Name of the Course: B.Sc. in Information Technology (Internet of Things) **Subject:** Programming for Problem Solving **&** Programming for Problem Solving Lab	
Course Code: BITIOT101 and BITIOT191	**Semester: I**
Duration: 36 Hrs.	**Maximum Marks: 100+100**
Teaching Scheme	**Examination Scheme**
Theory: 3 hrs./week	**End Semester Exam: 70**
Tutorial: 0	**Attendance : 5**
Practical: 4 hrs./week	**Continuous Assessment: 25**
Credit: 3 + 2	**Practical Sessional internal continuous evaluation: 40**
	Practical Sessional external examination: 60

Aim:	
Sl. No.	
1.	Implement your algorithms to build programs in the C programming language
2.	Use data structures like arrays, linked lists, and stacks to solve various problems
3.	Understand and use file handling in the C programming language

Objective:	
Sl. No.	
1.	To write efficient algorithms to solve various problems
2.	To understand and use various constructs of the programming language
3.	To apply such as conditionals, iteration, and recursion in programming

Pre-Requisite:	
Sl. No.	
1.	Basic Knowledge of Computer System

Contents		**3 Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	**Introduction to Computers** Computer Systems, Computing Environments, Computer Languages, Creating and Running Programs, Software Development, Flow charts. Number Systems: Binary, Octal, Decimal, Hexadecimal Introduction to C Language - Background, C Programs, Identifiers, Data Types, Variables, Constants, Input / Output Statements Arithmetic Operators	**6**	**10**

	and Expressions: Evaluating Expressions, Precedence and Associativity of Operators, Type Conversions.		
02	**Conditional Control Statements** Bitwise Operators, Relational and Logical Operators, If, If- Else, Switch-Statement and Examples. Loop Control Statements: For, While, DoWhile and Examples. Continue, Break and Goto statements Functions: Function Basics, User-defined Functions, Inter Function Communication, Standard Functions, Methods of Parameter Passing. Recursion- Recursive Functions.. Storage Classes: Auto, Register, Static, Extern, Scope Rules, and Type Qualifiers.	**8**	**10**
03	**Pre-processors and Arrays** Pre-processor Commands Arrays - Concepts, Using Arrays in C, Inter-Function Communication, Array Applications, Two-Dimensional Arrays, Multidimensional Arrays, Linear and Binary Search, Selection and Bubble Sort.	**8**	**16**
04	**Pointers** Pointers for Inter-Function Communication, Pointers to Pointers, Compatibility, Lvalue and Rvalue, Arrays and Pointers, Pointer Arithmetic and Arrays, Passing an Array to a Function, Memory Allocation Functions, Array of Pointers, Programming Applications, Pointers to void, Pointers to Functions, Command Line Arguments. Strings - Concepts, C Strings, String Input/ Output Functions, Arrays of Strings, String Manipulation Functions.	**8**	**16**
05	**Structures and File** Definition and Initialization of Structures, Accessing Structures, Nested Structures, Arrays of Structures, Structures and Functions, Pointers to Structures, Self-Referential Structures, Unions, Type Definition (typedef), Enumerated Types. Input and Output: Introduction to Files, Modes of Files, Streams, Standard Library Input/ Output Functions, Character Input/ Output Functions.	**6**	**18**
	Sub Total:	**36**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**

	Total:	**40**	**100**

Practical:

Skills to be developed:

Intellectual skills:

1. The ability to learn concepts and apply them to other problems. ...
2. Basic mathematical skills.
3. A passion for problem solving.
4. Confidence around a computer programming Language.

List of Practical: Sl. No. 1 to 10 compulsory & at least three from the rest)

1. Write a c program to display the word "welcome".
2. Write a c program to take a variable int and input the value from the user and display it.
3. Write a c program to add 2 numbers entered by the user and display the result.
4. Write a c program to calculate the area and perimeter of a circle.
5. Write a C program to find maximum between two numbers.
6. Write a C program to check whether a number is divisible by 5 and 11 or not.
7. Write a C program to input angles of a triangle and check whether triangle is valid or not.
8. Write a C program to check whether a year is leap year or not.
9. Write a C program to input basic salary of an employee and calculate its Gross salary according to following:
   Basic Salary <= 10000 : HRA = 20%, DA = 80%
   Basic Salary <= 20000 : HRA = 25%, DA = 90%
   Basic Salary > 20000 : HRA = 30%, DA = 95%
10. Write a c program to print “welcome” 10 times.
11. Write a c program to print first n natural numbers using while loop.
12. Write a c program to print all the odd numbers in a given range.
13. Write a c program to add first n numbers using while loop.
14. Write a c program to print all numbers divisible by 3 or 5 in a given range.
15. Write a c program to add even numbers in a given range.
16. Write a c program to find the factorial of a given number.
17. Write a c program to find whether a number is prime or not.
18. Write a c program to print the reverse of a number.
19. Write a c program to add the digits of a number.
20. Write a c program to print the Fibonacci series in a given range using recursion.
21. Write a c program to check whether a number is an Armstrong number or not.
22. Write a c program to find g.c.d. and l.c.m. of two numbers using function.

Assignments:

1. Based on theory lectures.

List of Books

Text Books:

Name of Author	Title of the Book	Edition/ISSN/ISBN	Name of the Publisher

Yashavant Kanetkar,	Let us C	13th Edition	BPB Publication
E. Balaguruswamy	Programming in ANSI C		Tata McGraw-Hill
Gary J. Bronson	A First Book of ANSI C	4th Edition	ACM
Reference Books:			
Byron Gottfried	Schaum's Outline of Programming with C		McGraw-Hill
Kenneth A. Reek	Pointers on C		Pearson
Brian W. Kernighan and Dennis M. Ritchie	The C Programming Language		Prentice Hall of India
List of equipment/apparatus for laboratory experiments:			
Sl. No.			
1.	Computer		

End Semester Examination Scheme. Maximum Marks-70. Time allotted-3hrs.

Group	Unit	Objective Questions (MCQ only with the correct answer)		Subjective Questions			
		No of question to be set	Total Marks	No of question to be set	To answer	Marks per question	Total Marks
A	1,2,3,4,5	10	10				
B	1,2,3,4,5			5	3	5	60
C	1,2,3,4,5			5	3	15	

- Only multiple choice type questions (MCQ) with one correct answer are to be set in the objective part.
- Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.

Examination Scheme for end semester examination:

Group	Chapter	Marks of each question	Question to be set	Question to be answered
A	All	1	10	10
B	All	5	5	3
C	All	15	5	3

Examination Scheme for Practical Sessional examination:			
Practical Internal Sessional Continuous Evaluation			
Internal Examination:			
Continuous evaluation			**40**
External Examination: Examiner-			
Signed Lab Assignments		**10**	
On Spot Experiment		**40**	
Viva voce		**10**	**60**

Name of the Course: B.Sc. in Information Technology (Internet of Things) **Subject:** Electrical and Electronics Engineering & Electrical and Electronics Engineering Lab			
Course Code: BITIOT102 and BITIOT192		**Semester: I**	
Duration: 36 Hrs.		**Maximum Marks: 100+100**	
Teaching Scheme		**Examination Scheme**	
Theory: 3 hrs./week		**End Semester Exam: 70**	
Tutorial: 0		**Attendance : 5**	
Practical: 4 hrs./week		**Continuous Assessment: 25**	
Credit: 3 + 2		**Practical Sessional internal continuous evaluation: 40**	
		Practical Sessional external examination: 60	
Aim:			
Sl. No.			
1.	It aims to apply knowledge of science, mathematics, and engineering principles to solve electrical and electronics engineering problems.		
2.	It also edifies understanding the impact of electrical & electronics engineering solutions in a global, economic, environmental, and societal context.		
Objective:			
Sl. No.			
1.	To impart profound scientific & engineering knowledge to comprehend, analyze, design and create new thoughts and products for solving real life Engineering problems.		
2.	Ability to conduct experimental investigation, analyze, evaluate and interpret results in the field electrical & electronics circuits & measurements, electrical machines, power systems, control systems, power electronics & drives and microprocessor & microcontroller, electronics devices etc.		
Contents		**3 Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	**Electrical Circuits & Measurements** Fundamental laws of electric circuits, Steady State Solution of DC Circuits – Introduction to AC Circuits -Sinusoidal steady state analysis, Power and Power factor - Single Phase and Three Phase Balanced Circuits. Classification of instruments - Operating Principles of indicating Instruments	**6**	**10**
02	**Electrical Machines** Construction, Principle of Operation, Basic Equations and	**6**	**13**

	Applications of DC Generators, DC Motors, Single Phase Transformer, single phase induction Motor.		
03	**Semiconductor Devices And Applications** Introduction - Characteristics of PN Junction Diode – Zener Effect - Zener Diode and its Characteristics - Half wave and Full wave Rectifiers - Voltage Regulation. Bipolar Junction Transistor - CB, CE, CC Configurations and Characteristics - Elementary Treatment of Small Signal Amplifier.	**10**	**20**
04	**Digital Electronics** Binary Number System – Boolean algebra theorems, Digital circuits - Introduction to sequential Circuits, Flip-Flops - Registers and Counters – A/D and D/A Conversion -digital processing architecture.	**8**	**13**
05	**Fundamentals of Communication Engineering** Introduction - Elements of Communication Systems, Modulation and Demodulation: Principles of Amplitude and Frequency Modulations. Digital Communication - Communication Systems: Radio, Antenna, TV, Fax, ISDN, Microwave, Satellite and Optical Fibre (Block Diagram Approach only).	**6**	**14**
	Sub Total:	**36**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**40**	**100**

Practical:

Skills to be developed:

Intellectual skills:

1.
2.
3.
4.
5.

List of Practical: Sl. No. 1& 2 compulsory & at least three from the rest)

1. Verification of Kirchhoff's current and voltage laws.

2. Verification of network theorems.
3. Study of characteristics of DC motor
4. Open circuit and short circuit test on single phase transformer.
5. Familiarization of resistors using colour coded method and multimeter.
6. PN junction diode and zener diode characteristics
7. Transistor CE and CB characteristics.
8. Full wave and Half wave Characteristics
9. Study of CRO.

Assignments:

1. Based on theory

List of Books

Text Books:

Name of Author	**Title of the Book**	**Edition/ISSN/ISBN**	**Name of the Publisher**
DP Kothari and J Nagarath	Electrical Machines "Basic Electrical and Electronics Engineering		McGraw Hill Education(India) Private Limited, Third Reprint,2016
S.K. Bhattacharya	Basic Electrical and Electronics Engineering		Pearson India, 2011
Reference Books:			
Sedha R.S	Applied Electronics		S. Chand & Co., 2006
A.E.Fitzgerald, David E Higginbotham and Arvin Grabel	Basic Electrical Engineering		*Mc*Graw Hill Education(India) Private Limited, 2009

List of equipment/apparatus for laboratory experiments:

Sl. No.	
1.	CRO/DSO, Multimeter
2.	Function Generator
3.	Electrical Trainer Kit

End Semester Examination Scheme. Maximum Marks-70. Time allotted-3hrs.

Group	**Unit**	**Objective Questions** (MCQ only with the correct answer)	**Subjective Questions**

		No of question to be set	Total Marks	No of question to be set	To answer	Marks per question	Total Marks
A	1,2,3,4,5	10	10				
B	3, 4, 5			5	3	5	60
C	1,2,3,4,5			5	3	15	

- Only multiple choice type question (MCQ) with one correct answer are to be set in the objective part.
- Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.

Examination Scheme for end semester examination:

Group	Chapter	Marks of each question	Question to be set	Question to be answered
A	All	1	10	10
B	All	5	5	3
C	All	15	5	3

Examination Scheme for Practical Sessional examination:

Practical Internal Sessional Continuous Evaluation

Internal Examination:

Continuous evaluation			**40**

External Examination: Examiner-

Signed Lab Assignments	**10**	
On Spot Experiment	**40**	
Viva voce	**10**	**60**

Name of the Course: B.Sc. in Information Technology (Internet of Things) **Subject:** Soft Skills & Soft Skills Lab			
Course Code: BITIOT103 and BITIOT193		**Semester: I**	
Duration: 36 Hrs.		**Maximum Marks: 100+100**	
Teaching Scheme		**Examination Scheme**	
Theory: 3 hrs./week		**End Semester Exam: 70**	
Tutorial: 0		**Attendance: 5**	
Practical: 4 hrs./week		**Continuous Assessment: 25**	
Credit: 3 + 2		**Practical Sessional internal continuous evaluation: 40**	
		Practical Sessional external examination: 60	
Aim:			
Sl. No.			
1.	Ability to read English with ability to read English with understanding and decipher paragraph patterns, writer techniques and conclusions		
2.	Skill to develop the ability to write English correctly and master the mechanics of writing the use of correct punctuation marks and capital letter		
3.	Ability to understand English when it is spoken in various contexts.		
Objective:			
Sl. No.			
1.	To enable the learner to communicate effectively and appropriately in real life situation		
2.	Touse English effectively for study purpose across the curriculum		
3.	To use R,W,L,S and integrate the use of four language skills, Reading, writing , listening and speaking.		
4.	To revise and reinforce structures already learnt.		
Pre-Requisite:			
Sl. No.			
1.	Basic knowledge of English Language.		
Contents		**3 Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	**Grammar** Correction of sentence, Vocabulary/word formation, Single word for a group of words, Fill in the blank, transformation of sentences, Structure of sentences – Active / Passive Voice – Direct / Indirect Narration.	**6**	**15**

02	**Essay Writing** Descriptive – Comparative – Argumentative – Thesis statement- Structure of opening / concluding paragraphs – Body of the essay.	**5**	**5**
03	**Reading Comprehension** Global – Contextual – Inferential – Select passages from recommended text.	**5**	**10**
04	**Business Correspondence** Letter Writing – Formal. Drafting. Bio data - Resume'- Curriculum Vitae.	**5**	**8**
05	**Report Writing** Structure, Types of report – Practice Writing.	**5**	**5**
06	**Communication skills** Public Speaking skills, Features of effective speech, verbal-nonverbal.	**5**	**15**
07	**Group discussion** Group discussion – principle – practice	**5**	**12**
	Sub Total:	**36**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**40**	**100**

Practical:

Skills to be developed:

Intellectual skills:

1. Skill of Grammar
2. Various writing skills
3. Skill of reading English text
4. Skill of effective written communication

Motor Skills:

1. Skill of using Correct body language while giving a presentation
2. Various non-verbal communication skills
3. Skill of using correct gestures and expressions while speaking publicly
4. Essential approach and attitude in Group Discussion or Viva

List of Practical:

1. Honing 'Listening Skill' and its sub skills through Language Lab Audio device.
2. Honing 'Speaking Skill' and its sub skills.
3. Helping them master Linguistic/Paralinguistic features (Pronunciation/Phonetics/Voice

modulation/ Stress/ Intonation/ Pitch & Accent) of connected speech.

4. Honing 'Conversation Skill' using Language Lab Audio –Visual input, Conversational Practice Sessions (Face to Face / via Telephone, Mobile phone & Role Play Mode).
5. Introducing 'Group Discussion' through audio –Visual input and acquainting them with key strategies for success.
6. GD Practice Sessions for helping them internalize basic Principles (turn- taking, creative intervention, by using correct body language, courtesies & other soft skills) of GD.
7. Honing 'Reading Skills' and its sub skills using Visual / Graphics/Diagrams /Chart Display/Technical/Non Technical Passages, Learning Global / Contextual / Inferential Comprehension.
8. Honing 'Writing Skill' and its sub skills by using Language Lab Audio –Visual input, Practice Sessions

Assignments:

Based on theory lectures.

List of Books

Text Books:

Name of Author	Title of the Book	Edition/ISSN/ISBN	Name of the Publisher
R.C. Sharma and K.Mohan	Business Correspondence and Report Writing		Tata McGraw Hill , New Delhi , 1994
.Gartside	Model Business Letters		Pitman , London , 1992
Reference Books:			
Mark MaCormack	Communication		
John Metchell	How to write reports		
S R Inthira&amp, V Saraswathi	Enrich your English – a) Communication skills b) Academic skills		CIEFL &amp, OUP
Longman	Longman Dictionary of Contemporary English/Oxford Advanced Learner's Dictionary of Current English		OUP , 1998

Maxwell Nurnberg and Rosenblum Morris	All About Words		General Book Depot, New Delhi , 1995
	A Text Book for English for Engineers &amp, Technologists		

List of equipment/apparatus for laboratory experiments:	
Sl. No.	
1.	Computer
2.	Audio Devices
3.	Visual Devices
4.	Language lab Devices and the dedicated software

End Semester Examination Scheme. Maximum Marks-70. Time allotted-3hrs.

Group	**Unit**	**Objective Questions** (MCQ only with the correct answer)		**Subjective Questions**			
		No of question to be set	Total Marks	No of question to be set	To answer	Marks per question	Total Marks
A B C	1,2,3,4,5, 6 1,2,3, 4, 5, 6 1,2,3,4,5, 6	10	10	5 5	3 3	5 15	60

- Only multiple choice type question (MCQ) with one correct answer are to be set in the objective part.
- Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.

Examination Scheme for end semester examination:

Group	**Chapter**	**Marks of each question**	**Question to be set**	**Question to be answered**
A	All	1	10	10

B	All	5	5	3
C	All	15	5	3
Examination Scheme for Practical Sessional examination:				
Practical Internal Sessional Continuous Evaluation				
Internal Examination:				
Continuous evaluation				**40**
External Examination: Examiner-				
Signed Lab Assignments			**10**	
On Spot Experiment			**40**	
Viva voce			**10**	**60**

Name of the Course: B.Sc. in Information Technology (Internet of Things) **Subject:** Mathematics for Computer Science			
Course Code: BITIOT104		**Semester: I**	
Duration: 36 Hrs.		**Maximum Marks: 100**	
Teaching Scheme		**Examination Scheme**	
Theory: 3 hrs./week		End Semester Exam: 70	
Tutorial:1 hr./week		Attendance: 5	
Practical:0		Continuous Assessment: 25	
Credit:4		Practical Sessional internal continuous evaluation: NA	
		Practical Sessional external examination: NA	
Aim:			
Sl. No.			
1.	To develop formal reasoning.		
2.	Create habit of raising questions		
3.	Knowledge regarding the use of Mathematics in Computer Science		
4.	Ability to communicate knowledge, capabilities and skills related to the computer engineer profession		
Objective: **Throughout the course, students will be expected to demonstrate their understanding of Mathematics by being able to do each of the following**			
Sl. No.			
1.	To understand and solve mathematical problems		
2.	To impart knowledge regarding relevant topics.		
3.	To familiarize students with linear Algebra, differential and integral calculus, numerical methods and statistics.		
Pre-Requisite:			
Sl. No.			
1.	**Knowledge of basic algebra, trigonometry and calculus.**		
Contents		**4 Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	**Modern algebra** Set, Relation, Mapping, Binary Operation, Addition Modulo n, Multiplication modulo n, semi group, properties of groups, subgroup.	**6**	**7**

02	**Trigonometry** Radian or circular Measure, Trigonometric Functions, Trigonometric ratios of angle θ when θ is acute, trigonometric ratios of certain standard angles, allied angles, compound angles, multiple and sub- multiple angles.	**6**	**5**
03	**Limits and Continuity** The real number system, The concept of limit, concept of continuity.	**6**	**5**
04	**Differentiation** Differentiation of powers of x, Differentiation of ex and log x, differentiation of trigonometric functions, Rules for finding derivatives, Different types of differentiation, logarithmic differentiation, differentiation by substitution, differentiation of implicit functions, differentiation from parametric equation. Differentiation from first principles.	**6**	**7**
05	**Integrations** Integration of standard Functions, rules of Integration, More formulas in integration, Definite integrals.	**4**	**7**
06	**Differential equations** First order differential equations, practical approach to Differential equations, first order and first degree differential equations, homogeneous equations. Linear equations, Bernoulli's equation, Exact Differential Equations.	**4**	**6**
07	**Complex Numbers** Complex Numbers, Conjugate of a complex number, modulus of a complex Number, geometrical representation of complex number, De Moivre's theorem, n^{th} roots of a complex number.	**3**	**5**
08	**Matrices and Determinants** Definition of a matrix, Operations on matrices, Square Matrix and its inverse, determinants, properties of determinants, the inverse of a matrix, solution of equations using matrices and determinants, solving equations using determinants.	**4**	**8**
09	**Infinite Series** Convergence and divergence, series of positive terms, binomial series, exponential series,logarithmic series.	**3**	**7**
10	**Probability**	**3**	**5**

	Concept of probability, sample space and events, three approaches of probability, kolmogorov's axiomatic approach to probability, conditional probability and independence of events, bay's theorem.		
11	**Introduction to Statistics** Measures of central Tendency, Standard Deviation, Discrete series. Methods, Deviation taken from assumed mean, continuous series, combined standard deviation, coefficient of variation, variance.	**3**	**8**
	Sub Total:	**48**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**52**	**100**

Assignments:

Based on the curriculum as covered by subject teacher.

List of Books

Text Books:

Name of Author	**Title of the Book**	**Edition/ISSN/ISBN**	**Name of the Publisher**
S. K. Mapa	Higher Algebra		Levant Books
Chakravorty and Ghosh	Advanced Higher Algebra		U N Dhar Pvt. Ltd
Reference Books:			
Das and Mukherjee	Integral Calculus		U N Dhar Pvt. Ltd
Das and Mukherjee	Differential Calculus		U N Dhar Pvt. Ltd

End Semester Examination Scheme. Maximum Marks-70. Time allotted-3hrs.

Group	**Unit**	**Objective Questions** (MCQ only with the correct answer)		**Subjective Questions**			
		No of question to be set	Total Marks	No of question to be set	To answer	Marks per question	Total Marks
A	**1 to 11**	**10**	**10**				
B	**1 to 11**			**5**	**3**	**5**	**60**

C	**1 to 11**			**5**	**3**	**15**	

- Only multiple choice type question (MCQ) with one correct answer are to be set in the objective part.
- Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.

Examination Scheme for end semester examination:

Group	Chapter	Marks of each question	Question to be set	Question to be answered
A	**All**	**1**	**10**	**10**
B	**All**	**5**	**5**	**3**
C	**All**	**15**	**5**	**3**

Name of the Course: B.Sc. in Information Technology (Internet of Things) **Subject:** Introduction to IoT Architecture			
Course Code: BITIOT105		**Semester: I**	
Duration: 36 Hrs.		**Maximum Marks: 100**	
Teaching Scheme		**Examination Scheme**	
Theory: 3 hrs./week		**End Semester Exam: 70**	
Tutorial: 1 hr./week		**Attendance : 5**	
Practical: 0		**Continuous Assessment: 25**	
Credit: 4		**Practical Sessional internal continuous evaluation: NA**	
		Practical Sessional external examination: NA	
Aim:			
Sl. No.			
1.	Students will understand the concepts of Internet of Things and can able to build IoT applications.		
Objective:			
Sl. No.			
1.	Understand the concepts of Internet of Things		
2.	Design IoT applications in different domain and be able to analyze their performance		
3.	Implement basic IoT applications on embedded platform		
Pre-Requisite:			
Sl. No.			
1.	**Basic Statistical and Computational knowledge**		
Contents		**4 Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	**Overview** IoT-An Architectural Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations. M2M and 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, Knowledge Management	**9**	**17**

02	**Reference Architecture** IoT Architecture-State of the Art – Introduction, State of the art, Reference Model and architecture, IoT reference Model - IoT Reference Architecture Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views. Real-World Design Constraints-Introduction, Technical Design constraints-hardware is popular again, Data representation and visualization, Interaction and remote control	**9**	**18**
03	**IOT Data Link Layer & Network Layer Protocols** PHY/MAC Layer(3GPP MTC, IEEE 802.11, IEEE 802.15), Wireless HART, Z-Wave, Bluetooth Low Energy, Zigbee Smart Energy, DASH7 - Network Layer-IPv4, IPv6, 6LoWPAN, 6TiSCH,ND, DHCP, ICMP, RPL, CORPL, CARP Unit IV – TRANSPORT & SESSION LAYER PROTOCOLS (12 hours) Transport Layer (TCP, MPTCP, UDP, DCCP, SCTP)-(TLS, DTLS) – Session Layer-HTTP, CoAP, XMPP, AMQP, MQTT	**9**	**18**
04	**Service Layer Protocols & Security** Service Layer -oneM2M, ETSI M2M, OMA, BBF – Security in IoT Protocols – MAC 802.15.4, 6LoWPAN, RPL, Application Layer	**9**	**17**
	Sub Total:	**36**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**40**	**100**

List of Books

Text Books:

Name of Author	Title of the Book	Edition/ISSN/ISBN	Name of the Publisher
Vijay Madisetti, Arshdeep Bahga	Internet of Things (A Hands-onApproach)	First	VPT
Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, StamatisKarnouskos, David Boyle	From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence	First	Academic Press
Bernd Scholz-Reiter, Florian Michahelles	Architecting the Internet of Things	ISBN 978-3-642-19156-5 e-ISBN 978-3-642-19157-2	Springer

Reference Books:			
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
Peter Waher	Learning Internet of Things		PACKT publishing

End Semester Examination Scheme. Maximum Marks-70. Time allotted-3hrs.

Group	**Unit**	**Objective Questions** (MCQ only with the correct answer)		**Subjective Questions**			
		No of question to be set	Total Marks	No of question to be set	To answer	Marks per question	Total Marks
A	1 to 4	10	10				
B	1 to 4			5	3	5	60
C	1 to 4			5	3	15	

- Only multiple choice type question (MCQ) with one correct answer are to be set in the objective part.
- Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.

Examination Scheme for end semester examination:

Group	**Chapter**	**Marks of each question**	**Question to be set**	**Question to be answered**
A	All	1	10	10
B	All	5	5	3
C	All	15	5	3

Name of the Course: B.Sc. in Information Technology (Internet of Things) **Subject:** Computer Organization and Architecture			
Course Code: BITIOT106		**Semester: I**	
Duration: 36 Hrs.		**Maximum Marks: 100**	
Teaching Scheme		**Examination Scheme**	
Theory: 3 hrs./week		**End Semester Exam: 70**	
Tutorial: 1 hr./week		**Attendance : 5**	
Practical: 0		**Continuous Assessment: 25**	
Credit: 4		**Practical Sessional internal continuous evaluation: NA**	
		Practical Sessional external examination: NA	
Aim:			
Sl. No.			
1.	This introductory course is aimed at giving basic understanding about computer architecture and organization.		
2.	This entry-level course covers design of simple processor, concepts of pipelining, and design of modern memory system.		
Objective:			
Sl. No.			
1.	To develop an understanding of number system.		
2.	To gain knowledge about assembly language.		
3.	To develop a basic understanding of arithmetic operations.		
4.	To develop an understanding of pipeling.		
5.	To gain knowledge about memory system.		
Pre-Requisite:			
Sl. No.			
1.	Not Required		
Contents		**4 Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	**Introduction** Concepts and Terminology: Digital computer components Hardware & Software and their dual nature, Role of Operating Systems (OS). The ALU: ALU organization, Integer representation, Serial and Parallel Adders, 1s and 2s complement, arithmetic Multiplication of signed	**9**	**17**

	binary numbers, Floating point number arithmetic, Overflow detection, Status flags.		
02	**Memory organization** Memory Unit: Memory classification, Bipolar and MOS storage cells. Organization of RAM, address decoding, memory hierarchy	**9**	**18**
03	**Instructions** General Organization: Instruction work formats, Addressing modes registers, Von-Neumann concept, Interconnecting system components, Interfacing buses, Timing diagrams, Examples from popular machines.	**9**	**17**
04	**Registers & Microprogramming** Registers and stack, ROM and PROM-basic cell. Organization and erasing schemes, Magnetic memories-recording formats and methods. Disk and tape Units. Concept of memory map. Timing diagrams, T-States, Timing diagram Controlling arithmetic and logic instructions. Instruction sequencing with examples, Introduction to Microprogramming, Variations in Micro-programming configuration	**9**	**18**
	Sub Total:	**36**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**40**	**100**

List of Books

Text Books:

Name of Author	**Title of the Book**	**Edition/ISSN/ISBN**	**Name of the Publisher**
Hayes J. P	Computer Architecture & Organisation		McGraw Hill
Mano, M.M	Computer System Architecture		PHI

Reference Books:

Chaudhuri P. Pal	Computer Organisation & Design		PHI
Ghosh & Pal	Computer Organization & Architecture		TMH

End Semester Examination Scheme. **Maximum Marks-70.** **Time allotted-3hrs.**

Group	**Unit**	**Objective Questions** (MCQ only with the	**Subjective Questions**

		correct answer)					
		No of question to be set	Total Marks	No of question to be set	To answer	Marks per question	Total Marks
A B C	1 to 4 1 to 4 1 to 4	10	10	 5 5	 3 3	 5 15	 60

- Only multiple choice type question (MCQ) with one correct answer are to be set in the objective part.
- Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.

Examination Scheme for end semester examination:

Group	**Chapter**	**Marks of each question**	**Question to be set**	**Question to be answered**
A	All	1	10	10
B	All	5	5	3
C	All	15	5	3

Name of the Course: B.Sc. in Information Technology (Internet of Things) **Subject:** Data Structure and Algorithm with Python & Data Structure and Algorithm with Python Lab	
Course Code: BITIOT201+ BITIOT291	**Semester: II**
Duration: 36 Hrs.	**Maximum Marks:**100+100
Teaching Scheme	**Examination Scheme**
Theory: 3 hrs./week	End Semester Exam:70
Tutorial: 0	Attendance: 5
Practical: 4 hrs./week	Continuous Assessment: 25
Credit: 3+2	Practical Sessional internal continuous evaluation: 40
	Practical Sessional external examination: 60

Aim:	
Sl. No.	
1.	The point of this course is to give you a vibe for algorithms and data structures as a focal area of what it is to be a computer science student.
2.	You ought to know about the way that there are regularly a few calculations for some issue, and one calculation might be superior to another, or one calculation better in certain conditions and another better in others.
3.	You should have some idea of how to work out the efficiency of an algorithm.
4.	You will be able to use and design linked data structures
5.	You will learn why it is good programming style to hide the details of a data structure within an abstract data type.
6.	You should have some idea of how to implement various algorithm using python programming.

Objective:	
Sl. No.	
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 understanding about writing algorithms and step by step approach in solving problems with the help of fundamental data structures

Pre-Requisite:	
Sl. No.	
1.	Basics of programming language.

1.	Logic building skills.		
Contents		**3 Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	**Introduction to Data Structure** Abstract Data Type.	**1**	**2**
02	**Arrays** 1D, 2D and Multi-dimensional Arrays, Sparse Matrices. Polynomial representation.	**3**	**4**
03	**Linked Lists** Singly, Doubly and Circular Lists, Normal and Circular representation of Self Organizing Lists, Skip Lists, Polynomial representation.	**4**	**7**
04	**Stacks** Implementing single / multiple stack/s in an Array, Prefix, Infix and Postfix expressions, Utility and conversion of these expressions from one to another, Applications of stack, Limitations of Array representation of stack.	**4**	**10**
05	**Queues** Array and Linked representation of Queue, Circular Queue, De-queue, Priority Queues.	**4**	**7**
06	**Recursion** Developing Recursive Definition of Simple Problems and their implementation, Advantages and Limitations of Recursion, Understanding what goes behind Recursion (Internal Stack Implementation)	**4**	**5**
07	**Trees** Introduction to Tree as a data structure, Binary Trees (Insertion, Deletion, Recursive and Iterative Traversals of Binary Search Trees), Threaded Binary Trees (Insertion, Deletion, Traversals), Height-Balanced Trees (Various operations on AVL Trees).	**5**	**15**
08	**Searching and Sorting** Linear Search, Binary Search, Comparison of Linear and Binary Search, Selection Sort, Insertion Sort, Merge Sort, Quick sort, Shell Sort, Comparison of Sorting Techniques	**6**	**15**

09	**Hashing** Introduction to Hashing, Deleting from Hash Table, Efficiency of Rehash Methods, Hash Table Reordering, Resolving collision by Open Addressing, Coalesced Hashing, Separate Chaining, Dynamic and Extendible Hashing, Choosing a Hash Function, Perfect Hashing Function.	**5**	**5**
	Sub Total:	**36**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**40**	**100**

Practical:

Skills to be developed:

Intellectual skills:

1. Skill to analyze algorithms and to determine algorithm correctness and their time efficiency.
2. Knowledge of advanced abstract data type (ADT) and data structures and their implementations.
3. Ability to implement algorithms to perform various operations on data structures.

List of Practical:

1. Implementation of array operations.
2. Stacks and Queues: adding, deleting elements.
3. Circular Queue: Adding & deleting elements
4. Merging Problem : Evaluation of expressions operations on Multiple stacks & queues
5. Implementation of linked lists: inserting, deleting, and inverting a linked list.
6. Implementation of stacks & queues using linked lists:
7. Polynomial addition, Polynomial multiplication
8. Sparse Matrices: Multiplication, addition.
9. Recursive and Non Recursive traversal of Trees Threaded binary tree traversal. AVL tree implementation Application of Trees.
10. Application of sorting and searching algorithms Hash tables' implementation: searching, inserting and deleting, searching & sorting techniques.

Assignments:

Based on the curriculum as covered by subject teacher.

List of Books

Text Books:

Name of Author	Title of the Book	Edition/ISSN/ISBN	Name of the Publisher

Michael H. Goldwasser, Michael T. Goodrich, and Roberto Tamassia	Data Structures and Algorithms in Python	1118476735, 9781118476734	John Wiley & Sons
Rance D Necaise	Data Structures and Algorithms Using Python	9788126562169	John Wiley & Sons

Reference Books:

Sartaj Sahni	DataStructures, Algorithms and applications in C++	Second Edition	Universities Press

List of equipment/apparatus for laboratory experiments:

Sl. No.	
1.	Computer with moderate configuration
2.	Python 2.7 or higher and other softwares as required.

End Semester Examination Scheme. Maximum Marks-70. Time allotted-3hrs.

Group	**Unit**	**Objective Questions** (MCQ only with the correct answer)		**Subjective Questions**			
		No of question to be set	Total Marks	No of question to be set	To answer	Marks per question	Total Marks
A	**1 to 9**	**10**	**10**				
				5	**3**	**5**	**60**
B	**1 to 9**						
				5	**3**	**15**	
C	**1 to 9**						

- Only multiple choice type question (MCQ) with one correct answer are to be set in the objective part.
- Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.

Examination Scheme for end semester examination:

Group	Chapter	Marks of each question	Question to be set	Question to be answered
A	All	1	10	10
B	All	5	5	3
C	All	15	5	3
Examination Scheme for Practical Sessional examination:				
Practical Internal Sessional Continuous Evaluation				
Internal Examination:				
Continuous evaluation				**40**
External Examination: Examiner-				
Signed Lab Note Book		**10**		
On Spot Experiment		**40**		
Viva voce		**10**		**60**

Name of the Course: B.Sc. in Information Technology (Internet of Things) **Subject:** IoT sensors device and components & IoT sensors device and components lab			
Course Code: BITIOT202+ BITIOT292		**Semester: II**	
Duration: 36 Hrs.		**Maximum Marks: 100+100**	
Teaching Scheme		**Examination Scheme**	
Theory: 3 hrs./week		**End Semester Exam: 70**	
Tutorial: 0		**Attendance : 5**	
Practical: 4 hrs./week		**Continuous Assessment: 25**	
Credit: 3 + 2		**Practical Sessional internal continuous evaluation: 40**	
		Practical Sessional external examination:60	
Aim:			
Sl. No.			
1.	Understand importance of sensors and components in IoT environment.		
2.	Understand how IoT components are used to develop smart environment.		
3.	Understand the real-life situation through hands-on session.		
Objective:			
Sl. No.			
1.	To develop knowledge about sensors and components of IoT.		
2.	To develop knowledge about wireless sensor network.		
3.	To understand various tools used in IoT.		
4.	To gain knowledge about real life situation through projects.		
Contents		**3 Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	**INTRODUCTION** Internet of Things Promises–Definition– Scope–Sensors for IoT Applications–Structure of IoT– IoT Map Device	**7**	**14**
02	**SEVEN GENERATIONS OF IOT SENSORS TO APPEAR** Industrial sensors – Description & Characteristics–First Generation – Description & Characteristics–Advanced Generation – Description & Characteristics–Integrated IoT Sensors – Description & Characteristics– Polytronics Systems – Description & Characteristics–Sensors' Swarm – Description & Characteristics–Printed Electronics – Description & Characteristics–IoT Generation Roadmap	**7**	**14**

03	**TECHNOLOGICAL ANALYSIS** Wireless Sensor Structure–Energy Storage Unit–Power Management Unit–RF Unit–Sensing Unit	**7**	**14**
04	**MENT EXAMPLES** ACOEM Eagle – EnOcean Push Button – NEST Sensor – Ninja Blocks - Focus on Wearable Electronics	**7**	**14**
05	**PREPARING IOT PROJECTS** Creating the sensor project - Preparing Raspberry Pi - Clayster libraries - Hardware- Interacting with the hardware - Interfacing the hardware- Internal representation of sensor values - Persisting data - External representation of sensor values - Exporting sensor data - Creating the actuator project Hardware - Interfacing the hardware - Creating a controller - Representing sensor values - Parsing sensor data - Calculating control states - Creating a camera - Hardware -Accessing the serial port on Raspberry Pi - Interfacing the hardware - Creating persistent default settings - Adding configurable properties - Persisting the settings - Working with the current settings - Initializing the camera	**8**	**14**
	Sub Total:	**36**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**40**	**100**

Practical:

Skills to be developed:

Intellectual skills:

1. Learn and apply different security aspects
2. Develop programming skills

List of Practical:

Based on test environment.

Assignments:

Based on theory lecture

List of Books

Text Books:

Name of Author	Title of the Book	Edition/ISSN/ISBN	Name of the

			Publisher
Samuel Greengard	Technologies & Sensors for the Internet of Things Businesses & Market Trends 2014 - 2024		MIT Press
Professor Dr.-Ing. Klaus Schwab	The Fourth Industrial Revolution	1st edition	Penguin
Peter Waher	Learning Internet of Things		Packt Publishing
Daniel Kellmereit and Daniel Obodovski.	The Silent Intelligence - The Internet of Things	1 edition	DND Ventures LLC;
Reference Books:			
Cuno Pfister	Getting Started with the Internet of Things: Connecting Sensors and Microcontrollers to the Cloud	1st edition	Maker Media
Timothy Chou	Precision: Principles, Practices and Solutions for the Internet of Things		Lulu.com
Erik Brynjolfsson and Andrew McAfee	The Second Machine Age: Work, Progress, and Prosperity in a Time of Brilliant Technologies		W. W. Norton & Company
List of equipment/apparatus for laboratory experiments:			
Sl. No.			
1.	**Computer**		
2.	**Switch**		
3.	**Test Server**		

End Semester Examination Scheme.		**Maximum Marks-70.**		**Time allotted-3hrs.**			
Group	**Unit**	**Objective Questions** (MCQ only with the correct answer)		**Subjective Questions**			
		No of question	Total Marks	No of question	To answer	Marks per	Total Marks

		to be set		to be set		question	
A B C	All All All	10	10	 5 5	 3 3	 5 15	 60

- Only multiple choice type question (MCQ) with one correct answer are to be set in the objective part.
- Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.

Examination Scheme for end semester examination:

Group	**Chapter**	**Marks of each question**	**Question to be set**	**Question to be answered**
A	All	1	10	10
B	All	5	5	3
C	All	15	5	3

Examination Scheme for Practical Sessional examination:

Practical Internal Sessional Continuous Evaluation

Internal Examination:

Continuous evaluation			**40**

External Examination: Examiner-

Signed Lab Note Book	**10**	
On Spot Experiment	**40**	
Viva voce	**10**	**60**

Name of the Course: B.Sc. in Information Technology (Internet of Things) **Subject:** Discrete Mathematics			
Course Code: BITIOT203		**Semester: II**	
Duration: 36 Hrs		**Maximum Marks: 100**	
Teaching Scheme		**Examination Scheme**	
Theory: 3 hrs./week		End Semester Exam: 70	
Tutorial:1 hr./week		Attendance: 5	
Practical:0		Continuous Assessment: 25	
Credit:4		Practical Sessional internal continuous evaluation: NA	
		Practical Sessional external examination: NA	
Aim:			
Sl. No.			
1.	The aim of this course is to introduce you with a new branch of mathematics which is discrete mathematics, the backbone of Computer Science.		
2.	In order to be able to formulate what a computer system is supposed to do, or to prove that it does meet its specification, or to reason about its efficiency, one needs the precision of mathematical notation and techniques. The Discrete Mathematics course aims to provide this mathematical background.		
Objective: Throughout the course, students will be expected to demonstrate their understanding of Discrete Mathematics by being able to do each of the following			
Sl. No.			
1.	Use mathematically correct terminology and notation.		
2.	Construct correct direct and indirect proofs.		
3.	Use division into cases in a proof.		
4.	Use counterexamples.		
5.	Apply logical reasoning to solve a variety of problems.		
Pre-Requisite:			
Sl. No.			
1.	**Knowledge of basic algebra**		
2.	**Ability to follow logical arguments.**		
Contents		**4 Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	**Set Theory**	**7**	**14**

	Definition of Sets, Venn Diagrams, complements, Cartesian products, power sets, counting principle, cardinality and countability (Countable and Uncountable sets), proofs of some general identities on sets, pigeonhole principle. Relation: Definition, types of relation, composition of relations, domain and range of a relation, pictorial representation of relation, properties of relation, partial ordering relation. Function: Definition and types of function, composition of functions, recursively defined functions.		
02	**Propositional logic** Proposition logic, basic logic, logical connectives, truth tables, tautologies, contradictions, normal forms (conjunctive and disjunctive), modus ponens and modus tollens, validity, predicate logic, universal and existential quantification. Notion of proof: proof by implication, converse, inverse, contrapositive, negation, and contradiction, direct proof, proof by using truth table, proof by counter example.	**8**	**14**
03	**Combinatorics** Mathematical induction, recursive mathematical definitions, basics of counting, permutations, combinations, inclusion-exclusion, recurrence relations (nth order recurrence relation with constant coefficients, Homogeneous recurrence relations, Inhomogeneous recurrence relation), generating function (closed form expression, properties of G.F., solution of recurrence relation using G.F, solution of combinatorial problem using G.F.)	**7**	**14**
04	**Algebraic Structure** Binary composition and its properties definition of algebraic structure, Groyas Semi group, Monoid Groups, Abelian Group, properties of groups, Permutation Groups, Sub Group, Cyclic Group, Rings and Fields (definition and standard results).	**6**	**10**
05	**Graphs** Graph terminology, types of graph connected graphs, components of graph, Euler graph, Hamiltonian path and circuits, Graph coloring, Chromatic number. Tree: Definition, types of tree(rooted, binary), properties of trees, binary search	**8**	**18**

	tree, tree traversing (preorder, inorder, post order). Finite Automata: Basic concepts of Automation theory, Deterministic finite Automation (DFA), transition function, transition table, Non Deterministic Finite Automata (NDFA), Mealy and Moore Machine, Minimization of finite Automation.		
	Sub Total:	**36**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**40**	**100**

Assignments:

Based on the curriculum as covered by subject teacher.

List of Books

Text Books:

Name of Author	**Title of the Book**	**Edition/ISSN/ISBN**	**Name of the Publisher**
Kenneth H. Rosen	Discrete Mathematics and its Applications		Tata Mc.Graw Hill
eymourLipschutz, M.Lipson	Discrete Mathematics		Tata Mc.Graw Hill
Reference Books:			
V. Krishnamurthy	Combinatorics:Theory and Applications		East-West Press
Kolman, Busby Ross	Discrete Mathematical Structures		Prentice Hall International

End Semester Examination Scheme. Maximum Marks-70. Time allotted-3hrs.

Group	**Unit**	**Objective Questions** (MCQ only with the correct answer)		**Subjective Questions**			
		No of question to be set	Total Marks	No of question to be set	To answer	Marks per question	Total Marks
A	**1 to 5**	**10**	**10**				
B	**1 to 5**			**5**	**3**	**5**	**60**

C	**1 to 5**			**5**	**3**	**15**	

- Only multiple choice type question (MCQ) with one correct answer are to be set in the objective part.
- Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.

Examination Scheme for end semester examination:

Group	Chapter	Marks of each question	Question to be set	Question to be answered
A	**All**	**1**	**10**	**10**
B	**All**	**5**	**5**	**3**
C	**All**	**15**	**5**	**3**

Name of the Course: B.Sc. in Information Technology (Internet of Things) **Subject:** Environmental Science			
Course Code: BITIOT204		**Semester: II**	
Duration: 36 Hrs		**Maximum Marks: 100**	
Teaching Scheme		**Examination Scheme**	
Theory: 1 hr./week		End Semester Exam: 70	
Tutorial: 0		Attendance: 5	
Practical: 0		Continuous Assessment: 25	
Credit: 1		Practical Sessional internal continuous evaluation: NA	
		Practical Sessional external examination: NA	
Aim:			
Sl. No.			
1.	To enable critical thinking in relation to environmental affairs.		
2.	Understanding about interdisciplinary nature of environmental issues		
3.	**Independent research regarding environmental problems in form of project report**		
Objective:			
Sl. No.			
1.	To create awareness about environmental issues.		
2.	To nurture the curiosity of students particularly in relation to natural environment.		
3.	To develop an attitude among students to actively participate in all the activities regarding environment protection		
4.	To develop an attitude among students to actively participate in all the activities regarding environment protection		
Contents		**4 Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	**Introduction** Basic ideas of environment, basic concepts, man, society &amp, environment, their interrelationship. Mathematics of population growth and associated problems, Importance of	**3**	**10**

	population study in environmental engineering, definition of resource, types of resource, renewable, non- renewable, potentially renewable, effect of excessive use vis-à-vis population growth, Sustainable Development. Materials balance: Steady state conservation system, steady state system with non-conservative pollutants, step function. Environmental degradation: Natural environmental Hazards like Flood, earthquake, Landslide-causes, effects and control/management, Anthropogenic degradation like Acid rain-cause, effects and control. Nature and scope of Environmental Science and Engineering.		
02	**Ecology** Elements of ecology: System, open system, closed system, definition of ecology, species, population, community, definition of ecosystem- components types and function. Structure and function of the following ecosystem: Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems, Mangrove ecosystem (special reference to Sundar ban), Food chain [definition and one example of each food chain], Food web. Biogeochemical Cycle- definition, significance, flow chart of different cycles with only elementary reaction [Oxygen, carbon, Nitrogen, Phosphate, Sulphur]. Biodiversity- types, importance, Endemic species, Biodiversity Hot-spot, Threats to biodiversity, Conservation of biodiversity.	**7**	**10**
03	**Air pollution and control** Atmospheric Composition: Troposphere, Stratosphere, Mesosphere, Thermosphere,Tropopause and Mesopause. Energy balance:Conductive and Convective heat transfer, radiation heat transfer, simple global temperature model [Earth as a black body, earth as albedo], Problems.Green house effects: Definition, impact of greenhouse gases on the global climate and consequently on sea water level, agriculture and marine food.Global warming and its consequence, Control of Global warming. Earth's heat budget. Lapse rate: Ambient lapse rate Adiabatic lapse rate, atmospheric stability, temperature	**6**	**10**

	inversion (radiation inversion). Atmospheric dispersion: Maximum mixing depth, ventilation coefficient, effective stack height, smokestack plumes and Gaussian plume model. Definition of pollutants and contaminants, Primary and secondary pollutants: emission standard, criteria pollutant. Sources and effect of different air pollutants- Suspended particulate matter, oxides of carbon, oxides of nitrogen, oxides of sulphur, particulate, PAN. Smog, Photochemical smog and London smog. Depletion Ozone layer: CFC, destruction of ozone layer by CFC, impact of other green house gases, effect of ozone modification. Standards and control measures: Industrial, commercial and residential air quality standard, control measure (ESP. cyclone separator, bag house, catalytic converter, scrubber (ventury), Statement with brief reference).		
04	**Water Pollution and Control** Hydrosphere, Hydrological cycle and Natural water. Pollutants of water, their origin and effects: Oxygen demanding wastes, pathogens, nutrients, Salts, thermal application, heavy metals, pesticides, volatile organic compounds. River/Lake/ground water pollution: River: DO, 5 day BOD test, Seeded BOD test, BOD reaction rate constants, Effect of oxygen demanding wastes on river[deoxygenation, reaeration], COD, Oil, Greases, pH. Lake: Eutrophication [Definition, source and effect]. Ground water: Aquifers, hydraulic gradient, ground water flow (Definition only) Standard and control: Waste water standard [BOD, COD, Oil, Grease], Water Treatment system [coagulation and flocculation, sedimentation and filtration, disinfection, hardness and alkalinity, softening] Wastewater treatment system, primary and secondary treatments [Trickling filters, rotating biological contractor, Activated sludge, sludge treatment, oxidation ponds] tertiary treatment definition. Water pollution due to the toxic elements and their biochemical effects: Lead, Mercury, Cadmium, and Arsenic.	**6**	**15**
05	**Land Pollution** Lithosphere, Internal structure of earth, rock and soil 1L Solid	**4**	**10**

	Waste: Municipal, industrial, commercial, agricultural, domestic, pathological and hazardous solid wastes, Recovery and disposal method- Open dumping, Land filling, incineration, composting, recycling. Solid waste management and control (hazardous and biomedical waste).		
06	**Noise Pollution** Definition of noise, effect of noise pollution, noise classification [Transport noise, occupational noise, neighbourhood noise] Definition of noise frequency, noise pressure, noise intensity, noise threshold limit value, equivalent noise level,(18hr Index), Ldn. Noise pollution control.	**5**	**10**
07	**Environmental Management** Environmental impact assessment, Environmental Audit, Environmental laws and protection act of India, Different international environmental treaty/ agreement/ protocol.	**5**	**5**
	Sub Total:	**36**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**40**	**100**

Name of Author	**Title of the Book**	**Edition/ISSN/ISBN**	**Name of the Publisher**
G. M.Masters,	Introduction to Environmental Engineering and Science		Prentice-Hall of India Pvt. Ltd., 1991
Reference Books:			
A. K. De	Environmental Chemistry		New Age International

End Semester Examination Scheme. **Maximum Marks-70.** **Time allotted-3hrs.**

Group	**Unit**	**Objective Questions** (MCQ only with the	**Subjective Questions**

		correct answer)					
		No of question to be set	Total Marks	No of question to be set	To answer	Marks per question	Total Marks
A **B** **C**	**1 to 5** **1 to 5** **1 to 5**	**10**	**10**	**5** **5**	**3** **3**	**5** **15**	**60**

- Only multiple choice type question (MCQ) with one correct answer are to be set in the objective part.
- Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.

Examination Scheme for end semester examination:

Group	Chapter	Marks of each question	Question to be set	Question to be answered
A	**All**	**1**	**10**	**10**
B	**All**	**5**	**5**	**3**
C	**All**	**15**	**5**	**3**

Name of the Course: B.Sc. in Information Technology (Internet of Things) **Subject:** Project I	
Course Code: BITIOT281	**Semester: II**
Duration: 36 Hrs.	**Maximum Marks: 100**
Teaching Scheme	**Examination Scheme**
Theory: 0	**End Semester Exam: 100**
Tutorial: 0	**Attendance: 0**
Practical: 2 hrs./week	**Continuous Assessment: 0**
Credit: 1	**Practical Sessional internal continuous evaluation: 40**
	Practical Sessional external examination: 60
Contents	
Students will do projects on application areas of latest technologies and current topics of societal relevance.	

Semester-III

Name of the Course: B.Sc. in Information Technology (Internet of Things) **Subject:** Operating System & Operating System lab			
Course Code: BITIOT301+ BITIOT391	**Semester: III**		
Duration: 36 Hrs.	**Maximum Marks: 100+100**		
Teaching Scheme	**Examination Scheme**		
Theory: 3 hrs./week	End Semester Exam: 70		
Tutorial: 0	Attendance : 5		
Practical:4 hrs./week	Continuous Assessment:25		
Credit: 3+2	Practical Sessional internal continuous evaluation:40		
	Practical Sessional external examination:60		
Aim:			
Sl. No.			
1.	General understanding of structure of modern computers		
2.	Purpose, structure and functions of operating systems		
3.	Illustration of key OS aspects by example		
Objective:			
Sl. No.			
1.	To learn the fundamentals of Operating Systems.		
2.	To learn the mechanisms of OS to handle processes and threads and their communication		
3.	To learn the mechanisms involved in memory management in contemporary OS		
4.	To gain knowledge on distributed operating system concepts that includes architecture, Mutual exclusion algorithms, deadlock detection algorithms and agreement protocols		
5.	To know the components and management aspects of concurrency management		
6.	To learn programmatically to implement simple OS mechanisms		
Pre-Requisite:			
Sl. No.			
1.	Strong programming skills (Knowledge of C)		
2.	Computer architecture		
3.	Elementary data structures and algorithms		
Contents		**Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	**Introduction** Concept of Operating Systems, Generations of Operating systems, Types of Operating Systems, OS Services, System Calls, Structure of an OS - Layered, Monolithic, Microkernel Operating Systems, Concept of Virtual Machine. Case study on UNIX and WINDOWS Operating System.	**3**	**5**

02	**Processes** Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching Thread: Definition, Various states, Benefits of threads, Types of threads, Concept of multithreads, Process Scheduling: Foundation and Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time; Scheduling algorithms: Pre-emptive and Non pre-emptive, FCFS, SJF, RR; Multiprocessor scheduling: Real Time scheduling: RM and EDF.	**8**	**20**
03	**Inter-process Communication:** Critical Section, Race Conditions, Mutual Exclusion, Hardware Solution, Strict Alternation, Peterson's Solution, The Producer\ Consumer Problem, Semaphores, Event Counters, Monitors, Message Passing, Classical IPC Problems: Reader's & Writer Problem, Dinning Philosopher Problem etc.	**4**	**5**
04	**Deadlocks** Definition, Necessary and sufficient conditions for Deadlock, Deadlock Prevention, Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery.	**4**	**10**
05	**Memory Management** Basic concept, Logical and Physical address map, Memory allocation: Contiguous Memory allocation – Fixed and variable partition– Internal and External fragmentation and Compaction; Paging: Principle of operation – Page allocation – Hardware support for paging, Protection and sharing, Disadvantages of paging. Virtual Memory: Basics of Virtual Memory – Hardware and control structures – Locality of reference, Page fault , Working Set , Dirty page/Dirty bit – Demand paging, Page Replacement algorithms: Optimal, First in First Out (FIFO), Second Chance (SC), Not recently used (NRU) and Least Recently used (LRU).	**8**	**10**

06	**I/O Hardware** I/O devices, Device controllers, Direct memory access Principles of I/O Software: Goals of Interrupt handlers, Device drivers, Device independent I/O software, Secondary-Storage Structure: Disk structure, Disk scheduling algorithms File Management: Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods (contiguous, linked, indexed), Free-space management (bit vector, linked list, grouping), directory implementation (linear list, hash table), efficiency and performance.	**6**	**10**
07	**Disk Management** Disk structure, Disk scheduling - FCFS, SSTF, SCAN, C-SCAN, Disk reliability, Disk formatting, Boot-block, Bad blocks.	**3**	**10**
	Sub Total:	**36**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**40**	**100**

Practical:
Skills to be developed:
Intellectual skills:

1. Can be able to identify the purpose of the analysis.
2. Can be considered a reliable source of information.
3. Can able to use a variety of techniques to extend the original idea.

List of Practical: Sl. No. 1& 2 compulsory & at least three from the rest)
1. Basics of UNIX commands.
2. Shell programming
3. Implementation of CPU scheduling. a) Round Robin b) SJF c) FCFS d) Priority
4. Implement all file allocation strategies
5. Implement Semaphores
6. Implement Bankers algorithm for Dead Lock Avoidance
7. Implement an Algorithm for Dead Lock Detection
9. Implement the all page replacement algorithms a) FIFO b) LRU c) LFU 10. Implement Shared memory and IPC
10. Implement Paging Technique f memory management.
11. Implement Threading & Synchronization Applications

Assignments:
Based on the curriculum as covered by subject teacher.

List of Books
Text Books:

Name of Author	Title of the Book	Edition/ISSN/ISBN	Name of the Publisher
AviSilberschatz, Peter Galvin, Greg Gagne, Wiley Asia	Operating System Concepts Essentials	978-1-119-32091-3	
William Stallings	Operating Systems: Internals and Design Principles	5th Edition	Prentice Hall of India
Reference Books:			
Charles Crowley	Operating System: A Design-oriented Approach	1st Edition	Irwin Publishing
J. Nutt, Addison-Wesley	Operating Systems: A Modern Perspective	2nd Edition	
Maurice Bach	Design of the Unix Operating Systems	8th Edition	Prentice-Hall of India
Daniel P. Bovet, Marco Cesati	Understanding the Linux Kernel	3rd Edition	O'Reilly and Associates

List of equipment/apparatus for laboratory experiments:

Sl. No.	
	Computer
	Linux/Ubantu operating system

End Semester Examination Scheme. **Maximum Marks-70.** **Time allotted-3hrs.**

Group	**Unit**	**Objective Questions** (MCQ only with the correct answer)		**Subjective Questions**			
		No of question to be set	Total Marks	No of question to be set	To answer	Marks per question	Total Marks
A	**1 to 7**	**10**	**10**				**60**
B				**5**	**3**	**5**	
C	**1 to 7**			**5**	**3**	**15**	
	1 to 7						

- Only multiple choice type question (MCQ) with one correct answer are to be set in the objective part.
- Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.

Examination Scheme for end semester examination:

Group	Chapter	Marks of each question	Question to be set	Question to be answered
A	**All**	**1**	**10**	**10**
B	**All**	**5**	**5**	**3**
C	**All**	**15**	**3**	**3**

Examination Scheme for Practical Sessional examination:

Practical Internal Sessional Continuous Evaluation

Internal Examination:

Continuous evaluation			**40**

External Examination: Examiner-

Signed Lab Note Book	**10**	
On Spot Experiment	**40**	
Viva voce	**10**	**60**

Name of the Course: B.Sc. in Information Technology (Internet of Things) **Subject:** Database Management System & Database Management System Lab	
Course Code: BITIOT302+ BITIOT392	**Semester: III**
Duration: 36 Hrs.	**Maximum Marks: 100+100**
Teaching Scheme	**Examination Scheme**
Theory: 3 hrs./week	End Semester Exam: 70
Tutorial: 0	Attendance : 5
Practical:4 hrs./week	Continuous Assessment:25
Credit: 3+2	Practical Sessional internal continuous evaluation:40
	Practical Sessional external examination:60

Aim:	
Sl. No.	
1.	To store and transform data into information
2.	To organize the data in the form of table, schema and report forms
3.	To provide security of data
4.	Data is stored in either hierarchical form or a navigational form

Objective:	
Sl. No.	
1.	Understand the uses the database schema and need for normalization
2.	Experience with SQL
3.	Use different types of physical implementation of database
4.	Use database for concurrent use

Pre-Requisite:	
Sl. No.	
1.	Elementary knowledge about computers including some experience using UNIX or Windows
2.	Computer Programming & Utilization

Contents		**Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	**Database system architecture** Data Abstraction, Data Independence, Data Definition Language (DDL), Data Manipulation Language (DML). Data models: Entity-relationship model, network model, relational and object oriented data models, integrity constraints, data manipulation operations.	**6**	**15**

02	**Relational query languages** Relational algebra, Tuple and domain relational calculus, SQL3, DDL and DML constructs, Open source and Commercial DBMS - MYSQL, ORACLE, DB2, SQL server. Relational database design: Domain and data dependency, Armstrong's axioms, Normal forms, Dependency preservation, Lossless design. Query processing and optimization: Evaluation of relational algebra expressions, Query equivalence, Join strategies, Query optimization algorithms.	**12**	**25**
03	**Storage strategies** Indices, B-trees, hashing.	**6**	**10**
04	**Transaction processing** Concurrency control, ACID property, Serializability of scheduling, Locking and timestamp based schedulers, Multi-version and optimistic Concurrency Control schemes, Database recovery.	**8**	**15**
05	**Advanced topics** Object oriented and object relational databases, Logical databases, Web databases, Distributed databases, Data warehousing and data mining.	**4**	**5**
	Sub Total:	**36**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**40**	**100**

Practical:

Skills to be developed:

Intellectual skills:

1. Can be able to implement the plan .
2. Can be able to use a variety of techniques to extend the original idea.
3. Can be able to analyze relevant data.
4. Can be considered valid by the fact of it.

List of Practical: Sl. No. 1& 2 compulsory & at least three from the rest)

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 following functions: MAX(),MIN(),AVG(),COUNT()
6. Write the query to implement the concept of Intergrity constrains
7. Write the query to create the views

8. Perform the queries for triggers
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.

Assignments:
Based on the curriculum as covered by subject teacher.

List of Books
Text Books:

Name of Author	**Title of the Book**	**Edition/ISSN/ISBN**	**Name of the Publisher**
Abraham Silberschatz, Henry F. Korth, S. Sudarshan	Database System Concepts	6th Edition	McGraw-Hill
R. Elmasri and S. Navathe	Fundamentals of Database Systems	5th Edition	Pearson Education
Reference Books:			
J. D. Ullman	Principles of Database and Knowledge – Base Systems		Computer Science Press
Abiteboul, Richard Hull, Victor Vianu, Addison-Wesley	Foundations of Databases		
List of equipment/apparatus for laboratory experiments:			
Sl. No.			
	Computer/Laptop		
	Oracle /Mysql		

End Semester Examination Scheme. Maximum Marks-70. Time allotted-3hrs.

Group	**Unit**	**Objective Questions** (MCQ only with the correct answer)		**Subjective Questions**			
		No of question to be set	Total Marks	No of question to be set	To answer	Marks per question	Total Marks
A	**1 to 5**	**10**	**10**				**60**
B	**1 to 5**			**5**	**3**	**5**	

C	**1 to 5**			**5**	**3**	**15**	

- Only multiple choice type question (MCQ) with one correct answer are to be set in the objective part.
- Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.

Examination Scheme for end semester examination:

Group	Chapter	Marks of each question	Question to be set	Question to be answered
A	**All**	**1**	**10**	**10**
B	**All**	**5**	**5**	**3**
C	**All**	**15**	**3**	**3**

Examination Scheme for Practical Sessional examination:

Practical Internal Sessional Continuous Evaluation

Internal Examination:

Continuous evaluation			**40**

External Examination: Examiner-

Signed Lab Note Book	**10**	
On Spot Experiment	**40**	
Viva voce	**10**	**60**

Name of the Course: B.Sc. in Information Technology (Internet of Things) **Subject:** Digital System Design			
Course Code: BITIOT303		**Semester: III**	
Duration: 36 Hrs.		**Maximum Marks: 100**	
Teaching Scheme		**Examination Scheme**	
Theory: 3 hrs./week		**End Semester Exam: 70**	
Tutorial: 1 hr./week		**Attendance : 5**	
Practical: 0		**Continuous Assessment: 25**	
Credit: 4		**Practical Sessional internal continuous evaluation: NA**	
		Practical Sessional external examination: NA	
Aim:			
Sl. No.			
1.	To gain skill to build and troubleshoot digital logic circuits		
2.	To gain skill to use the methods of systematic reduction of Boolean expressionusingK-Map		
3.	To be able to interpret logic gates and its operations		
4.	Familiarization with semiconductor memories in electronics.		
Objective:			
Sl. No.			
1.	To gain basic knowledge of digital electronics circuits and its levels.		
2.	To understand and examine the structure of various number system and its conversation.		
3.	To learn about the basic requirements for a design application		
4.	To enable the students to understand, analyze and design various combinational and sequential circuits		
5.	To understand the logic functions, circuits, truth table and Boolean algebra expression		
Pre-Requisite:			
Sl. No.			
1.	**None**		
Contents		**4 Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	**Number Systems & Codes** Decimal Number, Binary Number, Octal Number, Hexadecimal Number, Conversion – Decimal to Binary, Binary to Decimal, Octal to Binary, Binary to Octal, Hexadecimal to Binary, Binary to Hexadecimal, Octal to Binary to Hexadecimal, Hexadecimal to Binary to Octal; Floating Point Number Representation, Conversion of	**5**	**10**

	Floating Point Numbers, Binary Arithmetic, 1's and 2's Complement, 9's and 10's Complement, Complement Arithmetic, BCD, BCD addition, BCD subtraction, Weighted Binary codes, Non-weighted codes, Parity checker and generator, Alphanumeric codes.		
02	**Logic Gates** OR, AND, NOT, NAND, NOR, Exclusive – OR, Exclusive – NOR, Mixed logic.	**2**	**10**
03	**Boolean Algebra** Boolean Logic Operations, Basic Law of Boolean Algebra, Demorgan's Theorem, Principle of Duality.	**4**	**10**
04	**Minimization Techniques** Sum of Products, Product of Sums, Karnaugh Map [up to 4 variables].	**3**	**10**
05	**Multilevel Gate Network** Implementation of Multilevel Gate Network, Conversion to NAND-NAND and NOR-NOR Gate Networks.	**2**	**5**
06	**Arithmetic Circuits** Half Adder, Full Adder, Half Subtractor, Full Subtractor, Carry Look Ahead Adder, 4-Bit Parallel Adder	**5**	**5**
07	**Combinational Circuits** Basic 2-input and 4-input multiplexer, Demultiplexur, Basic binary decoder, BCD to binary converters, Binary to Gray code converters, Gray code to binary converters, Encoder.	**5**	**5**
08	**Sequential Circuits** Introduction to sequential circuit, Latch, SR Flip Flop, D Flip Flop, T Flip Flop, JK Flip Flop, Master Slave Flip Flop	**5**	**5**
09	**Basics of Counters** Asynchronous [Ripple or serial] counter, Synchronous [parallel] counter	**2**	**5**
10	**Basics of Registers** SISO, SIPO, PISO, PIPO, Universal Registers	**3**	**5**
	Sub Total:	**36**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**

	Total:	**40**	**100**

Assignments:

Based on the curriculum as covered by subject teacher.

List of Books

Text Books:

Name of Author	**Title of the Book**	**Edition/ISSN/ISBN**	**Name of the Publisher**
Salivahan	Digital Circuit & Design		VIKAS
M. Morris. Mano & Michael D. Ciletti	Digital Design		PEARSON
Anand Kumar	Fundamentals of Digital Circuits		PHI
Reference Books:			
Tokheim	Digital Electronics		TMH
S. Rangnekar	Digital Electronics		ISTE/EXCEL

End Semester Examination Scheme. Maximum Marks-70. Time allotted-3hrs.

Group	**Unit**	**Objective Questions** (MCQ only with the correct answer)		**Subjective Questions**			
		No of question to be set	Total Marks	No of question to be set	To answer	Marks per question	Total Marks
A	**1 to 10**	**10**	**10**				
B	**1 to 10**			**5**	**3**	**5**	**60**
C	**1 to 10**			**5**	**3**	**15**	

- Only multiple choice type questions (MCQ) with one correct answer are to be set in the objective part.
- Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.

Examination Scheme for end semester examination:

Group	**Chapter**	**Marks of each question**	**Question to be set**	**Question to be answered**
A	**All**	**1**	**10**	**10**
B	**All**	**5**	**5**	**3**
C	**All**	**15**	**5**	**3**

Name of the Course: B.Sc. in Information Technology (Internet of Things) **Subject:** Introduction to Graph Theory and its Applications			
Course Code: BITIOT304		**Semester: III**	
Duration: 36 Hrs.		**Maximum Marks: 100**	
Teaching Scheme		**Examination Scheme**	
Theory: 3 hrs./week		**End Semester Exam: 70**	
Tutorial: 1 hr./week		**Attendance : 5**	
Practical: 0		**Continuous Assessment: 25**	
Credit: 4		**Practical Sessional internal continuous evaluation: NA**	
		Practical Sessional external examination: NA	
Aim:			
Sl. No.			
1.	Understand the basic of graph theory.		
2.	Understand path, walks and cycle		
3.	Understand set covering and matches.		
4.	Understand vertex coloring.		
Objective:			
Sl. No.			
1.	To learn about the vertex, edge, path and cycle.		
2.	To learn about connected graph.		
3.	To learn about shortest path.		
4.	To learn about set covering and matching.		
5.	To learn about vertex coloring.		
Pre-Requisite:			
Sl. No.			
	None		
Contents		**4 Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	**Introduction** Discovery of graphs, Definitions, Subgraphs, Isomorphic graphs, Matrix representations of graphs, Degree of a vertex, Directed walks, paths and cycles, Connectivity in digraphs, Eulerian and Hamilton digraphs, Eulerian digraphs, Hamilton digraphs, Special graphs, Complements, Larger graphs from smaller graphs, Union, Sum, Cartesian Product, Composition, Graphic	**7**	**14**

	sequences, Graph theoretic model of the LAN problem, Havel-Hakimi criterion, Realization of a graphic sequence.		
02	**Connected graphs and shortest paths** Walks, trails, paths, cycles, Connected graphs, Distance, Cut-vertices and cut-edges, Blocks, Connectivity, Weighted graphs and shortest paths, Weighted graphs, Dijkstra's shortest path algorithm, Floyd-Warshall shortest path algorithm.	**7**	**14**
03	**Trees** Definitions and characterizations, Number of trees, Cayley's formula, Kircho-matrix-tree theorem, Minimum spanning trees, Kruskal's algorithm, Prim's algorithm, Special classes of graphs, Bipartite Graphs, Line Graphs, Chordal Graphs, Eulerian Graphs, Fleury's algorithm, Chinese Postman problem, Hamilton Graphs, Introduction, Necessary conditions and sufficient conditions.	**7**	**14**
04	**Independent sets coverings and matchings** Introduction, Independent sets and coverings: basic equations, Matchings in bipartite graphs, Hall's Theorem, K¨onig's Theorem, Perfect matchings in graphs, Greedy and approximation algorithms.	**8**	**14**
05	**Vertex Colorings** Basic definitions, Cliques and chromatic number, Mycielski's theorem, Greedy coloring algorithm, Coloring of chordal graphs, Brooks theorem, Edge Colorings, Introduction and Basics, Gupta-Vizing theorem, Class-1 and Class-2 graphs, Edge-coloring of bipartite graphs, Class-2 graphs, Hajos union and Class-2 graphs, A scheduling problem and equitable edge-coloring.	**7**	**14**
	Sub Total:	**36**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**40**	**100**

List of Books

Text Books:

Name of Author	**Title of the Book**	**Edition/ISSN/ISBN**	**Name of the**

			Publisher
J. A. Bondy and U. S. R. Murty	Graph Theory	1st edition	Springer
Richard J. Trudeau	Introduction to Graph Theory	2nd edition	Dover Publications
Reference Books:			
Chartrand and Zhang	A First Course in Graph Theory	ISBN-10: 0486483681 ISBN-13: 978-0486483689	Dover Publications
Maarten van Steen	Graph Theory and Complex Networks: An Introduction	ISBN-10: 9081540610 ISBN-13: 978-9081540612	Maarten van Steen

End Semester Examination Scheme. Maximum Marks-70. Time allotted-3hrs.

Group	**Unit**	**Objective Questions** (MCQ only with the correct answer)		**Subjective Questions**			
		No of question to be set	Total Marks	No of question to be set	To answer	Marks per question	Total Marks
A	**1 to 5**	**10**	**10**				
B	**1 to 5**			**5**	**3**	**5**	**60**
C	**1 to 5**			**5**	**3**	**15**	

- Only multiple choice type questions (MCQ) with one correct answer are to be set in the objective part.
- Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.

Examination Scheme for end semester examination:

Group	**Chapter**	**Marks of each question**	**Question to be set**	**Question to be answered**
A	**All**	**1**	**10**	**10**
B	**All**	**5**	**5**	**3**
C	**All**	**15**	**5**	**3**

Name of the Course: B.Sc. in Information Technology (Internet of Things) **Subject:** Value & Ethics in Data Science			
Course Code: BITIOT305		**Semester: III**	
Duration: 36 Hrs.		**Maximum Marks: 100**	
Teaching Scheme		**Examination Scheme**	
Theory: 3 hrs./week		End Semester Exam: 70	
Tutorial: 0		Attendance : 5	
Practical:0		Continuous Assessment:25	
Credit: 3		Practical Sessional internal continuous evaluation:NA	
		Practical Sessional external examination:NA	
Aim:			
Sl. No.			
1.	**To understand the ethics in data science**		
Objective:			
Sl. No.			
1.	Students will learn key philosophical concepts related to responsible conduct of research.		
2.	Students will develop familiarity with current debates in, and case studies of, ethical issues in non-medical scientific research.		
3.	Students will acquire skills to describe and explain the rationale behind philosophical ethical positions.		
Pre-Requisite:			
Sl. No.			
1	**Knowledge of Analysis**		
Contents		**Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	**HUMAN VALUES** Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management.	**6**	**15**
02	**ENGINEERING ETHICS** Senses of „Engineering Ethics" – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg"s theory – Gilligan"s theory – Consensus and Controversy – Models of professional roles - Theories about right action – Self-interest – Customs and Religion – Uses of	**8**	**15**

	Ethical Theories		
03	**ENGINEERING AS SOCIAL EXPERIMENTATION** Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law.	**8**	**15**
04	**SAFETY, RESPONSIBILITIES AND RIGHTS** Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk - Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination	**8**	**15**
05	**GLOBAL ISSUES** Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership –Code of Conduct – Corporate Social Responsibility	**6**	**10**
	Sub Total:	**36**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**40**	**100**

List of Books
Text Books:

Name of Author	**Title of the Book**	**Edition/ISSN/ISBN**	**Name of the Publisher**
W. Martin and Roland Schinzinger	Ethics in Engineering		Tata McGraw Hill
Govindarajan M, Natarajan S, Senthil Kumar V. S	Engineering Ethics		Prentice Hall of India
Charles B. Fleddermann	Engineering Ethics		Pearson Prentice Hall
Laura P. Hartman and Joe Desjardins	Business Ethics: Decision Making for Personal Integrity and Social Responsibility		Mc Graw Hill education

Reference Books:

Charles E. Harris, Michael S. Pritchard and Michael J. Rabins	Engineering Ethics – Concepts and Cases		Cengage Learning
John R Boatright	Ethics and the Conduct of Business		Pearson Education
Edmund G Seebauer and Robert L Barry	Fundamentals of Ethics for Scientists and Engineers		Oxford University Press

End Semester Examination Scheme. Maximum Marks-70. Time allotted-3hrs.

Group	**Unit**	**Objective Questions** (MCQ only with the correct answer)		**Subjective Questions**			
		No of question to be set	Total Marks	No of question to be set	To answer	Marks per question	Total Marks
A	**1 to 5**	**10**	**10**				**60**
B	**1 to 5**			**5**	**3**	**5**	
C	**1 to 5**			**5**	**3**	**15**	

- Only multiple choice type question (MCQ) with one correct answer are to be set in the objective part.
- Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.

Examination Scheme for end semester examination:

Group	**Chapter**	**Marks of each question**	**Question to be set**	**Question to be answered**
A	**All**	**1**	**10**	**10**
B	**All**	**5**	**5**	**3**
C	**All**	**15**	**3**	**3**

Name of the Course: B.Sc. in Information Technology (Internet of Things) **Subject:** Computer Networking & Computer Networking Lab			
Course Code: BITIOT401 + BITIOT491		**Semester: IV**	
Duration: 36 Hrs.		**Maximum Marks: 100 + 100**	
Teaching Scheme		**Examination Scheme**	
Theory: 3 hrs./week		**End Semester Exam: 70**	
Tutorial: 0		**Attendance : 5**	
Practical: 4 hrs./week		**Continuous Assessment: 25**	
Credit: 3 + 2		**Practical Sessional internal continuous evaluation: 40**	
		Practical Sessional external examination: 60	
Aim:			
Sl. No.			
1.	To gain knowledge of computer networks.		
2.	To gain knowledge of several layers and network architectures		
3.	To gain knowledge of communication through networks, protocols and algorithms.		
Objective:			
Sl. No.			
1.	Understand the division of network functionalities into layers.		
2.	Be familiar with the components required to build different types of networks Be exposed to the required functionality at each layer		
3.	Learn the flow control and congestion control algorithms		
Pre-Requisite:			
Sl. No.			
1.	Understanding of algorithms		
2.	Understanding of basic computer architecture		
Contents		**3 Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	**FUNDAMENTALS & LINK LAYER** Building a network – Requirements – Layering and protocols – Internet Architecture – Network software – Performance ; Link layer Services – Framing – Error Detection – Flow control	**7**	**14**
02	**MEDIA ACCESS & INTERNETWORKING** Media access control – Ethernet (802.3) – Wireless LANs –	**7**	**14**

	802.11 – Bluetooth – Switching and bridging – Basic Internetworking (IP, CIDR, ARP, DHCP,ICMP)		
03	**ROUTING** Routing (RIP, OSPF, metrics) – Switch basics – Global Internet (Areas, BGP, IPv6), Multicast – addresses – multicast routing (DVMRP, PIM)	**7**	**14**
04	**TRANSPORT LAYER** Overview of Transport layer – UDP – Reliable byte stream (TCP) – Connection management – Flow control – Retransmission – TCP Congestion control – Congestion avoidance (DECbit, RED) – QoS – Application requirements	**8**	**14**
05	**APPLICATION LAYER** Traditional applications -Electronic Mail (SMTP, POP3, IMAP, MIME) – HTTP – Web Services – DNS – SNMP	**7**	**14**
	Sub Total:	**36**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**40**	**100**

Practical:

Skills to be developed:

Intellectual skills:

1. Identify the components required to build different types of networks
2. Choose the required functionality at each layer for given application
3. Identify solution for each functionality at each layer
4. Trace the flow of information from one node to another node in the network

List of Practical: Based on theory lectures.

Assignments:

Adhered to theory curriculum as conducted by the subject teacher.

List of Books

Text Books:

Name of Author	Title of the Book	Edition/ISSN/ISBN	Name of the Publisher
Larry L. Peterson, Bruce S. Davie	Computer Networks: A Systems Approach	Fifth	Morgan Kaufmann Publishers

Behrouz A. Forouzan	Data Communication and Networking	Fourth	Tata McGraw – Hill
James F. Kurose, Keith W. Ross	Computer Networking – A Top-Down Approach Featuring the Internet	Fifth	Pearson Education

Reference Books:

Nader. F. Mir	Computer and Communication Networks		Pearson Prentice Hall Publishers
Ying-Dar Lin, Ren-Hung Hwang, Fred Baker	Computer Networks: An Open Source Approach		McGraw Hill Publisher

List of equipment/apparatus for laboratory experiments:

Sl. No.	
1.	Computer with Internet Connection

End Semester Examination Scheme. Maximum Marks-70. Time allotted-3hrs.

Group	Unit	Objective Questions (MCQ only with the correct answer)		Subjective Questions			
		No of question to be set	Total Marks	No of question to be set	To answer	Marks per question	Total Marks
A	**1 to 5**	**10**	**10**				
B	**1 to 5**			**5**	**3**	**5**	**60**
C	**1 to 5**			**5**	**3**	**15**	

- Only multiple choice type questions (MCQ) with one correct answer are to be set in the objective part.
- Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.

Examination Scheme for end semester examination:

Group	Chapter	Marks of each	Question to be	Question to be

		question	set	answered
A	**All**	**1**	**10**	**10**
B	**All**	**5**	**5**	**3**
C	**All**	**15**	**5**	**3**
Examination Scheme for Practical Sessional examination:				
Practical Internal Sessional Continuous Evaluation				
Internal Examination:				
Continuous evaluation				**40**
External Examination: Examiner-				
Signed Lab Assignments			**10**	
On Spot Experiment			**40**	
Viva voce			**10**	**60**

Name of the Course: B.Sc. in Information Technology (Internet of Things) **Subject:** Wireless Sensor Networks & Wireless Sensor Networks Lab			
Course Code: BITIOT402A + BITIOT492A		**Semester: IV**	
Duration: 36 Hrs.		**Maximum Marks: 100 + 100**	
Teaching Scheme		**Examination Scheme**	
Theory: 3 hrs./week		**End Semester Exam: 70**	
Tutorial: 0		**Attendance : 5**	
Practical: 4 hrs./week		**Continuous Assessment: 25**	
Credit: 3 + 2		**Practical Sessional internal continuous evaluation: 40**	
		Practical Sessional external examination: 60	
Aim:			
Sl. No.			
1.	This course aims to provide conceptual understanding of the function of Wireless Sensor Networks. Also to explain what the technology is and how it works at a high level.		
Objective:			
Sl. No.			
1.	To provide an overview about sensor networks and emerging technologies.		
2.	To study about the node and network architecture of sensor nodes and its execution environment		
3.	To study about sensor node hardware and software platforms and understand the simulation and programming techniques.		
Pre-Requisite:			
Sl. No.			
1.	Understanding of algorithms		
2.	Understanding of basic computer architecture		
Contents		**3 Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	**Introduction and Overview** Overview of wireless networks, types, infrastructure-based and infrastructure-less, introduction to MANETs (Mobile Ad-hoc Networks), characteristics, reactive and proactive routing protocols with examples, introduction to sensor networks, commonalities and differences with MANETs, constraints and challenges, advantages, applications, enabling technologies for WSNs.	**7**	**14**

02	**Architectures** Single-node architecture - hardware components, design constraints, energy consumption of sensor nodes , operating systems and execution environments, examples of sensor nodes, sensor network scenarios, types of sources and sinks – single hop vs. multi hop networks, multiple sources and sinks – mobility, optimization goals and figures of merit, gateway concepts, design principles for WSNs, service interfaces for WSNs.	**7**	**14**
03	**Communication Protocols** Physical layer and transceiver design considerations, MAC protocols for wireless sensor networks, low duty cycle protocols and wakeup concepts - S-MAC , the mediation device protocol, wakeup radio concepts, address and name management, assignment of MAC addresses, routing protocols- classification, gossiping, flooding, energy-efficient routing, unicast protocols, multi-path routing, data-centric routing, data aggregation, SPIN, LEACH, Directed-Diffusion, geographic routing.	**8**	**14**
04	**Infrastructure Establishment** Topology control, flat network topologies, hierarchical networks by clustering, time synchronization, properties, protocols based on sender-receiver and receiver-receiver synchronization, LTS, TPSN, RBS, HRTS, localization and positioning, properties and approaches, single-hop localization, positioning in multi-hop environment, range based localization algorithms – location services, sensor tasking and control.	**7**	**14**
05	**Sensor Network Platforms and Tools** Sensor node hardware, Berkeley motes, programming challenges, node-level software platforms, node-level simulators, state-centric programming, Tiny OS, nesC components,NS2 simulator, TOSSIM	**7**	**14**
	Sub Total:	**36**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**40**	**100**

Practical:

Skills to be developed:

Intellectual skills:

1. Identify knowledge about Wireless sensor network technology.
2. Identify trust essentials.

List of Practical: Based on theory lectures.

Assignments:

Adhered to theory curriculum as conducted by the subject teacher.

List of Books

Text Books:

Name of Author	**Title of the Book**	**Edition/ISSN/ISBN**	**Name of the Publisher**
Holger Karl & Andreas Willig,	Protocols and Architectures for Wireless Sensor Network		John Wiley
Feng Zhao & Leonidas J. Guibas	Wireless Sensor Networks- An Information Processing Approach		Elsevier,
Reference Books:			
Kazem Sohraby, Daniel Minoli, & Taieb Znati,	Wireless Sensor Networks- Technology, Protocols, and Application		John Wiley
Anna Hac	Wireless Sensor Network Design		John Wiley
Edgar Callaway	Wireless Sensor Networks: Architectures and Protocols		Auerbach

List of equipment/apparatus for laboratory experiments:	
Sl. No.	
1.	Computer with Internet Connection, NS3, NS2

End Semester Examination Scheme. **Maximum Marks-70.** **Time allotted-3hrs.**

Group	**Unit**	**Objective Questions** (MCQ only with the correct answer)		**Subjective Questions**			
		No of question to be set	Total Marks	No of question to be set	To answer	Marks per question	Total Marks
A	**1 to 5**	**10**	**10**				

B **C**	**1 to 5** **1 to 5**			**5** **5**	**3** **3**	**5** **15**	**60**

- Only multiple choice type questions (MCQ) with one correct answer are to be set in the objective part.
- Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.

Examination Scheme for end semester examination:

Group	Chapter	Marks of each question	Question to be set	Question to be answered
A	**All**	**1**	**10**	**10**
B	**All**	**5**	**5**	**3**
C	**All**	**15**	**5**	**3**

Examination Scheme for Practical Sessional examination:

Practical Internal Sessional Continuous Evaluation

Internal Examination:

Continuous evaluation			**40**

External Examination: Examiner-

Signed Lab Assignments	**10**	
On Spot Experiment	**40**	
Viva voce	**10**	**60**

Name of the Course: B.Sc. in Information Technology (Internet of Things) **Subject:** BlockChain Technologies & BlockChain Technologies Lab			
Course Code: BITIOT402B + BITIOT492B		**Semester: IV**	
Duration: 36 Hrs.		**Maximum Marks: 100 + 100**	
Teaching Scheme		**Examination Scheme**	
Theory: 3 hrs./week		**End Semester Exam: 70**	
Tutorial: 0		**Attendance : 5**	
Practical: 4 hrs./week		**Continuous Assessment: 25**	
Credit: 3 + 2		**Practical Sessional internal continuous evaluation: 40**	
		Practical Sessional external examination: 60	
Aim:			
Sl. No.			
1.	This course aims to provide conceptual understanding of the function of Blockchains. Also to explain what the technology is and how it works at a high level.		
Objective:			
Sl. No.			
1.	To understand what Blockchain is and why it is used		
2.	To be able to explain the different components involved within Blockchain		
3.	Evaluate the setting where a blockchain based structure may be applied, its potential and its limitations.		
Pre-Requisite:			
Sl. No.			
1.	Understanding of algorithms		
2.	Understanding of basic computer architecture		
Contents		**3 Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	**Introduction** Introduction to blockchain, structure and operational aspects of Bitcoin blockchain, different types of blockchains.	**3**	**10**
02	**Ethereum Blockchain** Innovation of the Ethereum blockchain, review its protocol, and explore the payment model for code execution.	**5**	**10**
03	**Algorithms & Techniques** Concept of asymmetric key encryption, concept of hashing, different techniques and algorithms to manage the integrity of transactions	**7**	**10**

	and blocks in blockchain.		
04	**Trust Essentials** Different elements of trust in blockchain, Consensus protocol.	**7**	**10**
05	**Setting Up Development Environment Using Hyperledger Composer** Setting up Development Environment using Composer, Introduction to Hyperledger Fabric, Hyperledger Fabric Model, Various ways to create Hyperledger Fabric Blockchain Network.	**8**	**20**
06	**Prospects Of Blockchain** Blockchain transforming business and professionalism, Discussing practical use-cases of Blockchain, Real case scenarios of Blockchain, How governments around the world are using Blockchain.	**6**	**10**
	Sub Total:	**36**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**40**	**100**

Practical:

Skills to be developed:

Intellectual skills:

1. Identify knowledge about blockchain technology.
2. Identify trust essentials.

List of Practical: Based on theory lectures.

Assignments:

Adhered to theory curriculum as conducted by the subject teacher.

List of Books

Text Books:

Name of Author	**Title of the Book**	**Edition/ISSN/ISBN**	**Name of the Publisher**
Melanie Swan	Blockchain: Blueprint for a New Economy		O'Reilly Media, Inc.
Reference Books:			
Alex Tapscott and Don Tapscott	Blockchain Revolution: How the Technology Behind Bitcoin Is Changing Money, Business, and the World		Penguin

List of equipment/apparatus for laboratory experiments:

Sl. No.							
1.		Computer with Internet Connection, IBM Blockchain Platform					
End Semester Examination Scheme.		**Maximum Marks-70.**				**Time allotted-3hrs.**	
Group	**Unit**	**Objective Questions** (MCQ only with the correct answer)		**Subjective Questions**			
		No of question to be set	Total Marks	No of question to be set	To answer	Marks per question	Total Marks
A **B** **C**	**1 to 6** **1 to 6** **1 to 6**	**10**	**10**	**5** **5**	**3** **3**	**5** **15**	**60**

- Only multiple choice type questions (MCQ) with one correct answer are to be set in the objective part.
- Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.

Examination Scheme for end semester examination:

Group	Chapter	Marks of each question	Question to be set	Question to be answered
A	**All**	**1**	**10**	**10**
B	**All**	**5**	**5**	**3**
C	**All**	**15**	**5**	**3**

Examination Scheme for Practical Sessional examination:

Practical Internal Sessional Continuous Evaluation

Internal Examination:

Continuous evaluation			**40**

External Examination: Examiner-

Signed Lab Assignments	**10**	
On Spot Experiment	**40**	
Viva voce	**10**	**60**

Name of the Course: B.Sc. in Information Technology (Internet of Things) **Subject:** Design and Analysis of Algorithms			
Course Code: BITIOT403		**Semester: IV**	
Duration: 36 Hrs.		**Maximum Marks: 100**	
Teaching Scheme		**Examination Scheme**	
Theory: 3 hrs./week		**End Semester Exam: 70**	
Tutorial: 1 hr./week		**Attendance : 5**	
Practical:0		**Continuous Assessment: 25**	
Credit: 4		**Practical Sessional internal continuous evaluation: 40**	
		Practical Sessional external examination: 60	
Aim:			
Sl. No.			
1.	To teach paradigms and approaches used to analyze and design algorithms and to appreciate the impact of algorithm design in practice.		
2.	To make students understand how the worst-case time complexity of an algorithm is defined, how asymptotic notation is used to provide a rough classification of algorithms.		
3.	To explain different computational models (e.g., divide-and-conquer), order notation and various complexity measures (e.g., running time, disk space) to analyze the complexity/performance of different algorithms.		
Objective:			
Sl. No.			
1.	Analyze the asymptotic performance of algorithms.		
2.	Write rigorous correctness proofs for algorithms.		
3.	Demonstrate a familiarity with major algorithms and data structures.		
Pre-Requisite:			
Sl. No.			
1.	Basic Programming Knowlwdge.		
Contents		**3 Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	**INTRODUCTION** Notion of an Algorithm – Fundamentals of Algorithmic Problem Solving – Important Problem Types – Fundamentals of the Analysis of Algorithmic Efficiency –Asymptotic Notations and	**7**	**14**

	their properties. Analysis Framework – Empirical analysis – Mathematical analysis for Recursive and Non-recursive algorithms – Visualization		
02	**BRUTE FORCE AND DIVIDE-AND-CONQUER** Brute Force – Computing an – String Matching – Closest-Pair and Convex-Hull Problems – Exhaustive Search – Travelling Salesman Problem – Knapsack Problem – Assignment problem. Divide and Conquer Methodology – Binary Search – Merge sort – Quick sort – Heap Sort – Multiplication of Large Integers – Closest-Pair and Convex – Hull Problems	**7**	**14**
03	**DYNAMIC PROGRAMMING AND GREEDY TECHNIQUE** Dynamic programming – Principle of optimality – Coin changing problem, Computing a Binomial Coefficient – Floyd's algorithm – Multi stage graph – Optimal Binary Search Trees – Knapsack Problem and Memory functions. Greedy Technique – Container loading problem – Prim's algorithm and Kruskal's Algorithm – 0/1 Knapsack problem, Optimal Merge pattern – Huffman Trees.	**7**	**14**
04	**ITERATIVE IMPROVEMENT** The Simplex Method – The Maximum-Flow Problem – Maximum Matching in Bipartite Graphs, Stable marriage Problem.	**8**	**14**
05	**COPING WITH THE LIMITATIONS OF ALGORITHM POWER** Lower – Bound Arguments – P, NP NP- Complete and NP Hard Problems. Backtracking – n-Queen problem – Hamiltonian Circuit Problem – Subset Sum Problem. Branch and Bound – LIFO Search and FIFO search – Assignment problem – Knapsack Problem – Travelling Salesman Problem – Approximation Algorithms for NP-Hard Problems – Travelling Salesman problem – Knapsack problem.	**7**	**14**
	Sub Total:	**36**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**40**	**100**
Assignments:			

Adhered to theory curriculum as conducted by the subject teacher.

List of Books

Text Books:

Name of Author	**Title of the Book**	**Edition/ISSN/ISBN**	**Name of the Publisher**
Anany Levitin	Introduction to the Design and Analysis of Algorithms	Third Edition	Pearson Education
Thomas H. Cormen,Charles E. Leiserson,Ronald L. Rivest,Clifford Stein	Introduction to Algorithms	III edition	The MIT Press
Reference Books:			
Steven S S. Skiena	The Algorithm Design Manual	2nd edition	Springer
Robert Sedgewick,Kevin Wayne	Algorithms	4th edition	Addison-Wesley Professional

List of equipment/apparatus for laboratory experiments:

Sl. No.	
1.	Computer

End Semester Examination Scheme. Maximum Marks-70. Time allotted-3hrs.

Group	**Unit**	**Objective Questions** (MCQ only with the correct answer)		**Subjective Questions**			
		No of question to be set	Total Marks	No of question to be set	To answer	Marks per question	Total Marks
A	**1 to 5**	**10**	**10**				
B	**1 to 5**			**5**	**3**	**5**	**60**
C	**1 to 5**			**5**	**3**	**15**	

- Only multiple choice type questions (MCQ) with one correct answer are to be set in the objective part.

- Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.

Examination Scheme for end semester examination:

Group	Chapter	Marks of each question	Question to be set	Question to be answered
A	All	1	10	10
B	All	5	5	3
C	All	15	5	3

Name of the Course: B.Sc. in Information Technology (Internet of Things) **Subject:** Working with Raspberry Pi & Arduino Platform			
Course Code: BITiot404		**Semester: IV**	
Duration: 36 Hrs.		**Maximum Marks: 100**	
Teaching Scheme		**Examination Scheme**	
Theory: 3 hrs./week		**End Semester Exam: 70**	
Tutorial: 1 hr./week		**Attendance : 5**	
Practical: 0		**Continuous Assessment: 25**	
Credit: 4		**Practical Sessional internal continuous evaluation: NA**	
		Practical Sessional external examination: NA	
Aim:			
Sl. No.			
1.	Introduce students to Raspberry Pi & Arduino Platform.		
2.	Enable students to use various tools for IoT programs.		
Objective:			
Sl. No.			
1.	To develop the knowledge of Raspberry Pi & Arduino Platform		
2.	To develop efficiency work with different platform.		
3.	To develop knowledge of pins and connections of Raspberry Pi & Arduino Platform.		
Contents		**4 Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	**Introduction:** Basic functionality the Raspberry Pi B+ board and Arduino, how to set up the boards, configure it, and use it,differentiating Raspberry Pi from the Arduino platform, Raspberry Pi uses an operating system, some of the implications of an operating system on the behavior of the Raspberry Pi as an IoT device.	**9**	**17**
02	Raspberry Pi with Linux**:** Raspberry Pi with Linux-based operating system, basics of Linux and its use. main features including navigating the file system and managing processes, the text-based user interface through theshell, the graphic user interface which is the default, Raspian Linux distribution.	**9**	**18**
03	Raspberry Pi with Python: Basics of the Python programming language, Raspberry Pi APIs and	**9**	**18**

	Arduino, basic operations, controlling the pins, Python features , control RPi by Python		
04	Raspberry Pi and Arduino pin configuration: Communicate with devices through the pins of the Raspberry Pi and Arduino, GPIO library with Python functions, used to access the pins, Tkinter Python library, access pins through a graphic user interface.	**9**	**17**
	Sub Total:	**36**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**40**	**100**

List of Books

Text Books:

Name of Author	**Title of the Book**	**Edition/ISSN/ISBN**	**Name of the Publisher**
Wolfram Donat	Learn Raspberry Pi Programming with Python: Learn to Program on the World's Most Popular Tiny Computer	2nd edition	Apress
Wolfram Donat	PiBot: Build Your Own Raspberry Pi Powered Robot 2.0		CyberWolf Publishing
Reference Books:			
Wolfram Donat	Make: A Raspberry Pi Controlled Robot - Building a Rover with Python, Linux, Motors, and Sensors	1st edition	**Make** Community

End Semester Examination Scheme. Maximum Marks-70. Time allotted-3hrs.

Group	**Unit**	**Objective Questions** (MCQ only with the correct answer)		**Subjective Questions**			
		No of question	Total Marks	No of question	To answer	Marks per	Total Marks

		to be set		to be set		question	
A **B** **C**	**1 to 4** **1 to 4** **1 to 4**	**10**	**10**	 **5** **5**	 **3** **3**	 **5** **15**	 **60**

- Only multiple choice type questions (MCQ) with one correct answer are to be set in the objective part.
- Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.

Examination Scheme for end semester examination:

Group	Chapter	Marks of each question	Question to be set	Question to be answered
A	**All**	**1**	**10**	**10**
B	**All**	**5**	**5**	**3**
C	**All**	**15**	**5**	**3**

Name of the Course: B.Sc. in Information Technology (Internet of Things) **Subject:** Technical Seminar and Communication Skill	
Course Code: BITIOT481	**Semester: IV**
Duration: 36 Hrs.	**Maximum Marks: 100**
Teaching Scheme	**Examination Scheme**
Theory: 0	**End Semester Exam: 100**
Tutorial: 0	**Attendance: 0**
Practical: 2 hrs./week	**Continuous Assessment: 0**
Credit: 1	**Practical Sessional internal continuous evaluation: 40**
	Practical Sessional external examination: 60
Contents	
Students will give technical seminar and improve their communication skill.	

Name of the Course: B.Sc. in Information Technology (Internet of Things) **Subject:** Project II	
Course Code: BITIOT482	**Semester: IV**
Duration: 36 Hrs.	**Maximum Marks: 100**
Teaching Scheme	**Examination Scheme**
Theory: 0	**End Semester Exam: 100**
Tutorial: 0	**Attendance: 0**
Practical: 4 hrs./week	**Continuous Assessment: 0**
Credit: 2	**Practical Sessional internal continuous evaluation: 40**
	Practical Sessional external examination: 60
Contents	
Students will do projects on application areas of latest technologies and current topics of societal relevance.	

Name of the Course: B.Sc. in Information Technology (Internet of Things) **Subject:** IoT Application Development & IoT Application Development Lab			
Course Code: BITIOT501 & BITIOT591		**Semester: V**	
Duration: 36 Hrs.		**Maximum Marks: 100+100**	
Teaching Scheme		**Examination Scheme**	
Theory: 3 hrs./week		**End Semester Exam: 70**	
Tutorial: 0		**Attendance : 5**	
Practical: 4 hrs./week		**Continuous Assessment: 25**	
Credit: 3 + 2		**Practical Sessional internal continuous evaluation: 40**	
		Practical Sessional external examination: 60	
Aim:			
Sl. No.			
1.	Provides knowledge about the technologies involved in IOT.		
Objective:			
Sl. No.			
1.	To identify IoT standards and concept.		
2.	To develop ability to create IoT system.		
3.	To identify IoT applications.		
4.	To identify IoT challenges.		
Pre-Requisite:			
Sl. No.			
1.	Database System, Algorithm		
Contents		**3 Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	Introduction to IoT Defining IoT, Characteristics of IoT, Physical design of IoT, Logical design of IoT, Functional blocks of IoT, Communication models & APIs	**6**	**11**
02	IoT & M2M Machine to Machine, Difference between IoTand M2M, Softwaredefine Network	**6**	**12**

03	Network & Communication aspects Wireless medium access issues, MAC protocol survey, Survey routing protocols, Sensor deployment & Node discovery, Data aggregation & dissemination	**6**	**12**
04	Challenges in IoT Design challenges, Development challenges, Security challenges, Other challenges	**6**	**11**
05	Domain specific applications of IoT Home automation, Industry applications, Surveillance applications,Other IoT applications	**6**	**12**
06	Developing IoTs Introduction to Python, Introduction to different IoT tools, Developing applications through IoT tools, Developing sensor based application through embedded system platform, Implementing IoT concepts with python	**6**	**12**
	Sub Total:	**36**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**40**	**100**

Practical:

Skills to be developed:

Intellectual skills:

1. Understand the definition of IoT fundamentals
2. Describe the types of IoT components.
3. Analyze various IoT systems.
4. Illustrate the methods for smart IoT system.

List of Practical:

Based on theory lectures.

Assignments:

Based on theory lectures.

List of Books

Text Books:			
Name of Author	**Title of the Book**	**Edition/ISSN/ISBN**	**Name of the Publisher**
Vijay Madisetti, Arshdeep Bahga	Internet of Things (A Hands-onApproach)	First	VPT
Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, StamatisKarnouskos, David Boyle	From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence	First	Academic Press
Bernd Scholz-Reiter, Florian Michahelles	Architecting the Internet of Things	ISBN 978-3-642-19156-5 e-ISBN 978-3-642-19157-2	Springer
Reference Books:			
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
Peter Waher	Learning Internet of Things		PACKT publishing
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
List of equipment/apparatus for laboratory experiments:			
Sl. No.			
1.	Computer with Internet Connection, IoT component		

End Semester Examination Scheme.		**Maximum Marks-70.**				**Time allotted-3hrs.**	
Group	**Unit**	**Objective Questions** (MCQ only with the correct answer)		**Subjective Questions**			
		No of question to be set	Total Marks	No of question to be set	To answer	Marks per question	Total Marks

A	**1 to 6**	**10**	**10**				
B	**1to 6**			**5**	**3**	**5**	**60**
C	**1 to 6**			**5**	**3**	**15**	

- Only multiple choice type questions (MCQ) with one correct answer are to be set in the objective part.
- Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.

Examination Scheme for end semester examination:

Group	Chapter	Marks of each question	Question to be set	Question to be answered
A	**All**	**1**	**10**	**10**
B	**All**	**5**	**5**	**3**
C	**All**	**15**	**5**	**3**

Examination Scheme for Practical Sessional examination:

Practical Internal Sessional Continuous Evaluation

Internal Examination:

Continuous evaluation			**40**

External Examination: Examiner-

Signed Lab Assignments	**10**	
On Spot Experiment	**40**	
Viva voce	**10**	**60**

Name of the Course: B.Sc. in Information Technology (Internet of Things) **Subject:** Embedded System & Embedded System Lab	
Course Code: BITIOT502A & BITIOT592A	**Semester: V**
Duration: 36 Hrs.	**Maximum Marks: 100+100**
Teaching Scheme	**Examination Scheme**
Theory: 3 hrs./week	**End Semester Exam: 70**
Tutorial: 0	**Attendance : 5**
Practical: 4 hrs./week	**Continuous Assessment: 25**
Credit: 3 + 2	**Practical Sessional internal continuous evaluation: 40**
	Practical Sessional external examination: 60

Aim:	
Sl. No.	
1.	Develop the knowledge about the fundamentals of embedded system.
2.	Acquire knowledge on standard algorithms used in embedded system.

Objective:	
Sl. No.	
1.	To understand the fundamentals of embedded system.
2.	To understand how embedded system works.
3.	To develop knowledge on standard algorithms used in embedded system.

Pre-Requisite:	
Sl. No.	
1.	Microprocessor and microcontroller

Contents		**3 Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	**Introduction** Introduction-defining Real time systems,Embedded Real Time Systems,Special Characteristics of real time systems,a brief evolutionary history. Hardware Architectures of Real Time systems.	**8**	**12**
02	Software architectures(concepts of interrupt driven activation,need for real time monitor,pseudo parallelism),meeting of dead lines & real time constraints.	**4**	**12**
03	Overview of WARD & MELLOR Methodology: Ward & Mellor Life Cycle,the essential model step,the implementation model,real time extensions of DFD	**10**	**12**

04	Real time languages: overview of ADA/Java Extension	**4**	**11**
05	Real time Operating Systems	**4**	**11**
06	System Development Methodologies	**6**	**12**
	Sub Total:	**36**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**40**	**100**

Practical:

Skills to be developed:

Intellectual skills:

1. Understand the definition of embedded system.
2. Describe methodology of system development.
3. Analyze real time operating systems.

List of Practical:

Based on theory lectures.

Assignments:

Based on theory lectures.

List of Books

Text Books:

Name of Author	**Title of the Book**	**Edition/ISSN/ISBN**	**Name of the Publisher**
Frank Vahid & Tony Givargis	Embedded System Design		John Wiley & sons, Inc.
Alan C. Shaw	Real – Time Systems and software		John Wiley & sons, Inc.
Reference Books:			
Daniel W. Lewis	Fundamentals of embedded Software		Pearson
J. W. S. Liu	Real time Systems		Pearson

List of equipment/apparatus for laboratory experiments:	
Sl. No.	
1.	Computer with Internet Connection, embedded component

End Semester Examination Scheme. Maximum Marks-70. Time allotted-3hrs.

Group	**Unit**	**Objective Questions**	**Subjective Questions**

		(MCQ only with the correct answer)					
		No of question to be set	Total Marks	No of question to be set	To answer	Marks per question	Total Marks
A **B** **C**	**1 to 6** **1to 6** **1 to 6**	**10**	**10**	**5** **5**	**3** **3**	**5** **15**	**60**

- Only multiple choice type questions (MCQ) with one correct answer are to be set in the objective part.
- Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.

Examination Scheme for end semester examination:

Group	Chapter	Marks of each question	Question to be set	Question to be answered
A	**All**	**1**	**10**	**10**
B	**All**	**5**	**5**	**3**
C	**All**	**15**	**5**	**3**

Examination Scheme for Practical Sessional examination:

Practical Internal Sessional Continuous Evaluation

Internal Examination:

Continuous evaluation			**40**

External Examination: Examiner-

Signed Lab Assignments	**10**	
On Spot Experiment	**40**	
Viva voce	**10**	**60**

Name of the Course: B.Sc. in Information Technology (Internet of Things) **Subject:** Cloud Computing & Cloud Computing Lab			
Course Code: BITIOT502B & BITIOT592B		**Semester: V**	
Duration: 36 Hrs.		**Maximum Marks: 100+100**	
Teaching Scheme		**Examination Scheme**	
Theory: 3 hrs./week		**End Semester Exam: 70**	
Tutorial: 0		**Attendance : 5**	
Practical: 4 hrs./week		**Continuous Assessment: 25**	
Credit: 3 + 2		**Practical Sessional internal continuous evaluation: 40**	
		Practical Sessional external examination: 60	
Aim:			
Sl. No.			
1.	An overview of the concepts, processes, and best practices needed to successfully secure information within Cloud infrastructures.		
2.	The student will also learn how to apply trust-based security model to real-world security problems.		
Objective:			
Sl. No.			
1.	To understand an overview of the concepts, processes, and best practices needed to successfully secure information within Cloud infrastructures.		
2.	To learn the basic Cloud types and delivery models and develop an understanding of the risk and compliance responsibilities and Challenges for each Cloud type and service delivery model.		
3.	To learn how to apply trust-based security model to real-world security problems.		
Pre-Requisite:			
Sl. No.			
1.	Internet of Things		
Contents		**3 Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	**Introduction to Cloud Computing** Online Social Networks and Applications, Cloud introduction and overview, Different clouds, Risks, Novel applications of cloud computing	**8**	**12**
02	**Cloud Computing Architecture**	**4**	**12**

	Requirements, Introduction Cloud computing architecture, On Demand Computing Virtualization at the infrastructure level, Security in Cloud computing environments, CPU Virtualization, A discussion on Hypervisors Storage Virtualization Cloud Computing Defined, The SPI Framework for Cloud Computing, The Traditional Software Model, The Cloud Services Delivery Model, Cloud Deployment Models Key Drivers to Adopting the Cloud, The Impact of Cloud Computing on Users, Governance in the Cloud, Barriers to Cloud Computing Adoption in the Enterprise		
03	**Security Issues in Cloud Computing** Infrastructure Security, Infrastructure Security: The Network Level, The Host Level, The Application Level, Data Security and Storage, Aspects of Data Security, Data Security Mitigation Provider Data and Its Security Identity and Access Management, Trust Boundaries and IAM, IAM Challenges, Relevant IAM Standards and Protocols for Cloud Services, IAM Practices in the Cloud, Cloud Authorization Management	**10**	**12**
04	**Security Management in the Cloud** Security Management Standards, Security Management in the Cloud, Availability Management: SaaS, PaaS, IaaS, Privacy Issues Privacy Issues, Data Life Cycle, Key Privacy Concerns in the Cloud, Protecting Privacy, Changes to Privacy Risk Management and Compliance in Relation to Cloud Computing, Legal and Regulatory Implications, U.S. Laws and Regulations, International Laws and Regulations	**4**	**11**
05	**Audit and Compliance** Internal Policy Compliance, Governance, Risk, and Compliance (GRC), Regulatory/External Compliance, Cloud Security Alliance, Auditing the Cloud for Compliance, Security-as-a-Cloud	**4**	**11**
06	**Advanced Topics** Recent devlopments in hybrid cloud and cloud security.	**6**	**12**
	Sub Total:	**36**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**40**	**100**
Practical:			

Skills to be developed:

Intellectual skills:

1. Understand the definition of cloud computing.
2. Learn the basic Cloud types and delivery models and develop an understanding of the risk and compliance responsibilities.
3. Develop a risk-management strategy for moving to the Cloud
4. Identify security aspects of each cloud model

List of Practical:

Based on theory lectures.

Assignments:

Based on theory lectures.

List of Books

Text Books:

Name of Author	Title of the Book	Edition/ISSN/ISBN	Name of the Publisher
Tim Mather	Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance (Theory in Practice)	ISBN-10: 0596802765	O'Reilly Media
Rao M.N.	Cloud Computing	**ISBN-10:** 8120350731 **ISBN-13:** 978-8120350731	PHI Learning Pvt Ltd
Reference Books:			
Thomas Erl, Ricardo Puttini, Zaigham Mahmood	Cloud Computing: Concepts, Technology & Architecture	1st edition	Prentice Hall
Thomas Erl, Robert Cope, Amin Naserpour	Cloud Computing Design Patterns	1st edition	Prentice Hall

List of equipment/apparatus for laboratory experiments:

Sl. No.	
1.	Computer with Internet Connection, embedded component

End Semester Examination Scheme. Maximum Marks-70. Time allotted-3hrs.

Group	Unit	Objective Questions (MCQ only with the correct answer)		Subjective Questions			
		No of question to be set	Total Marks	No of question to be set	To answer	Marks per question	Total Marks
A **B** **C**	**1 to 6** **1to 6** **1 to 6**	**10**	**10**	**5** **5**	**3** **3**	**5** **15**	**60**

- Only multiple choice type questions (MCQ) with one correct answer are to be set in the objective part.
- Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.

Examination Scheme for end semester examination:

Group	Chapter	Marks of each question	Question to be set	Question to be answered
A	**All**	**1**	**10**	**10**
B	**All**	**5**	**5**	**3**
C	**All**	**15**	**5**	**3**

Examination Scheme for Practical Sessional examination:

Practical Internal Sessional Continuous Evaluation

Internal Examination:

Continuous evaluation			**40**

External Examination: Examiner-

Signed Lab Assignments	**10**	
On Spot Experiment	**40**	
Viva voce	**10**	**60**

Name of the Course: B.Sc. in Information Technology (Internet of Things) **Subject:** Threats in Mobile Application			
Course Code: BITIOT503		**Semester: V**	
Duration: 36 Hrs.		**Maximum Marks: 100**	
Teaching Scheme		**Examination Scheme**	
Theory: 3 hrs./week		**End Semester Exam: 70**	
Tutorial: 1 hr./week		**Attendance : 5**	
Practical: 0		**Continuous Assessment: 25**	
Credit: 4		**Practical Sessional internal continuous evaluation: NA**	
		Practical Sessional external examination: NA	
Aim:			
Sl. No.			
1.	Get to know the most important security risks (OWASP Mobile Top 10) of mobile apps with the aid of intentionally vulnerable mobile apps for iPhone and Android.		
2.	Give overview of security architecture of a Mobile.		
Objective:			
Sl. No.			
1.	The security architecture of Android and iOS, you will be guided through various application vulnerabilities and the corresponding countermeasures		
2.	To apply what you have learned to your company's mobile application projects and will gain the competence for secure development and evaluation (self-assessment) of mobile apps		
Pre-Requisite:			
Sl. No.			
1.	Good understanding of mobile devices advantageous.		
2.	Ability to read and understand source code		
Contents		**3 Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	**Software and System Security** Control hijacking attacks – buffer overflow, integer overflow, bypassing browser memory protection, Sandboxing and Isolation, Tools and techniques for writing robust application software, Security vulnerability detection tools, and techniques – program analysis (static, concolic and dynamic analysis), Privilege, access	**7**	**14**

	control, and Operating System Security, Exploitation techniques, and Fuzzing		
02	**Network Security & Web Security** Security Issues in TCP/IP – TCP, DNS, Routing (Topics such as basic problems of security in TCP/IP,, IPsec, BGP Security, DNS Cache poisoning etc), Network Defense tools – Firewalls, Intrusion Detection, Filtering, DNSSec, NSec3, Distributed Firewalls, Intrusion Detection tools, Threat Models, Denial of Service Attacks, DOS-proof network architecture, Security architecture of World Wide Web, Security Architecture of Web Servers, and Web Clients, Web Application Security – Cross Site Scripting Attacks, Cross Site Request Forgery, SQL Injection Attacks, Content Security Policies (CSP) in web, Session Management and User Authentication, Session Integrity, Https, SSL/TLS, Threat Modeling, Attack Surfaces, and other comprehensive approaches to network design for security	**8**	**14**
03	**Security in Mobile Platforms** Android vs. ioS security model, threat models, information tracking, rootkits, Threats in mobile applications, analyzer for mobile apps to discover security vulnerabilities, Viruses, spywares, and keyloggers and malware detection	**7**	**14**
04	**Introduction to Hardware Security, Supply Chain Security** Threats of Hardware Trojans and Supply Chain Security, Side Channel Analysis based Threats, and attacks	**7**	**14**
05	**Issues in Critical Infrastructure and SCADA Security** Security issues in SCADA, IP Convergence Cyber Physical System Security threats, Threat models in SCADA and various protection approaches, Machine learning and SCADA Security	**7**	**14**
	Sub Total:	**36**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**40**	**100**

List of Books

Text Books:

Name of Author	Title of the Book	Edition/ISSN/ISBN	Name of the Publisher
Scott J. Roberts, Rebekah Brown	Intelligence- Driven Incident Response: Outwitting the Adversary		O'Reilly Media, 2017

Henry Dalzie	How to Define and Build an Effective Cyber Threat Intelligence Capability		Elsevier Science & Technology, 2014
Reference Books:			
John Robertson, Ahmad Diab, Ericsson Marin, Eric Nunes, VivinPaliath, Jana Shakarian, Paulo Shakarian,	DarkWeb Cyber Threat Intelligence Mining		Cambridge University Press, 2017
Bob Gourley	The Cyber Threat		Createspace Independent Pub, 2014
Wei-Meng Lee	Beginning AndroidTM 4 Application Development		John Wiley & Sons,2017

End Semester Examination Scheme. Maximum Marks-70. Time allotted-3hrs.

Group	**Unit**	**Objective Questions** (MCQ only with the correct answer)		**Subjective Questions**			
		No of question to be set	Total Marks	No of question to be set	To answer	Marks per question	Total Marks
A	**1 to 5**	**10**	**10**				
B	**1 to 5**			**5**	**3**	**5**	**60**
C	**1 to 5**			**5**	**3**	**15**	

- Only multiple choice type questions (MCQ) with one correct answer are to be set in the objective part.
- Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.

Examination Scheme for end semester examination:

Group	**Chapter**	**Marks of each question**	**Question to be set**	**Question to be answered**
A	**All**	**1**	**10**	**10**
B	**All**	**5**	**5**	**3**
C	**All**	**15**	**5**	**3**

Name of the Course: B.Sc. in Information Technology (Internet of Things) **Subject:** Data Privacy & Security	
Course Code: BITIOT 504	**Semester: V**
Duration: 36 Hrs.	**Maximum Marks: 100**
Teaching Scheme	**Examination Scheme**
Theory: 3 hrs./week	**End Semester Exam: 70**
Tutorial: 1 hr./week	**Attendance : 5**
Practical: 0	**Continuous Assessment: 25**
Credit: 4	**Practical Sessional internal continuous evaluation: NA**
	Practical Sessional external examination:NA

Aim:	
Sl. No.	
1.	Highlight several current attack vectors and the associated mitigating behaviour.
2.	Explain how employees can internally determine risk level of their actions while using the Internet.
3.	Explain how current threats to foreign adversaries, eg. Flame, could be adapted to assault US infrastructures, or could backfire causing domestic damage.
Objective:	
Sl. No.	
1.	Using the above attack vectors give real world, relatable scenarios, that the employees can identify in their own work days
2.	To understand Security policies.

Contents		**3 Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	**Introduction** Fundamental Concepts, Definitions, Statistics, Data Privacy Attacks, Data linking and profiling, access control models, role based access control, privacy policies, their specifications, languages and implementation, privacy policy languages, privacy in different domains- medical, financial, etc.	**7**	**10**
02	**Data explosion** Statistics and Lack of barriers in Collection and Distribution of Person-specific information, Mathematical model for characterizing and comparing real-world data sharing practices and policies and for computing privacy and risk measurements, Demographics and Uniqueness.	**6**	**10**

03	**Protection Models** Null-map, k-map, Wrong map	**3**	**10**
04	**Survey of techniques** Protection models (null-map, k-map, wrong map), Disclosure control, Inferring entity identities, Strength and weaknesses of techniques, entry specific databases	**7**	**10**
05	**Computation systems for protecting delimited data** MinGen, Datafly, Mu-Argus, k-Similar, Protecting textual documents: Scrub	**6**	**15**
06	**Technology, Policy, Privacy and Freedom** Medical privacy legislation, policies and best practices, Examination of privacy matters specific to the World Wide Web, Protections provided by the Freedom of Information Act or the requirement for search warrants.	**7**	**15**
	Sub Total:	**36**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**40**	**100**

Assignments:
Based on theory lecture
List of Books
Text Books:

Name of Author	Title of the Book	Edition/ISSN/ISBN	Name of the Publisher
B. Raghunathan	The Complete Book of Data Anonymization: From Planning to Implementation		Ch Pub, 2013.
Reference Books:			
. Sweeney	Computational Disclosure Control: A Primer on Data Privacy Protection		MIT Computer Science, 2002

List of equipment/apparatus for laboratory experiments:	
Sl. No.	
1.	**Computer**
2.	**Switch**
3.	**Test Server**

End Semester Examination Scheme.		**Maximum Marks-70.**		**Time allotted-3hrs.**			
Group	**Unit**	**Objective Questions** (MCQ only with the correct answer)		**Subjective Questions**			
		No of question to be set	Total Marks	No of question to be set	To answer	Marks per question	Total Marks
A	All	10	10	5	3	5	60
B	All			5	3	15	
C	All						

- Only multiple choice type question (MCQ) with one correct answer are to be set in the objective part.
- Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.

Examination Scheme for end semester examination:

Group	**Chapter**	**Marks of each question**	**Question to be set**	**Question to be answered**
A	All	1	10	10
B	All	5	5	3
C	All	15	5	3

Name of the Course: B.Sc. in Information Technology (Internet of Things) **Subject:** Industrial Training and Internship	
Course Code: BITIOT 581	**Semester: V**
Duration: NA	**Maximum Marks: 100**
Teaching Scheme	**Examination Scheme**
Theory: 0	**End Semester Exam: 100**
Tutorial: 0	**Attendance: 0**
Practical: 4 hrs./week	**Continuous Assessment: 0**
Credit: 2	**Practical Sessional internal continuous evaluation: NA**
	Practical Sessional external examination: 100
Contents	
Students be encouraged to go to Industrial Training/Internship for at least 2-3 months during semester break.	

Name of the Course: B.Sc. in Information Technology (Internet of Things) **Subject:** Major Project I	
Course Code:BITIOT582	**Semester: V**
Duration: 36 Hrs.	**Maximum Marks: 100**
Teaching Scheme	**Examination Scheme**
Theory: 0	**End Semester Exam: 100**
Tutorial: 0	**Attendance: 0**
Practical: 4 hrs./week	**Continuous Assessment: 0**
Credit: 2	**Practical Sessional internal continuous evaluation: 40**
	Practical Sessional external examination: 60
Contents	
Students will do projects on application areas of latest technologies and current topics of societal relevance.	

Semester-VI

Name of the Course: B.Sc. in Information Technology (Internet of Things) **Subject:** Big Data Analysis & Big Data Analysis Lab	
Course Code: BITIOT601 & BITIOT691	**Semester: VI**
Duration: 36 Hrs	**Maximum Marks:100+100**
Teaching Scheme	**Examination Scheme**
Theory: 3 hrs./week	End Semester Exam:70
Tutorial: 0	Attendance: 5
Practical: 4 hrs./week	Continuous Assessment: 25
Credit: 3+2	Practical Sessional internal continuous evaluation: 40
	Practical Sessional external examination: 60

Aim:	
Sl. No.	
1.	Understand big data for business intelligence
2.	Learn business case studies for big data analytics.
3.	Understand nosql big data management.
4.	Perform map-reduce analytics using Hadoop and related tools

Objective:	
Sl. No.	
1.	Understand the fundamentals of Big cloud and data architectures.
2.	Understand HDFS file structure and Mapreduce frameworks, and use them to solve complex problems, which require massive computation power
3.	Use relational data in a Hadoop environment, using Hive and Hbase tools of the Hadoop Ecosystem..
4.	Understand the Comparison with traditional databases.

Pre-Requisite:	
Sl. No.	
1.	Database Management Systems.
2.	Object Oriented Programming Through Java

Contents		3 Hrs./week	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	**Introduction to big data** Introduction to Big Data Platform – Challenges of Conventional Systems - Intelligent data analysis – Nature of Data - Analytic Processes and Tools - Analysis vs Reporting.	**6**	**10**
02	**Mining data streams** Introduction To Streams Concepts – Stream Data Model and Architecture - Stream Computing - Sampling Data in a Stream – Filtering Streams – Counting Distinct Elements in a Stream – Estimating Moments – Counting Oneness in a Window – Decaying Window - Real time Analytics Platform(RTAP) Applications - Case Studies - Real Time Sentiment Analysis- Stock Market Predictions.	**10**	**20**
03	**Hadoop** History of Hadoop- the Hadoop Distributed File System – Components of Hadoop Analysing the Data with Hadoop- Scaling Out- Hadoop Streaming- Design of HDFS-Java interfaces to HDFS Basics- Developing a Map Reduce Application-How Map Reduce Works-Anatomy of a Map Reduce Job run- Failures-Job Scheduling-Shuffle and Sort – Task execution - Map Reduce Types and Formats- Map Reduce FeaturesHadoop environment.	**12**	**20**
04	**Frameworks** Applications on Big Data Using Pig and Hive – Data processing operators in Pig – Hive services – HiveQL – Querying Data in Hive - fundamentals of HBase and ZooKeeper - IBM InfoSphere BigInsights and Streams. Predictive Analytics- Simple linear regression- Multiple linear regression- Interpretation 5 of regression coefficients. Visualizations - Visual data analysis techniques- interaction techniques - Systems and applications.	**8**	**20**
	Sub Total:	**36**	**70**

	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**40**	**100**

Practical:

Skills to be developed:

Intellectual skills:

1. The HDFS file system, MapReduce frameworks are studied in detail.
2. Hadoop tools like Hive, and Hbase, which provide interface to relational databases, are also covered as part of this course work.
3. Ability to implement algorithms to perform various operations on Mapreduce,Pig,Hive

List of Practical:

1. Basic Linux command
2. Installation of Hadoop .
3. Create a directory in HDFS at given path(s).
4. Copy a file from/To Local file system to HDFS
5. Remove a file or directory in HDFS.
6. Display the aggregate length of a file.
7. Word Count Map Reduce program to understand Map Reduce Paradigm
8. Implementing Matrix Multiplication with Hadoop Map Reduce
9. Pig Latin scripts to sort,group, join,project, and filter your data.
10. Hive Databases,Tables,Views,Functions and Indexes

Assignments:

Based on the curriculum as covered by subject teacher.

List of Books

Text Books:

Name of Author	**Title of the Book**	**Edition/ISSN/ISBN**	**Name of the Publisher**
Tom White	Hadoop: The Definitive Guide	Third Edition	O'reilly Media
Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, Paul Zikopoulos	Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data		McGrawHill Publishing
Reference Books:			
Anand Rajaraman and	Mining of Massive		CUP

Jeffrey David Ullman	Datasets		
Bill Franks	Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics		John Wiley& sons
Glenn J. Myatt	Making Sense of Data		John Wiley & Sons
Pete Warden	Big Data Glossary		O'Reilly

List of equipment/apparatus for laboratory experiments:

Sl. No.	
1.	Computer with moderate configuration
2.	Linux os or VM
3.	Hadoop 2.x or higher and other software as required.

End Semester Examination Scheme. Maximum Marks-70. Time allotted-3hrs.

Group	**Unit**	**Objective Questions** (MCQ only with the correct answer)		**Subjective Questions**			
		No of question to be set	Total Marks	No of question to be set	To answer	Marks per question	Total Marks
A	**1 to 5**	**10**	**10**				
B	**1 to 5**			**5**	**3**	**5**	**60**
C	**1 to 5**			**5**	**3**	**15**	

- Only multiple choice type question (MCQ) with one correct answer are to be set in the objective part.
- Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.

Examination Scheme for end semester examination:

Group	**Chapter**	**Marks of each question**	**Question to be set**	**Question to be answered**
A	**All**	**1**	**10**	**10**

B	**All**	**5**	**5**	**3**
C	**All**	**15**	**5**	**3**

Examination Scheme for Practical Sessional examination:			
Practical Internal Sessional Continuous Evaluation			
Internal Examination:			
Continuous evaluation			**40**
External Examination: Examiner-			
Signed Lab Note Book		**10**	
On Spot Experiment		**40**	
Viva voce		**10**	**60**

Name of the Course: B.Sc. in Information Technology (Internet of Things) **Subject:** Data Science in IoT & Data Science in IoT Lab	
Course Code: BITIOT602 & BITIOT692	**Semester: VI**
Duration: 36 Hrs	**Maximum Marks:100+100**
Teaching Scheme	**Examination Scheme**
Theory: 3 hrs./week	End Semester Exam:70
Tutorial: 0	Attendance: 5
Practical: 4 hrs./week	Continuous Assessment: 25
Credit: 3+2	Practical Sessional internal continuous evaluation: 40
	Practical Sessional external examination: 60

Aim:	
Sl. No.	
1.	To gain basic knowledge of data and information.
2.	To gain basic knowledge of data science.
3.	To understand the history, potential application area and future of data science.
4.	To gain basic knowledge of machine learning.
5.	To gain the knowledge between data science and IoT.
Objective:	
Sl. No.	
1.	To gain knowledge of data, information and data science.
2.	To be able to identify problems related to data science.
3.	To be able to enhance logical thinking.
4.	To be able to understand basic machine learning principles and apply the knowledge in appropriate domains.
Pre-Requisite:	
Sl. No.	
1.	Knowledge of basic mathematics.

2.	Analytical and Logical skills.		
3.	Knowledge of Internet of Things.		
Contents		**3 Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	**Introduction** What is Data Science? - Big Data and Data Science hype – and getting past the hype - Why now? – Datafication - Current landscape of perspectives - Skill sets needed.	**2**	**5**
02	**Introduction to Statistics** Statistical Inference - Populations and samples - Statistical modeling, probability distributions, fitting a model - Intro to R.	**4**	**5**
03	**Data Analysis** Exploratory Data Analysis and Data Science Process - Basic tools (plots, graphs and summary statistics) of EDA - Philosophy of EDA - The Data Science Process - Case Study: RealDirect (online real estate firm).	**4**	**10**
04	**Machine Learning** Three Basic Machine Learning Algorithms - Linear Regression - k-Nearest Neighbors (k-NN) - k-means.	**4**	**10**
05	**Application of Machine Learning** One More Machine Learning Algorithm and Usage in Applications - Motivating application: Filtering Spam - Why Linear Regression and k-NN are poor choices for Filtering Spam - Naive Bayes and why it works for Filtering Spam - Data Wrangling: APIs and other tools for scrapping the Web.	**3**	**10**
06	**Introduction to Feature** Feature Generation and Feature Selection (Extracting Meaning From Data) - Motivating application: user (customer) retention - Feature Generation (brainstorming, role of domain expertise, and place for imagination) - Feature Selection algorithms – Filters; Wrappers; Decision Trees; Random Forests.	**3**	**10**
07	**Recommendation Systems**	**4**	**5**

	Building a User-Facing Data Product - Algorithmic ingredients of a Recommendation Engine - Dimensionality Reduction - Singular Value Decomposition - Principal Component Analysis - Exercise: build your own recommendation system.		
08	**Social-Network Graphs** Mining Social-Network Graphs - Social networks as graphs - Clustering of graphs - Direct discovery of communities in graphs - Partitioning of graphs - Neighborhood properties in graphs.	**4**	**5**
09	**Data Visualization** Data Visualization - Basic principles, ideas and tools for data visualization 3 - Examples of inspiring (industry) projects - Exercise: create your own visualization of a complex dataset.	**4**	**5**
10	**Data Science and Ethical Issues** Discussions on privacy, security, ethics - A look back at Data Science - Next-generation data scientists.	**4**	**5**
	Sub Total:	**36**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**40**	**100**

Practical:

Skills to be developed:

Intellectual skills:

1. Specific analytics models used in IoT verticals
2. Pre-processing for IoT
3. Real Time processing and IoT

List of Practical: Based on theory lectures.

Assignments:

Adhered to theory curriculum as conducted by the subject teacher.

List of Books

Text Books:

Name of Author	Title of the Book	Edition/ISSN/ISBN	Name of the

			Publisher
Cathy O'Neil and Rachel Schutt	Doing Data Science, Straight Talk From The Frontline		O'Reilly
Trevor Hastie, Robert Tibshirani and Jerome Friedman	The Elements of Statistical Learning: Data Mining, Inference, and Prediction	Second Edition. ISBN 0387952845. 2009.	Springer
Reference Books:			
Foster Provost and Tom Fawcett	Data Science for Business: What You Need to Know about Data Mining and Data-analytic Thinking	1st edition	Shroff
Kai Hwang, Min Chen	Big–Data Analytics for Cloud, IoT and Cognitive Computing	1st edition	Wiley-Blackwell
Arshdeep Bahga	Big Data Analytics: A Hands-On Approach	1st edition	VPT
List of equipment/apparatus for laboratory experiments:			
Sl. No.			
1.	Computer with moderate configuration		
2.	AWS IoT Analytics		
3.	Hadoop 2.x or higher and other software as required.		
4.	AT&T IoT Platform		

End Semester Examination Scheme.		**Maximum Marks-70.**				**Time allotted-3hrs.**	
Group	**Unit**	**Objective Questions** (MCQ only with the correct answer)		**Subjective Questions**			
		No of	Total	No of	To	Marks	Total

		question to be set	Marks	question to be set	answer	per question	Marks
A	**1 to 10**	**10**	**10**				
B	**1 to 10**			**5**	**3**	**5**	**60**
C	**1 to 10**			**5**	**3**	**15**	

- Only multiple choice type question (MCQ) with one correct answer are to be set in the objective part.
- Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.

Examination Scheme for end semester examination:

Group	Chapter	Marks of each question	Question to be set	Question to be answered
A	**All**	**1**	**10**	**10**
B	**All**	**5**	**5**	**3**
C	**All**	**15**	**5**	**3**

Examination Scheme for Practical Sessional examination:

Practical Internal Sessional Continuous Evaluation

Internal Examination:

Continuous evaluation			**40**

External Examination: Examiner-

Signed Lab Note Book	**10**	
On Spot Experiment	**40**	
Viva voce	**10**	**60**

Name of the Course: B.Sc. in Information Technology (Internet of Things) **Subject:** Machine Learning for Financial Modelling and Forecasting			
Course Code: BITIOT603A		**Semester: VI**	
Duration: 36 Hrs.		**Maximum Marks: 100**	
Teaching Scheme		**Examination Scheme**	
Theory: 3 hrs./week		End Semester Exam: 70	
Tutorial: 0		Attendance : 5	
Practical:0		Continuous Assessment:25	
Credit: 3		Practical Sessional internal continuous evaluation: NA	
		Practical Sessional external examination: NA	
Aim:			
Sl. No.			
1.	Aim of this study to predict supply/demand/inventory of the market, and improve business performance.		
Objective:			
Sl. No.			
1.	To acquire expertise in the mechanics of the most popular machine learning models, and their inter-relationship, in order to do proper model selection and fitting.		
2.	To understand the behavior of financial time series, their statistical properties, and learn to design and assess financial forecasting models and investment strategies based on supervised learning models or other models that use different types (quantitative and qualitative) of information sets.		
Pre-Requisite:			
Sl. No.			
1.	Foundations of Data Science. Basic Statistics.		
2.	Knowledge of R or Python		
Contents		**Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	**Understanding Financial Time Series Data:** Asset's price and return. Basic statistics of returns. Measures of dependence. Stationarity. Forecasting. Volatility. Technical and Fundamental Financial indicators as information set.	**9**	**17**

02	**Financial Time Series Modeling:** Linear regression models and GARCH nonlinear model (quick review). Kernels in Statistical Machine Learning. Support Vector Regression. Neural Networks. Feed-forward networks. Multilayered Networks (Deep Learners). Recurrent networks. LSTM. Data preprocessing and Evaluation of Model Estimation.	**9**	**17**
03	**Optimization** Heuristics in Finance. Random search. Simulated Annealing, Genetic Programming, and other heuristics. Using heuristics for parameter estimation of GARCH, SVM, and Neural networks.	**9**	**18**
04	**Applications** Estimating and Forecasting Financial time series. Algorithmic trading. Porfolio selection. Portfolio optimization under different constraints sets. Credit scoring.	**9**	**18**
	Sub Total:	**36**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**40**	**100**

Assignments:
Based on the curriculum as covered by subject teacher.
List of Books
Text Books:

Name of Author	Title of the Book	Edition/ISSN/ISBN	Name of the Publisher
A. Arratia	Computational Finance, An Introductory Course with R		Atlantis Press & Springer, 2014
P. Cortez	Modern Optimization with R	2014	
Reference Books:			
R. Tsay	Analysis of Financial Time Series		Wiley, 2013
Cover, T. A., and Thomas, J. A.,	Elements of Information Theory	Second ed.	(Wiley, 2006).

End Semester Examination Scheme.		**Maximum Marks-70.**					**Time allotted-3hrs.**
Group	**Unit**	**Objective Questions** (MCQ only with the correct answer)		**Subjective Questions**			
		No of question to be set	Total Marks	No of question to be set	To answer	Marks per question	Total Marks
A	**1 to 4**	**10**	**10**				**60**
B	**1 to 4**			**5**	**3**	**5**	
C	**1 to 4**			**5**	**3**	**15**	

- Only multiple choice type question (MCQ) with one correct answer are to be set in the objective part.
- Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.

Examination Scheme for end semester examination:

Group	**Chapter**	**Marks of each question**	**Question to be set**	**Question to be answered**
A	**All**	**1**	**10**	**10**
B	**All**	**5**	**5**	**3**
C	**All**	**15**	**3**	**3**

Name of the Course: B.Sc. in Information Technology (Internet of Things) **Subject:** Machine Learning for IoT Applications	
Course Code: BITIOT603 B	**Semester: VI**
Duration: 36 Hrs.	**Maximum Marks: 100**
Teaching Scheme	**Examination Scheme**
Theory: 3 hrs./week	**End Semester Exam: 70**
Tutorial: 0	**Attendance : 5**
Practical: 0	**Continuous Assessment: 25**
Credit: 3	**Practical Sessional internal continuous evaluation: NA**
	Practical Sessional external examination: NA

Aim:	
Sl. No.	
1.	Understand Machine Learning approach and its relationship with data science
2.	Identify the application.
3.	Define Machine Learning (ML) and understand its relationship with IoT.

Objective:	
Sl. No.	
1.	Gain a historical perspective of machine learning and its foundations
2.	Become familiar with basic principles of machine learning toward problem solving, inference, perception, knowledge representation, and learning.
3.	Investigate applications of AI techniques in intelligent agents, expert systems, artificial neural networks and other machine learning models.
4.	Experience machine learning development tools such as expert system shell, and/or data mining tool.
5.	Experiment with a machine learning model for simulation and analysis.
6.	Explore the current scope, potential, limitations, and implications of machine learning.

Pre-Requisite:	
Sl. No.	
1.	**Basic Statistical and Computational knowledge**

Contents		**4 Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	**Artificial intelligence fundamentals** A.I. systems integrating approaches and methods.- Advanced search-	**7**	**14**

	Constraint satisfaction problems - Knowledge representation and reasoning - Non-standard logics - Uncertain and probabilistic reasoning (Bayesian networks, fuzzy sets).- Foundations of semantic web: semantic networks and description logics. - Rules systems: use and efficient implementation.- Planning systems		
02	**Machine learning** Computational learning tasks for predictions, learning as function approximation, generalization concept. - Linear models and Nearest-Neighbors (learning algorithms and properties, regularization). - Neural Networks (MLP and deep models, SOM). - Probabilistic graphical models. - Principles of learning processes: elements of statistical learning theory, model validation. - Support Vector Machines and kernel-based models. - Introduction to applications and advanced models. Applicative project: implementation and use of ML/NN models with emphasis to the rigorous application of validation techniques	**7**	**14**
03	**Human language technologies** Formal and statistical approaches to NLP. Statistical methods: Language Model, Hidden Markov Model, Viterbi Algorithm, Generative vs Discriminative Models Linguistic essentials (tokenization, morphology, PoS, collocations, etc.). Parsing (constituency and dependency parsing).Processing Pipelines. Lexical semantics: corpora, thesauri, gazetteers. Distributional Semantics: Word embeddings, Character embeddings. Deep Learning for natural language. **Applications:** Entity recognition, Entity linking, classification, summarization. Opinion mining, Sentiment Analysis. Question answering, Language inference, Dialogic interfaces. Statistical Machine Translation. NLP libraries: NLTK, Theano, Tensorflow	**7**	**14**
04	**Intelligent Systems for Pattern Recognition** Particular focus will be given to pattern recognition problems and models dealing with sequential and time-series data-Signal processing and time-series analysis-Image processing, filters and visual feature detectors-Bayesian learning and deep learning for machine vision and signal processing-Neural network models for pattern recognition on non-vectorial data (physiological data, sensor streams, etc)-Kernel and adaptive methods for relational data-Pattern recognition applications:	**7**	**14**

	machine vision, bio informatics, robotics, medical imaging, etc.-ML and deep learning libraries overview: e.g. scikit-learn, Keras, Theano		
05	**Smart applications and Robotics** Common designs for smart applications examples: fuzzy logic in control systems or cloud analysis of field sensors data streams Make or buy: selecting appropriate procurement strategies example: writing your own RRN architecture vs. using cloud services Development platforms for smart objects examples: Brillo (IoT devices) or Android TV (Smart TVs) Development platforms for smart architectures examples: TensorFlow (server-side RNNs), or the Face Recognition API (mobile) Cloud services for smart applications examples: Google Cloud Machine Learning API, Google Cloud Vision API, Google Cloud Speech API, or Deploying Deep Neural Networks on Microsoft Azure GPU VMs Deployment and operations examples: cloud hosting vs. device hosting, or harnessing user feedback to drive improvement Measuring success: methods and metrics examples: defining user engagement and satisfaction metrics, or assessing the naturalness of smart interactions **Introduction to robotics:** main definitions, illustration of application domains-Mechanics and kinematics of the robot-Sensors for robotics-Robot Control-Architectures for controlling behaviour in robots-Robotic Navigation-Tactile Perception in humans and robots-Vision in humans and robots-Analysis of case studies of robotic systems-Project laboratory: student work in the lab with robotic systems	**8**	**14**
	Sub Total:	**36**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**40**	**100**

List of Books
Text Books:

Name of Author	**Title of the Book**	**Edition/ISSN/ISBN**	**Name of the Publisher**
Amita Kapoor	Hands-On Artificial Intelligence for IoT: Expert machine learning and deep learning	1st edition	Packt Publishing
Stuart Russell and Peter	Artificial Intelligence: A		

Norvig	Modern Approach		
Nils J Nilsson	Artificial Intelligence: A New Sythesis		
Reference Books:			
Negnevitsky	Artificial Intelligence		
AkerkarRajendr	Intro. to artificial intelligence		
AnandHareendran S and Vinod Chandra S S	Artificial Intelligence and Machine Learning		

End Semester Examination Scheme. Maximum Marks-70. Time allotted-3hrs.

Group	**Unit**	**Objective Questions** (MCQ only with the correct answer)		**Subjective Questions**			
		No of question to be set	Total Marks	No of question to be set	To answer	Marks per question	Total Marks
A	1to 5	10	10				
B	1to 5			5	3	5	60
C	1to 5			5	3	15	

- Only multiple choice type question (MCQ) with one correct answer are to be set in the objective part.
- Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.

Examination Scheme for end semester examination:

Group	**Chapter**	**Marks of each question**	**Question to be set**	**Question to be answered**
A	All	1	10	10
B	All	5	5	3
C	All	15	5	3

Name of the Course: B.Sc. in Information Technology (Internet of Things) **Subject:** Data Warehousing			
Course Code: BITIOT603C		**Semester: VI**	
Duration: 36 Hrs.		**Maximum Marks: 100**	
Teaching Scheme		**Examination Scheme**	
Theory: 3 hrs./week		End Semester Exam: 70	
Tutorial: 0		Attendance : 5	
Practical:		Continuous Assessment:25	
Credit: 3		Practical Sessional internal continuous evaluation: NA	
		Practical Sessional external examination: NA	
Aim:			
Sl. No.			
1.	Understand the components, architecture and other important tools of data warehousing.		
Objective:			
Sl. No.			
1.	Be familiar with the concepts of data warehouse and data mining,		
2.	Be acquainted with the tools and techniques used for Knowledge Discovery in Databases.		
Pre-Requisite:			
Sl. No.			
1.	Data Base Management System		
Contents		**Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	Introduction to Data Warehousing; Data Mining: Mining frequent patterns, association and correlations; Sequential Pattern Mining concepts, primitives, scalable methods	**6**	**5**
02	Classification and prediction; Cluster Analysis – Types of Data in Cluster Analysis, Partitioning methods, Hierarchical Methods; Transactional Patterns and other temporal based frequent patterns	**6**	**20**
03	Mining Time series Data, Periodicity Analysis for time related sequence data, Trend analysis, Similarity search in Time-series analysis	**6**	**5**

04	Mining Data Streams, Methodologies for stream data processing and stream data systems, Frequent pattern mining in stream data, Sequential Pattern Mining in Data Streams, Classification of dynamic data streams, Class Imbalance Problem; Graph Mining; Social Network Analysis	**10**	**10**
05	Web Mining, Mining the web page layout structure, mining web link structure, mining multimedia data on the web, Automatic classification of web documents and web usage mining; Distributed Data Mining	**6**	**10**
06	Recent trends in Distributed Warehousing and Data Mining, Class Imbalance Problem; Graph Mining; Social Network Analysis	**3**	
	Sub Total:	**36**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**40**	**100**

Assignments:

Based on the curriculum as covered by subject teacher.

List of Books

Text Books:

Name of Author	**Title of the Book**	**Edition/ISSN/ISBN**	**Name of the Publisher**
Alex Berson and Stephen J. Smith	Data Warehousing, Data Mining, & OLAP	Second Edition	TataMcGraw Hill Education
Sam Aanhory & Dennis Murray	Data Warehousing in the Real World		Pearson Edn Asia
Reference Books:			
Ralph Kimball	Data warehouse Toolkit		Wiley India
Paulraj Ponnaiah Wiley	Data Warehousing Fundamentals		
K.P.Soman,S.Diwakar, V.Ajay	Insight into Data Mining		PHI

End Semester Examination Scheme. Maximum Marks-70. Time allotted-3hrs.

Group	**Unit**	**Objective Questions** (MCQ only with the	**Subjective Questions**

		correct answer)					
		No of question to be set	Total Marks	No of question to be set	To answer	Marks per question	Total Marks
A **B** **C**	**1 to 6** **1 to 6** **1 to 6**	**10**	**10**	**5** **5**	**3** **3**	**5** **15**	**60**

- Only multiple choice type question (MCQ) with one correct answer are to be set in the objective part.
- Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.

Examination Scheme for end semester examination:

Group	Chapter	Marks of each question	Question to be set	Question to be answered
A	**All**	**1**	**10**	**10**
B	**All**	**5**	**5**	**3**
C	**All**	**15**	**3**	**3**

Name of the Course: B.Sc. in Information Technology (Internet of Things) **Subject:** Natural Language Processing			
Course Code: BITIOT604		**Semester: VI**	
Duration: 36 Hrs.		**Maximum Marks: 100**	
Teaching Scheme		**Examination Scheme**	
Theory: 3 hrs./week		End Semester Exam: 70	
Tutorial: 0		Attendance : 5	
Practical:1 hr./week		Continuous Assessment:25	
Credit: 4		Practical Sessional internal continuous evaluation:NA	
		Practical Sessional external examination:NA	
Aim:			
Sl. No.			
1.	Process the text data at syntactic and semantic level.		
2.	Extract the ¬key information from Text data.		
3.	Analyze the text content to provide predictions related to a specific domain using language models.		
Objective:			
Sl. No.			
1.	To get introduced to language processing technologies for processing the text data		
2.	To understand the role of Information Retrieval and Information Extraction in Text Analytics.		
3.	To acquire knowledge on text data analytics using language models.		
Pre-Requisite:			
Sl. No.			
1.	Programming Knowledge in python/R		
Contents		**Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	**Regular Expressions and Automata Recap-** Introduction to NLP, Regular Expression, Finite State Automata	**11**	**20**

	Tokenization - Word Tokenization, Normalization, Sentence Segmentation, Named Entity Recognition, Multi Word Extraction, Spell Checking – Bayesian Approach, Minimum Edit Distance **Morphology** – Inflectional and Derivational Morphology, Finite State Morphological Parsing, The Lexicon and Morphotactics, Morphological Parsing with Finite State Transducers, Orthographic Rules and Finite State Transducers, Porter Stemmer		
02	**Language Modeling** Introduction to N-grams, Chain Rule, Smoothing – Add-One Smoothing, Witten-Bell Discounting; Backoff, Deleted Interpolation, N-grams for Spelling and Word Prediction, Evaluation of language models. **Hidden Markov Models and POS Tagging** Markov Chain, Hidden Markov Models, Forward Algorithm, Viterbi Algorithm, Part of Speech Tagging – Rule based and Machine Learning based approaches, Evaluation.	**8**	**20**
03	**Text Classification** Text Classification, Naïve Bayes' Text Classification, Evaluation, Sentiment Analysis – Opinion Mining and Emotion Analysis, Resources and Techniques. **Context Free Grammar** Context Free Grammar and Constituency, Some common CFG phenomena for English, Top-Down and Bottom-up parsing, Probabilistic Context Free Grammar, Dependency Parsing	**8**	**20**
04	**Computational Lexical Semantics** Introduction to Lexical Semantics – Homonymy, Polysemy, Synonymy, Thesaurus – WordNet, Computational Lexical Semantics – Thesaurus based and Distributional Word Similarity **Information Retrieval** Boolean Retrieval, Term-document incidence, The Inverted Index, Query Optimization, Phrase Queries, Ranked Retrieval – Term Frequency – Inverse Document Frequency based ranking, Zone Indexing, Query term proximity, Cosine ranking, Combining different features for ranking, Search Engine Evaluation, Relevance Feedback	**9**	**10**
	Sub Total:	**36**	**70**
	Internal Assessment Examination & Preparation of Semester	**4**	**30**

	Examination		
	Total:	**40**	**100**

Assignments:

Based on the curriculum as covered by subject teacher.

List of Books

Text Books:

Name of Author	Title of the Book	Edition/ISSN/ISBN	Name of the Publisher
Jurafsky and Martin,	Speech and Language Processing		Pearson Education
Manning and Schutze	Foundation of Statistical Natural Language Processing		MIT Press

Reference Books:

	Multilingual Natural Language Processing Applications from Theory to Practice		Bikel, Pearson
Matthew A. Russell	Mining the Social Web		O'Reilly

End Semester Examination Scheme. **Maximum Marks-70.** **Time allotted-3hrs.**

Group	Unit	Objective Questions (MCQ only with the correct answer)		Subjective Questions			
		No of question to be set	Total Marks	No of question to be set	To answer	Marks per question	Total Marks
A	**1 to 7**	**10**	**10**				**60**
B	**1 to 7**			**5**	**3**	**5**	
C	**1 to 7**			**5**	**3**	**15**	

- Only multiple choice type question (MCQ) with one correct answer are to be set in the objective part.
- Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.

Examination Scheme for end semester examination:				
Group	**Chapter**	**Marks of each question**	**Question to be set**	**Question to be answered**
A	**All**	**1**	**10**	**10**
B	**All**	**5**	**5**	**3**
C	**All**	**15**	**3**	**3**

Name of the Course: B.Sc. in Information Technology (Internet of Things) **Subject:** Grand Viva Voce	
Course Code: BITIOT681	**Semester: VI**
Duration: 36 Hrs.	**Maximum Marks: 100**
Teaching Scheme	**Examination Scheme**
Theory: 0	**End Semester Exam: 100**
Tutorial: 0	**Attendance: 0**
Practical: 2 hrs./week	**Continuous Assessment: 0**
Credit: 1	**Practical Sessional internal continuous evaluation: 0**
	Practical Sessional external examination: 0
Contents	
Students will give a viva from the entire subject that they have covered in the course.	

Name of the Course: B.Sc. in Information Technology (Internet of Things) **Subject:** Major Project II	
Course Code: BITIOT682	**Semester: VI**
Duration: 36 Hrs.	**Maximum Marks: 100**
Teaching Scheme	**Examination Scheme**
Theory: 0	**End Semester Exam: 100**
Tutorial: 0	**Attendance: 0**
Practical: 4 hrs./week	**Continuous Assessment: 0**
Credit: 2	**Practical Sessional internal continuous evaluation: 40**
	Practical Sessional external examination: 60
Contents	
Students will do projects on application areas of latest technologies and current topics of societal relevance.	