensors Lab	--	--	--	30	20	50	0	0	2	1
IoT 2077	DLC	Internship III (Evaluation Personality Development)	-	-	-	50	-	50	-	-	4	2
IoT 2078	DLC	Major Project prelim	-	-	-	100	50	150	-	-	4	2
Total			**350**	**100**	**50**	**180**	**70**	**750**	**15**	**2**	**10**	**22**

MST: Minimum two mid semester tests to be conducted during Semester,

ES: End Semester MS: Mid Semester L: Lecture T: Tutorial P: Practical

	DE – 4	DE -5	DE -6	OC – 3	OC -4
A	Big Data Analytics	Real Time Operating System	Mobile Application Development	Digital Image Processing	AI for IoT
B	Industrial IoT 4.0	Wireless Networks	UI/UX	Embedded System Design	Cyber Security

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE VIDISHA (M.P.)

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Scheme of Examination (Semester-VIII)

for Batch Admitted in session - 2021-22

Bachelor of Technology (B. Tech.) – Internet of Things

Subject Code	Subject Category	Subject Name	Maximum Marks Allotted						Contact Hrs.			Total Credits
			Theory			Practical		Total Marks				
			ES	MS	Assignment/ Quiz	ES	Term Work, Lab Work or Sessional		L	T	P	
IoT 2081	DE	Mooc Course -1/OC - 4	70	20	10			100	3	0	0	3
IoT 2082	OC	Mooc Course -2/OC -5	70	20	10			100	3	0	0	3
IoT 2083	PROJ	Major Project Final				400	150	550	0	0	16	8
Total			**140**	**40**	**20**	**400**	**150**	**750**	6	0	16	**14**
	NLC	**Participation and winning in national level competition**										
	SL	**MOOCs**										

MST: Minimum two mid semester tests to be conducted during Semester,

ES: End Semester MS: Mid Semester L: Lecture T: Tutorial P: Practical

Mooc Course -1	Mooc Course -2
SWAYAM/NPTEL – COURSE Suggested by Department.	

	Mooc Course -1/OC - 4	Mooc Course -2/OC -5
A	Foundation of Cloud IoT Edge ML	Digital Design with Verilog
B	Foundations of Cyber Physical Systems	Cloud Computing and Distributed Systems

SWAYAM/NPTEL MOOC's Course *

For batch admitted 2021-22

OC - 4	OC -5
A. Foundation of Cloud IoT Edge ML	A. Digital Design with Verilog
B. Foundations of Cyber Physical Systems	B. Cloud Computing and Distributed Systems

Sr. No	*Credit Points*	*Course/subject Name*	*Equivalent Course in NPTEL*	*Course Duration (Week)*	Link
1.	03	Foundation of Cloud IoT Edge ML	https://onlinecourses.nptel.ac.in/noc23_cs65/preview	08	https://archive.nptel.ac.in/courses/106/104/106104242/
2.	03	Foundations of Cyber Physical Systems	https://onlinecourses.nptel.ac.in/noc23_cs62/preview	12	https://nptel.ac.in/courses/106105241
3.	03	Digital Design with Verilog	https://onlinecourses.nptel.ac.in/noc24_cs61/preview	12	https://nptel.ac.in/courses/108103179
4.	03	Cloud Computing and Distributed Systems	https://onlinecourses.nptel.ac.in/noc21_cs15/preview	08	https://nptel.ac.in/courses/106104182

Tentative Pool of subjects for Honours and Minor Degree

SWAYAM/NPTEL/MOOC's Courses

S. No.	Honours Degree for students of parent department	Minor Degree for students of other department	Remark
1.	Cloud Computing and Distributed Systems	Analog and Digital Electronics	8-12 Weeks
2.	Switching Circuits and Logic Design	Computer Networks And Internet Protocol	8-12 Weeks
3.	Advanced Computer Networks	Microprocessor and Microcontroller	8-12 Weeks
4.	Embedded System Design with ARM	Foundation of Cloud IoT Edge ML	8-12 Weeks
5.	Embedded Sensing, Actuation and Interfacing Systems	Foundations of Cyber Physical Systems	8-12 Weeks
6.	Digital System Design	Introduction to Embedded System Design	8-12 Weeks
7.	An Introduction to Information Theory	Introduction To Industry 4.0 And Industrial Internet Of Things	8-12 Weeks
8.	Industrial Automation And Control	Introduction To Internet Of Things	8-12 Weeks

*Note: Those subjects which are already studied in the core scheme from I to VIII semester cannot be opted.

20 additionally to be earned between V to VIII semester Maximum 6 credits per semester from V semester onwards will be permitted.

Tentative pool of subjects for Honours & Minor Degree

SWAYAM/NPTEL/ MOOC's Course *

Annexure-I

NPTEL Courses Equivalence for Departmental and Open Electives
For
(Honour's Degree)

ExistingElectives			SimilarNPTELCourse		
Sr. No	*Credit Points*	*Course/subjectName*	*Equivalent Course inNPTEL*	*CourseDuration(Week)*	Link
1.	2	Cloud Computing and Distributed Systems	https://onlinecourses.nptel.ac.in/noc21_cs15/preview	08	https://nptel.ac.in/courses/106104182
2.	3	Switching Circuits and Logic Design	https://onlinecourses.nptel.ac.in/noc20_cs67/preview	12	https://nptel.ac.in/courses/106105185
3.	3	Advanced Computer Networks	https://onlinecourses.nptel.ac.in/noc23_cs35/preview	12	https://nptel.ac.in/courses/106106243
4.	2	Embedded System Design with ARM	https://onlinecourses.nptel.ac.in/noc22_cs93/preview	08	https://nptel.ac.in/courses/106105193
5.	3	Embedded Sensing, Actuation and Interfacing Systems	https://onlinecourses.nptel.ac.in/noc24_ee68/preview	12	https://nptel.ac.in/courses/108105376
6.	3	Digital System Design	https://onlinecourses.nptel.ac.in/noc21_ee39/preview	12	https://nptel.ac.in/courses/108106177
7.	2	An Introduction to Information Theory	https://onlinecourses.nptel.ac.in/noc22_ee49/preview	08	https://nptel.ac.in/courses/117104129
8.	3	Industrial Automation And Control	https://onlinecourses.nptel.ac.in/noc21_me67/preview	12	https://nptel.ac.in/courses/108105088

Tentative pool of subjects for Honours & Minor Degree

SWAYAM/NPTEL/ MOOC's Course *

Annexure-II

NPTEL Courses Equivalence for Departmental and Open Electives
For
(Minor Degree)

ExistingElectives			SimilarNPTELCourse		
Sr.No.	*Credit Points*	*Course/subjectName*	*Equivalent Course inNPTEL*	*CourseDuration(Week)*	Link
1.		Analog and Digital Electronics	https://nptel.ac.in/courses/108105158		https://nptel.ac.in/courses/108102112
2.	3	Computer Networks And Internet Protocol	https://onlinecourses.nptel.ac.in/noc22_cs19/preview	12	https://nptel.ac.in/courses/106105183
3.	3	Microprocessor and Microcontroller	https://onlinecourses.nptel.ac.in/noc22_ee12/preview	12	https://nptel.ac.in/courses/108105102
4.	2	Foundation of Cloud IoT Edge ML	https://onlinecourses.nptel.ac.in/noc23_cs65/preview	08	https://nptel.ac.in/courses/106104242
5.	3	Foundations of Cyber Physical Systems	https://onlinecourses.nptel.ac.in/noc23_cs62/preview	12	https://nptel.ac.in/courses/106105241
6.	3	Introduction to Embedded System Design	https://onlinecourses.nptel.ac.in/noc20_ee98/preview	12	https://nptel.ac.in/courses/108102169
7.	3	Introduction To Industry 4.0 And Industrial Internet Of Things	https://onlinecourses.nptel.ac.in/noc20_cs69/preview	12	https://nptel.ac.in/courses/106105195
8.	3	Introduction To Internet Of Things	https://onlinecourses.nptel.ac.in/noc22_cs53/preview	12	https://nptel.ac.in/courses/106105166

IoT-2031 Signals & Systems

Course Title	Course Code	Credits - 4		
		L	T	P
Signals & Systems	IoT-2031	3	1	-

COURSE OBJECTIVE

When a student completes this course, s/he should be able to:

- Understand the fundamentals of the Signals and systems.
- Understand linear time invariant systems and able to obtain mathematical modeling of the system.
- Apply the concepts of frequency domain representations to analyze continuous and discrete time signals/systems
- Understand and apply the Z-Transform, to the analysis and description of LTI discrete-time systems.
- Able to apply the knowledge to model a system

PRE-REQUISITES

- Differential equations
- Linear algebra.

COURSE CONTENTS

Unit I: An Introduction to Signals and Systems: Definition of signal and systems, communication and control systems as examples. Classification of signals: continuous time and discrete time signal even and odd, periodic and non-periodic, deterministic and non-deterministic, energy and power. Elementary signals/Functions: exponential, sine, unit impulse, unit step and its properties, ramp, rectangular, triangular, signum. Operations on signals: Amplitude scaling, addition, multiplication, differentiation, integration, time scaling, time shifting, and time folding. System properties: linearity, additively and homogeneity, causality, stability, reliability. Introduction to different types of systems like causal & non causal systems, static& dynamic, stable &unstable, linear& nonlinear, time variant &time invariant systems.

Unit-II: Linear Time- Invariant Systems: Introduction, Convolution: impulse response representation for LTI systems, properties of the impulse response representation for LTI systems, differential and difference equation for LTI Systems, block diagram representations (direct form-I, direct form-II, transpose, cascade and parallel).

Unit-III: Periodic and semi-periodic inputs to an LSI system, the notion of frequency response and its relation to impulse response, Fourier series representation, the Fourier transform convolution/multiplication and their effect in frequency domain, magnitude and phase response, Fourier domain duality.

Unit-IV: Sampling Theorem, reconstruction of a signal from its samples, aliasing, discrete time processing of continuous time signals, Sampling of band pass signals, Fourier series, Fourier transform (FT), Parseval's theorem.

Mr. Sudesh Morey Mr. Satish Asnani Dr. Dhananjay V. Gadre Dr. N. P. Patidar Prof. Vipin Patait

Dr. Divya Rishi Sahu Prof. Shaila Chugh Prof. C. S. Sharma Dr. Jyotsna V Ogale Dr. J. S. Chauhan

Unit-V: The z transform Basic principle of z-transform, definition, region of convergence, system functions, poles and zeros of systems and sequences, properties of ROC, properties of z-transform, inverse z-transform using, contour integration, residue theorem, power series expansion, and partial fraction expansion, relationship between z-transform and Fourier transform.

COURSE OUTCOMES:

This course develop students abilities to

CO 1: Acquire knowledge of basics, fundamentals of signal & systems and identify basic process involved in signal & system interaction.Apply the basic concepts in Modeling and transform domain analysis .

CO 2: Analysis signal & system in time and frequency domain and extract the necessary information Model, analyze and synthesize the systems and performance of systems.

TEXT BOOKS& REFERENCES:

- A.V. Oppenheim, A.S. Willsky and I.T. Young, "Signals and Systems", Prentice Hall, 1983.
- B.P. Lathi, "Signal Processing and Linear Systems", Oxford University Press, c1998.
- Douglas K. Lindner, "Introduction to Signals and Systems", Mc-Graw Hill International Edition: c1999.
- J. Nagrath, S. N. Sharan, R. Ranjan, S. Kumar, "Signals and Systems", Tata Mc Graw Hill Publishing Company Ltd., New Delhi
- R.F. Ziemer, W.H. Tranter and D.R. Fannin, "Signals and Systems - Continuous and Discrete", 4th edition, Prentice Hall, 1998.
- Papoulis, "Circuits and Systems: A Modern Approach", HRW, 1980.
- Robert A. Gabel, Richard A. Roberts, "Signals and Linear Systems", John Wiley and Sons (SEA) Private Limited, c1995.
- M. J. Roberts, "Signals and Systems - Analysis using Transform methods and MATLAB", Tata Mc Graw Hill Edition, 2003.
- Simon Haykin, Barry van Veen, "Signals and Systems", John Wiley and Sons (Asia) Private Limited, c1998.

END

Mr. Sudesh Morey Mr. Satish Asnani Dr. Dhananjay V. Gadre Dr. N. P. Patidar Prof. Vipin Patait

Dr. Divya Rishi Sahu Prof. Shama Chugh Prof. C. S. Sharma Dr. Jyotsna V Ogale Dr. J. S. Chauhan

IoT-2032 Electronic Devices & Circuits

Course Title	Course Code	Credits - 4		
		L	T	P
Electronic Devices & Circuits	IoT-2032	3	-	2

COURSE OBJECTIVE

The purpose of the course is to teach the fundamental principle of electronics. The material covers a variety of topics including various types of diodes, transistor, amplifiers and application.

PRE-REQUISITES

Basic knowledge of electronic components and laws such as KCL, KVL, etc.

COURSE CONTENTS

Unit I: Semiconductor Diodes: Basics of semiconductor theory, Introduction to PN junction diode, Special function diode, Zener diode, PIN, Varactor, Tunnel & Schottky diode and its applications. Design circuits using diodes. Optoelectronics- LED, LCD, Photo diode, Photo voltaic cell or solar cell. Drift of carrier in electric and magnetic field and Hall effect, Introduction to analog IC's.

Unit II: Bipolar Junction Transistors (BJTs): Physical structure and operation modes, Active region operation of transistor, D.C. and A.C. analysis of transistor circuits, Transistor as an amplifier. Biasing the BJT: fixed bias, emitter feedback bias, collector feedback bias and voltage divider. Basic BJT amplifier configuration: common emitter, common base and common collector amplifiers. Transistor as a switch: cut-off and saturation modes h and π model of BJT amplifier, Low and high frequency analysis of BJT.

Unit III: Field Effect Transistor (FET): Junction Field-Effect Transistor (JFET) - Construction, Operation and Biasing, Depletion-type MOSFET, Enhancement-type MOSFET: structure and physical operation, current-voltage characteristics, D.C. operation, Biasing, configuration: common source, gate and drain types. High frequency model of MOSFET.

Unit IV: Multistage or Cascade amplifier: classification , coupling and frequency response of cascaded systems, effect of cascading on voltage gain, current gain, phase, input and output impedances and bandwidth of cascaded or multistage amplifiers. Types of coupling, cascade and cascode circuits, Miller theorem, Darlington pair, bootstrap circuit.

Unit V: Tuned Amplifiers: Tuned amplifier: single tuned, double tuned and stagger tuned amplifiers characteristics and their frequency response, Power amplifier- Class A, B, C, AB, second-harmonic distortion.. Comparison of their efficiencies, types of distortion.

COURSE OUTCOMES:

On successful completion of this course student should be able to:

CO1: Identify, understand and demonstrate fundamental principle and working of electronic components and devices.

CO2: Analyze various electronic circuits and amplifiers.

Mr. Sudesh Morey Mr. Satish Asnani Dr. Dhananjay V. Gadre Dr. N. P. Patidar Prof. Vipin Patait

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CO3: Design different electronic circuits and systems by cascading different electronic stages.

TEXT BOOKS& REFERENCES:

- Electronics Circuits and Systems- Owen Bishop
- Intuitive Analog Circuit Design- Marc T. Thompson
- Electronic Devices & circuits – Boyelstad & Neshelsky – PHI
- A Text of electronic" 2nd edition S.Chand-R.S Sedha
- Integrated Electronics. – Millman Halkias
- Electronic Devices & Circuits – David A. Bell – PHI
- Principles of Electronic Devices – Malvino
- Starting Electronics (Fourth Edition)-Keith Brindley
- Microelectronics & circuit 5th edition - Sandra & Smith.

LABORATORY EXPERIMENTS

1. Familiarize with existing online simulation tools such as Circuit Simulation and Schematics Lab, MultiSim Lab, etc.
2. To design circuits, make wiring diagrams, to test analog and digital simulation, and perform the practical available at simulation lab.
3. Design voltage regulator using Zener diode and verify its characteristics.-CO3
4. To draw the output waveform of Full wave rectifier. Calculate PIV, Ripple Factor, Form Factor and Efficiency.-CO2
5. Analysis of common base PNP bipolar junction transistor and verify input and output characteristics.-CO2
6. Analysis of common emitter NPN bipolar junction transistor and verify input and output characteristics.-CO2
7. To draw the static characteristics of JFET and find out its parameters.-CO2
8. To design the power supply of +5V and -5V using IC regulator.-CO3
9. To design a positive clipper circuit using a 1 kHz square wave with a 10 volt peak-to-peak magnitude as the input signal.-CO3
10. To design a negative clamper circuit using a 1 kHz square wave with a 10-volt peak-to-peak magnitude as the input signal.-CO3
11. To draw the frequency response of two stage RC coupled class A amplifier using transistor.-CO2
12. To draw the frequency response of two stage Direct coupled class A amplifier using transistor.-CO2

END

Mr. Sudesh Morey Mr. Satish Asnani Dr. Dhananjay V. Gadre Dr. N. P. Patidar Prof. Vipin Patait

Dr. Divya Rishi Sahu Prof. Shaila Chugh Prof. C. S. Sharma Dr. Jyotsna V Ogale Dr. J. S. Chauhan

Samrat Ashok Technological Institute (Engineering College), VIDISHA (M.P.)
(An Autonomous Institute Affiliated to RGPV, Bhopal)
Syllabus: B.Tech (IoT)
Internet of Things

IoT – 2033 Analog Electronics

Course Title	Course Code	Credits - 4		
		L	T	P
Analog Electronics	IoT – 2033	3	-	2

COURSE OBJECTIVE	The purpose of this course is to study feedback techniques, oscillator's circuit & basic building blocks of linear integrated circuits; the linear and non-linear applications of operational amplifiers, special integrated circuits & active filters, IC 555 and signl generators circuits using op-amps.
PRE-REQUISITES	Basic Electricals & Electronics Engineering, Network Analysis
COURSE CONTENTS	**Unit I:** Feedback Amplifier and Oscillators: Concept of feedback and their types, Amplifier with negative feedback and its advantages, Feedback Topologies, Oscillators: Concept of Positive feedback, Classification of Oscillators, Barkhausen criterion, Types of oscillators: RC oscillator, RC Phase Shift, Wien Bridge Oscillators, LC Oscillator: Hartley, Colpitt's, Clapp and Crystal oscillator, Introduction to integrated circuits: Advantages and characteristic parameters of IC's, basic building components, data sheets. **Unit-II:** Operational Amplifier: Differential amplifier and analysis, Configurations- Dual input balanced output differential amplifier, Dual input Unbalanced output differential amplifier, Single input balanced output differential amplifier, Single input Unbalanced output differential amplifier Introduction of op-amp, Block diagram, characteristics and equivalent circuits of an ideal opamp, Power supply configurations for OP-AMP, Characteristics of op-amp: Ideal and Practical, Input offset voltage, offset current, Input bias current, Output offset voltage, thermal drift, Effect of variation in power supply voltage, common-mode rejection ratio (CMRR), Slew rate and its Effect, PSRR and gain bandwidth product, frequency limitations and compensations, transient response, analysis of TL082 datasheet. **Unit-III:** OP-AMP applications: Inverting and non-inverting amplifier configurations, Summing amplifier, Integrators and differentiators, Instrumentation amplifier, Differential input and differential output amplifier, Voltage-series feedback amplifier, Voltage-shunt feedback amplifier, Log/ Antilog amplifier, Triangular/rectangular wave generator, phase-shift oscillators, Wein bridge oscillator, analog multiplier-MPY634, VCO, Comparator, Zero Crossing Detector, OP-AMP AS FILTERS: Characteristics of filters, Classification of filters, Magnitude and frequency response, Butterworth 1st and 2nd order Low pass, High pass and band pass filters, Chebyshev filter characteristics, Band reject filters, Notch filter; all pass filters, self-tuned filters, AGC,AVC using op-AMP. **UNIT IV:** TIMER:IC-555 Timer concept, Block pin configuration of timer, Monostable, Bistable and Astable Multivibrator using timer 555-IC, Schmitt Trigger, Voltage limiters, Clipper and clampers circuits, Absolute value output circuit, Peak detector, Sample and hold Circuit, Precision rectifiers, Voltage-to-current converter, Current-to-voltage converter.

Mr. Sudesh Morey Mr. Satish Asnani Dr. Dhananjay V. Gadre Dr. N. P. Patidar Prof. Vipin Patait

Dr. Divya Rishi Sahu Prof. Shaila Chugh Prof. C. S. Sharma Dr. Jyotsna V Ogale Dr. J. S. Chauhan

UNIT V: Voltage Regulator: simple OP-AMP Voltage regulator. Fixed and Adjustable Voltage Regulators, Dual Power supply, Basic Switching Regulator and characteristics of standard regulator ICs such as linear regulator, Switching regulator and low-drop out regulator. Study of LM317, TPS40200 and TPS7250

COURSE OUTCOMES:

On completion of this course students should be able to:

CO 1: Able to understand & demonstrate the fundamentals of operational amplifiers & its applications
CO 2: Able to analyze different OP-Amp Circuits
CO 3: Able to design different applications of OP-Amp

TEXT BOOKS& REFERENCES:

- Ramakant A. Gaikward,"OP- Amp and linear Integrated circuits" Third edition 2006, Pearson.
- B. Visvesvara Rao Linear Integrated Circuits Pearson.

REFERENCES:

- David A. Bell: Operational Amplifiers & Linear ICs, Oxford University Press, 2nd edition,2010.
- D. Roy Choudhury: Linear Integrated Circuits New Age Publication.
- B. Somanathan Nair: Linear Integrated Circuits analysis design and application Wiley India Pvt. Ltd.
- Maheshwary and Anand: Analog Electronics, PHI.
- S Salivahanan,V S KanchanaBhaaskaran: Linear Integrated Circuits",second edition, McGraw Hill.
- Gray Hurst Lewis Meyer Analysis and design of analog Integrated Circuits fifth edition Wiley India.
- RobertF.Coughlin, Frederick,F.Driscoll: Operational Amplifiers and Linear Integrated Circuits, sixth edition, Pearson.
- Millman and Halkias: Integrated electronics, TMH.
- Boylestad and Nashelsky: Electronic Devices and Circuit Theory, Pearson Education.
- Sedra and Smith: Microelectronics, Oxford Press.

LABORATORY EXPERIMENTS

1. To measure and compare the op-amp characteristics: offset voltages, bias currents, CMRR, Slew Rate of OPAMP LM741 and TL082.
2. To determine voltage gain and frequency response of inverting and non-inverting amplifiers using TL082.
3. To design an instrumentation amplifier and determine its voltage gain using TL082
4. To design op-amp integrator (low pass filter) and determine its frequency response.
5. To design op-amp differentiator (high pass filter) and determine its frequency response.
6. Design 2nd order Butterworth filter using universal active filter topology with LM741
7. To design Astable, Monostable and Bistable multivibrator using 555 and analyse its characteristics.
8. Automatic Gain Control (AGC) Automatic Volume Control (AVC) using multiplier.

Mr. Sudesh Morey Mr. Satish Asnani Dr. Dhananjay V. Gadre Dr. N. P. Pathar Prof. Vipin Patait

Dr. Divya Rishi Sahu Prof. Shaila Chugh Prof. C. S. Sharma Dr. Jyotsna V Ogale Dr. J. S. Chauhan

IoT – 2034 Introduction to Internet of Things

Course Title	Course Code	Credits - 4		
		L	T	P
Digital Electronics	IoT-2034	3	-	2

COURSE OBJECTIVE

The purpose of this course to student should be able to study and appreciate the functioning of different digital components like logic gates, multiplexers, decoders, flip flops, counters, etc.

PRE-REQUISITES

- Basic knowledge of direct current circuits, concept of voltage, current, resistance, semiconductor, diodes and transistors.

COURSE CONTENTS

UNIT 1: Number Systems and Codes: Digital number systems, base conversion, Binary, Decimal, octal, Hexadecimal, number system with radix r, Gray codes.Alphanumeric codes – ASCII code and BCD codes, concept of parity, complementr's& (r-1)'s, subtraction with complements, signed Binary numbers, Error Detecting & Correcting codes. Basic Theorems & Properties of Boolean algebra: AND, OR, NOT operators, laws of Boolean algebra, Demorgon's theorem, Boolean expression & logic diagram Negative logic, Alternate logic gate representation (concept of bubbled gates) canonical and standard Forms (Minterms&Maxterms), sum of minterms& product of maxterms, conversion between canonical forms. Truth table & maps, 2,3,4,5 and 6 variable maps, solving digital problems using Maps, Don't care conditions, Tabular minimization Sum of product & product of sum reduction, Exclusive OR & Exclusive NOR circuits, Parity generator &checkers.

UNIT 2: Combinational Circuits: Design procedure, Adders (half and Full), subtractor (half and full) code convertors, Analysis of design, Universal building blocks, Implementation of any logic circuit with only NAND gates or with only NOR gates, Binary serial adder, parallel adder, serial/parallel adder, look ahead carry generator, BCD adder, Binary multiplier, Magnitude comparator, Decoder, Demultiplexer, Encoders, priority encoder, Multiplexers & implementation of combinational logic diagram.

UNIT 3: Sequential Logic Circuit : Latches, SR latch with NAND & NOR gates, D latch, edge triggered flip flop, J-K flip flop, T flip flop, Master slave flip flop, Analysis of clocked sequential circuit, state table, state diagram, state reduction state equations, state assignments, flip flop excitation table & characteristic equations, Design procedure for sequential circuits, Design with state reduction, Applications of flipflop.

UNIT 4: Registers and Counters : Asynchronous and Synchronous counter, counters with MOD numbers, Down counter, UP/DOWN counter, propagation delay in ripple counter, programmable counter, Pre- settable counter, BCD counter, cascading, counter applications, Decoding in counter, Decoding glitches, Ring Counter, Johnson counter, Rotate left & Rotate right counter, Registers – Buffer, Shift left, shift right, shift left/Right registers, parallel in parallel out, serial in serial out, parallel in serial out, serial in parallel out registers. Design at the Register Transfer Level.

UNIT 5: Logic Families: Introduction to different logic families and their characteristics, RTL, DTL, TTL, ECL, HL,TTL inverter – circuit description and operation, CMOS inverter

Mr. Sudesh Morey Mr. Satish Asnani Dr. Dhananjay V. Gadre Dr. N. P. Patidar Prof. Vipin Patait

Dr. Divya Rishi Sahu Prof. Shaila Chugh Prof. C. S. Sharma Dr. Jyotsna V Ogale Dr. J. S. Chauhan

– circuit description and operation, other TTL and CMOS gates.

Memories – ROM - ROM organization - PROM – EPROM – EEPROM –EAPROM, RAM – RAM organization Static RAM, Dynamic RAM, Programmable Logic Array (PLA) - Programmable Array Logic (PAL)

COURSE OUTCOMES:

On successful completion of this course student should be able to:

CO 1:The student will be able to represent numerical values in various number systems and perform number conversions between different number systems.

CO 2:The students will be able to design and debug complex combinational and sequential circuits based on an abstract functional specifications

CO 3:The students will be able to list the nomenclature and technology in the area of memory devices: ROM, RAM, PROM, PLD , FPGAs, etc.

CO 4: The students will be able to test and verify digital logic circuits

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Dr. Divya Rishi Sahu Prof. Shaila Chugh Prof. C. S. Sharma Dr. Jyotsna V Ogale Dr. J. S. Chauhan

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE

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Department of Computer Science and Information Technology

Internet of Things

Semester/Year			Program		B.Tech.
Subject Category	DC	Subject Code:	IOT-2041	Subject Name:	Data Structure and Algorithm

Maximum Marks Allotted							Contact Hours			Total Credits
Theory			Practical			Total Marks				
End Sem	Mid-Sem	Assignment	End Sem	Lab-Work	Quiz		L	T	P	
70	20	10	30	10	10	150	3	0	2	4

Prerequisites:

Programmingand BasicMathematicalknowledge

Course Objective:

1. To impart the basic concepts of data structures and algorithms.
2. To understand concepts about searching and sorting techniques
3. To understand basic concepts about stacks, queues, lists trees and graphs.
4. To enable them to write algorithms for solving problems with the help of fundamental data structures

Course Outcomes:

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

CO 1: Analyze the algorithms to determine the time and computation complexity and justify the correctness.

CO 2: Implement search technique for a given problem.

CO 3: Write algorithm for Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort and compare their performance in term of Space and Time complexity.

CO 4: Implement the logic of Stacks, Queues and linked list and analyse the same to determine the time and computation complexity.

CO 5: Implement Graph search and traversal algorithms and determine the time and computation complexity.

UNITs	Descriptions	Hrs.
I	Introduction Data structure, abstract data type, data object. Types of data structure – primitive & non-primitive, linear & non-linear. Operations on data structures – traversing, searching, inserting, deleting. Complexity analysis – worst case, best case, average case. Mathematical preliminaries - Time – space trade off, algorithm efficiency, asymptotic notations – big oh, omega, theta.	8
II	Arrays & Structure Introduction , declaration of arrays , operations on arrays – inserting , deleting , merging of two arrays , 1 dimensional & 2 dimensional arrays, row & column major representation , address calculation in array , storing values in arrays , evaluation of polynomial – addition & representation. Introduction - Searching & sorting, sequential search, binary search, Fibonacci search, indexed sequential search, hashed	8

	search. Types of sorting with general concepts – bubble, heap, insertion, selection, quick, heap, shell, bucket, radix and merge sort.	
III	Stacks & Queues Basic concept of stacks & queues, array representation of stacks, operation on stacks – push, pop, create, get Top, empty, linked representation of stack, multiple stacks. Application of stack – Conversion: infix, prefix, postfix and evaluation of arithmetic expression. Linked representation of queue, operations on queue – insertion & deletion. Types of queue with functions – circular, de-queue, priority queue. Applications of queues – job scheduling, Josephus problem.	8
IV	Linked List Introduction – basic terminology, memory allocation &deallocation for linked list. Linked list variants – head pointer, head node, types linked list – linear & circular linked list. Doubly linked list, creation of doubly list, deletion of node from doubly linked list, insertion of a node from doubly linked list, traversal of doubly linked list. Circular Linked Lists: all operations their algorithms and the complexity analysis. Applications of linked list – polynomial representation & garbage collection.	8
V	Trees and Graphs: Tree: Definition, Terminology Binary tree - definitions and properties, Representation, Binary Tree Traversal In-order, Pre-order, Post order, Insertion and deletion of nodes in binary search tree. Introduction to Binary Search Tree. AVL Tree; Tree operations on each of the trees and their algorithm and analysis. B Tree, B+ Tree: definitions, algorithms and analysis. Graph: Representation of graphs using adjacency matrix, adjacency.	8
Guest Lectures (if any)		--
Total Hours		40

List of Experiments

1. Find a pair with the given sum in an array.
2. Find the maximum product of two integers in an array.
3. Find the largest number possible from a given set of numbers.
4. Print all possible solutions to N–Queens problem.
5. Check if a number is even or odd without using any conditional statement.
6. All-Pairs Shortest Paths – Floyd Warshall Algorithm.
7. Check if a graph is strongly connected or not.
8. Print complete Binary Search Tree (BST) in increasing order.
9. Find the minimum and maximum element in an array using Divide and Conquer.
10. Calculate the height of a binary tree – Iterative and Recursive.
11. Find the maximum occurring word in a given set of strings.
12. Combinations of words formed by replacing given numbers with corresponding alphabets.
13. Find the path between given vertices in a directed graph.
14. Find number of customers who could not get any computer.

Text Books-

- Fundamentals of Data Structures in C -- by Horowitz, Sahni and Anderson-Freed (Silicon Press 2007).
- How to solve it by Computer -- by R G Dromey (PHI 1982, Paperback 2008).
- E. Horowitz, S. Sahni, S.Anderson-freed, ―Fundamentals of Data Structures in C, Second Edition, University Press, ISBN 978-81-7371-605-8
- B. Kernighan, D. Ritchie, ―The C Programming Language‖, Prentice Hall of India, Second Edition, ISBN 81-203-0596-5
- Data Structure Using C and C++ -- by Y. Langsam, M. J. Augenstein and A. N. Tanenbaum (Pearson Education, 2nd Edition, 2015).

Modes of Evaluation and Rubric
The evaluation modes consist of performance in Two mid-semester Tests, Quiz/ Assignments, term work, end-semester examinations, and end-semester practical examinations.
List/Links of e-learning resource
List and Links of e-learning resources: 1. https://nptel.ac.in/courses/106102064 2. https://de-iitr.vlabs.ac.in/

Recommendation by Board of studies on	Dec-2022
Approval by Academic council on	Dec-2022
Compiled and designed by	CS & IT
Subject handled by department	IOT

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE

(Engineering College), VIDISHA M.P.

(An Autonomous Institute Affiliated to RGPV Bhopal)

Department of Computer Science and Information Technology

Internet of Things

Semester/Year			Program		B.Tech.
Subject Category	DC	Subject Code:	IOT-2042	Subject Name:	Operating System

Maximum Marks Allotted							Contact Hours			Total Credits
Theory			Practical			Total Marks				
End Sem	Mid-Sem	Assignment	End Sem	Lab-Work	Quiz		L	T	P	
70	20	10	30	10	10	150	3	0	2	4

Prerequisites:

- None

Course Objective:

To understand operating system architecture and functioning along with in-depth knowledge of internals and working of OS modules like process management, Storage management, file system, security and protection.

Course Outcomes:

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

CO -1: Understanding of the inherent mechanism involved in functioning of an operating system.

CO -2: Ability to analyze various scheduling and synchronization techniques.

CO -3: Knowledge of file systems its implementation and protection.

CO -4: Analysis of memory and device management methodology.

CO -5: Comprehensive outlook in design principles of operating systems.

UNITs	Descriptions	Hrs.
I	Overview-Introduction to Operating Systems, Evolution of Operating System mainframe, desktop, multiprocessor,Distributed, Network Operating System, and Clustered andHandheld System), Operating System Structure- OperatingSystem Services and System Calls, System Programs. Types ofOperating Systems: Batch Processing, Real Time, Multitaskingand Multiprogramming, time-sharing system and DistributedOperating systems	8
II	Process Management-Concept, Process Control Blocks (PCB), Process Scheduling. Scheduling Criteria, Scheduling Algorithms and theirevaluation. Threads Overview and Multithreading Models Inter Processes Communication and Critical Section Problem andSolution-Semaphores and Monitors, DeadlockCharacterization, Methods for deadlock handling, deadlockprevention, deadlock avoidance, deadlock detection andrecovery from deadlock.	8
III	Storage Management-Memory Hierarchy, Concepts of memory management, MFT and MVT, logical and physical addressspace, swapping, contiguous and non- contiguous allocation,Paging and Segmentation Structure and Implementation ofPage table, Virtual memory, Cache Memory	9

	Organization,Demand paging, Page replacement Algorithms. Thrashing,Demand segmentation.	
IV	File and Disk Management-File concepts, Access methods, Directory Structure, File Sharing and Protection, Free spacemanagement, Efficiency and Performance- Case study on Unix,Linux and Windows, Disk Structure and Scheduling, efficiencycase study of UNIX.I?O system –Hardware ,Application, input-output interface.	7
V	Protection and Security- Protection Goals of Protection, Principles of Protection, Domain of Protections. Access Matrix,Implementation of Access Matrix, Access Control, Revocationof Access Rights Security The Security Problem, Programthreats system and network threats, Cryptography as s securitytool, user authentication, implementation of security defense-Firewall system, Case study - LINUX and Windows.	8
Guest Lectures (if any)		--
Total Hours		40

List of Experiments

1. Basic Linux Commands and Overview
2. Implementation of FCFS (First Come First Serve) CPU Scheduling.
3. Implementation of SJF (Shortest Job First) CPU Scheduling.
4. Implementation of Round Robin (RR) CPU Scheduling.
5. Implementation of Priority CPU Scheduling Algorithm.
6. Implementation of FIFO Replacement Algorithm.
7. Implementation of Optimal Page Replacement Algorithm.
8. Implementation of LRU Page Replacement Algorithm by Stack method.
9. Implement the producer-consumer problem using threads.
10. Write a program to implement Echo service using socket programming

Text Books-

1. Peterson, J.L. &Silberschatz, A.: Operating System Concepts, Addison, Wesley-Reading.
2. Brinch, Hansen: Operating System Principles, Prentice Hall of India.
3. Haberman, A.N.: Introduction to Operating System Design Galgotia Publication, New Delhi.
4. Tanenbaum, A.S.: Operating Systems.
5. Hansen, P.B.: Architecture of Concurrent Programs, PHI.
6. Shaw, A.C.: Logic Design of Operating Systems, PHI.

Modes of Evaluation and Rubric

The evaluation modes consist of performance in Two mid-semester Tests, Quiz/ Assignments, term work, end-semester examinations, and end-semester practical examinations.

List/Links of e-learning resource

List and Links of e-learning resources:
https://nptel.ac.in/courses/106105214

Recommendation by Board of studies on	Dec-2022
Approval by Academic council on	Dec-2022
Compiled and designed by	CS & IT
Subject handled by department	IOT

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE

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Department of Computer Science and Information Technology

Internet of Things

Semester/Year			Program		B.Tech.
Subject Category	DC	Subject Code:	IOT-2043	Subject Name:	Python Programming

Maximum Marks Allotted							Contact Hours			Total Credits
Theory			Practical			Total Marks				
End Sem	Mid-Sem	Assignment	End Sem	Lab-Work	Quiz		L	T	P	
70	20	10	30	10	10	150	3	0	2	4

Prerequisites:

Course Objective:

Thiscourse introduces core programming basics- including data types, control structures, algorithm development, and programdesign with functions viathe Python programming language. The course discuss the fundamental principles ofObject-Oriented Programming.

Course Outcomes:

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

CO1: Ability to install python and its different projects.

CO2: Implement solution logic of problem and draw it in the form of algorithm..

CO3: Design and write a python program for given algorithm.

CO4: Understand object oriented with reference to python programing

UNITs	Descriptions	Hrs.
I	Introduction to computer science, algorithms, data representation incomputers, hardware, software and operating system. Installation of python-interactive shells, IDlY, saving, editing, and running a script. The concepts or datatypes: variables, immutable variables, numerical types, operators, expressions Indentation and commentsin the program.	8
II	Conditional Statements - Conditions, Boolean Logic. logical operators and Range. Control Statements- Break Continue and Pass. FlowControl-if.If-else Nested if-else, l(loop statements- for loop, whileloop, Nested loops.	8
III	String: subscript operator, Indexing, slicing a string; strings anti number system: Converting strings to numbers and vice versa. Strings and text files, manipulating, files and directories, os and sys modules, text files: reading/writing text and numbers from/to a file, creating and reading a formatted file (csv or tab separated).	9
IV	Lists tuples, and dictionaries. Basic list operators, replacing, inserting, removing an clement, searching and sorting lists, dictionary literals, adding and removing keys, accessing and replacing values, traversing dictionaries.	7

V	Classes and OOP: Classes, objects, attributes and methods,defining classes, design with classes, inheritance, overloading. Overriding, and Data hiding, Exception: Exception handling except clause, Try IiIla II)' ciaUSt.:, User Defined Exceptions.	8
Guest Lectures (if any)		--
Total Hours		40

List of Experiments

1. Write a program in python to check a number whether it is prime or not.
2. Write a program to check a number whether it is palindrome or not.
3. Write a function to swap the values of two variables through a function.
4. Write a python program to Read a file line by line and print it.
5. Write a program to display the number of lines in the file and size of a file in bytes.
6. Write a program to calculate the factorial of an integer using recursion.
7. Write a program to print Fibonacci series using recursion.
8. Write a program for binary search.
9. Python Program for Sum of squares of first n natural numbers.
10. Python Program to find sum of array.
11. Python program to read character by character from a file.
12. Python Program to print with your own font.
13. Python program to print even length words in a string.
14. Python program to check if a string is palindrome or not.
15. Program to print ASCII Value of a character.
16. Python program to find smallest and largest number in a list.
17. Python program to find the size of a Tuple.

Text Books-

- Python Programming, R. NageshwarRao, Wiley India
- Think Python: Allen B. Downey, O'R

Modes of Evaluation and Rubric

The evaluation modes consist of performance in Two mid-semester Tests, Quiz/ Assignments, term work, end-semester examinations, and end-semester practical examinations.

List/Links of e-learning resource

List and Links of e-learning resources:
https://nptel.ac.in/courses/106105214

Recommendation by Board of studies on	Dec-2022
Approval by Academic council on	Dec-2022
Compiled and designed by	CS & IT
Subject handled by department	IOT

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE

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Department of Computer Science and Information Technology

Internet of Things

Semester/Year			Program		B.Tech.
Subject Category	DC	Subject Code:	IOT-2044	Subject Name:	Foundation of IoT

Maximum Marks Allotted							Contact Hours			Total Credits
Theory			Practical			Total Marks				
End Sem	Mid-Sem	Assign ment	End Sem	Lab-Work	Quiz		L	T	P	
70	20	10	-	-	-	100	3	0	0	3

Prerequisites:

- None

Course Objective:

1. Tomake students know the IoT ecosystem.
2. Toprovideanunderstandingofthetechnologiesandthestandardsrelatingtotheinternet ofThings.
3. TodevelopskillsonIoTtechnicalplanning.

Course Outcomes:

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

CO1: TounderstandtheFundamentals of IoT.

CO2: To know about the networking concepts of IoT.

CO3: Toknow about the different connectivity technologies.

CO4: To know about the WSN and UAV network.

CO5: To know about the various applications of IoT.

UNITs	Descriptions	Hrs.
I	Introduction to IoT: Introduction, Characteristics of IoT, Application of IoT, IoT Categories, IoT Enablers and Connectivity Layers, Baseline Technologies, Sensors, Actuators, IoT components and Implementation, Challenges for IoT.	8
II	IoT Networking: Connectivity Technologies, Gateway Prefix Allotment, Impact of Mobility on Addressing, Multihoming, Deviations from Regular Web, IoT identification and Data Protocols(IPv4, IPv6, MQTT, CoAP, XMPP and AMQP)	8
III	Connectivity Technologies: Introduction, IEEE 802.15.4, ZigBee, 6LoWPAN, RFID, HART and Wireless HART, NFC, Bluetooth, Z-Wave, ISA 100.11A.	9
IV	Wireless Sensor Network: Introduction, Components of Sensor Node, Modes of Detection, Challenges in WSN. UAV Network: Introduction, UAV Network(Feature, Challenges and Topology) FANET: Introduction, FANET design consideration.	7

V	Application of IoT: Smart Homes – Introduction, Origin of Smart Homes, Smart Home Technologies. Smart Cities – Characteristics of Smart Cities, Smart City Framework, Challenges in Smart Cities. Connected Vehicles – Introduction, levels of Automation, Vehicle to Everything(V2X) Paradigm, Vehicular Ad-hoc Network (VANETs)	8
Guest Lectures (if any)		--
Total Hours		40

Text Books-

- Dr.JeevaJose,InternetofThings,KhannaPublishingHouse.
- NiteshDhanjani,AbusingtheInternetofThings,ShroffPublisher/O'ReillyPublisher.
- InternetofThings,RMDSundaramShriramKVasudevan,AbhishekSNagarajan,John Wiley and Sons.
- Internet of Things, Shriram K Vasudevan, Abhishek S Nagarajan, RMD Sundaram,JohnWiley & Sons.
- CunoPfister,"GettingStartedwiththeInternetofThings",ShroffPublisher/MakerMedia.
- FrancisdaCosta,"RethinkingtheInternetofThings:AScalableApproachtoConnectingEverything", 1 st Edition, Apress Publications.
- MassimoBanzi,MichaelShilohMake:GettingStartedwiththeArduino,ShroffPublisher/MakerMedia Publishers.

Modes of Evaluation and Rubric

The evaluation modes consist of performance in Two mid-semester Tests, Quiz/ Assignments, term work, end-semester examinations, and end-semester practical examinations.

List/Links of e-learning resource

List and Links of e-learning resources:

https://onlinecourses.nptel.ac.in/noc19_cs65/preview

Recommendation by Board of studies on	Dec-2022
Approval by Academic council on	Dec-2022
Compiled and designed by	CS & IT
Subject handled by department	IOT

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE

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Department of Computer Science and Information Technology

Internet of Things

Semester/Year			Program		B.Tech.
Subject Category	DC	Subject Code:	IOT-2045	Subject Name:	**Sensors and Actuators**

Maximum Marks Allotted							Contact Hours			Total Credits
Theory			Practical			Total Marks				
End Sem	Mid-Sem	Assignment	End Sem	Lab-Work	Quiz		L	T	P	
70	20	10	-	-	-	100	3	1	0	4

Prerequisites:

- None

Course Objective:

1. To provide in depth knowledge in physical principles applied in sensing, measurement and a comprehensive understanding on how measurement systems are designed, calibrated, characterised, and analysed.
2. To introduce the students to sources and detectors of various Optical sensing mechanisms and provide in-depth understanding of the principle of measurement, and theory of instruments and sensors for measuring velocity and acceleration
3. To give a fundamental knowledge on the basic laws and phenomena on which operation of sensor transformation of energy is based.
4. To impart a reasonable level of competence in the design, construction, and execution of mechanical measurements strain, force, torque and pressure.

Course Outcomes:

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

CO1: Use concepts in common methods for converting a physical parameter into an electrical quantity

CO2: Choose an appropriate sensor comparing different standards and guidelines to make sensitive measurements of physical parameters like pressure, flow, acceleration, etc.

CO3: Design and develop sensors using optical methods with desired properties

CO4: Evaluate performance characteristics of different types of sensors

CO5: Locate different types of sensors used in real life applications and paraphrase their importance.

UNITs	Descriptions	Hrs.
I	Sensor fundamentals and characteristics, Sensor Classification, Performance and Types, Error Analysis characteristics. Optical Sources and Detectors: Electronic and Optical properties of semiconductor as sensors, LED, Fiber optic sensors, Thermal detectors, Photo multipliers, photoconductive detectors, Photo diodes, Avalanche photodiodes, CCDs.	7

II	Strain, Force, Torque and Pressure sensors: Strain gauges, strain gauge beam force sensor, piezoelectric force sensor, load cell, torque sensor, Piezo-resistive and capacitive pressure sensor, optoelectronic pressure sensors, vacuum sensors. Design of signal conditioning circuits for strain gauges, piezo, capacitance and optoelectronics sensors.	9
III	Position, Direction, Displacement and Level sensors: Potentiometric and capacitive sensors, Inductive and magnetic sensor, LVDT, RVDT, Fiber optic liquid level sensing, Fabry Perot sensor, ultrasonic sensor, capacitive liquid level sensor. Signal condition circuits for reactive and self-generating sensors. Acceleration sensors: Accelerometer characteristics, capacitive, piezo-resistive, piezoelectric accelerometer, thermal accelerometer, rotor, monolithic and optical gyroscopes.	8
IV	Flow, Temperature and Acoustic sensors: Pressure gradient technique, thermal transport, ultrasonic, electromagnetic and Laser anemometer. microflow sensor,. Temperature sensors- RTD, thermpcouple, thermoresistive, thermoelectric, semiconductor and optical. Piezoelectric temperature sensor. Acoustic sensors- microphones- resistive, capacitive, piezoelectric, fiber optic, solid state - electrect microphone.	8
V	Actuators: Concepts of motors: DC motor, stepper motor, servo motor. Electrical actuators, electromechanical actuator, electromagnetic actuator, magneto resistive actuator, Hydraulic and pneumatic actuators, smart material actuators.	9
Guest Lectures (if any)		--
Total Hours		40

List of Experiments

NA

Text Books-

- Jacob Fraden, "Hand Book of Modern Sensors: physics, Designs and Applications", 2015, 3rd edition, Springer, New York.
- GerdKeiser,"Optical Fiber Communications", 2017, 5th edition, McGraw-Hill Science, Delhi.
- John G Webster, "Measurement, Instrumentation and sensor Handbook", 2017, 2nd edition, CRC Press, Florida.
- Eric Udd and W.B. Spillman, "Fiber optic sensors: An introduction for engineers and scientists", 2013, 2nd edition, Wiley, New Jersey.
- Bahaa E. A. Saleh and Malvin Carl Teich, "Fundamentals of photonics", 2012, 1st edition, John Wiley, New York.

Modes of Evaluation and Rubric

The evaluation modes consist of performance in Two mid-semester Tests, Quiz/ Assignments, term work, end-semester examinations, and end-semester practical examinations.

List/Links of e-learning resource

List and Links of e-learning resources:https://nptel.ac.in/courses/108108147

Recommendation by Board of studies on	Dec-2022
Approval by Academic council on	Dec-2022
Compiled and designed by	CS & IT
Subject handled by department	IOT

Samrat Ashok Technological Institute (Engineering College), VIDISHA (M.P.)
(An Autonomous Institute Affiliated to RGPV, Bhopal)
Syllabus: B.Tech (IoT)
Internet of Things

IoT-2051 Microprocessors and Microcontrollers

Course Title	Course Code	Credits - 4		
		L	T	P
Microprocessors and Microcontrollers	IoT-2051	3	-	2

COURSE OBJECTIVE	1. To make students familiar with the basic blocks of 8 bit & 16 bit microprocessor device in general. 2. To provide comprehensive knowledge of the architecture, features and interfacing with peripherals of 8085/8086 microprocessor. 3. To use assembly and high level languages to interface the microprocessor to various applications.
COURSE CONTENTS	**Unit-I**: Introduction to 16 bit Microprocessor-Introduction to 8086 Microprocessor family Architecture. Pin diagram, Instruction set, Assembler directive, Addressing modes, Maximum and Minimum Mode operation. Elementary 8086 Programming. **Unit-II**: Microcontrollers and Embedded processors, overview of 8051 family. 8051 microcontroller hardware, oscillator and clock, CPU registers, Register banks and stack, flags, PSW, SFR's, I/O ports, internal memory, 8051 pin description. 8051 programming model, Assembly, Language programming, Data types, directives. Addressing modes of 8051, memory access using various addressing modes, Bit addresses for I/O and RAM, I/O port programming. **Unit-III**: Arithmetic Operations with 8051: Arithmetic instructions, signed number concepts and arithmetic operations. Branch Instructions: Jump Loop and Call Instructions. Time delay calculations. Logical Operations & Bit manipulation instructions: Logic and compare instructions, rotate and swap instructions, data serialization, single bit instructions, operations with carry, reading input pins. **8051 programming in C**: Data types and time delay in 8051, Data types and time delay in 8051, Data conversion, Accessing code and data serialization using 8051 C. **Unit-IV**: Timers: Programming, Counter programming, Serial communication, RS232, 8051 programming for serial port, Serial Port programming in C, Introduction to I2C. 8051 Interrupts, programming timer interrupts, external hardware interrupts, serial communication interrupts, interrupt priority in 8051, Interrupt programming in C, Interface 8051, LCD Interfacing, memory address decoding, interfacing with external ROM, data memory space, accessing external memory in C, Interfacing 8255, programming 8255, modes of 8255, 8255 connection to stepper motor, LCD,& ADC, 8051 C programming for 8255.

Mr. Satish Asnani | Dr. Dhananjay V. Gadre | Dr. N. P. Patidar | Prof. Vipin Patait | Dr. Divyarishi Sahu

Prof. Shaila Chugh | Prof. C. S. Sharma | Dr. Ashutosh Datar | Dr. Jyotsna V. Ogale

COURSE CONTENTS:	Unit-V: AVR architecture & assembly language: General purpose registers, data memory, instructions for data memory, status register, data format and directives, introduction to AVR assembly programming, assembling an AVR program, program counter & program ROM, RISC architecture, viewing registers and memory with AVR studio IDE.
COURSE OUTCOMES:	**On successful completion of this course student should be able to:** **CO 1:** Acquire and demonstrate fundamental knowledge of microprocessors or interfacing and programming (BL1,BL2) **CO 2:** Analyze the performance of microprocessor with the help of instruction set(BL3,BL4) **CO 3:** Define instruction sets and write assembly language programming. (BL3, BL6) **CO 4:** Evaluate performance of 8086 compare them.(BL3,BL5)
TEXT BOOKS& REFERENCES:	• Ramesh S Goankar, Micro processor Architecture, Programming & Applications with the 8085, Penram International Publishing (India) Pvt. Ltd., Fourth Edition, 2002. • Douglas V. Hall, Microprocessors and interfacing programming and hardware Gregg Division, McGraw-Hill, 1986 • A K Ray & K M Bhurchandi, Advanced Microprocessor and Peripheral, Tata McGraw-Hill Publishing Company Limited.
LABORATORY EXPERIMENTS:	1. WAP to add a data byte located at the offset address 0500H in the segment 2000H to another data byte located at the offset address 0600H in the segment 3000H. 2. WAP to move 0500H to register BX and CX, add 05H to each of them and store the result in 0700H. Segment address: 5000H. 3. WAP to add the contents of 2000H: 0500H to the contents of 3000H: 0600H and store the result in 5000H: 0700H. 4. WAP to find the square of a given number. 5. WAP to find the 2's compliment of a given number. 6. WAP to find the square root of a given number. 7. WAP to arrange the given set of bytes in ascending order. 8. WAP to arrange the given set of bytes in the descending order. 9. WAP to find out the largest number in the given set of 8-bit number stored at memory location 0500H in the segment 2000H. 10. WAP to find out the even and odd numbers from the given set of 10 data bytes stored at memory location 4000H: 0400H.

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Samrat Ashok Technological Institute (Engineering College), VIDISHA (M.P.)
(An Autonomous Institute Affiliated to RGPV, Bhopal)
Syllabus: B.Tech (IoT)
Internet of Things

IoT-2052 Data Structure

Course Title	Course Code	Credits - 4		
		L	T	P
Data Structure	IoT-2052	3	-	2

COURSE OBJECTIVE	1. To impart the basic concepts of data structures and algorithms. 2. To understand concepts about searching and sorting techniques 3. To understand basic concepts about stacks, queues, lists trees and graphs. 4. To enable them to write algorithms for solving problems with the help of fundamental data structures
COURSE CONTENTS	**Unit-I**: Introduction Data structure, abstract data type, data object. Types of data structure primitive & non-primitive, linear & non-linear. Operations on data structures traversing, searching, inserting, deleting. Complexity analysis worst case, best case, average case. Mathematical preliminaries - Time space trade off, algorithm efficiency, asymptotic notations big oh, omega, theta. **Unit-II**: Arrays & Structure Introduction , declaration of arrays , operations on arrays inserting , deleting , merging of two arrays , 1 dimensional & 2 dimensional arrays, row & column major representation , address calculation in array , storing values in arrays , evaluation of polynomial addition & representation. Introduction - Searching & sorting, sequential search, binary search, Fibonacci search, indexed sequential search, hashed search. Types of sorting with general concepts bubble, heap, insertion, selection, quick, heap, shell, bucket, radix and merge sort. **Unit-III**: Stacks & Queues Basic concept of stacks & queues, array representation of stacks, operation on stacks push, pop, create, getTop, empty, linked representation of stack, multiple stacks, Application of stack Conversion: infix, prefix, postfix and evaluation of arithmetic expression. Linked representation of queue, operations on queue insertion & deletion. Types of queue with functions circular, de-queue, priority queue. Applications of queues job scheduling, Josephus problem. **Unit-IV**: Linked List Introduction basic terminology, memory allocation & deallocation for linked list. Linked list variants head pointer, head node, types linked list linear & circular linked list. Doubly linked list, creation of doubly list, deletion of node from doubly linked list, insertion of a node from doubly linked list, traversal of doubly linked list. Circular Linked Lists: all operations their algorithms and the complexity analysis. Applications of linked list polynomial representation & garbage collection. **Unit-V**: Trees and Graphs: Tree: Definition, Terminology Binary tree - definitions and properties, Representation, Binary Tree Traversal In-order, Pre-order, Post order, Insertion and deletion of nodes in binary search tree. Introduction to Binary Search Tree. AVL Tree: Tree operations on each of the trees and their algorithm and analysis. B Tree, B+ Tree: definitions, algorithms and analysis. Graph: Representation of graphs using adjacency matrix, adjacency.

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Prof. Shaila Chugh Prof. C. S. Sharma Dr. Ashutosh Datar Dr. Jyotsna V. Ogale

LABORATORY EXPERIMENTS:	11. Write a program to add two hexadecimal no and store it in an accumulator. 12. Write a program to store 50H in R0, R3 register of RB0, RB1, RB2, RB3. 13. Write a program to push the contents of registers on stack (any register). 14. Write a program to push the data of R0&R1 register of register bank 2&3 and store stack pointer with 70H. 15. Write a program to store, push and pop the value stored on R0&R1 of Register bank 3 into Register bank0. 16. Write a program to take 10 byte of data RAM location 45H to 54 H, add 02H to each of them and save the result in the data RAM location 79Hdown to 70H. 17. Write a program to copy the value 55H into RAM memory location 40H to 45H using 18. Direct addressing mode 19. Register indirect addressing mode without a loop, and with loop. 20. Write a program to clear 16 RAM locations starting at RAM address 60H.

END

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Prof. Shaila Chugh Prof. C. S. Sharma Dr. Ashutosh Datar Dr. Jayesha V. Ogale

Samrat Ashok Technological Institute (Engineering College), VIDISHA (M.P.)
(An Autonomous Institute Affiliated to RGPV, Bhopal)
Syllabus: B.Tech (IoT)
Internet of Things

IoT – 2053 Data Communication and Computer Networks

Course Title	Course Code	Credits - 4		
		L	T	P
Data Communication and Computer Networks	IoT – 2053	3	-	2

COURSE OBJECTIVE

1. To build an understanding of the fundamental concepts of data communication,
2. To familiarize the student with the basic taxonomy, model and terminology of computer networking.
3. To develop an appreciation of the Internet architecture and protocols, as well as a sound understanding of the protocol mechanisms employed at the IP and Transport layers of the Internet.
4. Allow the student to gain expertise in some specific areas of networking such as the design and maintenance of individual networks.

COURSE CONTENTS

Unit-I: Introduction: Data Communication, Networks - Physical structures; different topologies, Categories of Networks: LAN, MAN, WAN, Interconnection of networks, The Internet, Transmission Modes, Protocols and Standards, Standards Organizations, The OSI model, different layers in OSI model, TCP/IP protocol suite with different layers, Addressing - physical, logical, port and specific addresses, Digital Data Transmission - Synchronous and asynchronous transmission.

Unit-II: Physical Layer: Line Coding, Line Coding Scheme, Multiplexing: Frequency Division, Wavelength Division, Synchronous Time Division, Statistical Time Division Multiplexing, Switching-Circuit Switched Networks, Datagram Networks, Virtual Circuit Networks, Structure of Circuit and Packet switches, Dial-up Modems, Digital Subscriber Line - ADSL, HDSL, SDSL, VDSL, Cable TV for Data Transfer- Bandwidth, Sharing, and Data Transmission Schemes.

Unit-III: Data Link Layer: Introduction - Types of Errors, Redundancy, Detection Vs Correction, Forward Error Correction Vs Retransmission, Modular Arithmetic, Block Coding Error Detection, Error Correction, Hamming Code, Linear Block Codes, Cyclic Codes - Cyclic Redundancy Check, Hardware Implementation, Polynomials, Checksum, Framin - Fixed and Variable-Size, Flow and Error Control, Simplest ARQ, Stop-and-Wait ARQ, Go-Back-N ARQ, Selective Repeat ARQ.

Unit-IV: Medium Access: Random Access - ALOHA, Carrier Sense Multiple Access (CSMA), Carrier Sense Multiple Access with Collision Detection (CSMA/CD), Carrier Sense Multiple Access with Collision Avoidance (CSMA/CA), Controlled Access-Reservation, Polling, Token Passing, Channelization- Frequency-Division Multiple Access (FDMA), Time-Division Multiple Access (TDMA), Code-Division Multiple Access (CDMA), IEEE Standards, standard Ethernet, Fast Ethernet, Gigabit Ethernet, Wireless Networks, IEEE 802.11 - Architecture, MAC Sub layer, Addressing Mechanism, Physical Layer, Bluetooth - Architecture, Radio Layer, Baseband Layer, L2CAP

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COURSE OUTCOMES	**CO 1:** Analyze the algorithms to determine the time and computation complexity and justify the correctness. **CO 2:** Implement search technique for a given problem. **CO 3:** Write algorithm for Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort and compare their performance in term of Space and Time complexity. **CO 4:** Implement the logic of Stacks, Queues and linked list and analyse the same to determine the time and computation complexity. **CO 5:** Implement Graph search and traversal algorithms and determine the time and computation complexity.
TEXT BOOKS& REFERENCES:	• Fundamentals of Data Structures in C – by Horowitz, Sahni and Anderson-Freed (Silicon Press 2007). • How to solve it by Computer -- by R G Dromey (PHI 1982, Paperback 2008). • E. Horowitz, S. Sahni, S.Anderson-freed, —Fundamentals of Data Structures in C, Second Edition, University Press, ISBN 978-81-7371-605-8 • B. Kernighan, D. Ritchie, —The C Programming Language‖, Prentice Hall of India, Second Edition, ISBN 81-203-0596-5 • Data Structure Using C and C++ -- by Y. Langsam, M. J. Augenstein and A. N. Tanenbaum (Pearson Education, 2nd Edition, 2015).
LABORATORY EXPERIMENTS:	1. Find a pair with the given sum in an array. 2. Find the maximum product of two integers in an array. 3. Find the largest number possible from a given set of numbers. 4. Print all possible solutions to N Queens problem. 5. Check if a number is even or odd without using any conditional statement. 6. All-Pairs Shortest Paths – Floyd Warshall Algorithm. 7. Check if a graph is strongly connected or not. 8. Print complete Binary Search Tree (BST) in increasing order. 9. Find the minimum and maximum element in an array using Divide and Conquer. 10. Calculate the height of a binary tree – Iterative and Recursive. 11. Find the maximum occurring word in a given set of strings. 12. Combinations of words formed by replacing given numbers with corresponding alphabets. 13. Find the path between given vertices in a directed graph. 14. Find number of customers who could not get any computer.

END

Mr. Satish Asnani Dr. Dhananjay V. Gadre Dr. N. P. Patidar Prof. Vipin Patait Dr. Divyarishi Sahu

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Samrat Ashok Technological Institute (Engineering College), VIDISHA (M.P.)
(An Autonomous Institute Affiliated to RGPV, Bhopal)
Syllabus: B.Tech (IoT)
Internet of Things

IoT – 2054 Fundamentals of Internet of Things

Course Title	Course Code	Credits - 4		
		L	T	P
Fundamentals of Internet of Things	IoT – 2054	3	1	-

COURSE OBJECTIVE	1. To make students know the IoT ecosystem. 2. To provide an understanding of the technologies and the standards relating to theInternet of Things. 3. To develop skills on IoT technical planning.
COURSE CONTENTS	**Unit-I:** IoT & Web Technology: The Internet of Things Today, Time for Convergence, Towards the IoT Universe, Internet of Things Vision, IoT Strategic Research and Innovation Directions, IoT Applications, Future Internet Technologies, Infrastructure, Networks and Communication, Processes, Data Management, Security, Privacy & Trust, Device Level Energy Issues, IoT Related Standardization, Recommendations on Research Topics. **Unit-II:** M2M to IoT – A Basic Perspective- Introduction, Some Definitions, M2M Value Chains, IoT Value Chains, an emerging industrial structure for IoT, the international driven global value chain and global information monopolies. M2M to IoT-An Architectural Overview- Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations. **Unit-II:** IoT Architecture -State of the Art – Introduction, State of the art, Architecture Reference Model- Introduction, Reference Model and architecture, IoT reference Model, IoT Reference Architecture- Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views. **Unit-IV:** IoT Applications for Value Creations Introduction, IoT applications for industry: Future Factory Concepts, Brownfield IoT, Smart Objects, Smart Applications, Four Aspects in your Business to Master IoT, Value Creation from Big Data and Serialization, IoT for Retailing Industry, IoT for Oil and Gas Industry, Opinions on IoT Application and Value for Industry, Home Management, eHealth. **Unit-V:** Internet of Things Privacy, Security and Governance Introduction, Overview of Governance, Privacy and Security Issues, Contribution from FP7 Projects, Security, Privacy and Trust in IoT-Data-Platforms for Smart Cities, First Steps Towards a Secure Platform, Smart Approach. Data Aggregation for the IoT in Smart Cities, Security

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COURSE CONTENTS	**Unit-V:** Network Security and Connecting Networks: Encryption Decryption, Digital Signature, Data Encryption Standard (DES), PGP, Access Authorization. Connecting Devices - Hubs, Repeaters, Bridges, Routers and Gateway. Connecting Remote LANs. Virtual LANs - Membership, Configuration, Communication between Switches, IPv4- Address Space, Notation, Classful & Classless Addressing, IPv6 - Structure and Address Space, Advantages, Packet Format. The Integrated Services Digital Network (ISDN)- Narrow band ISDN, Broadband ISDN Service. Digital hierarchies *(SONET/SDH).*
COURSE OUTCOMES	On successful completion of this course student should be able to: **CO 1:** Independently understand basic computer network technology **CO 2:** Understand and explain data communication and its components. **CO 3:** Enumerate the layers of the OSI model and TCP/IP. Explain the functions of each layer. **CO 4:** Understand and explain network security and connecting networks.
TEXT BOOKS& REFERENCES	• B. A. Forouzan and Sophia Chung Fegan: Data Communications and Networking, 4th Ed, TMH. • W. Tomasi: Introduction to Data Communications and Networking, Pearson Education. • S. Tanenbaum: Computer Networks, Pearson Education. • W. Stalling: Data and Computer Communication, Pearson Education. • P. C. Gupta: Data Communications and Computer Networks, PHI. • Elahi and M. Elahi: Data Network and Internet-Communications Technology, Cengage Learning. • Duck: Data Communication and Networking, Pearson Education. • The TCP/IP Guide, by Charles M. Kozierok, Free online Resource
LABORATORY EXPERIMENTS:	Study of different types of Network cables and Network devices in detail 1. Study of Network IP 2. Introduction to packet tracer 3. Configure a Network topology using packet tracer 4. Configure LAN and WAN interfaces Configuration of Router using packet tracer. 5. Configure network using Distance Vector Routing protocol 6. Configure network using Link State Vector Routing protocol 7. Creating web server using packet tracer 8. Creating email server using packet tracer 9. Network analysis using wireshark. 10. Discovering hosts and services on a computer using Nmap security scanner.

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Samrat Ashok Technological Institute (Engineering College), VIDISHA (M.P.)
(An Autonomous Institute Affiliated to RGPV, Bhopal)
Syllabus: B.Tech (IoT)
Internet of Things

IoT – 2055 Embedded System for IoT

Course Title	Course Code	Credits - 4		
		L	T	P
OC-1(A) Embedded System for IoT	IoT – 2055	3	-	-

COURSE OBJECTIVE	To make students know the basic concept and architecture of embedded systems. 1. Different design platforms used for an embedded system for IoT applications. 2. To have knowledge about the IoT enabled technology.
COURSE CONTENTS	**Unit-I:** Purpose and requirement specification, IoT level specification, Functional view specification, Operational view specification, Device and component integration, Pillars of Embedded IoT and Physical Devices: The internet of devices. Design of Embedded Systems: Common Sensors, Actuators, Embedded Processors, Memory Architectures, Software architecture. **Unit-II:** Design of Power Supply for Embedded Systems, Linear Regulator Topologies, Switching Power Supply Topologies, Power Supply Design Considerations for Embedded Systems. Introduction to MSP430 Microcontroller, MSP430 CPU Architecture, Programming Methods for MSP430. Introduction to Launchbox Platform. Fundamentals of Physical Interfacing. Connecting Input Devices: Switches, Keyboard and Output devices: LEDs, Seven Segment Displays (SSD). **Unit-III:** Inputs and Outputs: Digital Inputs and Outputs, Digital Inputs, Digital Outputs, BusIn, BusOut, and BusInOut, Analog Inputs and Outputs, Analog Inputs, Analog Outputs, Pulse Width Modulation (PWM), Accelerometer and Magnetometer, SD Card, Local File System (LPC1768). **Unit-IV:** IoT Enabling Technologies: Communications, RFID and NFC (Near-Field Communication), Bluetooth Low Energy (BLE), LiFi, 6LowPAN, ZigBee, Z-Wave, LoRa, Protocols, HTTP, WebSocket, MQTT, CoAP, XMPP, Node-RED, Platforms, IBM Watson IoT – Bluemix, Eclipse IoT, AWS IoT, Microsoft Azure IoT Suite, Google Cloud IoT, ThingWorx, GE Predix, Xively, macchina.io, Carriots. **Unit-V:** Web of Things and Cloud of Things: Web of Things versus Internet of Things, Two Pillars of the Web, Architecture Standardization for WoT, Platform Middleware for WoT, Cloud of Things, IoT Physical Servers, Cloud Offerings and IoT Case Studies: Introduction to Cloud Storage Models, Communication API.
COURSE OUTCOMES	After completion of course, students would be able to: **CO1:** Understand the embedded system concepts and architecture of embedded systems. **CO2:** Understand the different hardware/software co-design techniques for microcontroller-based embedded systems, apply techniques in IoT applications. **CO3:** To be able to design web/cloud based IoT applications.

Mr. Satish Asnani Dr. Dhananjay V. Gadre Dr. N. P. Patidar Prof. Vipin Patait Dr. Divyanshi Sahu

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COURSE OUTCOMES	CO1: To understand the technology and standards relating to IoT. CO2: To understand the critical ecosystem required to mainstream IoT. CO3: To Acquire skills on developing their own national and enterprise level technicalstrategies.
TEXT BOOKS& REFERENCES	• Dr. Jeeva Jose, Internet of Things, Khanna Publishing House. • Nitesh Dhanjani, Abusing the Internet of Things, Shroff Publisher/O'Reilly Publisher. • Internet of Things, RMD Sundaram Shriram K Vasudevan, Abhishek S Nagarajan,John Wiley and Sons. • Internet of Things, Shriram K Vasudevan, Abhishek S Nagarajan, RMD Sundaram,John Wiley & Sons. • Cuno Pfister, "Getting Started with the Internet of Things", Shroff Publisher/MakerMedia. • Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1 st Edition, Apress Publications. • Massimo Banzi, Michael Shiloh Make: Getting Started with the Arduino, Shroff Publisher/Maker Media Publishers.

END

Mr. Satish Asnani Dr. Dhananjay V. Gadre Dr. N. P. Patidar Prof. Vipin Patait Dr. Divyarishi Sahu

Prof. Shaila Chugh Prof. C.S. Sharma Dr. Ashutosh Datar Dr. Jyotsna V. Ogale

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE

(Engineering College), VIDISHA M.P.

(An Autonomous Institute Affiliated to RGPV Bhopal)

Department of Computer Science and Information Technology

Internet of Things

Semester/Year		**VI/III**	**Program**		**B.Tech.**
Subject Category	DC	Subject Code:	IOT 2061	Subject Name:	**Operating System**

Maximum Marks Allotted						Contact Hours			Total Credits
Theory			Practical		Total Marks				
End Sem	Mid-Sem	Assign Ment/Quiz	End Sem	Term Work/Lab-Work/Sessional		L	T	P	
70	20	10	-	-	100	3	0	0	3

Prerequisites:

- None

Course Objective:

To understand operating system architecture and functioning along with in-depth knowledge of internals and working of OS modules like process management, Storage management, file system, security and protection

Course Outcomes:

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

CO -1: Understanding of the inherent mechanism involved in functioning of an operating system.

CO -2: Ability to analyze various scheduling and synchronization techniques.

CO -3: Knowledge of file systems its implementation and protection.

CO -4: Analysis of memory and device management methodology.

CO -5: Comprehensive outlook in design principles of operating systems.

UNITs	Descriptions	Hrs.
I	Overview-Introduction to Operating Systems, Evolution of Operating System mainframe, desktop, multiprocessor, Distributed, Network Operating System, and Clustered and Handheld System), Operating System Structure- Operating System Services and System Calls, System Programs. Types of Operating Systems: Batch Processing, Real Time, Multitasking and Multiprogramming, time-sharing system and Distributed Operating systems	8
II	Process Management-Concept, Process Control Blocks (PCB), Process Scheduling. Scheduling Criteria, Scheduling Algorithms and their evaluation. Threads Overview and Multithreading Models Inter Processes Communication and Critical Section Problem and Solution-Semaphores and Monitors, Deadlock Characterization, Methods for deadlock handling, deadlock prevention, deadlock avoidance, deadlock detection and recovery from deadlock.	8

III	Storage Management-Memory Hierarchy, Concepts of memory management, MFT and MVT, logical and physical address space, swapping, contiguous and non- contiguous allocation, Paging and Segmentation Structure and Implementation of Page table, Virtual memory, Cache Memory Organization, Demand paging, Page replacement Algorithms. Thrashing, Demand segmentation.	9
IV	File and Disk Management-File concepts, Access methods, Directory Structure, File Sharing and Protection, Free space management, Efficiency and Performance- Case study on Unix, Linux and Windows, Disk Structure and Scheduling, efficiency case study of UNIX.I?O system –Hardware ,Application, input-output interface.	7
V	Protection and Security- Protection Goals of Protection, Principles of Protection, Domain of Protections. Access Matrix, Implementation of Access Matrix, Access Control, Revocation of Access Rights Security The Security Problem, Program threats system and network threats, Cryptography as s security tool, user authentication, implementation of security defense- Firewall system, Case study - LINUX and Windows.	8
Guest Lectures (if any)		--
Total Hours		40

Text Books-

1. Peterson, J.L. &Silberschatz, A.: Operating System Concepts, Addison, Wesley-Reading.
2. Brinch, Hansen: Operating System Principles, Prentice Hall of India.
3. Haberman, A.N.: Introduction to Operating System Design Galgotia Publication, New Delhi.
4. Tanenbaum, A.S.: Operating Systems.
5. Hansen, P.B.: Architecture of Concurrent Programs, PHI.
6. Shaw, A.C.: Logic Design of Operating Systems, PHI.

Modes of Evaluation and Rubric

The evaluation modes consist of performance in Two mid-semester Tests, Quiz/ Assignments, term work, end-semester examinations, and end-semester practical examinations.

List/Links of e-learning resource

List and Links of e-learning resources:

1. https://nptel.ac.in/courses/106105214

Recommendation by Board of studies on	Dec-2022
Approval by Academic council on	Dec-2022
Compiled and designed by	CS & IT
Subject handled by department	IOT

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE

(Engineering College), VIDISHA M.P.

(An Autonomous Institute Affiliated to RGPV Bhopal)

Department of Computer Science and Information Technology

Internet of Things

Semester/Year		**VI/III**	**Program**		**B.Tech.**
Subject Category	DE-1	Subject Code:	IOT 2062(A)	Subject Name:	**Introduction to IoT Development Board**

Maximum Marks Allotted						Contact Hours			Total Credits
Theory			Practical		Total Marks				
End Sem	Mid-Sem	Assign Ment/Quiz	End Sem	Term Work/Lab-Work/Sessional		L	T	P	
70	20	10	30	20	150	3	0	2	4

Prerequisites:

- None

Course Objective:

- To give students hands-on experience using different IoT architectures.
- To provide skills for interfacing sensors and actuators with different IoT architectures.
- To develop skills on data collection and logging in the cloud.

Course Outcomes:

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

CO 1: To know basics of development boards.

CO2: To know about the Arduino board and its interfacing with various components.

CO 3: To know about the ESP 8266 board and its interfacing with various components.

CO4: To know about the Raspberry Pi architecture. .

CO5: To know about the Raspberry Pi and its interfacing with various components.

UNITs	**Descriptions**	Hrs.
I	IoT- introduction and its components, IoT building blocks, Sensors and Actuators, IoT Devices, IoT boards (Arduino Uno, ESP 8266-12E Node MCU, and Raspberry Pi 3).	8
II	Arduino Uno – Getting started with the Uno boards, blink program, connection of sensors to the Uno board, reading values of sensors from the Uno board, interrupts. Case study: Temperature/Humidity Control; Case Study: Sending values Temperature/Humidity values to the Internet via GSM module.	8
III	ESP 8266-12E Node MCU – Getting started with the ESP board, Micropython and Esplorer IDE, Flushing the ESP8266 board with micropython, connecting sensors to the ESP board, Connecting ESP board to WiFi, Interfacing ESP with the Cloud (REST APIGET, POST, MQTT), interrupts, comparison of ESP 32 board with the ESP 8266 board. Case Study: Switching light on /off remotely. Case Study: Voice-based Home 57 Automation for switching lights on/off.	9
IV	Raspberry Pi 3 - Rpi3 introduction and installing the Raspbian Stretch OS, Headless - Computer and Rpi3 configuration to connect through SSH via Ethernet, Headless - connecting Rpi3 remotely without Ethernet cable via SSH, IP address, Rpi 3 - Testing the GPIO pins through Scripts.	7

V	Raspberry pi3 interfacing with Sensor DHT11, Raspberry pi3 python library install and reading sensor feed, 'Plug and play ' type cloud platform overview for integration to IOT devices, 'Plug and play' cloud platform for integration to IOT device - actuator (LED), Plug and play platform - Custom widget (DHT11-Sensor) integration through Python. New - Raspeberry Pi 4 Vs Raspberry Pi3 Mobel B Comparison, LoRawan /LPWAN – Overview.	8
Guest Lectures (if any)		--
Total Hours		40

List of Experiments

1.IR OBSTACLE SENSOR- If object is detected pin 13 will go high (onboard LED ON) and "object detected" message will be displayed in serial monitor
If object is not detected pin 13 will go low (onboard LED OFF) and "object not detected" message will be displayed in serial monitor

2. GAS SENSOR- If Gas is detected pin 13 will go high (onboard LED ON) and "gas detected" message will be displayed in serial monitor
If Gas is not detected pin 13 will go low (onboard LED OFF) and "gas not detected" message will be displayed in serial monitor

3. FIRE SENSOR- If FIRE is detected pin 13 will go high (onboard LED ON) and "FIRE detected" message will bedisplayed in serial monitor
If FIRE is not detected pin 13 will go low (onboard LED OFF) and "FIRE not detected" message will be displayed in serial monitor

4. RELAY SHIELD- Controlling relay shield from serial monitor (Arduino IDE)

5. GSM SHIELD- If GAS is detected pin 7 will go LOW and "GAS detected" message will be sent to destination number.

6. Analog to Digital and PHOTORESISTOR- light-dependent resistor (LDR), the photo resistor adjusts its resistance according to the light received from the environment. It works not only with sunlight, but also with artificial light. Now lets see how we can integrate it to the real world.

7.Introduction to RaspberryPi-Learn how to wire light-emitting diodes (LEDs) and buzzers to GPIO pins. Practice conditionals and loops.

8. Interfacing of DHT11 with Raspberry Pi 3

Text Books-

- Dr.Jeeva Jose, Internet of Things, Khanna Publishing House
- Rao, M. (2018). Internet of Things with Raspbery Pi 3: Leverage the power of Raspberry Pi 3 and JavaScript to build exciting IoT projects. Packt Publishing Ltd
- Baichtal, J. (2013). Arduino for beginners: essential skills every maker needs. Pearson Education
- Schwartz, M. (2016). Internet of Things with ESP8266. Packt Publishing Ltd.
- Richardson, M., & Wallace, S. (2012). Getting started with raspberry PI. " O'Reilly Publisher Media, Inc."

Modes of Evaluation and Rubric	
The evaluation modes consist of performance in Two mid-semester Tests, Quiz/ Assignments, term work, end-semester examinations, and end-semester practical examinations.	
List/Links of e-learning resource	
List and Links of e-learning resources: 2. https://nptel.ac.in/courses/106105166	
Recommendation by Board of studies on	Dec-2022
Approval by Academic council on	Dec-2022
Compiled and designed by	CS & IT
Subject handled by department	IOT

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE

(Engineering College), VIDISHA M.P.

(An Autonomous Institute Affiliated to RGPV Bhopal)

Department of Computer Science and Information Technology

Internet of Things

Semester/Year		**VI/III**	**Program**		**B.Tech.**
Subject Category	DE-2	Subject Code:	IOT 2063(A)	Subject Name:	Data Base Management System

Maximum Marks Allotted						Contact Hours			Total Credits
Theory			Practical		Total Marks				
End Sem	Mid-Sem	Assign Ment/Quiz	End Sem	Term Work/Lab-Work/Sessional		L	T	P	
70	20	10	30	20	150	3	0	2	4

Prerequisites:

- Basic Knowledge of Mathematics and Programming.

Course Objective:

At the completion of this course, students should be able to do the following:

1. To understand the different issues involved in the design and implementation of a database system.
2. To study the physical and logical database designs, database modeling, relational, hierarchical, and network models and database normalization.
3. To understand and use data manipulation language to query, update, and manage a database
4. To develop an understanding of essential DBMS concepts such as: concurrency, recovery, backup.
5. Identifies the file organization methods access methods to store the data.

Course Outcomes:

CO-1: Realize the basic concepts, principles and applications of database system.
CO-2: Discuss the components of DBMS, data models, Relational models.
CO-3: Use knowledge to find the functional dependencies and differentiate between different normal forms.
CO-4: Execute transaction concepts and concurrency protocols
CO-5: Design the databases system

UNITs	**Descriptions**	Hrs.
I	Database System- concepts and architecture: Data modeling using the Entity Relationship (ER) modeling and Enhanced Entity Relationship (EER) modeling, Specialization and Generalization.	6
II	The Relational Model: Relational database design using ER to relational mapping, Relational algebra and relational calculus, Tuple Relational Calculus, Domain Relational Calculus, SQL.	6
III	Database design theory and methodology: Functional dependencies and normalization of relations, Normal Forms, Properties of relational decomposition, and Algorithms for relational database schema design.	10

IV	Transaction processing concepts: Schedules and serializability, Concurrency control, Two Phase Locking Techniques, Optimistic Concurrency Control, Database recovery concepts and techniques	12
V	Data Storage and indexing: Single level and multi level indexing, Dynamic Multi level indexing using B Trees and B+ Trees, Query processing, Introduction to database security.	6
Guest Lectures (if any)		--
Total Hours		40

List of Experiments

1. Write the queries for Data Manipulation and Data Definition Language.
2. Write SQL queries using logical operations and operators.
3. Write SQL query using group by function.
4. Write SQL queries for group functions.
5. Write SQL queries for sub queries, nested queries.
6. Write program by the use of PL/SQL.
7. Write SQL queries to create views.
8. Write an SQL query to implement JOINS.
9. Write a query for extracting data from more than one table.
10. Write a query to understand the concepts for ROLL BACK, COMMIT & CHECK POINTS.

Text Books -

1. RamezElmasri and Shamkant B. Navathe, Fundamentals of Database Systems (7/e), Pearson Education, 2016
2. Silberschatz, Korth, "Data base System Concepts", 7th ed., McGraw hill, 2019.
3. C. J. Date, "An Introduction to Database Systems", 8th ed., Pearson, 2003.
4. Raghu Ramakrishnan and Johannes Gehrke, Database Management Systems (3/e), McGraw Hill, 2014.
5. Peter Rob and Carlos Coronel, Database System- Design, Implementation and Management (7/e), Cengage Learning, 2007.

Modes of Evaluation and Rubric

The evaluation modes consist of performance in Two mid-semester Tests, Quiz/ Assignments, term work, end-semester examinations, and end-semester practical examinations.

List/Links of e-learning resource

List and Links of e-learning resources:
https://archive.nptel.ac.in/courses/106/105/106105175/

Recommendation by Board of studies on	Dec-2022
Approval by Academic council on	Dec-2022
Compiled and designed by	CS & IT
Subject handled by department	IOT

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE

(Engineering College), VIDISHA M.P.

(An Autonomous Institute Affiliated to RGPV Bhopal)

Department of Computer Science and Information Technology

Internet of Things

Semester/Year	**VI/III**	**Program**		**B.Tech.**
Subject Category	DE-3	Subject Code:	IOT 2064(A)	Subject Name:	**Introduction to Cloud Computing for IoT**

Maximum Marks Allotted						Contact Hours			Total Credits
Theory			Practical		Total Marks				
End Sem	Mid-Sem	Assign Ment/Quiz	End Sem	Term Work/Lab-Work/Sessional		L	T	P	
70	20	10	30	20	150	3	0	2	4

Prerequisites:

Knowledge of Computer network, Internet Technology and ACA.

Course Objective:

1. To learn how to use Cloud Services.
2. To implement Virtualization
3. To implement Task Scheduling algorithms.
4. Apply Map-Reduce concept to applications.
5. To build Private Cloud.
6. Broadly educate to know the impact of engineering on legal and societal issues involved.

Course Outcomes:

The students would be able to:

CO-1: Explain the core concepts of the cloud computing paradigm: how and why this paradigm shift came about, the characteristics, advantages and challenges brought about by the various models and services in cloud computing.

CO-2: Describe importance of virtualization along with their technologies and compare various load balancing algorithm.

CO-3: Describe and analyze the key components of Google and Amazon web service and apply them to solve problems on the cloud.

CO-4: Describe the key components of Microsoft azure platform and cloud management on azure.

CO-5: Explain major security and privacy problems in the cloud and how they are addressed with the security mechanisms

UNITs	**Descriptions**	Hrs.
I	Defining a Cloud, Cloud Types – NIST model, Cloud Cube model, Deployment models (Public , Private, Hybrid and Community Clouds), Service models – Infrastructure as a Service, Platform as a Service, Software as a Service with examples of services/ service providers, Cloud Reference model Characteristics of Cloud Computing – a shift in paradigm Benefits and advantages of Cloud Computing Architecture ,Infrastructure, Platforms, Virtual Appliances, Communication Protocols, Applications, Connecting to the Cloud by Clients Services and Applications by Type IaaS – Basic concept, Workload, partitioning of virtual private server instances, Pods, aggregations, silos PaaS – Basic concept, tools and development environment with examples SaaS - Basic concept .	6

II	Concepts of Abstraction and Virtualization (access, application, CPU, storage), Mobility patterns (P2V, V2V, V2P, P2P, D2C, C2C, C2D, D2D) Load Balancing and Virtualization ,Network resources for load balancing, Advanced load balancing (including Application Delivery Controller and Application Delivery Network), Mention of The Google Cloud as an example of use of load balancing Hypervisors: Virtual machine technology and types, VMware vSphere Machine Imaging (including mention of Open Virtualization Format – OVF).Distinction between SaaS and PaaS (knowledge of Salesforce.com and Force.com), Application development Use of PaaS.	6
III	Application frameworks Use of Google Web Services ,Google Applications Portfolio – Indexed search, Dark Web, Aggregation and disintermediation, Productivity applications and service, Adwords, Google Analytics, Google Translate, Google Toolkit (including introduction of Google APIs), major features of Google App Engine service. Use of Amazon Web Services Amazon Web Service components and services: Amazon Elastic Cloud, Amazon Simple Storage system, Amazon Elastic Block Store.	10
IV	Windows Azure platform: Microsoft's approach, architecture, and main elements, Windows Azure AppFabric, Content Delivery Network, SQL Azure, and Windows Live services, Types of services required in implementation – Consulting, Configuration, Customization and Support Cloud Management. An overview of the features of network management systems and a brief introduction of related products from large cloud vendors, Monitoring of an entire cloud computing deployment stack – an overview with mention of some products, Lifecycle management of cloud services (six stages of lifecycle) .	12
V	Cloud security concerns, Security boundary, Security service boundary Security of data, Brokered cloud storage access, Storage location and tenancy, encryption, and auditing and compliance Identity management.Service Oriented Architecture,message-based transactions, Protocol stack for an SOA architecture, Event-driven SOA, Enterprise Service Bus, Concepts of cloud transactions, functionality mapping, Application attributes, Cloud service attributes, System abstraction and Cloud Bursting, Applications and Cloud APIs, Cloud storage definition – Manned and Unmanned ,Cloud mail services including Google Gmail, Mail2Web, Windows Live Hotmail, Yahoo mail, concepts of Syndication services.	6
Guest Lectures (if any)		--
Total Hours		40

List of Experiments

1. Creating a Warehouse Application in SalesForce.com.
2. Creating an Application in SalesForce.com using Apex programming Language.
3. Implementation of SOAP Web services in C#/JAVA Applications.
4. Implementation of Para-Virtualization using VM Ware‘s Workstation/ Oracle‘s Virtual Box and Guest O.S.
5. Installation and Configuration of Hadoop.
6. Create an application (Ex: Word Count) using Hadoop Map/Reduce.
7. Case Study: PAAS(Facebook, Google App Engine)
8. Case Study: Amazon Web Services.
9. Install Virtualbox/VMware Workstation with different flavours of linux or windows OS on top of windows7 or 8.
10. Install a C compiler in the virtual machine created using virtual box and execute Simple Programs
11. Install Google App Engine. Create hello world app and other simple web applications using python/java.
12. Use GAE launcher to launch the web applications.
13. Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim.
14. Find a procedure to transfer the files from one virtual machine to another virtual machine.
15. Find a procedure to launch virtual machine using trystack (Online Openstack Demo Version)
16. Install Hadoop single node cluster and run simple applications like wordcount.

Text Books -

1. Cloud Computing – Second Edition by Dr. Kumar Saurabh, Wiley India
2.Cloud Computing Bible by Barrie Sosinsky, Wiley India Pvt. Ltd, 2013
3. Mastering Cloud Computing by RajkumarBuyya, Christian Vecchiola, S. ThamaraiSelvi, McGraw Hill
Education (India) Private Limited, 2013
4. Cloud computing: A practical approach, Anthony T. Velte, Tata Mcgraw-Hill
5. Cloud Computing, Miller, Pearson
6. Building applications in cloud:Concept, Patterns and Projects, Moyer, Pearson

Modes of Evaluation and Rubric

The evaluation modes consist of performance in Two mid-semester Tests, Quiz/ Assignments, term work, end-semester examinations, and end-semester practical examinations.

List/Links of e-learning resource

List and Links of e-learning resources:

Recommendation by Board of studies on	Dec-2022
Approval by Academic council on	Dec-2022
Compiled and designed by	CS & IT
Subject handled by department	IOT

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE

(Engineering College), VIDISHA M.P.

(An Autonomous Institute Affiliated to RGPV Bhopal)

Department of Computer Science and Information Technology

Internet of Things

Semester/Year		**VI/III**	**Program**		**B.Tech.**
Subject Category	OC-1	Subject Code:	IOT 2065(A)	Subject Name:	**Introduction to AI and ML for IoT**

Maximum Marks Allotted						Contact Hours			Total Credits
Theory			Practical		Total Marks				
End Sem	Mid-Sem	Assign Ment/Quiz	End Sem	Term Work/Lab-Work/Sessional		L	T	P	
70	20	10	-	-	100	3	0	0	3

Prerequisites:

- **None**

Course Objective:

- To review and strengthen important mathematical concepts required for AI & ML.
- Introduce the concept of learning patterns from data and develop a strong theoretical foundation for understanding state of the art Machine Learning algorithms.

Course Outcomes:

After completion of course, students would be able to:

CO 1. Design and implement machine learning solutions to classification, regression and clustering problems.
CO 2. Evaluate and interpret the results of the different ML techniques.
CO 3. Design and implement various machine learning algorithms in a range of Real-world applications

UNITs	**Descriptions**	Hrs.
I	Defining Artificial Intelligence, Defining AI techniques, Using Predicate Logic and Representing Knowledge as Rules, Representing simple facts in logic, Computable functions and predicates, Procedural vs Declarative knowledge, Logic Programming, Mathematical foundations: Matrix Theory and Statistics for Machine Learning.	6
II	Idea of Machines learning from data, Classification of problem – Regression and Classification, Supervised and Unsupervised learning.	6
III	Linear Regression: Model representation for single variable, Single variable Cost Function, Gradient Decent for Linear Regression, Gradient Decent in practice.	10
IV	Logistic Regression: Classification, Hypothesis Representation, Decision Boundary, Cost function, Advanced Optimization, Multi-classification (One vs All), Problem of Overfitting.	12
V	Discussion on clustering algorithms and use-cases cantered around clustering and classification.	6
Guest Lectures (if any)		--
Total Hours		40

Text Books
1. SarojKaushik, Artificial Intelligence, Cengage Learning, 1st Edition 2011. 2. Anindita Das Bhattacharjee, "Practical Workbook Artificial Intelligence and Soft Computing for beginners, Shroff Publisher-X team Publisher. 3. M.C. Trivedi, A Classical Approach to Artificial Intelligence, Khanna Publishing House, Delhi. 4. Jeeva Jose, Introduction to Machine Learning, Khanna Publishing House, Delhi. 5. Yuxi (Hayden) Liu, "Python Machine Learning by Example", Packet Publishing Limited, 2017. 6. Tom Mitchell, Machine Learning, McGraw Hill, 2017. 7. Christopher M. Bishop, Pattern Recognition and Machine Learning, Springer, 2011. 8. T. Hastie, R. Tibshirani, J. Friedman. The Elements of Statistical Learning, 2e, 2011.
Modes of Evaluation and Rubric
The evaluation modes consist of performance in Two mid-semester Tests, Quiz/ Assignments, term work, end-semester examinations, and end-semester practical examinations.
List/Links of e-learning resource
List and Links of e-learning resources: https://nptel.ac.in/courses/106102220

Recommendation by Board of studies on	Dec-2022
Approval by Academic council on	Dec-2022
Compiled and designed by	CS & IT
Subject handled by department	IOT

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE
(Engineering College), VIDISHA M.P.
(An Autonomous Institute Affiliated to RGPV Bhopal)
DEPARTMENT OF IT

Semester/Year		VII/IV	Program		B.Tech – Internet of Things
Subject Category	DE	Subject Code:	IoT 2071 DE – 4A	Subject Name	Big Data Analytics

Maximum Marks Allotted						Contact Hours			Total Credits
Theory			Practical		Total Marks				
ES	MS	Assignment/Quiz	ES	LW		L	T	P	
70	20	10	-	-	100	3	1	0	4

Prerequisites:

Should have knowledge of one Programming Language (Java preferably), Practice of SQL (queries and sub queries), exposure to Linux Environment.

Course Objective:

- Understand the Big Data Platform and its Use cases
- Provide an overview of Apache Hadoop
- Provide HDFS Concepts and Interfacing with HDFS
- Understand Map Reduce Jobs
- Provide hands on Hadoop Eco System
- Apply analytics on Structured, Unstructured Data.
- Exposure to Data Analytics with R.

UNITs	Descriptions	Hrs.
I	INTRODUCTION TO BIG DATA AND HADOOP Types of Digital Data, Introduction to Big Data, Big Data Analytics, History of Hadoop, Apache Hadoop, Analysing Data with Unix tools, Analysing Data with Hadoop, Hadoop Streaming, Hadoop Echo System, IBM Big Data Strategy, Introduction to InfosphereBigInsights and Big Sheets.	**8**
II	HDFS(Hadoop Distributed File System) The Design of HDFS, HDFS Concepts, Command Line Interface, Hadoop file system interfaces, Data flow, Data Ingest with Flume and Scoop and Hadoop archives, Hadoop I/O: Compression, Serialization, Avro and File-Based Data structures.	8
III	Map Reduce Anatomy of a Map Reduce Job Run, Failures, Job Scheduling, Shuffle and Sort, Task Execution, Map Reduce Types and Formats, Map Reduce Features.	8
IV	Hadoop Eco System Pig: Introduction to PIG, Execution Modes of Pig, Comparison of Pig with Databases, Grunt, Pig Latin, User Defined Functions, Data Processing operators. Hive: Hive Shell, Hive Services, Hive Metastore, Comparison with Traditional Databases, HiveQL, Tables, Querying Data and User Defined Functions. Hbase :HBasics, Concepts, Clients, Example, Hbase Versus RDBMS. Big SQL : Introduction	8
V	Data Analytics with R Machine Learning: Introduction, Supervised Learning, Unsupervised Learning, Collaborative Filtering. Big Data Analytics with BigR.	8
Total Hours		40

Course Outcomes:

CO-1 Identify Big Data and its Business Implications.
CO-2 List the components of Hadoop and Hadoop Eco-System**.**
CO-3 Access and Process Data on Distributed File System.
CO-4 Develop Big Data Solutions using Hadoop Eco System.
CO-5 Apply Machine Learning Techniques using R.

Text Book & Reference Books-

1. Tom White " Hadoop: The Definitive Guide" Third Edit on, O'reily Media, 2012.
2. SeemaAcharya, SubhasiniChellappan, "Big Data Analytics" Wiley 2015. E.Balaguruswamy, "Programming InJava"; TMHPublications.
3. Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, 2007.
4. Jay Liebowitz, "Big Data and Business Analytics" Auerbach Publications, CRC press (2013).
5. Tom Plunkett, Mark Hornick, "Using R to Unlock the Value of Big Data: Big Data Analytics with Oracle R Enterprise and Oracle R Connector for Hadoop", McGraw-Hill/Osborne Media (2013), Oracle press.
6. AnandRajaraman and Jefrey David Ulman, "Mining of Massive Datasets", Cambridge University Press, 2012.
7. Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", John Wiley & sons, 2012.
8. Glen J. Myat, "Making Sense of Data", John Wiley & Sons, 2007.
9. Pete Warden, "Big Data Glossary", O'Reily, 2011.
10. Michael Mineli, Michele Chambers, AmbigaDhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley Publications, 2013.

List/Links of e-learning resource

- https://onlinecourses.nptel.ac.in/noc20_cs92/preview

Modes of Evaluation and Rubric

The evaluation modes consist of performance in two mid semester Tests, Quiz/Assignments, term work, end semester practical examination.

CO-PO Mapping:

COs	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_1	PO_{11}	PO_{12}	PSO1	PSO2
CO-1	1	1	2	1									1	2
CO-2	2	1	1	1	2								1	2
CO-3	2	1	2	1			1						1	1
CO-4	2	1	2	1										2
CO-5	2	1			1								1	

Recommendation by Board of studies on	
Approval by Academic council on	
Compiled and designed by	
Subject handled by department	Department of IT

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE
(Engineering College), VIDISHA M.P.
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DEPARTMENT OF IT

Semester/Year		VII/IV	Program		B.Tech – Internet of Things
Subject Category	DE	Subject Code:	IoT 2071 DE – 4B	Subject Name	Industrial IoT 4.0

Maximum Marks Allotted						Contact Hours			Total Credits
Theory			Practical		Total Marks				
ES	MS	Assignment/Quiz	ES	LW		L	T	P	
70	20	10	-	-	100	3	1	0	4

Prerequisites:

Basic Knowledge of Signals and Systems

Course Objective:

- To impart basic idea in Industry 4.0.
- To provide students with good depth of knowledge of designing Industrial 4.0 Systems for various application.
- Learn the design and analysis of Industry 4.0 systems for Energy and smart vehicular• applications.

UNITs	Descriptions	Hrs.
I	Introduction, Historical Context, General framework, Application areas, Dissemination of Industry 4.0 and the disciplines that contribute to its development, Artificial intelligence, The Internet of Things and Industrial Internet of Things, Additive manufacturing, Robotization and automation, Current situation of Industry 4.0.	**8**
II	Implementation systems for IIoT: Sensors and Actuators for Industrial Processes, Sensor networks, Process automation and Data Acquisitions on IoT Platform, Microcontrollers and Embedded PC roles in IIoT, Wireless Sensor nodes with Bluetooth, WiFi, and LoRa Protocols and IoT Hub systems.	8
III	IIoT Data Monitoring & Control: IoT Gate way, IoT Edge Systems and It's Programming, Cloud computing, Real Time Dashboard for Data Monitoring, Data Analytics and Predictive Maintenance with IIoT technology.	8
IV	INDUSTRY 4.0 AND CYBER PHYSICAL SYSTEM: Introduction to Cyber Physical Systems (CPS), Architecture of CPS- Components, Data science and technology for CPS, Emerging applications in CPS in different fields. Case study: Application of CPS in health care domain.	10
V	Healthcare, Power Plants, Inventory Management & Quality Control, Plant Safety and Security (Including AR and VR safety applications), Facility Management.	6
Total Hours		40

Course Outcomes:

CO1: Knowledge of theory and practice related to Industrial IoT Systems.

CO2: Ability to identify, formulate and solve engineering problems by using Industrial IoT

CO3: Ability to implement real field problem by gained knowledge of Industrial applications with IoT capability.

CO4: Implement the industry 4.0 to solve engineering problems.

Text Book & Reference Books-

1. Industry 4.0: The Industrial Internet of Things Alasdair GilchristPublications: Apress
2. The Concept Industry 4.0 An Empirical Analysis of Technologies and Applications in Production Logistics Authors: Bartodziej, Christoph Jan Springer: Publication in the field of economic science..
3. Diego GalarPascual, Pasquale Daponte, Uday Kumar, ―Handbook of Industry 4.0 and SMART Systems‖ Taylor and Francis,2020
4. Miller M, ―The internet of things: How smart TVs, smart cars, smart homes, and smart cities are changing the world‖, Pearson Education, 2015, ISBN: 9780134021300.
5. Pengwei Du and Ning Lu, ―Energy storage for smart grids: planning and operation for renewable and variable energy resources VERs ‖, Academic Press, 2018, Reprint edition , ISBN-13:978-0128100714
6. Hossam A. Gabbar, ―Smart Energy Grid Engineering‖, Academic Press, 2017, ISBN 978- 0-12-805343-0.

List/Links of e-learning resource

- https://onlinecourses.nptel.ac.in/noc20_cs69/preview

Modes of Evaluation and Rubric

The evaluation modes consist of performance in two mid semester Tests, Quiz/Assignments, term work, end semester practical examination.

CO-PO Mapping:

COs	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_1	PO_{11}	PO_{12}	PSO1	PSO2
CO-1	1	1	2										1	2
CO-2	2	1	1		1								1	2
CO-3	1	1	2										1	1
CO-4	2	1	2			1				1				2

Recommendation by Board of studies on	
Approval by Academic council on	
Compiled and designed by	
Subject handled by department	Department of IT

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE
(Engineering College), VIDISHA M.P.
(An Autonomous Institute Affiliated to RGPV Bhopal)
DEPARTMENT OF IT

Semester/Year		VII/IV	Program		B.Tech – Internet of Things
Subject Category	DE	Subject Code:	IoT 2072 DE – 5A	Subject Name	Real Time Operating System

Maximum Marks Allotted						Contact Hours			Total Credits
Theory			Practical		Total Marks				
ES	MS	Assignment/Quiz	ES	LW		L	T	P	
70	20	10	-	-	100	3	1	0	4

Prerequisites:

Course Objective:

- The objective of the course is to introduce the principles shared by many real-time operating systems, and their use in the development of embedded multitasking application software.

UNITs	Descriptions	Hrs.
I	Basics of real-time concepts: Brief history of Real Time Systems, A brief history of Embedded Systems. Terminology: RTOS concepts and definitions, real-time design issues, examples, Hardware Considerations: logic states, CPU, memory, I/O, Architectures, RTOS building blocks, Real-Time Kernel.	**6**
II	Process management: Concepts, scheduling, IPC, RPC, CPU Scheduling, scheduling criteria, scheduling algorithms Threads: Multi-threading models, threading issues, thread libraries, synchronization Mutex: creating, deleting, prioritizing mutex, mutex internals.	8
III	I/O Resources: Worst-case Execution time, Intermediate I/O, Execution efficiency, I/O Architecture. Memory: Physical hierarchy, Capacity and allocation, Shared Memory, ECC Memory, Flash filesystems.	8
IV	Embedded System Components: Firmware components, RTOS system software mechanisms, Software application components. Debugging Components: Exceptions assert, Checking return codes, Single-step debugging, kernel scheduler traces, Test access ports, Trace ports, Power-On self-test and diagnostics, External test equipment, Application-level debugging.	10
V	Performance Tuning: Basic concepts of drill-down tuning, hardware – supported profiling and tracing, Building performance monitoring into software, Path length, Efficiency, and Call frequency, Fundamental optimizations.	8
Total Hours		40

Course Outcomes:

CO1: To understand the functionality and selection criteria of various operating systems when designing automation systems for technological complexes in real time.

CO2: To know the structure, basic principles of construction and the scope of use of embedded operating systems.

CO3: To be able to program applied tasks for embedded systems and be able to control the processes occurring in real-time systems.

CO4: To have practical skills for solving problems of designing control and monitoring systems for technological complexes in real time based on existing operating systems and programming languages.

CO5: To understand the working of real-time operating systems and real-time database

Text Book & Reference Books-

1. Jane W. S. Liu, "Real-time systems", Prentice Hall, 20002.
2. Philips A. Laplante, "Real-Time System Design and Analysis", 3rd Edition, John Wley& Sons, 2004

List/Links of e-learning resource

- https://nptel.ac.in/courses/117105135

Modes of Evaluation and Rubric

The evaluation modes consist of performance in two mid semester Tests, Quiz/Assignments, term work, end semester practical examination.

CO-PO Mapping:

COs	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_1	PO_{11}	PO_{12}	PSO1	PSO2
CO-1	1	1	1										1	2
CO-2	2	1	1										1	2
CO-3	1	1	2							1			1	2
CO-4	2	1	1							1				2
CO-5	1	1	1										1	

Recommendation by Board of studies on	
Approval by Academic council on	
Compiled and designed by	
Subject handled by department	Department of IT

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE
(Engineering College), VIDISHA M.P.
(An Autonomous Institute Affiliated to RGPV Bhopal)
DEPARTMENT OF IT

Semester/Year		VII/IV	Program		B.Tech – Internet of Things
Subject Category	DE	Subject Code:	IoT 2072 DE – 5B	Subject Name	Wireless Networks

Maximum Marks Allotted						Contact Hours			Total Credits
Theory			Practical		Total Marks				
ES	MS	Assignment/Quiz	ES	LW		L	T	P	
70	20	10	-	-	100	3	1	0	4

Prerequisites:

Course Objective:

- To provide an overview of Wireless Communication networks and its applications in communication engineering.
- Enable students to understand the contribution of Wireless Communication networks to overall technological growth, make them understand related terminology, principles, devices, schemes, concepts, algorithms and different methodologies used in Wireless Communication Networks.

UNITs	Descriptions	Hrs.
I	Introduction of Wireless Networks: Different Generations of Wireless Networks. Characteristics of the Wireless Medium: Radio Propagation Mechanisms, Path Loss Modeling and Signal Coverage, Effect of Multipath and Doppler, Channel Measurement and Modeling Techniques.	**6**
II	Network Planning: Introduction, Wireless Network Topologies, Cellular Topology, Cell Fundamentals Signal to Interferences Radio Calculations, Network Planning for CDMA Systems. Wireless Network Operations: Mobility Management, Radio Resources and Power Management.	9
III	Multiple Division Techniques: FDMA, TDMA, CDMA, OFDM, SDMA. Comparison of Multiple Division Techniques, Modulation Techniques – AM, FM, FSK, PSK, QPSK, QAM, 16QAM Mobile Data Networks: Introduction, Data Oriented CDPD Network, GPRS, EDGE and High Data Rates, SMS in GSM, Mobile Application Protocols.	9
IV	Introduction to Wireless LAN: Evolution of WLAN, Wireless Home Networking, Technologies for Home Area Network (HAN), Overview of IEEE 802.11, Reference Architecture, PHY and MAC Layer, Wireless ATM, HIPERLAN.	7
V	IEEE 802.15 WPAN, HomeRF, Bluetooth, Interference between Bluetooth and 802.11, Adhoc Networks, Introduction to 2G, 3G, LTE (4G), and 5G networks.	8
Total Hours		40

Course Outcomes:

CO1: To understand the functionality and selection criteria of various operating systems when designing automation systems for technological complexes in real time.

CO2: To know the structure, basic principles of construction and the scope of use of embedded operating systems.

CO3: To be able to program applied tasks for embedded systems and be able to control the processes occurring in real-time systems.

CO4: To have practical skills for solving problems of designing control and monitoring systems for

technological complexes in real time based on existing operating systems and programming languages.

CO5: Implement different type of applications for smart phones and mobile devices with latest network strategies

Text Book & Reference Books-

1. KavehPahlavan, Prashant Krishnamurthy, "Principles of Wireless Networks", PHI.
2. Qing- AnZeng, Dharma PrakashAgrawal, "Introduction to Wireless and Mobile Systems", CENGAGE Learning.
3. SumitKasera, NishitNarang, A P Priyanka, "2.5 G Mobile Networks: GPRS and EDGE", TMH
4. Dr.KamiloFeher, "Wireless Digital Communications", PHI.
5. Jochen Schiller, "Mobile Communications", PEARSON.

List/Links of e-learning resource

- https://nptel.ac.in/courses/106105172

Modes of Evaluation and Rubric

The evaluation modes consist of performance in two mid semester Tests, Quiz/Assignments, term work, end semester practical examination.

CO-PO Mapping:

COs	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_1	PO_{11}	PO_{12}	PSO1	PSO2
CO-1	1	1	2										1	2
CO-2	2	1	1										1	2
CO-3	1	1	2							1			1	2
CO-4	2	1	2							1				2
CO-5	1	1	2										1	

Recommendation by Board of studies on	
Approval by Academic council on	
Compiled and designed by	
Subject handled by department	Department of IT

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE
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DEPARTMENT OF IT

Semester/Year		VII/IV	Program		B.Tech – Internet of Things
Subject Category	DE	Subject Code:	IoT 2073 DE – 6 A	Subject Name	Mobile Application Development

Maximum Marks Allotted						Contact Hours			Total Credits
Theory			Practical		Total Marks				
ES	MS	Assignment/Quiz	ES	LW		L	T	P	
70	20	10	-	-	100	3	0	0	3

Prerequisites:

Basic knowledge of programming skills.

Course Objective:

- To facilitate students to understand android SDK.
- To help students to gain a basic understanding of Android application development.
- To inculcate working knowledge of Android Studio development tool

UNITs	Descriptions	Hrs.
I	Introduction to Android: The Android Platform, Android SDK, Eclipse Installation, Android Installation, Building you First Android application, Understanding Anatomy of Android Application, Android Manifest file.	6
II	Android Application Design Essentials: Anatomy of an Android applications, Android terminologies, Application Context, Activities, Services, Intents, Receiving and Broadcasting Intents, Android Manifest File and its common settings, Using Intent Filter, Permissions.	8
III	Android User Interface Design Essentials: User Interface Screen elements, Designing User Interfaces with Layouts, Drawing and Working with Animation.	8
IV	Testing Android applications, Publishing Android application, Using Android preferences, Managing Application resources in a hierarchy, working with different types of resources.	10
V	Using Common Android APIs: Using Android Data and Storage APIs, Managing data using Sqlite, Sharing Data between Applications with Content Providers, Using Android Networking APIs, Using Android Web APIs, Using Android Telephony APIs, Deploying Android Application to the World.	8
Total Hours		40

Course Outcomes:

CO1: Identify various concepts of mobile programming that make it unique from Programming for other platforms**.**
CO2: Critique mobile applications on their design pros and cons.
CO3: Utilize rapid prototyping techniques to design and develop sophisticated mobile Interfaces.
CO4: Program mobile applications for the Android operating system that use basic and Advanced phone features.
CO5: Deploy applications to the Android marketplace for distribution.

Text Book & Reference Books-

1. T1. Lauren Darcey and Shane Conder, “Android Wireless Application Development”,
2. Pearson Education, 2nd ed. (2011).
3. Reto Meier, “Professional Android 2 Application Development”, Wiley India Pvt Ltd.
4. Mark L Murphy, “Beginning Android”, Wiley India Pvt Ltd.

5. Android Application Development All in one for Dummies by Barry Burd, Edition.

List/Links of e-learning resource

- https://archive.nptel.ac.in

Modes of Evaluation and Rubric

The evaluation modes consist of performance in two mid semester Tests, Quiz/Assignments, term work, end semester practical examination.

CO-PO Mapping:

COs	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_1	PO_{11}	PO_{12}	PSO1	PSO2
CO-1		2			2							2	1	2
CO-2	2	3		2	1						1	2	3	3
CO-3	2	3	3	2								2	2	2
CO-4	2	2		2								2	3	3
CO-5	2	2	2									2	3	3

Recommendation by Board of studies on	
Approval by Academic council on	
Compiled and designed by	
Subject handled by department	Department of IT

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE
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DEPARTMENT OF IT

Semester/Year		VII/IV	Program		B.Tech – Internet of Things
Subject Category	DE	Subject Code:	IoT 2073 DE – 6B	Subject Name	UI/UX

Maximum Marks Allotted						Contact Hours			Total Credits
Theory			Practical		Total Marks				
ES	MS	Assignment/Quiz	ES	LW		L	T	P	
70	20	10	-	-	100	3	0	0	3

Prerequisites:

Knowledge of computer programming with any programming language like C/C++, Java.

Course Objective:

- The aim of the UI/UX course is to provide students with the knowledge of user- centered design, user-cantered methods in design, graphic design on screens, simulation and prototyping techniques.
- Also usability testing methods, interface technologies and user centered design in corporate perspective.

UNITs	Descriptions	Hrs.
I	Introduction to the UI: What is User Interface Design (UI) -The Relationship Between UI and UX , Roles in UI/UX, A Brief Historical Overview of Interface Design, Interface Conventions, Approaches to Screen Based UI, Template vs Content, Formal Elements of Interface Design, Active Elements of Interface Design, Composing the Elements of Interface Design, UI Design Process, Visual Communication design component in Interface Design.	**8**
II	Introduction to UX: UX Basics- Foundation of UX design, Good and poor design, Understanding Your Users, Designing the Experience Elements of user Experience, Visual Design Principles, Functional Layout, Interaction design.	8
III	Introduction to the Interface, Navigation Design, User Testing, Developing and Releasing Your Design.	8
IV	UI/ UX Design Tools: User Study- Interviews, writing personas: user and device personas, User Context, Building Low Fidelity Wireframe and High-Fidelity Polished Wireframe Using wire framing Tools, Creating the working Prototype using Prototyping tools, Sharing and Exporting Design.	8
V	Information and Data Study: Understanding and collection of data, methods of collecting data, tools for collecting data, analysing data, using data analytics tools like Google analytics for user experience, heat mapping tools.	8
Total Hours		40

Course Outcomes:

CO1: Understand iterative user-centered design of graphical user interfaces.
CO2: Apply the user Interfaces to different devices and requirements.
CO3: Create high quality professional documents and artifacts related to the design process.
CO4: Students are capable of programming using mainstream programming languages, can conduct fine software-engineering practices to implement problem-solving schemes as correct, efficient, and well-structured programs
CO5: Students have the logical, algorithmic, andmathematical capability to model and analyze real-world problems in different application domains

Text Book & Reference Books-

1. A Project Guide to UX Design: For user experience designers in the field or in the making (2nd. ed.). Russ Unger and Carolyn Chandler. New Riders Publishing, USA, 2012..
2. The Elements of User Experience: User-Centered Design for the Web and Beyond, Second Edition Jesse James Garrett, Pearson Education. 2011
3. The Essential Guide to User Interface Design: An Introduction to GUI Design Principles and Techniques, Third Edition Wilbert O. Galitz , Wiley Publishing, 2007.
4. The UX Book Process and Guidelines for Ensuring a Quality User Experience, Rex Hartson and Pardha S. Pyla, Elsevier, 2012.

List/Links of e-learning resource

- https://onlinecourses.nptel.ac.in/noc21_ar05/preview

Modes of Evaluation and Rubric

The evaluation modes consist of performance in two mid semester Tests, Quiz/Assignments, term work, end semester practical examination.

CO-PO Mapping:

COs	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_1	PO_{11}	PO_{12}	PSO1	PSO2
CO-1	1	1				1							1	2
CO-2	1	1	1										1	2
CO-3	1	1	1							1				1
CO-4				1	1			1						1
CO-5	1	1	1										1	1

Suggestive list of experiments:

Recommendation by Board of studies on	
Approval by Academic council on	
Compiled and designed by	
Subject handled by department	Department of IT

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE
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DEPARTMENT OF IT

Semester/Year	VII/IV	Program	B.Tech – Internet of Things
Subject Category: OC	Subject Code: IoT 2074 OC – 3A	Subject Name	Digital Image Processing

Maximum Marks Allotted						Contact Hours			Total Credits
Theory			Practical		Total Marks				
ES	MS	Assignment/Quiz	ES	LW		L	T	P	
70	20	10	-	-	100	3	0	0	3

Prerequisites:

Knowledge of Computer Programming Language and MATLAB

Course Objective:

- To study the image fundamentals and mathematical transforms necessary for image processing.
- To study the image enhancement techniques
- To study image restoration procedures
- To study the image compression procedures.

UNITs	Descriptions	Hrs.
I	Digital Image Fundamentals: A simple image model, Sampling and Quantization. Relationship between pixels, Imaging geometry, Image acquisition systems, Different types of digital images.	**6**
II	Image Transformations Introduction to Fourier transforms, Discrete Fourier transforms, Fast Fourier transform, Walsh transformation, Hadmord transformation, Discrete Cosine Transformation.	8
III	Image Enhancement Filters in spatial and frequency domains, Histogram based processing. Image subtraction, Averaging, Image smoothing, Nedion filtering, Low pass filtering, Image sharpening by High pass filtering.	8
IV	Image Encoding and Segmentation Encoding: Mapping, Quantizer, Coder. Error free compression, Lossy Compression schemes. JPEG Compression standard. Detection of discontinuation by point detection, Line detection, edge detection, Edge linking and boundary detection, Local analysis, Global processing via Hough transforms and graph theoretic techniques.	10
V	Mathematical Morphology Binary, Dilation, crosses, Opening and closing, Simple methods of representation, Signatures, Boundary segments, Skeleton of a region, Polynomial approximation.	8
Total Hours		40

Course Outcomes:

On successful completion of this course student should be able to:

CO1: Ability to apply principles and techniques of digital image processing in applications related to design and analysis of digital imaging systems.

CO2: Ability to analyze and implement image processing algorithms to real problems.

CO3: Gaining of hands-on experience in using software tools for processing digital images.

CO4: Interpret image segmentation and representation techniques.

CO5: Apply Mathematical Morphology using Polynomial approximation.

Text Book & Reference Books-

1. Rafael C Gonzalez, Richard E Woods 3rd Edition, Digital Image Processing Pearson.
2. Sonka, Digital Image Processing & Computer Vision, Cengage Learning.
3. Jayaraman, Digital Image Processing, TMH.
4. Pratt, Digital Image Processing, Wiley India.

5. Annadurai, Fundamentals of Digital Image Processing,Pearson Education.

List/Links of e-learning resource

- https://nptel.ac.in/courses/117105135

Modes of Evaluation and Rubric

The evaluation modes consist of performance in two mid semester Tests, Quiz/Assignments, term work, end semester practical examination.

CO-PO Mapping:

COs	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_1	PO_{11}	PO_{12}	PSO1	PSO2
CO-1	1	1	1										1	2
CO-2	2	1	1										1	2
CO-3	1	1											1	2
CO-4	2	1	1											2
CO-5	1	1	1										1	

Recommendation by Board of studies on	
Approval by Academic council on	
Compiled and designed by	
Subject handled by department	Department of IT

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE
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DEPARTMENT OF CS & IT

Semester/Year	VII/IV	Program	B.Tech – Internet of Things
Subject Category: OC	Subject Code: IoT 2074 OC – 3B	Subject Name	Embedded System Design

Maximum Marks Allotted						Contact Hours			Total Credits
Theory			Practical		Total Marks				
ES	MS	Assignment/Quiz	ES	LW		L	T	P	
70	20	10	-	-	100	3	0	0	3

Prerequisites:

Knowledge of microprocessor and controllers.

Course Objective:

- Attain the knowledge of embedded system and its development environment.
- Gain the knowledge of RTOS based embedded system design and its applications.

UNITs	Descriptions	Hrs.
I	Introduction to Embedded Systems: Definition of embedded system, embedded systems vs. general computing systems, history of embedded systems, classification, major application areas, purpose of embedded systems, characteristics and quality attributes of embedded systems, common design metrics, and processor technology: general purpose processor, application specific processor, single purpose processor.	**8**
II	Embedded System Architecture: Von Neumann v/s Harvard architecture, instruction set architecture, CISC and RISC instructions set architecture, basic embedded processor, microcontroller architecture, CISC & RISC examples: 8051, ARM, DSP processors.	8
III	Input Output and Peripheral Devices Timers and counters, watchdog timers, interrupt controllers, PWM, keyboard controller, analog to digital converters, real time clock. Introduction to communication protocols: basic terminologies, concepts, serial protocol: I2C, CAN, firewire, USB. Parallel protocols: PCI bus, IrDA, bluetooth, IEEE 802.11, wireless protocols.	8
IV	Memory System Architecture Caches, virtual memory, MMU, address translation, memory and interfacing, memory write ability and storage performance. Memory types, composing memory – advance RAM interfacing, microprocessor interfacing I/O addressing, interrupts, direct memory access, arbitration multilevel bus architecture.	8
V	Embedded System Supporting Technologies Difference between normal OS and RTOS, scheduling algorithms. Case study: Tiny OS, Vx Works, QNX. Overview of VLSI technology, introduction to device drivers. Case studies: washing machine, air-conditioning, auto focus camera.	8
Total Hours		40

Course Outcomes:

CO1: Explain the embedded system concepts and architecture of embedded systems
CO2: Describe the architecture of 8051 microcontroller and write embedded program for 8051 microcontroller
CO3: Select elements for an embedded systems tool.
CO4: Understand the memory types used in embedded systems.
CO5: Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety,Manufacturability and sustainability.

Text Book & Reference Books-

1. F Vahid, T Giogarvis, Embedded systems: A unified hardware/software approach, Wiley, 1999.
2. Raj Kamal, Embedded Systems Introduction, 2nd Ed., TMH publication, 2015.
3. David E Simons, An Embedded Software Primer, Pearson, 1999.

List/Links of e-learning resource

- https://onlinecourses.nptel.ac.in/noc20_ee98/preview

Modes of Evaluation and Rubric

The evaluation modes consist of performance in two mid semester Tests, Quiz/Assignments, term work, end semester practical examination.

CO-PO Mapping:

COs	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_1	PO_{11}	PO_{12}	PSO1	PSO2
CO-1	1	1	3			1							1	2
CO-2	2	1	1	1									1	2
CO-3	2	2	2							1			1	1
CO-4	2	1	2											2
CO-5	1					1	2	1					1	1

Recommendation by Board of studies on	
Approval by Academic council on	
Compiled and designed by	
Subject handled by department	Department of IT

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE
(Engineering College), VIDISHA M.P.
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DEPARTMENT OF IT

Semester/Year		VII/IV	Program		B.Tech – Internet of Things
Subject Category	OC	Subject Code:	IoT 2075 DE – 4A	Subject Name	AI for IoT

Maximum Marks Allotted						Contact Hours			Total Credits
Theory			Practical		Total Marks				
ES	MS	Assignment/Quiz	ES	LW		L	T	P	
70	20	10	-	-	100	3	0	0	3

Prerequisites:

Basic Knowledge of algorithms

Course Objective:

- Identify problems that are amenable to solution by AI methods, and which AI methods may be suited to solving a given problem.
- Review of classical problem solving: search and forward and backward chaining.
- Formalize a given problem in the language/framework of different AI methods (e.g., as a search problem, as a constraint satisfaction problem, as a planning problem etc.

UNITs	Descriptions	Hrs.
I	The AI Problems, The Underlying Assumption, AI Techniques, Level of the Model, Criteria for Success, Some general references, one Final Word. Problems and State Space Search, Defining Problems as a State Space Search, Production Systems, Production Characteristics, Production System Characteristics, and issues in the design of Search Programs, additional problems. Generate-and-Test, Hill Climbing, Best-First Search, Problem Reduction, Constraint Satisfaction, Means-Ends Analysis.	**8**
II	Representations and Mappings, Approaches to Knowledge Representation. Using Predicate Logic, Representation Simple Facts in Logic, Representing instance and is a Relationships, Computable Functions and Predicates, Resolution. Representing Knowledge Using Rules Procedural versus Declarative Knowledge, Logic Programming, Forward versus Backward Reasoning.	8
III	Introduction to Non-monotonic Reasoning, Logics for Non-monotonic Reasoning. Statistical Reasoning, Probability and Bay's Theorem, Certainty Factors and Rule-Base Systems, Bayesian Networks, Dempster-Shafer Theory, Fuzzy Logic. Weak Slot-And-Filler Structure, Semantic Nets, Frames. Game Playing: Overview, Example Domain the Blocks World, Components of a Planning System, Goal Stack Planning.	8
IV	Nonlinear Planning Using Constraint Posting, Hierarchical Planning, Reactive Systems, Other Planning Techniques. Natural Language Processing introduction, Syntactic Processing, Semantic Analysis, Discourse and Pragmatic Processing. Connectionist Models introduction: Hopfield Network, Learning in Neural Networks, Application of Neural Networks, Recurrent Networks, Distributed Representations, Connectionist AI and Symbolic AI.	8
V	Developments Process, knowledge Acquisition. Introduction to Prolog, Syntax and Numeric Function, Basic List Manipulation Functions in Prolog, Functions, Predicates and Conditional, input, output and Local Variables, iteration and Recursion, Property Lists and Arrays, LISP and other AI Programming Languages.	8

Total Hours	40

Course Outcomes:

CO-1: Describe various searching methods and reasoning in AI.
CO-2: Uses of Knowledge Representation Techniques.
CO-3: Analysis the concepts of reasoning and planning.
CO-4: Illustrate the concept of NLP and NN.
CO-5: Applyand evaluate AI Techniques using prolog and lisp.

Text Book & Reference Books-

1. Artificial Intelligence -By Elaine Rich And Kevin Knight (2nd Edition) Tata Mcgraw-Hill
2. Introduction to Prolog Programming By Carl Townsend.
3. "PROLOG Programming For Artificial Intelligence" -By Ivan Bratko(Addison-Wesley)
4. "Programming with PROLOG" —By Klocksin and Mellish.
5. "Artificial Intelligence" (Fifth Edition) -By George F Luger, Pearson Education.
6. "Artificial Intelligence" (Second Edition}-By Stuart Russell and Peter Norvig, Pearson
7. Education.
8. Artificial Intelligence Application Programming, Tim Jones, Wiley India.
9. "Artificial Intelligence And Expert Systems " -By D.W Patterson

List/Links of e-learning resource

- https://nptel.ac.in/courses/106102220

Modes of Evaluation and Rubric

The evaluation modes consist of performance in two mid semester Tests, Quiz/Assignments, term work, end semester practical examination.

CO-PO Mapping:

COs	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_1	PO_{11}	PO_{12}	PSO1	PSO2
CO-1	2	1	2										1	2
CO-2	2	2	2	1									2	1
CO-3	2	1	2	1									2	1
CO-4	2	1	2	1									2	1
CO-5	2	2	1										1	2

Recommendation by Board of studies on	
Approval by Academic council on	
Compiled and designed by	
Subject handled by department	Department of IT

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE
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DEPARTMENT OF CS & IT

Semester/Year		VII/IV	Program		B.Tech – Internet of Things
Subject Category	OC	Subject Code:	IoT 2075 OC – 4B	Subject Name	Cyber Security for IoT

Maximum Marks Allotted						Contact Hours			Total Credits
Theory			Practical		Total Marks				
ES	MS	Assignment/Quiz	ES	LW		L	T	P	
70	20	10	-	-	100	3	0	0	3

Prerequisites:

Course Objective:

- The course aims at providing students with concepts of computer security, cryptography, digital money, secure protocols, detection and other security techniques.

UNITs	Descriptions	Hrs.
I	Cyber Security Concepts: Essential Terminologies: CIA, Risks, Breaches, Threats, Attacks, Exploits. Information Gathering (Social Engineering, Foot Printing & Scanning). Open Source/ Free/ Trial Tools: nmap, zenmap, Port Scanners, Network scanners.	**8**
II	Introduction to Cryptography, Symmetric key Cryptography, Asymmetric key Cryptography, Message Authentication, Digital Signatures, Applications of Cryptography. Overview of Firewalls-Types of Firewalls, User Management, VPN Security, Security Protocols: - security at the Application Layer- PGP and S/MIME, Security at Transport Layer- SSL and TLS, Security at Network Layer-IPSec.	8
III	Introduction to System Security, Server Security, OS Security, Physical Security, Introduction to Networks, Network packet Sniffing, Network Design Simulation. DOS/ DDOS attacks. Asset Management and Audits, Vulnerabilities and Attacks. Intrusion detection and Prevention Techniques, Host based Intrusion prevention Systems, Security Information Management, Network Session Analysis, System Integrity Validation.	8
IV	Internet Security, Cloud Computing &Security, Social Network sites security, Cyber Security Vulnerabilities-Overview, vulnerabilities in software, System administration, Complex Network Architectures, Open Access to Organizational Data, Weak Authentication, Authorization, Unprotected Broadband communications, Poor Cyber Security Awareness..	7
V	Security in Evolving Technology: Biometrics, Mobile Computing and Hardening on android and ios, IOT Security, Web server configuration and Security. Introduction, Basic security for HTTP Applications and Services, Basic Security for Web Services like SOAP, REST etc., Identity Management and Web Services, Authorization Patterns, Security Considerations, Challenges.	9
Total Hours		40

Course Outcomes:

CO1: Understand, appreciate, employ, design and implement appropriate security technologies and policies to protect computers and digital information.

CO2: Identify & Evaluate Information Security threats and vulnerabilities in Information Systems and apply security measures to real time scenarios.

CO3: Identify common trade-offs and compromises that are made in the design and development process of Information Systems
CO4: Demonstrate the use of standards and cyber laws to enhance information security in the development process and infrastructure protection.
CO5: Design and develop a security architecture for an organization.

Text Book & Reference Books-

1. William Stallings, "Cryptography and Network Security", Pearson Education/PHI, 2006.
2. V.K. Jain, "Cryptography and Network Security", Khanna Publishing House.
3. Gupta Sarika, "Information and Cyber Security", Khanna Publishing House, Delhi.
4. AtulKahate, "Cryptography and Network Security", McGraw Hill.
5. V.K. Pachghare, "Cryptography and Information Security", PHI Learning

List/Links of e-learning resource

- https://nptel.ac.in/courses/106106129

Modes of Evaluation and Rubric

The evaluation modes consist of performance in two mid semester Tests, Quiz/Assignments, term work, end semester practical examination.

CO-PO Mapping:

COs	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_1	PO_{11}	PO_{12}	PSO1	PSO2
CO-1	1	3				1							1	2
CO-2	1	1	1										1	2
CO-3	1	2	1			2		2		1				1
CO-4		1	2					1						2
CO-5	1	1	1										1	1

Suggestive list of experiments:

Recommendation by Board of studies on	
Approval by Academic council on	
Compiled and designed by	
Subject handled by department	Department of IT

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DEPARTMENT OF IT

Semester/Year		VII/IV	Program		B.Tech – Internet of Things
Subject Category	DLC	Subject Code:	IoT 2076	Subject Name	Digital Sensor Lab

Maximum Marks Allotted						Contact Hours			Total Credits
Theory			Practical		Total Marks				
ES	MS	Assignment/Quiz	ES	LW		L	T	P	
-	-	-	30	20	50	0	0	2	1

Prerequisites:

Microprocessor and Microcontroller

Course Objective:

- To give students hands-on experience using different IoT architectures.
- To provide skills for interfacing sensors and actuators with different IoT architectures.
- To develop skills on data collection and logging in the cloud.

UNITs	List of Experiments	Hrs.
	1.IR OBSTACLE SENSOR- If object is detected pin 13 will go high (onboard LED ON) and "object detected" message will be displayed in serial monitor If object is not detected pin 13 will go low (onboard LED OFF) and "object not detected" message will be displayed in serial monitor. 2. GAS SENSOR- If Gas is detected pin 13 will go high (onboard LED ON) and "gas detected" message will be displayed in serial monitor If Gas is not detected pin 13 will go low (onboard LED OFF) and "gas not detected" message will be displayed in serial monitor. 3. FIRE SENSOR- If FIRE is detected pin 13 will go high (onboard LED ON) and "FIRE detected" message will be displayed in serial monitor If FIRE is not detected pin 13 will go low (onboard LED OFF) and "FIRE not detected" message will be displayed in serial monitor. 4. RELAY SHIELD- Controlling relay shield from serial monitor. 5. GSM SHIELD- If GAS is detected pin 7 will go LOW and "GAS detected" message will be sent to destination number. 6. Analog to Digital and PHOTORESISTOR- light-dependent resistor (LDR), the photo resistor adjusts its resistance according to the light received from the environment. It works not only with sunlight, but also with artificial light. Now let's see how we can integrate it to the real world. 7. Interfacing of DHT11. 8. Iot Based Air Pollution Control System. 9. Tds Sensor Interfacing With Arduino. 10. Actuator Controlling by Mobile Using Arduino.	
Total Hours		40

Course Outcomes:

CO 1: To know basics of development boards.
CO2: To know about the Arduino board and its interfacing with various components.
CO 3: To know about the ESP 8266 board and its interfacing with various components.
CO4: To know about the Raspberry Pi architecture. .
CO5: To know about the Raspberry Pi and its interfacing with various components.

Text Book & Reference Books-

List/Links of e-learning resource

Modes of Evaluation and Rubric

The evaluation modes consist of performance in two mid semester Tests, Quiz/Assignments, term work, end semester practical examination.

CO-PO Mapping:

COs	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_1	PO_{11}	PO_{12}	PSO1	PSO2
CO-1	2	1	2										1	2
CO-2	3	2	2	1									1	2
CO-3	3	2	2	1									2	1
CO-4	3	2	2	1									2	1
CO-5	2	2	1										1	1

Suggestive list of experiments:

Recommendation by Board of studies on	
Approval by Academic council on	
Compiled and designed by	
Subject handled by department	Department of IT

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE
(Engineering College), VIDISHA M.P.
(An Autonomous Institute Affiliated to RGPV Bhopal)
DEPARTMENT OF CS & IT

Semester/Year		VIII/IV	Program		B.Tech – Internet of Things
Subject Category	DLC	Subject Code:	IoT 2078	Subject Name	Major Project Prelim

Maximum Marks Allotted						Contact Hours			Total Credits
Theory			Practical		Total Marks				
ES	MS	Assignment/Quiz	ES	LW		L	T	P	
350	100	50	180	70	750	15	2	10	2

Prerequisites:

Course Objective:

UNITs	Descriptions	Hrs.
Procedure:	a) Each defined project needs to be from Industry/Research organization/Govt.organization/socio-technical issues. b) Project identification should be based on Analysis carried out by the students after completion of B.E Semester 6th Examination but before starting of the 7th Semester. c) Problem definition for the project needs to be submitted by every student in the first week of the 7th Semester to his/her college. d) Each definition will be evaluated based on merit in the beginning of the 7th semester itself by the College. **Facilitation:** You may contact your Major Project In charge co-ordinator/Faculty /Department Head for skilfulAnalysis .	**40**
Guidliness:	1. The project work will be in-house industry project, where student need to implement project related to any domain of industry like education, legal, manufacturing, design, pharmaceutical, Ecommerce, etc. 2. Students are required to get approval of project definition from the department. 3. After approval of project definition students are required to report their project work weekly to respective internal guide. 4. Maximum 4 students can allow working in particular project group. 5. The students are required to identify their project within two weeks of the commencement of the classes and they are required to follow all the rules and instructions issued by department. 6. Each student or student group would work under the guidance of the Faculty from the College. In case any problem/other issue arises for the smooth progress of Inter Departmental project work discovery/Practical Training, it should be immediately brought to the notice of the major project in charge coordinators/Faculty. 7. The students are required to submit Project synopsis Pre-report to their Head of the Department with the remarks of guide in their College during Eighth week of the semester	
Total Hours		40

Course Outcomes:

On successful completion of theproject student should be able to:

CO1: Identify the problem domain correctly and to represent problem using mathematical structures and logics.

CO2: Analyze possible solution strategies and investigate problem domain and design feasible solutions for it.

CO3: Make use of cutting edge tools and technologies to derive solutions for the problems and carried a detailed studied about the feasibility and societal impact of solutions

CO4: Acknowledges the previous work and support required in the solution. Justify the role of individual in project work. Demonstrate leadership skills in team work.

CO5: Present and communicate the importance of solutions of problem domain. Conduct and accomplish all the subtasks for project completion in time and cost effective manner and conclude the project work with possible scopes.

Text Book & Reference Books-

List/Links of e-learning resource

Modes of Evaluation and Rubric

The evaluation modes consist of performance in two mid semester Tests, Quiz/Assignments, term work, end semester practical examination.

CO-PO Mapping:

COs	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_1	PO_{11}	PO_{12}	PSO1	PSO2
CO-1	3	3	2										2	2
CO-2	2			2		1	2			1			2	
CO-3			3		3	2	3						2	2
CO-4									3				1	
CO-5					2					3	3	3		2

Suggestive list of experiments:

Recommendation by Board of studies on	
Approval by Academic council on	
Compiled and designed by	
Subject handled by department	Department of CS & IT

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE VIDISHA (M.P.)

(A Govt. Aided UGC Autonomous & NAAC Accredited Institute Affiliated to RGPV Bhopal)

Scheme of Examination (Semester-VIII)

for Batch Admitted in session - 2020-21

Bachelor of Technology (B. Tech.) – Internet of Things

Subject Code	Subject Category	Subject Name	Maximum Marks Allotted						Contact Hrs.			Total Credits
			Theory			Practical		Total Marks				
			ES	MS	Assignment/ Quiz	ES	Term Work, Lab Work or Sessional		L	T	P	
IoT 2081	OC	Mooc Course -1/OC - 4	70	20	10			100	3	0	0	3
IoT 2082	OC	Mooc Course -2/OC -5	70	20	10			100	3	0	0	3
IoT 2083	PROJ	Major Project Final				400	150	550	0	0	16	8
Total			**140**	**40**	**20**	**400**	**150**	**750**	6	0	16	**14**
	NLC	**Participation and winning in national level competition**										

	SL	**MOOCs**										
MST: Minimum two mid semester tests to be conducted during Semester,												

ES: End Semester MS: Mid Semester L: Lecture T: Tutorial P: Practical

Mooc Course -1	**Mooc Course -2**
SWAYAM/NPTEL – COURSE Suggested by Department.	

	Mooc Course -1/OC - 4	Mooc Course -2/OC -5
A	Foundation of Cloud IoT Edge ML	Digital Design with Verilog
B	Foundations of Cyber Physical Systems	Cloud Computing and Distributed Systems

SWAYAM/NPTEL MOOC's Course *

For batch admitted 2020-21

OC - 4	OC -5
A. Foundation of Cloud IoT Edge ML	A. Digital Design with Verilog
B. Foundations of Cyber Physical Systems	B. Cloud Computing and Distributed Systems

Sr. No	*Credit Points*	*Course/subject Name*	*Equivalent Course in NPTEL*	*Course Duration (Week)*	Link
1.	03	Foundation of Cloud IoT Edge ML	https://onlinecourses.nptel.ac.in/noc23_cs65/preview	08	https://archive.nptel.ac.in/courses/106/104/106104242/
2.	03	Foundations of Cyber Physical Systems	https://onlinecourses.nptel.ac.in/noc23_cs62/preview	12	https://nptel.ac.in/courses/106105241
3.	03	Digital Design with Verilog	https://onlinecourses.nptel.ac.in/noc24_cs61/preview	12	https://nptel.ac.in/courses/108103179
4.	03	Cloud Computing and Distributed Systems	https://onlinecourses.nptel.ac.in/noc21_cs15/preview	08	https://nptel.ac.in/courses/106104182

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE
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DEPARTMENT OF IT

Semester/Year				Program		B.Tech – IOT						
Subject Category	OC-4(A)	Subject Code: IoT 2081		IOT	Subject Name	Foundation of, Cloud, IOT, Edge, ML						
Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			Total Marks				
ES	MS	Assignment	Quiz	ES	LW	Quiz		L	T	P	
70	20	10						3	0	0	3

Prerequisites:

Course Objective:

To enable the students to relate various concepts of Globalization and its impact on Indian Society.

UNITs	Descriptions	Hrs.
I	Introduction to Cloud, Internet of Things (IoT), and Edge Computing Paradigms, Integrating Cloud+ IoT + Edge Infrastructures: System Modelling and Research Challengesin Federating Edge Resources	8
II	Management and Orchestration of Network Slices in 5G, Edge, and Clouds, Introduction to Lightweight Container Middleware for Edge Cloud Architectures	10
III	Data Management and Predictive Analysis to Support Edge Application Deployment, **Edge** Computing Realization for Big Data Analytics	12
IV	Introduction to Machine Learning Services at Public Cloud (AWS Sage Maker), Use Cases for Machine Learning and Deep Learning at the Edge: Smart Surveillance Video Stream Processing, AR/VR, Health Monitoring and Self-driving cars	8
V	.Application of IoT: Smart Homes – Introduction, Origin of Smart Homes, Smart Home Technologies. Smart Cities – Characteristics of Smart Cities, Smart City Framework, Challenges in Smart Cities. Connected Vehicles – Introduction, levels of Automation, Vehicle to Everything(V2X) Paradigm, Vehicular Ad-hoc Network (VANETs)	7
Total Hours		45

Course Outcomes:

CO1: To understand the Fundamentals of IoT.
CO2: To understand the Fundamentals of Edge Computing.
CO3: To understand the Fundamentals of Cloud.
CO4: To understand the Fundamentals of ML.

Text Book

Arshdeep Bagha and Vijay Madisetti, "Internet of Things – A hands-on approach", Orient Blackswan Private Limited - New Delhi.
Cloud Computing Bible by Barrie Sosinsky, Wiley India Pvt. Ltd, 2013 .
P. Langley. "Elements of Machine Learning" Morgan Kaufmann Publishers, Inc. 2296.

Reference Books-

List/Links of e-learning resource

- https://archive.nptel.ac.in/courses/106/106/106106131/

Modes of Evaluation and Rubric

The evaluation modes consist of performance in two mid semester Tests, Quiz/Assignments, term work, end semester practical examination.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1	PO_{11}	PO_{12}	PSO-1	PSO2

CO-1	3	3	2	3	1							2	3	
CO-2		3	3	2	3									
CO-3	2	3	3	3	2									
CO-4		2	3	3										
CO-5		3	2	3										

1.

Recommendation by Board of studies on	
Approval by Academic council on	
Compiled and designed by	
Subject handled by department	Department of IT

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE
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DEPARTMENT OF IT

Semester/Year			Program		B.Tech – IOT							
Subject Category	OC 4(B)	Subject Code: IoT 2081	IOT	Subject Name	Foundation of Cyber Physical system							
Maximum Marks Allotted								Contact Hours				Total Credits
Theory					Practical		Total Marks					
ES	MS	Assignment		ES	LW	Quiz	Total	L	T	P	Credit	
70	20	10					100	3	0	0	3	

Prerequisites:

Course Objective: To understand important safety-critical aspects and feel confident designing and analysing system models. It will provide an excellent foundation for students who seek industry positions and for students interested in pursuing research.

To enable the students to relate various concepts of Globalization and its impact on Indian Society.

UNITs	Descriptions	Hrs.
I	Dynamical Systems Modeling**:** Cyber-Physical Systems (CPS) in the real world, Dynamical Systems: stability and performance, Different notions of stability, Controller Design techniques	8
II	Logic based system specification, Controller Synthesis as a logic problem, Tutorials: System modeling, Control design, stability, Z3 solver, Compute /Communicate/Scheduling, Real time scheduling theory, CAN bus scheduling, Wireless CPS	10
III	Packet drops and their effects on stability/performance, Delay/Deadline-miss aware control design, Tutorials :True time/Jitter time, CAN tools, WSN-CPS simulation with drops, Example of miss aware control	12
IV	Safe-AI based and Secure CPS**,** Safe Reinforcement learning for CPS, MPC+Gaussian Process learning for CPS, Distributed CPS: Cooperative driving	8
V	Attack detection and mitigation in CPS, Smart Grid Security and Privacy : Automated Generation Control attacks and privacy aware metering, Tutorials : Use of OpenAI-gym, Carla, Matlab for safe-RL/MPC based autonomous driving, Ventos/SUMO for Cooperative driving, Matlab for power system loop modeling	7
Total Hours		45

Course Outcomes:

CO1: Understand the core principles behind CPSs.
CO2: Develop models and controls.
CO3: Identify safety specifications and critical properties of CPSs.
CO4: Understand abstraction and system architectures.
CO5: Learn how to design by invariant.

Text Book

André Platzer. LOGICAL FOUNDATIONS OF CYBER-PHYSICAL SYSTEMS. Springer, Cham, 2018. 659 pages. ISBN 978-3-319-63587-3.

Reference Books-

List/Links of e-learning resource

- https://archive.nptel.ac.in/courses/106/106/106106131/

Modes of Evaluation and Rubric

The evaluation modes consist of performance in two mid semester Tests, Quiz/Assignments, term work, end semester practical examination.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1	PO_{11}	PO_{12}	PSO-1	PSO2
CO-1	3	3	2	3	1							2	3	
CO-2		3	3	2	3									
CO-3	2	3	3	3	2									
CO-4		2	3	3										
CO-5		3	2	3										

1.

Recommendation by Board of studies on	
Approval by Academic council on	
Compiled and designed by	
Subject handled by department	Department of IT

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE
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DEPARTMENT OF IT

Semester/Year			Program		B.Tech – IOT					
Subject Category	OC 5 (A)	Subject Code: IoT 2082	IOT	Subject Name	Digital Design with Verilog					
Maximum Marks Allotted								Contact Hours		Total Credits
Theory				Practical			Total Marks			
ES	MS	Assignment	Quiz	ES	LW	Quiz		L	T	P	Credit
70	20	10					100	3	0	0	3

Prerequisites:

Switching Theory and Logic Design.

Course Objective:

To learn the concepts of modeling a digital system using Verilog hardware description Language.

UNITs	Descriptions	Hrs.
I	INTRODUCTION TO VERILOG: Verilog as HDL, Levels of Design Description, Concurrency, Simulation and Synthesis, Functional Verification, System Tasks, Programming Language Interface (PLI), Module, Simulation and Synthesis Tools, Test Benches. LANGUAGE CONSTRUCTS AND CONVENTIONS: Introduction, Keywords, Identifiers, White Space Characters, Comments, Numbers, Strings, Logic Values, Strengths, Data Types, Scalars and Vectors, Parameters, Memory, Operators, System Tasks.	8
II	UNIT-II GATE LEVEL MODELING: Introduction, AND Gate Primitive, Module Structure, Other Gate Primitives, Illustrative Examples, Tri-State Gates, Array of Instances of Primitives, Additional Examples, Design of Flipflops with Gate Primitives, Delays, Strengths and Contention Resolution, Net Types, Design of Basic Circuits. DATA FLOW LEVEL MODELING: Introduction, Continuous Assignment Structures, Delays and Continuous Assignments, Assignment to Vectors, Operators.	10
III	BEHAVIORAL MODELING: Introduction, Operations and Assignments, Functional Bifurcation, Initial Construct, Always Construct, Examples, Assignments with Delays, Wait construct, Multiple Always Blocks, Designs at Behavioral Level, Blocking and Non-blocking Assignments, The case statement, Simulation Flow. i*f*andi*f*-else constructs, assign-deassign construct, repeat construct, for loop, the disable construct, whileloop, forever loop, parallel blocks, force-release construct, Event. SWITCH LEVEL MODELING: Introduction, Basic Transistor Switches, CMOS Switch, Bi-directional Gates, Time Delays with Switch Primitives, Instantiations with Strengths and Delays, Strength Contention with Tri-reg Nets.	12
IV	FUNCTIONS, TASKS, AND U SER-DEFINED PRIMITIVES: Introduction, Function, Tasks, User- Defined Primitives (UDP), FSM Design (Moore and Mealy Machines). SYSTEM TASKS, FUNCTIONS AND COMPILER DIRECTIVES: Introduction, Parameters, Path Delays, Module Parameters, System Tasks and Functions, File-Based Tasks and Functions, Compiler Directives, Hierarchical Access, General Observations. VERILOG MODELS FOR MEMORIES AND BUSES: Static RAM Memory, A simplified 486 Bus Model, UART Design.	8
V	DESIGNING WITH FIELD PROGRAMMABLE GATE ARRAYS AND COMPLEX PROGRAMMABLE LOGIC DEVICES: Xilinx 3000 Series FPGAs, Designing with FPGAs, Using a One-Hot State Assignment, Altera Complex Programmable Logic Devices (CPLDs), Altera FLEX 10K Series CPLDs.	7
Total Hours		45

Course Outcomes:

Students can model digital circuits using Verilog.
Student can represent Function of any digital system using hardware description language

Text Book

1. T.R. Padmanabhan and B. Bala Tripura Sundari, "Design through Verilog HDL'', WSE, IEEE Press 2008.
2. J. Bhaskar, "A Verilog Primer'', BSP, 2nd edition 2003.

Reference Books-

1.Samir Palnitkar, "Verilog HDL", Pearson Education, 2nd Edition,2003.
2. Thomas and Moorby, "The Verilog Hardware Description Language", kluwer academic publishers, 5th edition, 2002.
3. Stephen Brown and Zvonko Vranesic, "Fundamentals of Logic Design with Verilog", TMH publications, 2007.
4. Charles.H.Roth,Jr., Lizy Kurian John "Digital System Design using VHDL" , Thomson, 2nd Edition, 2008

List/Links of e-learning resource

- https://archive.nptel.ac.in/courses/106/106/106106131/

Modes of Evaluation and Rubric

The evaluation modes consist of performance in two mid semester Tests, Quiz/Assignments, term work, end semester practical examination.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1	PO_{11}	PO_{12}	PSO-1	PSO2
CO-1	3	3	2	3	1							2	3	
CO-2		3	3	2	3									
CO-3	2	3	3	3	2									
CO-4		2	3	3										
CO-5		3	2	3										

Recommendation by Board of studies on	
Approval by Academic council on	
Compiled and designed by	
Subject handled by department	Department of IT

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE
(Engineering College), VIDISHA M.P.
(An Autonomous Institute Affiliated to RGPV Bhopal)
DEPARTMENT OF IT

Semester/Year			Program		B.Tech – IOT					
Subject Category	DE	Subject Code:	IOT	Subject Name	Cloud computing and Distributed System					
Maximum Marks Allotted							Contact Hours			Total Credits
Theory				Practical			Total Marks			
ES	MS	Assignment	Quiz	ES	LW	Quiz		L	T	P	Credits
60	20	10	10				100	3	0	0	3

Prerequisites:

Course Objective:

A basic grounding in designing and implementing distributed and cloud systems. Developers of cloud services question how those services should be implemented.

UNITs	Descriptions	Hrs.
I	Introduction to distributed systems and cloud computing. Cloud architectures: SaaS, PaaS, IaaS. End-to-end system design. Networks and protocol stacks, Client-server computing. Sockets and remote procedure call, Distributed file systems and cache consistency. NFS, AFS. Storage in the Cloud: Google/ Hadoop file system.	8
II	Web services and REST. Example: Amazon S3. The JAX-RS API. Persistent cloud services. Failure models and failure detectors, Asynchrony: publish-subscribe. Server-side events and REST. Web sockets. Vert.x: Node.js for Java. Distributed snapshots. Distributed debugging. Time and ordering of events. Causal broadcasts.	10
III	Batch cloud computing: map-reduce and Hadoop. Domain-specific languages for cloud data processing: Pig and Hive. Transactions. Serializability and recoverability. Long-lived transactions. Transactions. Atomic commitment protocols: 2PC and 3PC.	12
IV	Highly available services. Replicated services and quorum consensus. The CAP Theorem, NoSQL data stores. Table-based (Google BigTable), key-based (Amazon Dynamo), and Cassandra. The Hector API. Query processing with Map-reduce.	8
V	Consensus and the Paxos algorithm. Applications in the cloud: Google Chubby, Yahoo Zookeeper, Peer-to-peer systems. Distributed hash tables. Applications in multiplayer game-playing.	7
Total Hours		45

Course Outcomes:

1. Describe system models for distributed and cloud computing.
2. Describe the design principles of computer clusters and data centers.
3. Describe and distinguish different virtualization techniques.
4. Explain cloud enabling technologies, cloud mechanisms, and cloud architectures.
5. Use cloud programming (e.g., Google App Engine, Amazon Web Services) to solve real problems.

Text Book

1.Dominic Duggan, Enterprise Software Architecture and Design

Reference Books-

George Coulouris, Jean Dollimore, T. Kindberg, and Gordon Blair, Distributed Systems: Concepts and Design, 5th Edition, Addison Wesley, 2012.

Thomas Erl, Ricardo Puttini, and Zaigham Mahmood, Cloud Computing: Concepts, Technology & Architecture, Prentice Hall, 2013.

Kai Hwang, Jack Dongarra, and Geoffrey C. Fox, Distributed and Cloud Computing: From Parallel Processing to the Internet of Things, 1st Edition, Morgan Kaufmann, 2011.

List/Links of e-learning resource

- https://archive.nptel.ac.in/courses/106/106/106106131/

Modes of Evaluation and Rubric

The evaluation modes consist of performance in two mid semester Tests, Quiz/Assignments, term work, end semester practical examination.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1	PO_{11}	PO_{12}	PSO-1	PSO2
CO-1	3	3	2	3	1							2	3	
CO-2		3	3	2	3									
CO-3	2	3	3	3	2									
CO-4		2	3	3										
CO-5		3	2	3										

Recommendation by Board of studies on	
Approval by Academic council on	
Compiled and designed by	
Subject handled by department	Department of IT

Tentative pool of subjects for Honours & Minor Degree
SWAYAM/NPTEL/ MOOC's Course *

Annexure-I

NPTEL Courses Equivalence for Departmental and Open Electives
For
(Honour's Degree)

ExistingElectives			SimilarNPTELCourse		
Sr. No	*Credit Points*	*Course/subjectName*	*Equivalent Course inNPTEL*	*CourseDuration(Week)*	Link
1.	2	Cloud Computing and Distributed Systems	https://onlinecourses.nptel.ac.in/noc21_cs15/preview	08	https://nptel.ac.in/courses/106104182
2.	3	Switching Circuits and Logic Design	https://onlinecourses.nptel.ac.in/noc20_cs67/preview	12	https://nptel.ac.in/courses/106105185
3.	3	Advanced Computer Networks	https://onlinecourses.nptel.ac.in/noc23_cs35/preview	12	https://nptel.ac.in/courses/106106243
4.	2	Embedded System Design with ARM	https://onlinecourses.nptel.ac.in/noc22_cs93/preview	08	https://nptel.ac.in/courses/106105193
5.	3	Embedded Sensing, Actuation and Interfacing Systems	https://onlinecourses.nptel.ac.in/noc24_ee68/preview	12	https://nptel.ac.in/courses/108105376
6.	3	Digital System Design	https://onlinecourses.nptel.ac.in/noc21_ee39/preview	12	https://nptel.ac.in/courses/108106177
7.	2	An Introduction to Information Theory	https://onlinecourses.nptel.ac.in/noc22_ee49/preview	08	https://nptel.ac.in/courses/117104129
8.	3	Industrial Automation And Control	https://onlinecourses.nptel.ac.in/noc21_me67/preview	12	https://nptel.ac.in/courses/108105088

Tentative pool of subjects for Honours & Minor Degree
SWAYAM/NPTEL/ MOOC's Course *

Annexure-II

NPTEL Courses Equivalence for Departmental and Open Electives
For
(Minor Degree)

ExistingElectives			SimilarNPTELCourse		
Sr.No.	*Credit Points*	*Course/subjectName*	*Equivalent Course inNPTEL*	*CourseDuration(Week)*	Link
1.		Analog and Digital Electronics	https://nptel.ac.in/courses/108105158		https://nptel.ac.in/courses/108102112
2.	3	Computer Networks And Internet Protocol	https://onlinecourses.nptel.ac.in/noc22_cs19/preview	12	https://nptel.ac.in/courses/106105183
3.	3	Microprocessor and Microcontroller	https://onlinecourses.nptel.ac.in/noc22_ee12/preview	12	https://nptel.ac.in/courses/108105102
4.	2	Foundation of Cloud IoT Edge ML	https://onlinecourses.nptel.ac.in/noc23_cs65/preview	08	https://nptel.ac.in/courses/106104242
5.	3	Foundations of Cyber Physical Systems	https://onlinecourses.nptel.ac.in/noc23_cs62/preview	12	https://nptel.ac.in/courses/106105241
6.	3	Introduction to Embedded System Design	https://onlinecourses.nptel.ac.in/noc20_ee98/preview	12	https://nptel.ac.in/courses/108102169
7.	3	Introduction To Industry 4.0 And Industrial Internet Of Things	https://onlinecourses.nptel.ac.in/noc20_cs69/preview	12	https://nptel.ac.in/courses/106105195
8.	3	Introduction To Internet Of Things	https://onlinecourses.nptel.ac.in/noc22_cs53/preview	12	https://nptel.ac.in/courses/106105166