



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**  
 (Established by Govt. of A.P., ACT No.30 of 2008)  
 ANANTHAPURAMU – 515 002 (A.P) INDIA

**Computer Science & Engineering (Internet of Things)**

**II B.TECH.**

**Semester-III**

S.No	Course Code	Course Name	Category	Hours per week			Credits
				L	T	P	
1.	20A54304	Discrete Mathematics & Graph Theory	BS	3	0	0	3
2.	20A04304T	Digital Electronics& Microprocessors	ES	3	0	0	3
3.	20A05303	Computer Organization	PC	3	0	0	3
4.	20A05301T	Advanced Data Structures & Algorithms	PC	3	0	0	3
5.	20A35301T	Sensor and IoT	PC	3	0	0	3
6.	20A04304P	Digital Electronics& Microprocessors Lab	ES	0	0	3	1.5
7.	20A05301P	Advanced Data Structures and Algorithms Lab	PC	0	0	3	1.5
8.	20A35301P	Sensor and IoT Lab					
9	20A35302	<b>Skill Oriented Course – I</b> Programming Arduino	SC	1	0	2	2
10	20A99201	<b>Mandatory noncredit course - II</b> Environmental Science	MC	3	0	0	0
<b>Total</b>							<b>21.5</b>

**Semester-IV**

S.No	Course Code	Course Name	Category	Hours per week			Credits
				L	T	P	
1.	20A54406	Mathematical Modeling and Simulation	BS	3	0	0	3
2.	20A05401T	Database Management Systems	PC	3	0	0	3
3.	20A05402T	Operating Systems	PC	3	0	0	3
4.	20A05403T	Software Engineering	PC	3	0	0	3
5.	20A52301 20A52302 20A52303	<b>Humanities Elective– I</b> Managerial Economics & Financial Analysis Organizational Behaviour Business Environment	HS	3	0	0	3
6.	20A05401P	Database Management SystemsLab	PC	0	0	3	1.5
7.	20A05402P	Operating SystemsLab	PC	0	0	3	1.5
8.	20A05403P	Software Engineering Lab	PC	0	0	3	1.5
9.	20A35401	<b>Skill Oriented Course– II</b> Python Programming for IoT	SC	1	0	2	2
10.	20A99401	<b>Mandatory noncredit course – III</b> Design Thinking for Innovation	MC	2	1	0	0
11.	20A99301	NSS/NCC/NSO Activities	MC	0	0	2	0
<b>Total</b>							<b>21.5</b>
Community Service Internship/Project(Mandatory) for 6 weeks duration during summer vacation							



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**Note:**

1. Eligible and interested students can register either for Honors or for a Minor in IV Semester as per the guidelines issued by the University
2. Students shall register for NCC/NSS/NSO activities and will be required to participate in an activity for two hours in a week during fourth semester.
3. Lateral entry students shall undergo a bridge course in Mathematics during third semester



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Course Code	Discrete Mathematics & Graph theory (Common to CSE, IT, CSE( DS), CSE (IoT), CSE (AI), CSE (AI & ML) and AI & DS)		L	T	P	C
20A54304			3	0	0	3
<b>Pre-requisite</b>	<b>Basic Mathematics</b>	<b>Semester</b>	<b>III</b>			
Course Objectives:						
Introduce the concepts of mathematical logic and gain knowledge in sets, relations and functions and Solve problems using counting techniques and combinatorics and to introduce generating functions and recurrence relations. Use Graph Theory for solving real world problems						
Course Outcomes (CO):						
After completion of the course, students will be able to						
<ul style="list-style-type: none"> <li>• Apply mathematical logic to solve problems.</li> <li>• Understand the concepts and perform the operations related to sets, relations and functions.</li> <li>• Gain the conceptual background needed and identify structures of algebraic nature.</li> <li>• Apply basic counting techniques to solve combinatorial problems.</li> <li>• Formulate problems and solve recurrence relations.</li> <li>• Apply Graph Theory in solving computer science problems</li> </ul>						
UNIT - I	<b>Mathematical Logic</b>		8 Hrs			
Introduction, Statements and Notation, Connectives, Well-formed formulas, Tautology, Duality law, Equivalence, Implication, Normal Forms, Functionally complete set of connectives, Inference Theory of Statement Calculus, Predicate Calculus, Inference theory of Predicate Calculus.						
UNIT - II	<b>Set theory</b>		9 Hrs			
Basic Concepts of Set Theory, Relations and Ordering, The Principle of Inclusion- Exclusion, Pigeon hole principle and its application, Functions composition of functions, Inverse Functions, Recursive Functions, Lattices and its properties. Algebraic structures: Algebraic systems-Examples and General Properties, Semi groups and Monoids, groups, sub groups, homomorphism, Isomorphism.						
UNIT - III	<b>Elementary Combinatorics</b>		8 Hrs			
Basics of Counting, Combinations and Permutations, Enumeration of Combinations and Permutations, Enumerating Combinations and Permutations with Repetitions, Enumerating Permutations with Constrained Repetitions, Binomial Coefficients, The Binomial and Multinomial Theorems.						
UNIT - IV	<b>Recurrence Relations</b>		9 Hrs			
Generating Functions of Sequences, Calculating Coefficients of Generating Functions, Recurrence relations, Solving Recurrence Relations by Substitution and Generating functions, The Method of Characteristic roots, Solutions of Inhomogeneous Recurrence Relations.						
UNIT - V	<b>Graphs</b>		9 Hrs			
Basic Concepts, Isomorphism and Subgraphs, Trees and their Properties, Spanning Trees, Directed Trees, Binary Trees, Planar Graphs, Euler's Formula, Multigraphs and Euler Circuits, Hamiltonian Graphs, Chromatic Numbers, The Four Color Problem						
Textbooks:						



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1. Joe L. Mott, Abraham Kandel and Theodore P. Baker, Discrete Mathematics for Computer Scientists & Mathematicians, 2nd Edition, Pearson Education.
2. J.P. Tremblay and R. Manohar, Discrete Mathematical Structures with Applications to Computer Science, Tata McGraw Hill, 2002.

Reference Books:

1. Kenneth H. Rosen, Discrete Mathematics and its Applications with Combinatorics and Graph Theory, 7th Edition, McGraw Hill Education (India) Private Limited.
2. Graph Theory with Applications to Engineering and Computer Science by Narsingh Deo.

Online Learning Resources:

<http://www.cs.yale.edu/homes/aspnes/classes/202/notes.pdf>





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|--|
| <ol style="list-style-type: none"><li>1. Thomas L. Floyd, Digital Fundamentals – A Systems Approach, Pearson, 2013.</li><li>2. Charles H. Roth, Fundamentals of Logic Design, Cengage Learning, 5th, Edition, 2004.</li><li>3. D.V.Hall, Microprocessors and Interfacing. TMGH, 2nd edition, 2006.</li><li>4. Kenneth.J.Ayala, The 8051 microcontroller, 3rd edition, Cengage Learning,2010.</li></ol> |
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<b>Online Learning Resources:</b>
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NPTEL, SWAYAM
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Course Code	Computer Organization	L	T	P	C
20A05303	(Common to CSE, IT, CSE( DS), CSE (IoT), CSE (AI), CSE (AI & ML) and AI & DS)	3	0	0	3
Pre-requisite	Digital Electronics	Semester		III	
<b>Course Objectives:</b>					
<ul style="list-style-type: none"> <li>To learn the fundamentals of computer organization and its relevance to classical and modern problems of computer design</li> <li>To understand the structure and behavior of various functional modules of a computer.</li> <li>To learn the techniques that computers use to communicate with I/O devices</li> <li>To acquire the concept of pipelining and exploitation of processing speed.</li> <li>To learn the basic characteristics of multiprocessors</li> </ul>					
<b>Course Outcomes (CO):</b>					
After completion of the course, students will be able to					
<ul style="list-style-type: none"> <li>Understand computer architecture concepts related to the design of modern processors, memories and I/Os</li> <li>Identify the hardware requirements for cache memory and virtual memory</li> <li>Design algorithms to exploit pipelining and multiprocessors</li> <li>Understand the importance and trade-offs of different types of memories.</li> <li>Identify pipeline hazards and possible solutions to those hazards</li> </ul>					
UNIT - I	<b>Basic Structure of Computer, Machine Instructions and Programs</b>	8Hrs			
<b>Basic Structure of Computer:</b> Computer Types, Functional Units, Basic operational Concepts, Bus Structure, Software, Performance, Multiprocessors and Multicomputer. <b>Machine Instructions and Programs:</b> Numbers, Arithmetic Operations and Programs, Instructions and Instruction Sequencing, Addressing Modes, Basic Input/output Operations, Stacks and Queues, Subroutines, Additional Instructions.					
UNIT - II	<b>Arithmetic, Basic Processing Unit</b>	9Hrs			
<b>Arithmetic:</b> Addition and Subtraction of Signed Numbers, Design of Fast Adders, Multiplication of Positive Numbers, Signed-operand Multiplication, Fast Multiplication, Integer Division, Floating-Point Numbers and Operations. <b>Basic Processing Unit:</b> Fundamental Concepts, Execution of a Complete Instruction, Multiple-Bus Organization, Hardwired Control, and Multi programmed Control.					
UNIT - III	<b>The Memory System</b>	8Hrs			
<b>The Memory System:</b> Basic Concepts, Semiconductor RAM Memories, Read-Only Memories, Speed, Size and Cost, Cache Memories, Performance Considerations, Virtual Memories, Memory Management Requirements, Secondary Storage.					
UNIT - IV	<b>Input/Output Organization</b>	8Hrs			
<b>Input/Output Organization:</b> Accessing I/O Devices, Interrupts, Processor Examples, Direct Memory Access, Buses, Interface Circuits, Standard I/O Interfaces.					
UNIT - V	<b>Pipelining, Large Computer Systems</b>	9 Hrs			
<b>Pipelining:</b> Basic Concepts, Data Hazards, Instruction Hazards, Influence on Instruction Sets. <b>Large Computer Systems:</b> Forms of Parallel Processing, Array Processors, The Structure of General-Purpose multiprocessors, Interconnection Networks.					
Textbooks:					



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|--|
| 1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, “Computer Organization”, 5 <sup>th</sup> Edition, McGraw Hill Education, 2013. |
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<b>Reference Books:</b>
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|---|
| <ol style="list-style-type: none"><li>1. M.Morris Mano, “Computer System Architecture”, 3<sup>rd</sup> Edition, Pearson Education.</li><li>2. Themes and Variations, Alan Clements, “Computer Organization and Architecture”, CENGAGE Learning.</li><li>3. SmrutiRanjanSarangi, “Computer Organization and Architecture”, McGraw Hill Education.</li><li>4. John P.Hayes, “Computer Architecture and Organization”, McGraw Hill Education</li></ol> |
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<b>Online Learning Resources:</b>
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<a href="https://nptel.ac.in/courses/106/103/106103068/">https://nptel.ac.in/courses/106/103/106103068/</a>
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Course Code	Advanced Data Structures & Algorithms (Common to CSE, IT, CSE( DS), CSE (IoT), CSE (AI), CSE (AI & ML) and AI & DS)	L	T	P	C
20A05301T		3	0	0	3
Pre-requisite	Data Structures	Semester		III	
<b>Course Objectives:</b>					
<ul style="list-style-type: none"> <li>Learn asymptotic notations, and analyze the performance of different algorithms.</li> <li>Understand and implement various data structures.</li> <li>Learn and implement greedy, divide and conquer, dynamic programming and backtracking algorithms using relevant data structures.</li> <li>Understand non-deterministic algorithms, polynomial and non-polynomial problems.</li> </ul>					
<b>Course Outcomes (CO):</b>					
After completion of the course, students will be able to <ul style="list-style-type: none"> <li>Analyze the complexity of algorithms and apply asymptotic notations.</li> <li>Apply non-linear data structures and their operations.</li> <li>Understand and apply greedy, divide and conquer algorithms.</li> <li>Develop dynamic programming algorithms for various real-time applications.</li> <li>Illustrate Backtracking algorithms for various applications.</li> </ul>					
UNIT - I	<b>Introduction to Algorithms</b>	9 Hrs			
<b>Introduction to Algorithms:</b> Algorithms, Pseudocode for expressing algorithms, Performance Analysis-Space complexity, Time complexity, Asymptotic Notation- Big oh, Omega, Theta notation and Little oh notation, Polynomial Vs Exponential Algorithms, Average, Best and Worst Case Complexities, Analysing Recursive Programs.					
UNIT - II	<b>Trees Part-I</b>	8 Hrs			
<b>Trees Part-I</b> <b>Binary Search Trees:</b> Definition and Operations, AVL Trees: Definition and Operations, Applications. <b>B Trees:</b> Definition and Operations.					
UNIT - III	<b>Trees Part-II</b>	8 Hrs			
<b>Trees Part-II</b> Red-Black Trees, Splay Trees, Applications. <b>Hash Tables:</b> Introduction, Hash Structure, Hash functions, Linear Open Addressing, Chaining and Applications.					
UNIT - IV	<b>Divide and conquer, Greedy method</b>	9 Hrs			
<b>Divide and conquer:</b> General method, applications-Binary search, Finding Maximum and minimum, Quick sort, Merge sort, Strassen's matrix multiplication. <b>Greedy method:</b> General method, applications-Job sequencing with deadlines, knapsack problem, Minimum cost spanning trees, Single source shortest path problem.					
UNIT - V	<b>Dynamic Programming &amp; Backtracking</b>	9 Hrs			
<b>Dynamic Programming:</b> General method, applications- 0/1 knapsack problem, All pairs shortest path problem, Travelling salesperson problem, Reliability design. <b>Backtracking:</b> General method, applications-n-queen problem, sum of subsets problem, graph coloring, Hamiltonian cycles. <b>Introduction to NP-Hard and NP-Complete problems:</b> Basic Concepts.					
Textbooks:					
1. Data Structures and algorithms: Concepts, Techniques and Applications, G A V Pai.					



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2. Fundamentals of Computer Algorithms, Ellis Horowitz, Sartaj Sahni and Rajasekharam, Galgotia publications Pvt. Ltd.

Reference Books:

1. Classic Data Structures by D. Samanta, 2005, PHI
2. Design and Analysis of Computer Algorithms by Aho, Hopcraft, Ullman 1998, PEA.
3. Introduction to the Design and Analysis of Algorithms by Goodman, Hedetniemi, TMG.

Online Learning Resources:

[https://www.tutorialspoint.com/advanced\\_data\\_structures/index.asp](https://www.tutorialspoint.com/advanced_data_structures/index.asp)

<http://peterindia.net/Algorithms.html>



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Course Code	SENSORS AND INTERNET OF THINGS		L	T	P	C
20A35301T			3	0	0	3
<b>Pre-requisite</b>	Basic Electrical and Electronics Engineering and Applied Physics	<b>Semester</b>	<b>III</b>			
<b>Course Objectives:</b>						
<ul style="list-style-type: none"> <li>• To provide knowledge on Sensor Principles.</li> <li>• To provide familiarity with different sensors and their application in real life.</li> <li>• To understand Basics of IoT, and enabling technologies.</li> <li>• To design IoT applications using Arduino and Raspberry pi.</li> </ul>						
<b>Course Outcomes (CO):</b>						
After completion of the course, students will be able to						
<ul style="list-style-type: none"> <li>• Demonstrate knowledge on the characteristics of sensors and principles of IoT.</li> <li>• Select appropriate sensors for the given application development.</li> <li>• Design basic IoT Applications using Arduino.</li> <li>• Design IoT Applications using Raspberry Pi.</li> <li>• Perform Data Acquisition and analysis using Cloud and Tkinter</li> </ul>						
UNIT - I	INTRODUCTION		09 Hours			
<p><b>Introduction to Sensors:</b> Sensors, Criteria to choose a Sensor, Generation of Sensors.</p> <p><b>Optical Sources and Detectors:</b> Electronic and Optical properties of semiconductor as sensors, LED, Semiconductor lasers, Fiber optic sensors, Thermal detectors, Photo multipliers, photoconductive detectors.</p> <p><b>Strain, Force, Torque and Pressure sensors:</b> Strain gages, strain gage beam force sensor, piezoelectric force sensor, load cell, torque sensor, Piezo-resistive and capacitive pressure sensor, optoelectronic pressure sensors, vacuum sensors.</p>						
UNIT - II	TYPES OF SENSORS AND APPLICATIONS		09 Hours			
<p><b>Position, Direction, Displacement, Level sensors Velocity and Acceleration sensors.</b></p> <p><b>Temperature sensors:</b> thermoresistive, thermoelectric, semiconductor and optical. Piezoelectric temperature sensor.</p> <p><b>Wearable Sensors:</b> From fibers to textile sensors - Interlaced network -Textile sensors for physiological state monitoring - Biomechanical sensing –Non-invasive sweat monitoring by textile sensors and other applications. FBG sensor in Intelligent Clothing and Biomechanics</p>						
UNIT - III	INTRODUCTION to ToT		09 Hours			
<p><b>Introduction to Internet of Things:</b> Characteristics of IoT, Design principles of IoT, IoT Architecture and Protocols, Enabling Technologies for IoT, IoT levels and IoT vs M2M.</p> <p><b>IoT Design Methodology:</b> Design methodology, Challenges in IoT Design, IoT System Management, IoT Servers..</p> <p><b>Basics of Arduino:</b> Introduction to Arduino, Arduino IDE, Basic Commands for Arduino, Connecting LEDs with Arduino, Connecting LCD with Arduino.</p>						
UNIT - IV	IoT APPLICATION DEVELOPMENT		09 Hours			



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<p><b>Basics of Raspberry Pi:</b> Introduction to Raspberry pi, Installation of NOOBS on SD Card, Installation of Raspbian on SD Card, Terminal Commands, Installation of Libraries on Raspberry Pi, Getting the static IP address of Raspberry Pi, Run a Program on Raspberry Pi, Installing the Remote Desktop Server, Pi Camera, Face Recognition using Raspberry Pi, Installation of I2C driver on Raspberry Pi, SPI (serial peripheral interface) with Raspberry Pi, Programming a Raspberry Pi, Play with LED and Raspberry Pi, Reading the digital input, Reading an edge triggered input, Interfacing of Relay with Raspberry Pi, Interfacing of Relay with Raspberry Pi, Interfacing of LCD with Raspberry Pi, Interfacing LCD with Raspberry Pi in I2C mode, Interfacing of DHT11 sensor with Raspberry Pi, Interfacing of ultrasonic sensor with Raspberry Pi, Interfacing of camera with Raspberry pi.</p>		
UNIT - V	DATA ACQUISITION AND CLOUD	09 Hours
<p><b>Data Acquisition with Python and Tkinter:</b> Basics-CSV file, Storing Arduino data with CSV file, Plotting random numbers using matplotlib, Plotting real-time from Arduino, Integrating the plots in the Tkinter window.</p> <p><b>Connecting to the Cloud:</b> Smart IoT Systems, DHT11 Data Logger with ThingSpeak Server, Ultrasonic Sensor Data Logger with ThingSpeak Server, Air Quality Monitoring System and Data Logger with ThingSpeak Server, Landslide Detection and Disaster Management System, Smart Motion Detector and Upload Image to gmail.com.</p>		
Textbooks:		
<ol style="list-style-type: none"> <li>1. J. Fraden, Handbook of Modern Sensors: Physical, Designs, and Applications, AIP Press, Springer, Fourth Edition, 2010.</li> <li>2. Rajesh Singh, Anita Gehlot, Lovi Raj Gupta, Bhupendra Singh, Mahendra Swain, Internet of Things with Raspberry Pi and Arduino, CRC Press, 2019.</li> </ol>		
Reference Books:		
<ol style="list-style-type: none"> <li>1. D. Patranabis, Sensors and Transducers, PHI Publication, New Delhi, 2003.</li> <li>2. Jan Holler and Vlasios Tsiatsis, From Machine-to-Machine to the Internet of Things Introduction to a New Age of Intelligence, Elsevier Ltd., 2014.</li> <li>3. David Hanes and Gonzalo Salgueiro, IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things, Cisco Press, 2017</li> </ol>		
Online Learning Resources:		
<ul style="list-style-type: none"> <li>• <a href="https://www.guru99.com/iot-tutorial.html">https://www.guru99.com/iot-tutorial.html</a></li> <li>• <a href="https://developer.ibm.com/technologies/iot/tutorials/">https://developer.ibm.com/technologies/iot/tutorials/</a></li> </ul>		



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Course Code	DIGITAL ELECTRONICS & MICROPROCESSORS LAB		L	T	P	C
20a04304P			0	0	3	1.5
<b>Pre-requisite</b>	<b>Basic Electronics Engineering</b>	<b>Semester</b>	<b>III</b>			
<b>Course Objectives:</b>						
<ul style="list-style-type: none"> <li>• To understand all the concepts of Logic Gates and Boolean Functions.</li> <li>• To learn about Combinational Logic and Sequential Logic Circuits.</li> <li>• To design logic circuits using Programmable Logic Devices.</li> <li>• To understand basics of 8086 Microprocessor and 8051 Microcontroller.</li> <li>• To understand architecture of 8086 Microprocessor and 8051 Microcontroller.</li> <li>• To learn Assembly Language Programming of 8086 and 8051.</li> </ul>						
<b>Course Outcomes (CO):</b>						
After Completion of this course, the student will be able to: <ul style="list-style-type: none"> <li>• Design any Logic circuit using basic concepts of Boolean Algebra.</li> <li>• Design any Logic circuit using basic concepts of PLDs.</li> <li>• Design and develop any application using 8086 Microprocessor.</li> <li>• Design and develop any application using 8051 Microcontroller.</li> </ul>						
<b>List of Experiments:</b>						
Note: Minimum of 12 (6+6) experiments shall be conducted from both the sections given below:						
<b>DIGITAL ELECTRONICS:</b>						
<ol style="list-style-type: none"> <li>1. Verification of Truth Table for AND, OR, NOT, NAND, NOR and EX-OR gates.</li> <li>2. Realisation of NOT, AND, OR, EX-OR gates with only NAND and only NOR gates.</li> <li>3. Karnaughmap Reduction and Logic Circuit Implementation.</li> <li>4. Verification of DeMorgan's Laws.</li> <li>5. Implementation of Half-Adder and Half-Subtractor.</li> <li>6. Implementation of Full-Adder and Full-Subtractor.</li> <li>7. Four Bit Binary Adder</li> <li>8. Four Bit Binary Subtractor using 1's and 2's Complement.</li> </ol>						
<b>MICROPROCESSORS (8086 Assembly Language Programming)</b>						
<ol style="list-style-type: none"> <li>1. 8 Bit Addition and Subtraction.</li> <li>2. 16 Bit Addition.</li> <li>3. BCD Addition .</li> <li>4. BCD Subtraction.</li> <li>5. 8 Bit Multiplication.</li> <li>6. 8 Bit Division.</li> <li>7. Searching for an Element in an Array.</li> <li>8. Sorting in Ascending and Descending Orders.</li> <li>9. Finding Largest and Smallest Elements from an Array.</li> <li>10. Block Move</li> </ol>						
<b>Text Books:</b>						



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- 1.M. Morris Mano, Michael D. Ciletti, Digital Design, Pearson Education, 5<sup>th</sup> Edition, 2013.
2. Anil K. Maini, Digital Electronics: Principles, Devices and Applications, John Wiley & Sons, Ltd., 2007.
3. N. Senthil Kumar, M. Saravanan, S. Jeevanathan, Microprocessor and Microcontrollers, Oxford Publishers, 2010.
4. Advanced microprocessors and peripherals-A.K ray and K.M.Bhurchandani, TMH, 2nd edition, 2006.

**Reference Books:**

1. Thomas L. Floyd, Digital Fundamentals – A Systems Approach, Pearson, 2013.
2. Charles H. Roth, Fundamentals of Logic Design, Cengage Learning, 5th, Edition, 2004.
3. D.V.Hall, Microprocessors and Interfacing. TMGH, 2nd edition, 2006.
4. Kenneth. J. Ayala, The 8051 microcontroller, 3rd edition, Cengage Learning, 2010.

**Online Learning Resources/Virtual Labs:**

<https://www.vlab.co.in/>



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Course Code	Advanced Data Structures and Algorithms Lab (Common to CSE, IT, CSE( DS), CSE (IoT), CSE (AI), CSE (AI & ML) and AI & DS)	L	T	P	C
20A05301P		0	0	3	1.5
Pre-requisite	Basics of Data Structures	Semester		III	
Course Objectives:					
<ul style="list-style-type: none"> <li>• Learn data structures for various applications.</li> <li>• Implement different operations of data structures by optimizing the performance.</li> <li>• Develop applications using Greedy, Divide and Conquer, dynamic programming.</li> <li>• Implement applications for backtracking algorithms using relevant data structures.</li> </ul>					
Course Outcomes (CO):					
<p>After completion of the course, students will be able to</p> <ul style="list-style-type: none"> <li>• Understand and apply data structure operations.</li> <li>• Understand and apply non-linear data structure operations.</li> <li>• Apply Greedy, divide and conquer algorithms.</li> <li>• Develop dynamic programming algorithms for various real-time applications.</li> <li>• Illustrate and apply backtracking algorithms, further able to understand non-deterministic algorithms.</li> </ul>					
List of Experiments:					
<ol style="list-style-type: none"> <li>1. Write a program to implement the following operations on Binary Search Tree: a) Insert                      b) Delete                      c) Search                      d) Display</li> <li>2. Write a program to perform a Binary Search for a given set of integer values.</li> <li>3. Write a program to implement Splay trees.</li> <li>4. Write a program to implement Merge sort for the given list of integer values.</li> <li>5. Write a program to implement Quicksort for the given list of integer values.</li> <li>6. Write a program to find the solution for the knapsack problem using the greedy method.</li> <li>7. Write a program to find minimum cost spanning tree using Prim's algorithm</li> <li>8. Write a program to find minimum cost spanning tree using Kruskal's algorithm</li> <li>9. Write a program to find a single source shortest path for a given graph.</li> <li>10. Write a program to find the solution for job sequencing with deadlines problems.</li> <li>11. Write a program to find the solution for a 0-1 knapsack problem using dynamic programming.</li> <li>12. Write a program to solve Sum of subsets problem for a given set of distinct numbers using backtracking.</li> <li>13. Implement N Queen's problem using Back Tracking.</li> </ol>					
References:					
<ol style="list-style-type: none"> <li>1. Y Daniel Liang, "Introduction to Programming using Python", Pearson.</li> <li>2. Benjamin Baka, David Julian, "Python Data Structures and Algorithms", Packt Publishers, 2017.</li> <li>3. Rance D. Necaie, "Data Structures and Algorithms using Python", Wiley Student Edition.</li> </ol>					
Online Learning Resources/Virtual Labs:					
<a href="http://cse01-iiith.vlabs.ac.in/">http://cse01-iiith.vlabs.ac.in/</a> <a href="http://peterindia.net/Algorithms.html">http://peterindia.net/Algorithms.html</a>					



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**Computer Science & Engineering (Internet of Things)**

Course Code	SENSORS AND INTERNET OF THINGS	L	T	P	C
20A35301P	LAB	1	0	2	2
<b>Pre-requisite</b>	Basic Electrical and Electronics Engineering and Applied Physics, Sensors and Internet of Things	<b>Semester</b>	<b>III</b>		
<b>Course Objectives:</b>					
<ul style="list-style-type: none"> <li>• To provide basic skills on IoT sensor functionality.</li> <li>• To understand functionalities of Sensors with micro controllers.</li> <li>• To demonstrate skills on IoT application development</li> </ul>					
<b>Course Outcomes (CO):</b>					
<ul style="list-style-type: none"> <li>• Identify different types of Sensors and study their functionality in IoT</li> <li>• Demonstrate skills in connecting peripherals to Arduino/Raspberry Pi for data exchange.</li> <li>• Develop a Cloud platform to upload and analyze any sensor data</li> <li>• Demonstrate skills in connecting GSM, GPS, Gateways to micro controllers and perform Data Management in IoT.</li> <li>• Build a complete working IoT system involving prototyping, programming and data analysis.</li> </ul>					
<b>List of Experiments:</b>					
<ol style="list-style-type: none"> <li>1. Introduction to Raspberry Pi platform and programming</li> <li>2. Measuring Temperature, Pressure, and Humidity in real time using Sensors using Raspberry Pi.</li> <li>3. Study the Light, Distance, Motion, Accelerometer, Position Data using Sensors using Raspberry Pi.</li> <li>4. Log Data using Raspberry PI and upload to the cloud platform ( using <b>Tkinter</b>)</li> <li>5. Develop an IoT application using Raspberry Pi for fire alarm.</li> <li>6. Develop an IoT application to measure soil moisture, air and water quality using Raspberry Pi.</li> <li>7. Develop an IoT application using Raspberry Pi to monitor heartbeat, blood pressure, etc. of a person and to upload health information to cloud</li> <li>8. Build Smart Parking application using IoT Platform             <ol style="list-style-type: none"> <li>a) Monitored Parameters: Vehicle detection</li> <li>b) Function1: Provide information to user about free space in parking slots</li> </ol> </li> <li>9. Build Smart Home system using IoT Platform             <ol style="list-style-type: none"> <li>a) Monitored Parameters: People presence, Outside ambient conditions, IAQ parameters</li> <li>b) Function1: Control Home appliances through manual application control</li> <li>c) Function2: Intelligently control appliances based on monitoring parameters</li> </ol> </li> </ol>					
<b>References:</b>					
<ol style="list-style-type: none"> <li>1. Arshdeep Bahga and Vijay Madisetti, <i>Internet of Things( A hands on approach)</i>, First Edition, VPI Publications, 2014.</li> </ol>					





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2. Adrian McEwen and Hakin Cassimally, *Designing the Internet of Things*, Wiley India.
3. Massimo Banzi and Michael Shiloh, *Getting Started with Arduino*, Third Edition, Maker Media.
4. Matt Richardson and Shawn Wallace, *Getting Started with Raspberry Pi*, O'Reilly, 2014.

Online Learning Resources/Virtual Labs:

1. [https://www.tutorialspoint.com/internet\\_of\\_things/index.htm](https://www.tutorialspoint.com/internet_of_things/index.htm)
2. <https://www.javatpoint.com/iot-internet-of-things>
3. [http://www.cse.wustl.edu/~jain/cse570-15/ftp/iot\\_prot/index.html](http://www.cse.wustl.edu/~jain/cse570-15/ftp/iot_prot/index.html)



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**Computer Science & Engineering (Internet of Things)**

Course Code	Programming Arduino		L	T	P	C
20A35302			1	0	2	2
Pre-requisite		Semester	III			
Course Objectives:						
<ul style="list-style-type: none"> <li>• To understand the fundamentals of Internet of Things and its building blocks along with their characteristics</li> <li>• To understand the recent application domains of IoT in day-to-day life</li> <li>• To understand the protocols and standards designed for IoT</li> </ul>						
Course Outcomes (CO):						
After completion of the course, students will be able to <ul style="list-style-type: none"> <li>• Understand the programming of basic Arduino examples</li> <li>• Develop prototype circuits and connect them to the Arduino</li> <li>• Program the Arduino microcontroller to make the circuits work</li> <li>• Explore the given example code and online resources for extending knowledge about the capabilities of the Arduino</li> </ul>						
<b>List of Experiments:</b>						
<b>Module-1: Arduino</b>						
<ul style="list-style-type: none"> <li>• Introduction to Arduino</li> <li>• Pin configuration and architecture.</li> <li>• Device and platform features.</li> <li>• Concept of digital and analog ports.</li> <li>• Familiarizing with Arduino Interfacing Board</li> <li>• Introduction to Embedded C and Arduino platform</li> </ul>						
<b>Module-2: Arduino Displays</b>						
<ul style="list-style-type: none"> <li>• Working with Serial Monitor</li> <li>• Line graph via serial monitor</li> <li>• Interfacing a 8 bit LCD to Arduino</li> <li>• Fixed one-line static message display.</li> <li>• Running message display.</li> <li>• Using the LCD Library of Arduino.</li> </ul>						
<b>Module-3: Arduino Sensors</b>						
<ul style="list-style-type: none"> <li>• Arduino – Humidity Sensor</li> <li>• Arduino – Temperature Sensor</li> <li>• Arduino – Water Detector / Sensor</li> <li>• Arduino – PIR Sensor</li> <li>• Arduino – Ultrasonic Sensor</li> <li>• Arduino – Connecting Switch (Magnetic relay switches)</li> </ul>						
<b>Case Study-1: Arduino Ping Pong Game</b>						



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Design ping pong game using an Arduino Uno and Colour OLED display. The main objective of this game is to gain the highest score. This game is an interesting addictive fun game. This is a human vs human two-player game, and the players have to play from both sides with the help of up and down keys. The game ends whenever the player fails to touch the ball and it touches the other part of the screen. Also, the player must play the game turn-wise and use some strategy to win the game.

Source- <https://www.youtube.com/watch?v=ZRLOGUqebFs>

**Case Study-2: Control Light & Fan with Clap using Arduino**

Design a IoT application which controls the home appliances like Fan, TV, light and etc using sound effect. This project is very useful for elderly and differently abled persons to control their room with depending one other.

Source link: <https://www.youtube.com/watch?v=hzUFnP3Xt7c>

**Case Study -3: Rain Alert System using Arduino**

Design a system to alert the people when is raining. This system is very useful for vehicles to switch on the wipers as well as many places where the device working based on rain.

Source link: <https://www.youtube.com/watch?v=YIIH1ti4Vy0>

**Case Study -4: Theft Alert System using Arduino**

Design a system to alert the people using IR sensor when the motion is detected. This system is useful for high security areas. This system

Source link: <https://www.youtube.com/watch?v=zOmsl-dTq8M>

**Case Study-5: Water Level Meter using Water Level Sensor**

Design a sensor which can sense the water level in tanks where the motor pumps are used. There is no specific method to check the level of the water.

Source Link: <https://www.youtube.com/watch?v=n7WRi5U5IQk>

**References:**

- [https://www.tutorialspoint.com/internet\\_of\\_things/index.htm](https://www.tutorialspoint.com/internet_of_things/index.htm)
- <https://www.javatpoint.com/iot-internet-of-things>
- <https://www.guru99.com/iot-tutorial.html>

**Online Learning Resources/Virtual Labs:**



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**Computer Science & Engineering (Internet of Things)**

Course Code	ENVIRONMENTAL SCIENCE (Common to All Branches of Engineering)		L	T	P	C
20A99201			3	0	0	0
Pre-requisite	NIL	Semester	III			
<b>Course Objectives:</b>						
<ul style="list-style-type: none"> <li>• To make the students to get awareness on environment</li> <li>• To understand the importance of protecting natural resources, ecosystems for future generations and pollution causes due to the day to day activities of human life</li> <li>• To save earth from the inventions by the engineers.</li> </ul>						
<b>Course Outcomes (CO):</b>						
<p>At the end of the course, the student will be able to</p> <ul style="list-style-type: none"> <li>• Grasp multidisciplinary nature of environmental studies and various renewable and nonrenewable resources.</li> <li>• Understand flow and bio-geo- chemical cycles and ecological pyramids.</li> <li>• Understand various causes of pollution and solid waste management and related preventive measures.</li> <li>• About the rainwater harvesting, watershed management, ozone layer depletion and waste land reclamation.</li> <li>• Casus of population explosion, value education and welfare programmes.</li> </ul>						
<b>UNIT - I</b>					<b>8 Hrs</b>	
<p><b>Multidisciplinary Nature Of Environmental Studies:</b> – Definition, Scope and Importance – Need for Public Awareness.</p> <p><b>Natural Resources :</b> Renewable and non-renewable resources – Natural resources and associated problems – Forest resources – Use and over – exploitation, deforestation, case studies – Timber extraction – Mining, dams and other effects on forest and tribal people – Water resources – Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. – Energy resources:</p>						
<b>UNIT - II</b>					<b>12 Hrs</b>	
<p><b>Ecosystems:</b> Concept of an ecosystem. – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the following ecosystem:</p> <ol style="list-style-type: none"> <li>a. Forest ecosystem.</li> <li>b. Grassland ecosystem</li> <li>c. Desert ecosystem</li> <li>d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)</li> </ol> <p><b>Biodiversity And Its Conservation :</b> Introduction 0 Definition: genetic, species and ecosystem diversity – Bio-geographical classification of India – Value of biodiversity: consumptive use, Productive use, social, ethical, aesthetic and option values – Biodiversity at global, National and local levels – India as a mega-diversity nation – Hot-spots of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – Endangered and endemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.</p>						
<b>UNIT - III</b>					<b>8 Hrs</b>	



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**Environmental Pollution:** Definition, Cause, effects and control measures of :

- a. Air Pollution.
- b. Water pollution
- c. Soil pollution
- d. Marine pollution
- e. Noise pollution
- f. Thermal pollution
- g. Nuclear hazards

**Solid Waste Management:** Causes, effects and control measures of urban and industrial wastes – Role of an individual in prevention of pollution – Pollution case studies – Disaster management: floods, earthquake, cyclone and landslides.

**UNIT - IV**

**10 Hrs**

**Social Issues and the Environment:** From Unsustainable to Sustainable development – Urban problems related to energy – Water conservation, rain water harvesting, watershed management – Resettlement and rehabilitation of people; its problems and concerns. Case studies – Environmental ethics: Issues and possible solutions – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies – Wasteland reclamation. – Consumerism and waste products. – Environment Protection Act. – Air (Prevention and Control of Pollution) Act. – Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act – Issues involved in enforcement of environmental legislation – Public awareness.

**UNIT - V**

**8 Hrs**

**Human Population And The Environment:** Population growth, variation among nations. Population explosion – Family Welfare Programmes. – Environment and human health – Human Rights – Value Education – HIV/AIDS – Women and Child Welfare – Role of information Technology in Environment and human health – Case studies.

**Field Work:** Visit to a local area to document environmental assets River/forest grassland/hill/mountain – Visit to a local polluted site-Urban/Rural/Industrial/Agricultural Study of common plants, insects, and birds – river, hill slopes, etc..

**Textbooks:**

1. Text book of Environmental Studies for Undergraduate Courses ErachBharucha for University Grants Commission, Universities Press.
2. Palaniswamy, “Environmental Studies”, Pearson education
3. S.AzeemUnnisa, “Environmental Studies” Academic Publishing Company
4. K.Raghavan Nambiar, “Text book of Environmental Studies for Undergraduate Courses as per UGC model syllabus”, Scitech Publications (India), Pvt. Ltd.

**Reference Books:**

1. Deeksha Dave and E.Sai Baba Reddy, “Textbook of Environmental Science”, Cengage Publications.
2. M.Anji Reddy, “Text book of Environmental Sciences and Technology”, BS Publication.
3. J.P.Sharma, Comprehensive Environmental studies, Laxmi publications.
4. J. Glynn Henry and Gary W. Heinke, “Environmental Sciences and Engineering”, Prentice hall of India Private limited
5. G.R.Chatwal, “A Text Book of Environmental Studies” Himalaya Publishing House
6. Gilbert M. Masters and Wendell P. Ela, “Introduction to Environmental Engineering and Science, Prentice hall of India Private limited.



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**Computer Science & Engineering (Internet of Things)**

Course Code	Mathematical Modelling & Simulation	L	T	P	C
20A54406	CSE (Internet of Things)	0	3	0	3
Pre-requisite	Semester	IV			
Course Objectives:					
This course focuses on what is needed to build simulation software environments, and not just building simulations using preexisting packages.					
Course Outcomes (CO): Student will be able to					
<ul style="list-style-type: none"> <li>• understand basic Model Forms.</li> <li>• understand basic Simulation Approaches.</li> <li>• evaluate handling Stepped and Event-based Time in Simulations.</li> <li>• distinguish Discrete versus Continuous Modeling.</li> <li>• apply Numerical Techniques.</li> <li>• calculate Sources and Propagation of Error.</li> </ul>					
UNIT - I		8 Hrs			
Simulation Basics-Handling Stepped and Event-based Time in Simulations-Discrete versus Continuous Modelling-Numerical Techniques-Sources and Propagation of Error					
UNIT - II		9 Hrs			
Dynamical, Finite State, and Complex Model Simulations-Graph or Network Transitions Based Simulations-Actor Based Simulations-Mesh Based Simulations-Hybrid Simulations					
UNIT - III		8 Hrs			
Converting to Parallel and Distributed Simulations-Partitioning the Data-Partitioning the Algorithms-Handling Inter-partition Dependencies					
UNIT - IV		8 Hrs			
Probability and Statistics for Simulations and Analysis-Introduction to Queues and Random Noise-Random Variates Generation-Sensitivity Analysis					
UNIT - V		9 Hrs			
Simulations Results Analysis and Viewing Tools-Display Forms: Tables, Graphs, and Multidimensional Visualization-Terminals, X and MS Windows, and Web Interfaces-Validation of Model Results.					
Textbooks:					
<ol style="list-style-type: none"> <li>1. Mathematical modeling, JN Kapur, Newage publishers</li> <li>2. Mathematical Modeling and Simulation: Introduction for Scientists and Engineers by Kai Velten, Wiley Publishers</li> </ol>					
Reference Books:					



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1. Introduction to Mathematical Modeling and Computer Simulations

By Vladimir Mityushev, [Wojciech Nawalaniec](#) [Natalia Rylko](#) Published by Chapman and Hall/CRC.

Online Learning Resources:

<http://www.cse.chalmers.se/~dag/docs/matmodReport6.pdf>

<https://www.slideshare.net/arupparia/introduction-to-mathematical-modelling-42588379>

<https://www.slideshare.net/mailrenuka/simulation-for-queuing-problems-using-random-numbers>



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**Computer Science & Engineering (Internet of Things)**

Course Code	DATABASE MANAGEMENT SYSTEMS (Common to CSE, IT, CSE( DS), CSE (IoT), CSE (AI), CSE (AI & ML) and AI & DS)		L	T	P	C
20A05401T			3	0	0	3
Pre-requisite	NIL	Semester	IV			
<b>Course Objectives:</b>						
<p>This course is designed to:</p> <ul style="list-style-type: none"> <li>• Train in the fundamental concepts of database management systems, database modeling and design, SQL, PL/SQL and system implementation techniques.</li> <li>• Enable students to model ER diagrams for any customized application</li> <li>• Inducting appropriate strategies for optimization of queries.</li> <li>• Provide knowledge on concurrency techniques</li> <li>• Demonstrate the organization of Databases</li> </ul>						
<b>Course Outcomes (CO):</b>						
<p>After completion of the course, students will be able to</p> <ul style="list-style-type: none"> <li>• Design a database for a real-world information system</li> <li>• Define transactions that preserve the integrity of the database</li> <li>• Generate tables for a database</li> <li>• Organize the data to prevent redundancy</li> <li>• Pose queries to retrieve the information from the database.</li> </ul>						
UNIT - I	<b>Introduction, Introduction to Relational Model</b>					9Hrs
<p><b>Introduction:</b> Database systems applications, Purpose of Database Systems, view of Data, Database Languages, Relational Databases, Database Design, Data Storage and Querying, Transaction Management, Database Architecture, Data Mining and Information Retrieval, Specialty Databases, Database users and Administrators,  <b>Introduction to Relational Model:</b> Structure of Relational Databases, Database Schema, Keys, Schema Diagrams, Relational Query Languages, Relational Operations</p>						
UNIT - II	<b>Introduction to SQL, Advanced SQL</b>					9 Hrs
<p><b>Introduction to SQL:</b> Overview of the SQL Query Language, SQL Data Definition, Basic Structure of SQL Queries, Additional Basic Operations, Set Operations, Null Values, Aggregate Functions, Nested Sub-queries, Modification of the Database. <b>Intermediate SQL:</b> Joint Expressions, Views, Transactions, Integrity Constraints, SQL Data types and schemas, Authorization.  <b>Advanced SQL:</b> Accessing SQL from a Programming Language, Functions and Procedures, Triggers, Recursive Queries, OLAP, Formal relational query languages.</p>						
UNIT - III	<b>Database Design and the E-R Model, Relational Database Design</b>					8Hrs
<p><b>Database Design and the E-R Model:</b> Overview of the Design Process, The Entity-Relationship Model, Constraints, Removing Redundant Attributes in Entity Sets, Entity-Relationship Diagrams, Reduction to Relational Schemas, Entity-Relationship Design Issues.  <b>Relational Database Design:</b> Features of Good Relational Designs, Atomic Domains and First Normal Form, Decomposition Using Functional Dependencies, Functional-Dependency Theory, Algorithms for Decomposition, Decomposition Using Multivalued Dependencies, More Normal Forms.</p>						
UNIT - IV	<b>Query Processing, Query optimization</b>					8 Hrs
<p><b>Query Processing:</b> Overview, Measures of Query cost, Selection operation, sorting, Join Operation, other operations, Evaluation of Expressions.  <b>Query optimization:</b> Overview, Transformation of Relational Expressions, Estimating statistics of Expression results, Choice of Evaluation Plans, Materialized views, Advanced Topics in Query Optimization.</p>						
UNIT - V	<b>Transaction Management, Concurrency Control, Recovery System</b>					10Hrs
<b>Transaction Management:</b>						





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Transactions: Concept, A Simple Transactional Model, Storage Structures, Transaction Atomicity and Durability, Transaction Isolation, Serializability, Isolation and Atomicity, Transaction Isolation Levels, Implementation of Isolation Levels, Transactions as SQL Statements. <b>Concurrency Control:</b> Lock-based Protocols, Deadlock Handling, Multiple granularity, Timestamp-based Protocols, and Validation-based Protocols. <b>Recovery System:</b> Failure Classification, Storage, Recovery and Atomicity, Recovery Algorithm, Buffer Management, Failure with Loss of Nonvolatile Storage, Early Lock Release and Logical Undo Operations.
Textbooks:
1. A.Silberschatz, H.F.Korth, S.Sudarshan, “Database System Concepts”,6/e, TMH 2019
Reference Books:
1. Database Management System, 6/e RamezElmasri, Shamkant B. Navathe, PEA 2. Database Principles Fundamentals of Design Implementation and Management, Carlos Coronel, Steven Morris, Peter Robb, Cengage Learning. 3.Database Management Systems, 3/e, Raghurama Krishnan, Johannes Gehrke, TMH
Online Learning Resources:
<a href="https://onlinecourses.nptel.ac.in/noc21_cs04/preview">https://onlinecourses.nptel.ac.in/noc21_cs04/preview</a>



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Course Code	OPERATING SYSTEMS		L	T	P	C
20A05402T	(Common to CSE, IT, CSE( DS), CSE (IoT), CSE (AI), CSE (AI & ML) and AI & DS)		3	0	0	3
Pre-requisite	Basics of CO and DBMS	Semester	IV			
<b>Course Objectives:</b>						
<p>The course is designed to</p> <ul style="list-style-type: none"> <li>• Understand basic concepts and functions of operating systems</li> <li>• Understand the processes, threads and scheduling algorithms.</li> <li>• Provide good insight on various memory management techniques</li> <li>• Expose the students with different techniques of handling deadlocks</li> <li>• Explore the concept of file-system and its implementation issues</li> <li>• Familiarize with the basics of the Linux operating system</li> <li>• Implement various schemes for achieving system protection and security</li> </ul>						
<b>Course Outcomes (CO):</b>						
<p>After completion of the course, students will be able to</p> <ul style="list-style-type: none"> <li>• Realize how applications interact with the operating system</li> <li>• Analyze the functioning of a kernel in an Operating system.</li> <li>• Summarize resource management in operating systems</li> <li>• Analyze various scheduling algorithms</li> <li>• Examine concurrency mechanism in Operating Systems</li> <li>• Apply memory management techniques in the design of operating systems</li> <li>• Understand the functionality of the file system</li> <li>• Compare and contrast memory management techniques.</li> <li>• Understand deadlock prevention and avoidance.</li> <li>• Perform administrative tasks on Linux based systems.</li> </ul>						
UNIT - I	<b>Operating Systems Overview, System Structures</b>		8Hrs			
<p><b>Operating Systems Overview:</b> Introduction, Operating system functions, Operating systems operations, Computing environments, Open-Source Operating Systems  <b>System Structures:</b> Operating System Services, User and Operating-System Interface, systems calls, Types of System Calls, system programs, Operating system Design and Implementation, Operating system structure, Operating system debugging, System Boot.</p>						
UNIT - II	<b>Process Concept, Multithreaded Programming, Process Scheduling, Inter-process Communication</b>		10Hrs			
<p><b>Process Concept:</b> Process scheduling, Operations on processes, Inter-process communication, Communication in client server systems.  <b>Multithreaded Programming:</b> Multithreading models, Thread libraries, Threading issues, Examples.  <b>Process Scheduling:</b> Basic concepts, Scheduling criteria, Scheduling algorithms, Multiple processor scheduling, Thread scheduling, Examples.  <b>Inter-process Communication:</b> Race conditions, Critical Regions, Mutual exclusion with busy waiting, Sleep and wakeup, Semaphores, Mutexes, Monitors, Message passing, Barriers, Classical IPC Problems - Dining philosophers problem, Readers and writers problem.</p>						
UNIT - III	<b>Memory-Management Strategies, Virtual Memory Management</b>		Lecture 8Hrs			
<p><b>Memory-Management Strategies:</b> Introduction, Swapping, Contiguous memory allocation, Paging, Segmentation, Examples.</p>						



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<b>Virtual Memory Management:</b> Introduction, Demand paging, Copy on-write, Page replacement, Frame allocation, Thrashing, Memory-mapped files, Kernel memory allocation, Examples.		
UNIT - IV	<b>Deadlocks, File Systems</b>	Lecture 9Hrs
<p><b>Deadlocks:</b> Resources, Conditions for resource deadlocks, Ostrich algorithm, Deadlock detection And recovery, Deadlock avoidance, Deadlock prevention.</p> <p><b>File Systems:</b> Files, Directories, File system implementation, management and optimization.</p> <p>Secondary-Storage Structure: Overview of disk structure, and attachment, Disk scheduling, RAID structure, Stable storage implementation.</p>		
UNIT - V	<b>System Protection, System Security</b>	Lecture 8Hrs
<p><b>System Protection:</b> Goals of protection, Principles and domain of protection, Access matrix, Access control, Revocation of access rights.</p> <p><b>System Security:</b> Introduction, Program threats, System and network threats, Cryptography as a security, User authentication, implementing security defenses, firewalling to protect systems and networks, Computer security classification.</p> <p>Case Studies: Linux, Microsoft Windows.</p>		
Textbooks:		
<ol style="list-style-type: none"> <li>1. Silberschatz A, Galvin P B, and Gagne G, Operating System Concepts, 9th edition, Wiley, 2016.</li> <li>2. Tanenbaum A S, Modern Operating Systems, 3rd edition, Pearson Education, 2008.</li> </ol> <p>(Topics: Inter-process Communication and File systems.)</p>		
Reference Books:		
<ol style="list-style-type: none"> <li>1. Tanenbaum A S, Woodhull A S, Operating Systems Design and Implementation, 3rd edition, PHI, 2006.</li> <li>2. Dhamdhare D M, Operating Systems A Concept Based Approach, 3rd edition, Tata McGraw-Hill, 2012.</li> <li>3. Stallings W, Operating Systems -Internals and Design Principles, 6th edition, Pearson Education, 2009</li> <li>4. Nutt G, Operating Systems, 3rd edition, Pearson Education, 2004</li> </ol>		
Online Learning Resources:		
<p><a href="https://nptel.ac.in/courses/106/106/106106144/">https://nptel.ac.in/courses/106/106/106106144/</a></p> <p><a href="http://peterindia.net/OperatingSystems.html">http://peterindia.net/OperatingSystems.html</a></p>		



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Course Code	Software Engineering (Common to CSE, IT, CSE( DS), CSE (IoT))	L	T	P	C
20A05403T		3	0	0	3
Pre-requisite	Semester	IV			
Course Objectives:					
<ul style="list-style-type: none"> <li>To learn the basic concepts of software engineering and life cycle models</li> <li>To explore the issues in software requirements specification and enable to write SRS documents for software development problems</li> <li>To elucidate the basic concepts of software design and enable to carry out procedural and object oriented design of software development problems</li> <li>To understand the basic concepts of black box and white box software testing and enable to design test cases for unit, integration, and system testing</li> <li>To reveal the basic concepts in software project management</li> </ul>					
Course Outcomes (CO):					
After completion of the course, students will be able to					
<ul style="list-style-type: none"> <li>Obtain basic software life cycle activity skills.</li> <li>Design software requirements specifications for given problems.</li> <li>Implement structure, object oriented analysis and design for given problems.</li> <li>Design test cases for given problems.</li> <li>Apply quality management concepts at the application level.</li> </ul>					
UNIT - I	<b>Basic concepts in software engineering and software project management</b>	Lecture 8Hrs			
Basic concepts: abstraction versus decomposition, evolution of software engineering techniques, Software development life cycle (SDLC) models: Iterative waterfall model, Prototype model, Evolutionary model, Spiral model, RAD model, Agile models, software project management: project planning, project estimation, COCOMO, Halstead's Software Science, project scheduling, staffing, Organization and team structure, risk management, configuration management.					
UNIT - II	<b>Requirements analysis and specification</b>	Lecture 8Hrs			
The nature of software, The Unique nature of Webapps, Software Myths, Requirements gathering and analysis, software requirements specification, Traceability, Characteristics of a Good SRS Document, IEEE 830 guidelines, representing complex requirements using decision tables and decision trees, overview of formal system development techniques, axiomatic specification, algebraic specification.					
UNIT - III	<b>Software Design</b>	Lecture 9Hrs			
Good Software Design, Cohesion and coupling, Control Hierarchy: Layering, Control Abstraction, Depth and width, Fan-out, Fan-in, Software design approaches, object oriented vs. function oriented design. Overview of SA/SD methodology, structured analysis, Data flow diagram, Extending DFD technique to real life systems, Basic Object oriented concepts, UML Diagrams, Structured design, Detailed design, Design review, Characteristics of a good user interface, User Guidance and Online Help, Mode-based vs Mode-less Interface, Types of user interfaces, Component-based GUI development, User interface design methodology: GUI design methodology.					
UNIT - IV	<b>Coding and Testing</b>	Lecture 9Hrs			
Coding standards and guidelines, code review, software documentation, Testing, Black Box Testing, White Box Testing, debugging, integration testing, Program Analysis Tools, system testing, performance testing, regression testing, Testing Object Oriented Programs.					
UNIT - V	<b>Software quality, reliability, and other issues</b>	Lecture 9Hrs			
Software reliability, Statistical testing, Software quality and management, ISO 9000, SEI capability maturity model (CMM), Personal software process (PSP), Six sigma, Software quality metrics, CASE and its scope, CASE environment, CASE support in software life cycle, Characteristics of software maintenance, Software reverse engineering, Software maintenance processes model, Estimation maintenance cost. Basic issues in any reuse program, Reuse approach, Reuse at organization level.					
Textbooks:					



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|---|
| <ol style="list-style-type: none"><li>1. Rajib Mall, “Fundamentals of Software Engineering”, 5th Edition, PHI, 2018.</li><li>2. Pressman R, “Software Engineering- Practioner Approach”, McGraw Hill.</li></ol> |
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<b>Reference Books:</b>
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| <ol style="list-style-type: none"><li>1. Somerville, “Software Engineering”, Pearson 2.</li><li>2. Richard Fairley, “Software Engineering Concepts”, Tata McGraw Hill.</li><li>3. JalotePankaj, “An integrated approach to Software Engineering”, Narosa</li></ol> |
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<b>Online Learning Resources:</b>
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<p><a href="https://nptel.ac.in/courses/106/105/106105182/">https://nptel.ac.in/courses/106/105/106105182/</a> <a href="http://peterindia.net/SoftwareDevelopment.html">http://peterindia.net/SoftwareDevelopment.html</a></p>
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Course Code	MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS (Common to All branches of Engineering)		L	T	P	C
20A52301			3	0	0	3
<b>Pre-requisite</b>	<b>NIL</b>	<b>Semester</b>	<b>III</b>			
<b>Course Objectives:</b>						
<ul style="list-style-type: none"> <li>To inculcate the basic knowledge of micro economics and financial accounting</li> <li>To make the students learn how demand is estimated for different products, input-output relationship for optimizing production and cost</li> <li>To Know the Various types of market structure and pricing methods and strategy</li> <li>To give an overview on investment appraisal methods to promote the students to learn how to plan long-term investment decisions.</li> <li>To provide fundamental skills on accounting and to explain the process of preparing financial statements</li> </ul>						
<b>Course Outcomes (CO):</b>						
<ul style="list-style-type: none"> <li>Define the concepts related to Managerial Economics, financial accounting and management.</li> <li>Understand the fundamentals of Economics viz., Demand, Production, cost, revenue and markets</li> <li>Apply the Concept of Production cost and revenues for effective Business decision</li> <li>Analyze how to invest their capital and maximize returns</li> <li>Evaluate the capital budgeting techniques</li> <li>Develop the accounting statements and evaluate the financial performance of business entity.</li> </ul>						
UNIT - I	<b>Managerial Economics</b>					
Introduction – Nature, meaning, significance, functions, and advantages. Demand-Concept, Function, Law of Demand - Demand Elasticity- Types – Measurement. Demand Forecasting- Factors governing Forecasting, Methods. Managerial Economics and Financial Accounting and Management.						
UNIT - II	<b>Production and Cost Analysis</b>					
Introduction – Nature, meaning, significance, functions and advantages. Production Function– Least-cost combination– Short run and Long run Production Function- Isoquants and Isocosts, MRTS - Cobb-Douglas Production Function - Laws of Returns - Internal and External Economies of scale. Cost & Break-Even Analysis - Cost concepts and Cost behavior- Break-Even Analysis (BEA) - Determination of Break-Even Point (Simple Problems)-Managerial significance and limitations of Break-Even Analysis.						
UNIT - III	<b>Business Organizations and Markets</b>					
Introduction – Nature, meaning, significance, functions and advantages. Forms of Business Organizations- Sole Proprietary - Partnership - Joint Stock Companies - Public Sector Enterprises. Types of Markets - Perfect and Imperfect Competition - Features of Perfect Competition Monopoly- Monopolistic Competition–Oligopoly-Price-Output Determination - Pricing Methods and Strategies						
UNIT - IV	<b>Capital Budgeting</b>					
Introduction – Nature, meaning, significance, functions and advantages. Types of Working Capital, Components, Sources of Short-term and Long-term Capital, Estimating Working capital requirements. Capital Budgeting– Features, Proposals, Methods and Evaluation. Projects – Pay Back Method, Accounting Rate of Return (ARR) Net Present Value (NPV) Internal Rate Return (IRR) Method (sample problems)						
UNIT - V	<b>Financial Accounting and Analysis</b>					



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Introduction – Nature, meaning, significance, functions and advantages. Concepts and Conventions- Double-Entry Book Keeping, Journal, Ledger, Trial Balance- Final Accounts (Trading Account, Profit and Loss Account and Balance Sheet with simple adjustments). *Financial Analysis* - Analysis and Interpretation of Liquidity Ratios, Activity Ratios, and Capital structure Ratios and Profitability.

**Textbooks:**

1. Varshney&Maheswari: Managerial Economics, Sultan Chand, 2013.
2. Aryasri: Business Economics and Financial Analysis, 4/e, MGH, 2019

**Reference Books:**

1. Ahuja HI Managerial economics Schand,3/e,2013
2. S.A. Siddiqui and A.S. Siddiqui: Managerial Economics and Financial Analysis, New Age International, 2013.
3. Joseph G. Nellis and David Parker: Principles of Business Economics, Pearson, 2/e, New Delhi.
4. Domnick Salvatore: Managerial Economics in a Global Economy, Cengage, 2013.

**Online Learning Resources:**

<https://www.slideshare.net/123ps/managerial-economics-ppt>  
<https://www.slideshare.net/rossanz/production-and-cost-45827016>  
<https://www.slideshare.net/darkyla/business-organizations-19917607>  
<https://www.slideshare.net/balarajbl/market-and-classification-of-market>  
<https://www.slideshare.net/ruchi101/capital-budgeting-ppt-59565396>  
<https://www.slideshare.net/ashu1983/financial-accounting>



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Course Code	ORGANISATIONAL BEHAVIOUR (Common to All branches of Engineering)		L	T	P	C
20A52302			3	0	0	3
Pre-requisite	NIL	Semester	III			
<b>Course Objectives:</b>						
<ul style="list-style-type: none"> <li>• To enable student's comprehension of organizational behavior</li> <li>• To offer knowledge to students on self-motivation, leadership and management</li> <li>• To facilitate them to become powerful leaders</li> <li>• To Impart knowledge about group dynamics</li> <li>• To make them understand the importance of change and development</li> </ul>						
<b>Course Outcomes (CO):</b>						
<ul style="list-style-type: none"> <li>• Define the Organizational Behaviour, its nature and scope.</li> <li>• Understand the nature and concept of Organizational behaviour</li> <li>• Apply theories of motivation to analyse the performance problems</li> <li>• Analyse the different theories of leadership</li> <li>• Evaluate group dynamics</li> <li>• Develop as powerful leader</li> </ul>						
UNIT - I	<b>Introduction to Organizational Behavior</b>					
Meaning, definition, nature, scope and functions - Organizing Process – Making organizing effective -Understanding Individual Behaviour –Attitude -Perception - Learning – Personality.						
UNIT - II	<b>Motivation and Leading</b>					
Theories of Motivation- Maslow's Hierarchy of Needs - Herzberg's Two Factor Theory - Vroom's theory of expectancy – Mc Clelland's theory of needs–Mc Gregor's theory X and theory Y– Adam's equity theory – Locke's goal setting theory– Alderfer's ERG theory .						
UNIT - III	<b>Organizational Culture</b>					
Introduction – Meaning, scope, definition, Nature - Organizational Climate - Leadership - Traits Theory–Managerial Grid - Transactional Vs Transformational Leadership - Qualities of good Leader - Conflict Management -Evaluating Leader- Women and Corporate leadership.						
UNIT - IV	<b>Group Dynamics</b>					
Introduction – Meaning, scope, definition, Nature- Types of groups - Determinants of group behavior - Group process – Group Development - Group norms - Group cohesiveness - Small Groups - Group decision making - Team building - Conflict in the organization– Conflict resolution						
UNIT - V	<b>Organizational Change and Development</b>					
Introduction –Nature, Meaning, scope, definition and functions- Organizational Culture - Changing the Culture – Change Management – Work Stress Management - Organizational management – Managerial implications of organization's change and development						
<b>Textbooks:</b>						
1. Luthans, Fred, Organisational Behaviour, McGraw-Hill, 12 Th edition 2011 2. P Subba Ran, Organisational Behaviour, Himalya Publishing House 2017						
<b>Reference Books:</b>						
<ul style="list-style-type: none"> <li>▪ McShane, Organizational Behaviour, TMH 2009</li> <li>▪ Nelson, Organisational Behaviour, Thomson, 2009.</li> <li>▪ Robbins, P. Stephen, Timothy A. Judge, Organisational Behaviour, Pearson 2009.</li> <li>▪ Aswathappa, Organisational Behaviour, Himalaya, 2009</li> </ul>						
<b>Online Learning Resources:</b>						
<a href="httphttps://www.slideshare.net/Knight1040/organizational-culture-9608857s://www.slideshare.net/AbhayRajpoot3/motivation-165556714">httphttps://www.slideshare.net/Knight1040/organizational-culture-9608857s://www.slideshare.net/AbhayRajpoot3/motivation-165556714</a> <a href="https://www.slideshare.net/harshrastogi1/group-dynamics-159412405">https://www.slideshare.net/harshrastogi1/group-dynamics-159412405</a> <a href="https://www.slideshare.net/vanyasingla1/organizational-change-development-26565951">https://www.slideshare.net/vanyasingla1/organizational-change-development-26565951</a>						





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Course Code	Business Environment (Common to All branches of Engineering)		L	T	P	C
20A52303			3	0	0	3
Pre-requisite	NIL	Semester	III			
<b>Course Objectives:</b>						
<ul style="list-style-type: none"> <li>• To make the student to understand about the business environment</li> <li>• To enable them in knowing the importance of fiscal and monetary policy</li> <li>• To facilitate them in understanding the export policy of the country</li> <li>• To Impart knowledge about the functioning and role of WTO</li> <li>• To Encourage the student in knowing the structure of stock markets</li> </ul>						
<b>Course Outcomes (CO):</b>						
<ul style="list-style-type: none"> <li>• Define Business Environment and its Importance.</li> <li>• Understand various types of business environment.</li> <li>• Apply the knowledge of Money markets in future investment</li> <li>• Analyse India's Trade Policy</li> <li>• Evaluate fiscal and monetary policy</li> <li>• Develop a personal synthesis and approach for identifying business opportunities</li> </ul>						
UNIT - I	<b>Overview of Business Environment</b>					
Introduction – meaning Nature, Scope, significance, functions and advantages. Types-Internal & External, Micro and Macro. Competitive structure of industries -Environmental analysis- advantages & limitations of environmental analysis& Characteristics of business.						
UNIT - II	<b>Fiscal &amp; Monetary Policy</b>					
Introduction – Nature, meaning, significance, functions and advantages. Public Revenues - Public Expenditure - Evaluation of recent fiscal policy of GOI. Highlights of Budget- Monetary Policy - Demand and Supply of Money –RBI -Objectives of monetary and credit policy - Recent trends- Role of Finance Commission.						
UNIT - III	<b>India's Trade Policy</b>					
Introduction – Nature, meaning, significance, functions and advantages. Magnitude and direction of Indian International Trade - Bilateral and Multilateral Trade Agreements - EXIM policy and role of EXIM bank -Balance of Payments– Structure & Major components - Causes for Disequilibrium in Balance of Payments - Correction measures.						
UNIT - IV	<b>World Trade Organization</b>					
Introduction – Nature, significance, functions and advantages. Organization and Structure - Role and functions of WTO in promoting world trade - GATT -Agreements in the Uruguay Round –TRIPS, TRIMS - Disputes Settlement Mechanism - Dumping and Anti-dumping Measures.						
UNIT - V	<b>Money Markets and Capital Markets</b>					
Introduction – Nature, meaning, significance, functions and advantages. Features and components of Indian financial systems - Objectives, features and structure of money markets and capital markets - Reforms and recent development – SEBI – Stock Exchanges - Investor protection and role of SEBI, Introduction to international finance.						
<b>Textbooks:</b>						
1. Francis Cherunilam (2009), International Business: Text and Cases, Prentice Hall of India.						



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2. K. Aswathappa, Essentials of Business Environment: Texts and Cases & Exercises 13th Revised Edition.HPH2016

**Reference Books:**

- 1.K. V. Sivayya, V. B. M Das (2009), Indian Industrial Economy, Sultan Chand Publishers, New Delhi, India.
2. Sundaram, Black (2009), International Business Environment Text and Cases, Prentice Hall of India, New Delhi, India.
3. Chari. S. N (2009), International Business, Wiley India.
- 4.E. Bhattacharya (2009), International Business, Excel Publications, New Delhi.

**Online Learning Resources:**

- <https://www.slideshare.net/ShompaDhali/business-environment-53111245>
- <https://www.slideshare.net/rbalsells/fiscal-policy-ppt>
- <https://www.slideshare.net/aguness/monetary-policy-presentationppt>
- <https://www.slideshare.net/DaudRizwan/monetary-policy-of-india-69561982>
- <https://www.slideshare.net/ShikhaGupta31/indias-trade-policyppt>
- <https://www.slideshare.net/viking2690/wto-ppt-60260883>
- <https://www.slideshare.net/prateeknepal3/ppt-mo>



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Course Code	Database Management Systems Laboratory (Common to CSE, IT, CSE( DS), CSE (IoT), CSE (AI), CSE (AI & ML) and AI & DS)	L	T	P	C												
20A05401P		0	0	3	1.5												
<b>Pre-requisite</b>		<b>Semester</b>		<b>IV</b>													
<b>Course Objectives:</b>																	
<ul style="list-style-type: none"> <li>• To implement the basic knowledge of SQL queries and relational algebra.</li> <li>• To construct database models for different database applications.</li> <li>• To apply normalization techniques for refining of databases.</li> <li>• To practice various triggers, procedures, and cursors using PL/SQL.</li> <li>• To design and implementation of a database for an organization</li> </ul>																	
<b>Course Outcomes (CO):</b>																	
After completion of the course, students will be able to <ul style="list-style-type: none"> <li>• Design database for any real world problem</li> <li>• Implement PL/SQL programs</li> <li>• Define SQL queries</li> <li>• Decide the constraints</li> <li>• Investigate for data inconsistency</li> </ul>																	
<b>List of Experiments:</b>																	
<b>Week-1: CREATION OF TABLES</b>																	
1. Create a table called Employee with the following structure.																	
		<table border="1"> <thead> <tr> <th>Name</th> <th>Type</th> </tr> </thead> <tbody> <tr> <td>Empno</td> <td>Number</td> </tr> <tr> <td>Ename</td> <td>Varchar2(20)</td> </tr> <tr> <td>Job</td> <td>Varchar2(20)</td> </tr> <tr> <td>Mgr</td> <td>Number</td> </tr> <tr> <td>Sal</td> <td>Number</td> </tr> </tbody> </table>				Name	Type	Empno	Number	Ename	Varchar2(20)	Job	Varchar2(20)	Mgr	Number	Sal	Number
Name	Type																
Empno	Number																
Ename	Varchar2(20)																
Job	Varchar2(20)																
Mgr	Number																
Sal	Number																
a. Add a column commission with domain to the Employee table. b. Insert any five records into the table. c. Update the column details of job d. Rename the column of Employ table using alter command. e. Delete the employee whose empno is 19.																	
2. Create department table with the following structure.																	
		<table border="1"> <thead> <tr> <th>Name</th> <th>Type</th> </tr> </thead> <tbody> <tr> <td>Deptno</td> <td>Number</td> </tr> <tr> <td>Deptname</td> <td>Varchar2(20)</td> </tr> <tr> <td>location</td> <td>Varchar2(20)</td> </tr> </tbody> </table>				Name	Type	Deptno	Number	Deptname	Varchar2(20)	location	Varchar2(20)				
Name	Type																
Deptno	Number																
Deptname	Varchar2(20)																
location	Varchar2(20)																
a. Add column designation to the department table. b. Insert values into thetable. c. List the records of emp table grouped bydeptno. d. Update the record where deptno is 9. e. Delete any column data from thetable																	



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3. Create a table called Customertable

Name	Type
Cust name	Varchar2(20)
Cust street	Varchar2(20)
Cust city	Varchar2(20)

- a. Insert records into thetable.
- b. Add salary column to thetable.
- c. Alter the table columndomain.
- d. Drop salary column of the customertable.
- e. Delete the rows of customer table whose ust\_city is 'hyd'.
- f. Create a table called branchtable.

Name	Type
Branch name	Varchar2(20)
Branch city	Varchar2(20)
asserts	Number

4. Increase the size of data type for asserts to the branch.

- a. Add and drop a column to the branch table.
- b. Insert values to the table.
- c. Update the branch name column
- d. Delete any two columns from the table

5. Create a table called sailor table

Name	Type
Sid	Number
Sname	Varchar2(20)
rating	Varchar2(20)

- a. Add column age to the sailor table.
- b. Insert values into the sailor table.
- c. Delete the row with rating>8.
- d. Update the column details of sailor.
- e. Insert null values into the table.

6. Create a table called reserves table

Name	Type
Boat id	Integer
sid	Integer
day	Integer

- a. Insert values into the reservestable.
- b. Add column time to the reservestable.
- c. Alter the column day data type todate.
- d. Drop the column time in thetable.
- e. Delete the row of the table with somecondition.

**Week-2: QUERIES USING DDL AND DML**



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1.
  - a. Create a user and grant all permissions to the user.
  - b. Insert the any three records in the employee table and use rollback. Check the result.
  - c. Add primary key constraint and not null constraint to the employee table.
  - d. Insert null values to the employee table and verify the result.
2.
  - a. Create a user and grant all permissions to the user.
  - b. Insert values in the department table and use commit.
  - c. Add constraints like unique and not null to the department table.
  - d. Insert repeated values and null values into the table.
3.
  - a. Create a user and grant all permissions to the user.
  - b. Insert values into the table and use commit.
  - c. Delete any three records in the department table and use rollback.
  - d. Add constraint primary key and foreign key to the table.
4.
  - a. Create a user and grant all permissions to the user.
  - b. Insert records in the sailor table and use commit.
  - c. Add save point after insertion of records and verify save point.
  - d. Add constraints not null and primary key to the sailor table.
5.
  - a. Create a user and grant all permissions to the user.
  - b. Use revoke command to remove user permissions.
  - c. Change password of the user created.
  - d. Add constraint foreign key and not null.
6.
  - a. Create a user and grant all permissions to the user.
  - b. Update the table reserves and use savepoint and rollback.
  - c. Add constraint primary key, foreign key and not null to the reserves table
  - d. Delete constraint not null to the table column

**Week-3: QUERIES USING AGGREGATE FUNCTIONS**

1.
  - a. By using the group by clause, display the enames who belongs to deptno 10 along with average salary.
  - b. Display lowest paid employee details under each department.
  - c. Display number of employees working in each department and their department number.
  - d. Using built in functions, display number of employees working in each department and their department name from dept table. Insert deptname to dept table and insert deptname for each row, do the required thing specified above.
  - e. List all employees which start with either B or C.
  - f. Display only these ename of employees where the maximum salary is greater than or equal to 5000.
2.
  - a. Calculate the average salary for each different job.
  - b. Show the average salary of each job excluding manager.
  - c. Show the average salary for all departments employing more than three people.
  - d. Display employees who earn more than the lowest salary in department 30
  - e. Show that value returned by sign (n) function.
  - f. How many days between day of birth to current date
3.
  - a. Show that two substring as single string.
  - b. List all employee names, salary and 15% rise in salary.
  - c. Display lowest paid emp details under each manager
  - d. Display the average monthly salary bill for each deptno.
  - e. Show the average salary for all departments employing more than two people.
  - f. By using the group by clause, display the eid who belongs to deptno 05 along with average salary.
4.
  - a. Count the number of employees in department 20
  - b. Find the minimum salary earned by clerk.



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- c. Find minimum, maximum, average salary of allemployees.
- d. List the minimum and maximum salaries for each jobtype.
- e. List the employee names in descendingorder.
- f. List the employee id, names in ascending order byempid.
5. a. Find the sids ,names of sailors who have reserved all boats called“INTERLAKE  
 Find the age of youngest sailor who is eligible to vote for each rating level with at least two such sailors.
- b. Find the sname , bid and reservation date for eachreservation.
- c. Find the ages of sailors whose name begin and end with B and has at least 3characters.
- d. List in alphabetic order all sailors who have reserved redboat.
- e. Find the age of youngest sailor for each ratinglevel.
6. a. List the Vendors who have delivered products within 6 months from orderdate.
- b. Display the Vendor details who have supplied both Assembled and Subparts.
- c. Display the Sub parts by grouping the Vendor type (Local or NonLocal).
- d. Display the Vendor details in ascendingorder.
- e. Display the Sub part which costs more than any of the Assembledparts.
- f. Display the second maximum cost Assembledpart

**Week-4: PROGRAMS ON PL/SQL**

1. a. Write a PL/SQL program to swaptwonumbers.
- b. Write a PL/SQL program to find the largest of threenumbers.
2. a. Write a PL/SQL program to find the total and average of 6 subjects and display thegrade.
- b. Write a PL/SQL program to find the sum of digits in a givennumber.
3. a. Write a PL/SQL program to display the number in reverseorder.
- b. Writea PL/SQLprogramtocheckwhetherthegivennumberisprimeornot.
4. a. Write a PL/SQL program to find the factorial of a givennumber.
- b. Write a PL/SQL code block to calculate the area of a circle for a value of radius varying from 3 to 7. Store the radius and the corresponding values of calculated area in an empty table named areas, consisting of two columns radius andarea.
5. a. Write a PL/SQL program to accept a string and remove the vowels from the string. (When ‘hello’ passed to the program it should display ‘Hll’ removing e and o from the worldHello).
- b. Write a PL/SQL program to accept a number and a divisor. Make sure the divisor is less than or equal to 10. Else display an error message. Otherwise Display the remainderin words.

**Week-5: PROCEDURES AND FUNCTIONS**

1. Write a function to accept employee number as parameter and return Basic +HRA together as single column.
2. Accept year as parameter and write a Function to return the total net salary spent for a givenyear.
3. Create a function to find the factorial of a given number and hence findNCR.
4. Write a PL/SQL block o pint prime Fibonacci series using localfunctions.
5. Create a procedure to find the lucky number of a given birthdate.
6. Create function to the reverse of givennumber

**Week-6: TRIGGERS**

1. Create a row level trigger for the customers table that would fire for INSERT or UPDATE or DELETE operations performed on the CUSTOMERS table. This trigger will display the salary difference between the old values and newvalues:

CUSTOMERS table:



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ID	NAME	AGE	ADDRESS	SALARY
1	Alive	24	Khammam	2000
2	Bob	27	Kadappa	3000
3	Catri	25	Guntur	4000
4	Dena	28	Hyderabad	5000
5	Eeshwar	27	Kurnool	6000
6	Farooq	28	Nellore	7000

2. Creation of insert trigger, delete trigger, update trigger practice triggers using the passenger database.  
 Passenger( Passport\_ id INTEGER PRIMARY KEY, Name VARCHAR (50) NotNULL, Age Integer Not NULL, Sex Char, Address VARCHAR (50) NotNULL);
  - a. Write a Insert Trigger to check the Passport\_id is exactly six digits ornot.
  - b. Write a trigger on passenger to display messages '1 Record is inserted', '1 record is deleted', '1 record is updated' when insertion, deletion and updation are done on passengerrespectively.
3. Insert row in employee table using Triggers. Every trigger is created with name any trigger have same name must be replaced by new name. These triggers can raised before insert, update or delete rows on data base. The main difference between a trigger and a stored procedure is that the former is attached to a table and is only fired when an INSERT, UPDATE or DELETEoccurs.
4. Convert employee name into uppercasse whenever an employee record is inserted or updated. Trigger to fire before the insert orupdate.
5. Trigger before deleting a record from emp table. Trigger will insert the row to be deleted into table called delete \_emp and also record user who has deleted the record and date and time ofdelete.
6. Create a transparent audit system for a table CUST\_MSTR. The system must keep track of the records that are being deleted orupdated

**Week-7:PROCEDURES**

1. Create the procedure for palindrome of givennumber.
2. Create the procedure for GCD: Program should load two registers with two Numbers and then apply the logic for GCD of two numbers. GCD of two numbers is performed by dividing the greater number by the smaller number till the remainder is zero. If it is zero, the divisor is the GCD if not the remainder and the divisors of the previous division are the new set of two numbers. The process is repeated by dividing greater of the two numbers by the smaller number till the remainder is zero and GCD isfound.
3. Write the PL/SQL programs to create the procedure for factorial of givennumber.
4. Write the PL/SQL programs to create the procedure to find sum of N naturalnumber.
5. Write the PL/SQL programs to create the procedure to find Fibonacciseries.
6. Write the PL/SQL programs to create the procedure to check the given number is perfect ornot

**Week-8: CURSORS**

1. Write a PL/SQL block that will display the name, dept no, salary of fist highest paidemployees.
2. Update the balance stock in the item master table each time a transaction takes place in the item transaction table. The change in item master table depends on the item id is already present in the item master then update operation is performed to decrease the balance stock by the quantity specified in the item transaction in case the item id is not present in the item



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master table then the record is inserted in the item mastertable.

3. Write a PL/SQL block that will display the employee details along with salary using cursors.
4. To write a Cursor to display the list of employees who are working as a Managers or Analyst.
5. To write a Cursor to find employee with given job and deptno.
6. Write a PL/SQL block using implicit cursor that will display message, the salaries of all the employees in the 'employee' table are updated. If none of the employee's salary are updated we get a message 'None of the salaries were updated'. Else we get a message like for example, 'Salaries for 1000 employees are updated' if there are 1000 rows in 'employee' table

**Week-9: CASE STUDY: BOOK PUBLISHING COMPANY**

A publishing company produces scientific books on various subjects. The books are written by authors who specialize in one particular subject. The company employs editors who, not necessarily being specialists in a particular area, each take sole responsibility for editing one or more publications.

A publication covers essentially one of the specialist subjects and is normally written by a single author. When writing a particular book, each author works with one editor, but may submit another work for publication to be supervised by other editors. To improve their competitiveness, the company tries to employ a variety of authors, more than one author being a specialist in a particular subject for the above case study, do the following:

1. Analyze the data required.
2. Normalize the attributes.

Create the logical data model using E-R diagrams

**Week-10: CASE STUDY GENERAL HOSPITAL**

A General Hospital consists of a number of specialized wards (such as Maternity, Pediatric, Oncology, etc.). Each ward hosts a number of patients, who were admitted on the recommendation of their own GP and confirmed by a consultant employed by the Hospital. On admission, the personal details of every patient are recorded. A separate register is to be held to store the information of the tests undertaken and the results of a prescribed treatment. A number of tests may be conducted for each patient. Each patient is assigned to one leading consultant but may be examined by another doctor, if required. Doctors are specialists in some branch of medicine and may be leading consultants for a number of patients, not necessarily from the same ward. For the above case study, do the following.

1. Analyze the data required.
2. Normalize the attributes.

Create the logical data model using E-R diagrams

**Week-11: CASE STUDY: CAR RENTAL COMPANY**

A database is to be designed for a car rental company. The information required includes a description of cars, subcontractors (i.e. garages), company expenditures, company revenues and customers. Cars are to be described by such data as: make, model, year of production, engine size, fuel type, number of passengers, registration number, purchase price, purchase date, rent price and insurance details. It is the company policy not to keep any car for a period exceeding one year. All major repairs and maintenance are done by subcontractors (i.e. franchised garages), with whom CRC has long-term agreements. Therefore the data about garages to be kept in the database includes garage names, addresses, range of services and the like. Some garages require payments immediately after a repair has been made; with others CRC has made arrangements for credit facilities. Company expenditures are to be registered for all outgoings connected with purchases, repairs, maintenance, insurance etc. Similarly the cash inflow coming from all sources: Car hire, car sales, insurance claims must be kept of file. CRC maintains a reasonably stable client base. For this privileged category of customers special credit card facilities are provided. These customers may also book in advance a particular car. These reservations can be made for any period of time up to one month. Casual customers must pay a deposit for an estimated time of





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rental, unless they wish to pay by credit card. All major credit cards are accepted. Personal details such as name, address, telephone number, driving license, number about each customer are kept in the database. For the above case study, do the following:

1. Analyze the data required.
2. Normalize the attributes.

Create the logical data model using E-R diagrams

**Week-12: CASE STUDY: STUDENT PROGRESS MONITORING SYSTEM**

A database is to be designed for a college to monitor students' progress throughout their course of study. The students are reading for a degree (such as BA, BA (Hons.) M.Sc., etc) within the framework of the modular system. The college provides a number of modules, each being characterized by its code, title, credit value, module leader, teaching staff and the department they come from. A module is coordinated by a module leader who shares teaching duties with one or more lecturers. A lecturer may teach (and be a module leader for) more than one module. Students are free to choose any module they wish but the following rules must be observed: Some modules require pre-requisites modules and some degree programs have compulsory modules. The database is also to contain some information about students including their numbers, names, addresses, degrees they read for, and their past performance i.e. modules taken and examination results. For the above case study, do the following:

1. Analyze the data required.
2. Normalize the attributes.
3. Create the logical data model i.e., ER diagrams.
4. Comprehend the data given in the case study by creating respective tables with primary keys and foreign keys wherever required.
5. Insert values into the tables created (Be vigilant about Master- Slave tables).
6. Display the Students who have taken M.Sc course
7. Display the Module code and Number of Modules taught by each Lecturer.
8. Retrieve the Lecturer names who are not Module Leaders.
9. Display the Department name which offers 'English' module.
10. Retrieve the Prerequisite Courses offered by every Department (with Department names).
11. Present the Lecturer ID and Name who teaches 'Mathematics'.
12. Discover the number of years a Module is taught.
13. List out all the Faculties who work for 'Statistics' Department.
14. List out the number of Modules taught by each Module Leader.
15. List out the number of Modules taught by a particular Lecturer.
16. Create a view which contains the fields of both Department and Module tables. (Hint- The fields like Module code, title, credit, Department code and its name).
17. Update the credits of all the prerequisite courses to 5. Delete the Module 'History' from the Module table.

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1. Ramez Elmasri, Shamkant, B. Navathe, "Database Systems", Pearson Education, 6th Edition, 2013.
2. Peter Rob, Carles Coronel, "Database System Concepts", Cengage Learning, 7th Edition, 2008.

**Online Learning Resources/Virtual Labs:**

<http://www.scoopworld.in>

<http://vlabs.iitb.ac.in/vlabs-dev/labs/dblab/index.php>



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Course Code	OPERATING SYSTEMS LAB		L	T	P	C
20A05402P	(Common to CSE, IT, CSE( DS), CSE (IoT), CSE (AI), CSE (AI & ML) and AI & DS)		0	0	3	1.5
Pre-requisite	Basics of CO and DBMS	Semester	IV			
<b>Course Objectives:</b>						
<ul style="list-style-type: none"> <li>• To familiarize students with the architecture of OS.</li> <li>• To provide necessary skills for developing and debugging CPU Scheduling algorithms.</li> <li>• To elucidate the process management and scheduling and memory management.</li> <li>• To explain the working of an OS as a resource manager, file system manager, process manager, memory manager, and page replacement tool.</li> <li>• To provide insights into system calls, file systems and deadlock handling.</li> </ul>						
<b>Course Outcomes (CO):</b>						
<p>After completion of the course, students will be able to</p> <ul style="list-style-type: none"> <li>• Trace different CPU Scheduling algorithms (L2).</li> <li>• Implement Bankers Algorithms to Avoid and prevent the Dead Lock (L3).</li> <li>• Evaluate Page replacement algorithms (L5).</li> <li>• Illustrate the file organization techniques (L4).</li> <li>• Illustrate shared memory process (L4).</li> <li>• Design new scheduling algorithms (L6)</li> </ul>						
<b>List of Experiments:</b>						
<ol style="list-style-type: none"> <li>1. Practicing of Basic UNIX Commands.</li> <li>2. Write programs using the following UNIX operating system calls Fork, exec, getpid, exit, wait, close, stat, opendir and readdir</li> <li>3. Simulate UNIX commands like cp, ls, grep, etc.,</li> <li>4. Simulate the following CPU scheduling algorithms a) Round Robin b) SJF c) FCFS d) Priority</li> <li>5. Implement a dynamic priority scheduling algorithm.</li> <li>6. Assume that there are five jobs with different weights ranging from 1 to 5. Implement round robin algorithm with time slice equivalent to weight.</li> <li>7. Implement priority scheduling algorithm. While executing, no process should wait for more than 10 seconds. If the waiting time is more than 10 seconds that process has to be executed for at least 1 second before waiting again.</li> <li>8. Control the number of ports opened by the operating system with a) Semaphore b) Monitors.</li> <li>9. Simulate how parent and child processes use shared memory and address space.</li> <li>10. Simulate sleeping barber problem.</li> <li>11. Simulate dining philosopher's problem.</li> <li>12. Simulate producer-consumer problem using threads.</li> <li>13. Implement the following memory allocation methods for fixed partition a) First fit b) Worst fit c) Best fit</li> <li>14. Simulate the following page replacement algorithms a) FIFO b) LRU c) LFU etc.,</li> <li>15. Simulate Paging Technique of memory management</li> <li>16. Simulate Bankers Algorithm for Dead Lock avoidance and prevention</li> <li>17. Simulate the following file allocation strategies a) Sequential b) Indexed c) Linked</li> <li>18. Simulate all File Organization Techniques a) Single level directory b) Two level c) Hierarchical d) DAG</li> </ol>						
<b>References:</b>						



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1. “Operating System Concepts”, Abraham Silberchatz, Peter B. Galvin, Greg Gagne, Eighth Edition, John Wiley.
2. “Operating Systems: Internals and Design Principles”, Stallings, Sixth Edition–2009, Pearson Education
3. “Modern Operating Systems”, Andrew S Tanenbaum, Second Edition, PHI.
4. “Operating Systems”, S.Haldar, A.A.Aravind, Pearson Education.
5. “Principles of Operating Systems”, B.L.Stuart, Cengage learning, India Edition.2013-2014
6. “Operating Systems”, A.S.Godbole, Second Edition, TMH.
7. “An Introduction to Operating Systems”, P.C.P. Bhatt, PHI.

Online Learning Resources/Virtual Labs:

<https://www.cse.iitb.ac.in/~mythili/os/>

<http://peterindia.net/OperatingSystems.html>



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Course Code	SOFTWARE ENGINEERING LAB	L	T	P	C
20A05403P	(Common to CSE, IT, CSE( DS), CSE (IoT))	0	0	3	1.5
Pre-requisite	Semester	IV			
Course Objectives:					
<ul style="list-style-type: none"> <li>To learn and implement the fundamental concepts of Software Engineering.</li> <li>To explore functional and non-functional requirements through SRS.</li> <li>To practice the various design diagrams through the appropriate tool.</li> <li>To learn to implement various software testing strategies.</li> </ul>					
Course Outcomes (CO):					
After completion of the course, students will be able to <ul style="list-style-type: none"> <li>Acquaint with historical and modern software methodologies</li> <li>Understand the phases of software projects and practice the activities of each phase</li> <li>Practice clean coding</li> <li>Take part in project management</li> <li>Adopt skills such as distributed version control, unit testing, integration testing, build management, and deployment</li> </ul>					
List of Experiments:					
1	Draw the Work Breakdown Structure for the system to be automated				
2	Schedule all the activities and sub-activities Using the PERT/CPM charts				
3	Define use cases and represent them in use-case document for all the stakeholders of the system to be automated				
4	Identify and analyze all the possible risks and its risk mitigation plan for the system to be automated				
5	Diagnose any risk using Ishikawa Diagram (Can be called as Fish Bone Diagram or Cause& Effect Diagram)				
6	Define Complete Project plan for the system to be automated using Microsoft Project Tool				
7	Define the Features, Vision, Business objectives, Business rules and stakeholders in the vision document				
8	Define the functional and non-functional requirements of the system to be automated by using Use cases and document in SRS document				
9	Define the following traceability matrices :				
	1. Use case Vs. Features				
	2. Functional requirements Vs. Usecases				
10	Estimate the effort using the following methods for the system to be automated:				
	1. Function point metric				
	2. Usecase point metric				
11	Develop a tool which can be used for quantification of all the non-functional requirements				
12	Write C/C++/Java/Python program for classifying the various types of coupling.				
13	Write a C/C++/Java/Python program for classifying the various types of cohesion.				
14	Write a C/C++/Java/Python program for object oriented metrics for design proposed by Chidamber and Kremer. (Popularly called CK metrics)				
15	Convert the DFD into appropriate architecture styles.				
16	Draw a complete class diagram and object diagrams using Rational tools				
17	Define the design activities along with necessary artifacts using Design Document.				
18	Reverse Engineer any object-oriented code to an appropriate class and object diagrams.				
19	Test a piece of code that executes a specific functionality in the code to be tested and asserts a certain behavior or state using Junit.				
20	Test the percentage of code to be tested by unit test using any code coverage tools				
21	Define appropriate metrics for at least 3 quality attributes for any software application of your interest.				



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22	Define a complete call graph for any C/C++ code. (Note: The student may use any tool that generates call graph for source code)
<b>References:</b>	
<ol style="list-style-type: none"><li>1. Software Engineering? A Practitioner's Approach, Roger S. Pressman, 1996, MGH.</li><li>2. Software Engineering by Ian Sommerville, Pearson Edu, 5th edition, 1999</li><li>3. An Integrated Approach to software engineering by Pankaj Jalote , 1991 Narosa</li></ol>	
<b>Online Learning Resources/Virtual Labs:</b>	
<a href="http://vlabs.iitkgp.ac.in/se/">http://vlabs.iitkgp.ac.in/se/</a>	



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Course Code	Python Programming for IoT		L	T	P	C
20A35401			1	0	2	2
Pre-requisite	Python Programming Basics	Semester	IV			
Course Objectives:						
<ul style="list-style-type: none"> <li>Understand the architecture of Internet of Things and connected world.</li> <li>Explore on use of various hardware and sensing technologies to build IoT applications.</li> <li>Illustrate the real time IoT applications to make smart world.</li> <li>Understand the available cloud services and communication API's for developing smart cities</li> </ul>						
Course Outcomes (CO):						
After completion of the course, students will be able to <ul style="list-style-type: none"> <li>Understand the concept of Internet of Things and connected world.</li> <li>Explore on use of various hardware and sensing technologies to build IoT applications</li> <li>Illustrate the architecture of Internet of Things and python.</li> <li>Understand the working with python on intel galileo gen.</li> <li>Explore on Interacting with digital outputs with python</li> </ul>						
<b>List of Experiments:</b>						
<b>Module-1: Understanding and Setting up the Base IoT Hardware</b>						
<ul style="list-style-type: none"> <li>Understanding the Intel Galileo Gen 2 board and its components</li> <li>Recognizing the Input/Output and the Arduino 1.0 pinout</li> <li>Recognizing additional expansion and connectivity capabilities</li> <li>Understanding the buttons and the LEDs</li> <li>Checking and upgrading the board's firmware</li> </ul>						
<b>Module-2: Working with Python on Intel Galileo Gen 2</b>						
<ul style="list-style-type: none"> <li>Setting up the board to work with Python as the programming language</li> <li>Retrieving the board's assigned IP address</li> <li>Connecting to the board's operating system</li> <li>Installing and upgrading the necessary libraries to interact with the board</li> <li>Installing pip and additional libraries</li> <li>Invoking the Python interpreter</li> </ul>						
<b>Module-3: Interacting with Digital Outputs with Python</b>						
<ul style="list-style-type: none"> <li>Turning on and off an onboard component</li> <li>Prototyping with breadboards</li> <li>Working with schematics to wire digital outputs</li> <li>Counting from 1 to 9 with LEDs, Python code and the mraa library</li> <li>Taking advantage of object-oriented code to control digital outputs</li> <li>Improving our object-oriented code to provide new features</li> <li>Isolating the pin numbers to improve wirings</li> <li>Controlling digital outputs with the wiring-x86 library</li> </ul>						
<b>Module-4: Working with a RESTful API and Pulse Width Modulation</b>						



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- Printing numbers in LEDs with a RESTful API
- Composing and sending HTTP requests
- Wiring pins with PWM capabilities
- Using PWM to generate analog values
- Generating analog values via HTTP requests
- Preparing the RESTful API for Web application requirements
- Using PWM plus a RESTful API to set colors for an RGB LED
- Controlling PWM with the wiring-x86 library

**Module-5: Working with Digital Inputs, Polling and Interrupts**

- Understanding pushbuttons and pullup resistors
- Wiring digital input pins with pushbuttons
- Reading pushbutton statuses with digital inputs and the mraa library
- Reading pushbutton statuses and running a RESTful API
- Reading digital inputs with the wiring-x86 library
- Using interrupts to detect pressed pushbuttons

**Module-6: Working with Analog Inputs and Local Storage**

- Understanding the analog inputs
- Wiring an analog input pin with a voltage source
- Measuring voltage with analog inputs and the mraa library
- Wiring a photoresistor to an analog input pin
- Determining the darkness level with analog inputs and the mraa library
- Firing actions when the environment light changes
- Controlling analog inputs with the wiring-x86 library
- Logging to files in the local storage
- Working with USB attached storage

**Module-7: Retrieving Data from the Real World with Sensors**

- Understanding sensors and their connection types
- Working with accelerometers
- Wiring an analog accelerometer to the analog input pins
- Measuring three axis acceleration with an analog accelerometer
- Wiring a digital accelerometer to the I2C bus
- Measuring three axis acceleration with a digital accelerometer
- Using the I2C bus to control a digital accelerometer with themraa library
- Wiring an analog temperature sensor
- Measuring ambient temperature with an analog sensor
- Wiring a digital temperature and humidity sensor to the I2C bus
- Measuring temperature and humidity with a digital sensor

**Module-8: Displaying Information and Performing Actions**

- Understanding LCD displays and their connection types
- Wiring an LCD RGB backlight to the I2C bus
- Displaying text on an LCD display



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- Wiring an OLED dot matrix to the I2C bus
- Displaying text on an OLED display
- Wiring a servo motor
- Positioning a shaft to indicate a value with a servo motor

**Case Study-1: Smart Traffic Management System Using IoT**

Waiting in a traffic jam has always been a bad experience for everyone. In this case study, you will develop a smart traffic management system. The traffic will be controlled based on the number of vehicles waiting. The lane with a greater number of vehicles will be allowed to move first.

Source: <https://www.youtube.com/watch?v=5z2t0lftDAg>

**References:**

1. Gaston C. Hillar Gaston C Hillar , “Internet of Things with Python”, ISBN 978-1-78588-138-1
2. [https://www.tutorialspoint.com/internet\\_of\\_things/index.htm](https://www.tutorialspoint.com/internet_of_things/index.htm)
3. <https://docs.oracle.com/en/cloud/paas/iot-cloud/tutorial-qs-iot-python/index.html>





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Course Code	Design Thinking for Innovation (Common to All branches of Engineering)		L	T	P	C
20A99401			2	1	0	0
Pre-requisite	NIL	Semester	IV			
<b>Course Objectives:</b>						
The objective of this course is to familiarize students with design thinking process as a tool for breakthrough innovation. It aims to equip students with design thinking skills and ignite the minds to create innovative ideas, develop solutions for real-time problems.						
<b>Course Outcomes (CO):</b>						
<ul style="list-style-type: none"> <li>● Define the concepts related to design thinking.</li> <li>● Explain the fundamentals of Design Thinking and innovation</li> <li>● Apply the design thinking techniques for solving problems in various sectors.</li> <li>● Analyse to work in a multidisciplinary environment</li> <li>● Evaluate the value of creativity</li> <li>● Formulate specific problem statements of real time issues</li> </ul>						
<b>UNIT - I</b>	<b>Introduction to Design Thinking</b>					<b>10 Hrs</b>
Introduction to elements and principles of Design, basics of design-dot, line, shape, form as fundamental design components. Principles of design. Introduction to design thinking, history of Design Thinking, New materials in Industry.						
<b>UNIT - II</b>	<b>Design Thinking Process</b>					<b>10 Hrs</b>
Design thinking process (empathize, analyze, idea & prototype), implementing the process in driving inventions, design thinking in social innovations. Tools of design thinking - person, costumer, journey map, brain storming, product development						
<b>Activity:</b> Every student presents their idea in three minutes, Every student can present design process in the form of flow diagram or flow chart etc. Every student should explain about product development.						
<b>UNIT - III</b>	<b>Innovation</b>					<b>8 Hrs</b>
Art of innovation, Difference between innovation and creativity, role of creativity and innovation in organizations. Creativity to Innovation. Teams for innovation, Measuring the impact and value of creativity.						
<b>Activity:</b> Debate on innovation and creativity, Flow and planning from idea to innovation, Debate on value-based innovation.						
<b>UNIT - IV</b>	<b>Product Design</b>					<b>8 Hrs</b>
Problem formation, introduction to product design, Product strategies, Product value, Product planning, product specifications. Innovation towards product design Case studies.						
<b>Activity:</b> Importance of modelling, how to set specifications, Explaining their own product design.						
<b>UNIT - V</b>	<b>Design Thinking in Business Processes</b>					<b>10 Hrs</b>
Design Thinking applied in Business & Strategic Innovation, Design Thinking principles that redefine business – Business challenges: Growth, Predictability, Change, Maintaining Relevance, Extreme competition, Standardization. Design thinking to meet corporate needs. Design thinking for Startups. Defining and testing Business Models and Business Cases. Developing & testing prototypes.						
<b>Activity:</b> How to market our own product, About maintenance, Reliability and plan for startup.						



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**Textbooks:**

1. Change by design, Tim Brown, Harper Bollins (2009)
2. Design Thinking for Strategic Innovation, Idris Mootee, 2013, John Wiley & Sons.

**Reference Books:**

1. Design Thinking in the Classroom by David Lee, Ulysses press
2. Design the Future, by Shrrutin N Shetty, Norton Press
3. Universal principles of design- William lidwell, kritinaholden, Jill butter.
4. The era of open innovation – chesbrough.H

**Online Learning Resources:**

<https://nptel.ac.in/courses/110/106/110106124/>  
<https://nptel.ac.in/courses/109/104/109104109/>  
[https://swayam.gov.in/nd1\\_noc19\\_mg60/preview](https://swayam.gov.in/nd1_noc19_mg60/preview)



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**COMMUNITY SERVICE PROJECT**

.....**Experiential learning through community engagement**

**Introduction**

- Community Service Project is an experiential learning strategy that integrates meaningful community service with instruction, participation, learning and community development
- Community Service Project involves students in community development and service activities and applies the experience to personal and academic development.
- Community Service Project is meant to link the community with the college for mutual benefit. The community will be benefited with the focused contribution of the college students for the village/ local development. The college finds an opportunity to develop social sensibility and responsibility among students and also emerge as a socially responsible institution.

**Objective**

Community Service Project should be an integral part of the curriculum, as an alternative to the 2 months of Summer Internships / Apprenticeships / On the Job Training, whenever there is an exigency when students cannot pursue their summer internships. The specific objectives are;

- To sensitize the students to the living conditions of the people who are around them,
- To help students to realize the stark realities of the society.
- To bring about an attitudinal change in the students and help them to develop societal consciousness, sensibility, responsibility and accountability
- To make students aware of their inner strength and help them to find new /out of box solutions to the social problems.
- To make students socially responsible citizens who are sensitive to the needs of the disadvantaged sections.
- To help students to initiate developmental activities in the community in coordination with public and government authorities.
- To develop a holistic life perspective among the students by making them study culture, traditions, habits, lifestyles, resource utilization, wastages and its management, social problems, public administration system and the roles and responsibilities of different persons across different social systems.

**Implementation of Community Service Project**

- Every student should put in a 6 weeks for the Community Service Project during the summer vacation.
- Each class/section should be assigned with a mentor.
- Specific Departments could concentrate on their major areas of concern. For example, Dept. of Computer Science can take up activities related to Computer Literacy to different sections of people like - youth, women, house-wives, etc
- A log book has to be maintained by each of the student, where the activities undertaken/involved to be recorded.
- The logbook has to be countersigned by the concerned mentor/faculty incharge.



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- Evaluation to be done based on the active participation of the student and grade could be awarded by the mentor/faculty member.
- The final evaluation to be reflected in the grade memo of the student.
- The Community Service Project should be different from the regular programmes of NSS/NCC/Green Corps/Red Ribbon Club, etc.
- Minor project report should be submitted by each student. An internal Viva shall also be conducted by a committee constituted by the principal of the college.
- Award of marks shall be made as per the guidelines of Internship/apprentice/ on the job training

**Procedure**

- A group of students or even a single student could be assigned for a particular habitation or village or municipal ward, as far as possible, in the near vicinity of their place of stay, so as to enable them to commute from their residence and return back by evening or so.
- The Community Service Project is a twofold one –
  - First, the student/s could conduct a survey of the habitation, if necessary, in terms of their own domain or subject area. Or it can even be a general survey, incorporating all the different areas. A common survey format could be designed. This should not be viewed as a duplication of work by the Village or Ward volunteers, rather, it could be another primary source of data.
  - Secondly, the student/s could take up a social activity, concerning their domain or subject area. The different areas, could be like –
    - Agriculture
    - Health
    - Marketing and Cooperation
    - Animal Husbandry
    - Horticulture
    - Fisheries
    - Sericulture
    - Revenue and Survey
    - Natural Disaster Management
    - Irrigation
    - Law & Order
    - Excise and Prohibition
    - Mines and Geology
    - Energy
    - Internet
    - Free Electricity
    - Drinking Water

**EXPECTED OUTCOMES**

**BENEFITS OF COMMUNITY SERVICE PROJECT TO STUDENTS**



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**Learning Outcomes**

- Positive impact on students' academic learning
- Improves students' ability to apply what they have learned in "the real world"
- Positive impact on academic outcomes such as demonstrated complexity of understanding, problem analysis, problem-solving, critical thinking, and cognitive development
- Improved ability to understand complexity and ambiguity

**Personal Outcomes**

- Greater sense of personal efficacy, personal identity, spiritual growth, and moral development
- Greater interpersonal development, particularly the ability to work well with others, and build leadership and communication skills

**Social Outcomes**

- Reduced stereotypes and greater inter-cultural understanding
- Improved social responsibility and citizenship skills
- Greater involvement in community service after graduation

**Career Development**

- Connections with professionals and community members for learning and career opportunities
- Greater academic learning, leadership skills, and personal efficacy can lead to greater opportunity

**Relationship with the Institution**

- Stronger relationships with faculty
- Greater satisfaction with college
- Improved graduation rates

**BENEFITS OF COMMUNITY SERVICE PROJECT TO FACULTY MEMBERS**

- Satisfaction with the quality of student learning
- New avenues for research and publication via new relationships between faculty and community
- Providing networking opportunities with engaged faculty in other disciplines or institutions
- A stronger commitment to one's research

**BENEFITS OF COMMUNITY SERVICE PROJECT TO COLLEGES AND UNIVERSITIES**

- Improved institutional commitment
- Improved student retention
- Enhanced community relations

**BENEFITS OF COMMUNITY SERVICE PROJECT TO COMMUNITY**

- Satisfaction with student participation
- Valuable human resources needed to achieve community goals
- New energy, enthusiasm and perspectives applied to community work
- Enhanced community-university relations.



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**SUGGESTIVE LIST OF PROGRAMMES UNDER COMMUNITY SERVICE PROJECT**

The following the recommended list of projects for Engineering students. The lists are not exhaustive and open for additions, deletions and modifications. Colleges are expected to focus on specific local issues for this kind of projects. The students are expected to carry out these projects with involvement, commitment, responsibility and accountability. The mentors of a group of students should take the responsibility of motivating, facilitating, and guiding the students. They have to interact with local leadership and people and appraise the objectives and benefits of this kind of projects. The project reports shall be placed in the college website for reference. Systematic, Factual, methodical and honest reporting shall be ensured.

**For Engineering Students**

1. Water facilities and drinking water availability
2. Health and hygiene
3. Stress levels and coping mechanisms
4. Health intervention programmes
5. Horticulture
6. Herbal plants
7. Botanical survey
8. Zoological survey
9. Marine products
10. Aqua culture
11. Inland fisheries
12. Animals and species
13. Nutrition
14. Traditional health care methods
15. Food habits
16. Air pollution
17. Water pollution
18. Plantation
19. Soil protection
20. Renewable energy
21. Plant diseases
22. Yoga awareness and practice
23. Health care awareness programmes and their impact
24. Use of chemicals on fruits and vegetables
25. Organic farming
26. Crop rotation
27. Flourey culture
28. Access to safe drinking water
29. Geographical survey
30. Geological survey
31. Sericulture
32. Study of species



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33. Food adulteration
34. Incidence of Diabetes and other chronic diseases
35. Human genetics
36. Blood groups and blood levels
37. Internet Usage in Villages
38. Android Phone usage by different people
39. Utilisation of free electricity to farmers and related issues
40. Gender ration in schooling level- observation.

Complimenting the community service project the students may be involved to take up some awareness campaigns on social issues/special groups. The suggested list of programmes are;

**Programmes for School Children**

1. Reading Skill Programme (Reading Competition)
2. Preparation of Study Materials for the next class.
3. Personality / Leadership Development
4. Career Guidance for X class students
5. Screening Documentary and other educational films
6. Awareness Programme on Good Touch and Bad Touch (Sexual abuse)
7. Awareness Programme on Socially relevant themes.

**Programmes for Women Empowerment**

1. Government Guidelines and Policy Guidelines
2. Womens' Rights
3. Domestic Violence
4. Prevention and Control of Cancer
5. Promotion of Social Entrepreneurship

**General Camps**

1. General Medical camps
2. Eye Camps
3. Dental Camps
4. Importance of protected drinking water
5. ODF awareness camp
6. Swatch Bharath
7. AIDS awareness camp
8. Anti Plastic Awareness
9. Programmes on Environment
10. Health and Hygiene
11. Hand wash programmes
12. Commemoration and Celebration of important days

**Programmes for Youth Empowerment**

1. Leadership
2. Anti-alcoholism and Drug addiction
3. Anti-tobacco



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4. Awareness on Competitive Examinations
5. Personality Development

**Common Programmes**

1. Awareness on RTI
2. Health intervention programmes
3. Yoga
4. Tree plantation
5. Programmes in consonance with the Govt. Departments like –
  - i. Agriculture
  - ii. Health
  - iii. Marketing and Cooperation
  - iv. Animal Husbandry
  - v. Horticulture
  - vi. Fisheries
  - vii. Sericulture
  - viii. Revenue and Survey
  - ix. Natural Disaster Management
  - x. Irrigation
  - xi. Law & Order
  - xii. Excise and Prohibition
  - xiii. Mines and Geology
  - xiv. Energy

**Role of Students:**

- Students may not have the expertise to conduct all the programmes on their own. The students then can play a facilitator role.
- For conducting special camps like Health related, they will be coordinating with the Governmental agencies.
- As and when required the College faculty themselves act as Resource Persons.
- Students can work in close association with Non-Governmental Organizations like Lions Club, Rotary Club, etc or with any NGO actively working in that habitation.
- And also with the Governmental Departments. If the programme is rolled out, the District Administration could be roped in for the successful deployment of the programme.
- An in-house training and induction programme could be arranged for the faculty and participating students, to expose them to the methodology of Service Learning.

**Timeline for the Community Service Project Activity**

**Duration: 8 weeks**

**1. Preliminary Survey (One Week)**

- A preliminary survey including the socio-economic conditions of the allotted habitation to be conducted.





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- A survey form based on the type of habitation to be prepared before visiting the habitation with the help of social sciences faculty. (However, a template could be designed for different habitations, rural/urban.
- The Governmental agencies, like revenue administration, corporation and municipal authorities and village secretariats could be aligned for the survey.

**2. Community Awareness Campaigns (One Week)**

- Based on the survey and the specific requirements of the habitation, different awareness campaigns and programmes to be conducted, spread over two weeks of time. The list of activities suggested could be taken into consideration.

**3. Community Immersion Programme (Three Weeks)**

**Along with the Community Awareness Programmes**, the student batch can also work with any one of the below listed governmental agencies and work in tandem with them. This community involvement programme will involve the students in exposing themselves to the experiential learning about the community and its dynamics. Programmes could be in consonance with the Govt. Departments.

**4. Community Exit Report (One Week)**

- During the last week of the Community Service Project, a detailed report of the outcome of the 8 weeks work to be drafted and a copy shall be submitted to the local administration. This report will be a basis for the next batch of students visiting that particular habitation. The same report submitted to the teacher-mentor will be evaluated by the mentor and suitable marks are awarded for onward submission to the University.

Throughout the Community Service Project, a daily log-book need to be maintained by the students batch, which should be countersigned by the governmental agency representative and the teacher-mentor, who is required to periodically visit the students and guide them.